MWP

Natura Impact Statement

Ballycar Wind Farm, County Clare

Ballycar Green Energy Limited

January 2024

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1. Summary of Findings

1.1 Natura Impact Statement

Project Title	Proposed Ballycar Wind Farm
Project Proponent	Ballycar Green Energy Limited
Project Location	The proposed development site is situated within the townlands of Glennagross, (orse Glenagross, Glennacross – hereafter referred to as Glennagross within this document) Cappateemore East, Ballycannan West, Ballycannan East, Ballycar South and Ballycar North in southeast County Clare, approximately 3 kilometres northwest of Limerick City and suburbs and 6.7 kilometres east of Sixmilebridge.
Natura Impact Statement	In cases where an Appropriate Assessment is required, a Natura Impact Statement (NIS) is prepared and includes a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any adverse impacts a project may have, either individually or in combination with other plans or projects, on the integrity of a European site(s) in view of the conservation objectives of the site(s).
Conclusion	For the reasons set out in detail in this NIS, and based on best scientific knowledge, the proposed development will not, either alone or in combination with other plans and projects, adversely affect (directly or indirectly) the integrity of two the identified European sites, namely the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA, considering the specific conservation objectives of each site. The NIS contains information which the competent authority may consider in making its own complete, precise and definitive findings and conclusions, and upon which the competent authority is capable of determining that all reasonable scientific doubt has been removed as to the effects of the project on the integrity of the relevant European sites. Provided that the mitigation measures are implemented in full, it is considered that the proposed development, either individually, or in combination with other plans/projects, will not affect the integrity of two European sites, namely: ▪ Lower River Shannon SAC (002165); ▪ River Shannon and River Fergus Estuaries SPA (004077).

2. Introduction

2.1 Purpose of the Assessment and Legislative Context

Appropriate Assessment is the consideration of the impact of a project on the integrity of a European site[1], either alone or in combination with other plans or projects, with respect to the site's ecological structure and function, and in view of the site's conservation objectives. The conservation objectives of European sites are site specific and based on the ecological requirements of the species and habitats present. They define the desired conservation condition of certain species and habitat types for the site. Conservation objectives are defined using attributes and targets that are based on parameters as set out in the Habitats Directive for defining favourable status, namely area, range, structure and function. The conservation objectives may be either to maintain or restore the favourable conservation condition of a habitat/species.

Article 6(3) of Directive 92/43/EEC stipulates that certain projects and plans must be subjected to an "appropriate assessment" of their effects on the integrity of European site(s). Article 6(3) provides in full:

"*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*."

A screening for Appropriate Assessment report was completed for the proposed Ballycar Wind Farm to establish whether the project is likely to have a significant effect on any European sites. The screening for Appropriate Assessment report determined that a full Appropriate Assessment of the proposed development is required, as it could not be excluded based on objective information that the proposed development, individually or in combination with other plans or projects, will not have a significant impact on any European sites, in view of the sites' conservation objectives.

It was concluded that the proposed wind energy development at Ballycar is likely to have a significant effect, or the potential for significant effects cannot be ruled out (at the screening stage), in the absence of mitigation on the following European sites:

- Lower River Shannon SAC (002165); and
- River Shannon and River Fergus Estuaries SPA (004077).

Refer to **Appendix 1** for the Screening for Appropriate Assessment report.

An Appropriate Assessment of the project is required; hence, this Natura Impact Statement (NIS) has been prepared to detail the scientific examination of evidence and data and to identify and classify any implications for European sites likely to have a significant effect in view of the conservation objectives of those sites. The aim of the assessment is to provide a sufficient level of information to the competent authority on which to base their appropriate assessment of the project. Additionally, mitigation measures to avoid or reduce ecological effects were considered. The project is fully described in **Section 4.4**, below, and includes details on all elements of the project, particularly in relation to the aspects that could interact with the surrounding environment.

This NIS identifies the aspects of the proposed development that will interact with the ecological requirements or sensitivities of the habitats and species listed in **Section 6.2.2** and **Section 6.3.2**, below, and determines whether

[1] 'European sites' are defined in Section 177R of Part XAB of the Planning and Development Act 2000 and include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) at all stages of designation.

these will result in adverse effects for the species and/or habitats for which the European sites listed above are designated. Mitigation measures to avoid or reduce ecological effects are provided in Section 7, below.

2.2 Statement of Competency

This Natura Impact Statement has been prepared by Hazel Dalton (BSc.) Senior Ecologist, and Úna Williams (BSc. MSc.), Ecologist and Environmental Scientist, both of Malachy Walsh and Partners (MWP) Engineering and Environmental Consultants.

Hazel has over eight years' experience with MWP in ecological surveying and impact assessment for AA and EIAR and has authored and contributed to numerous screening reports for AA, Natura Impact Statements (NIS) and Ecological Impact Assessments (EcIA). She is an appropriately qualified, trained and competent professional. She has completed numerous ecological assessments for a wide variety of projects. She is an experienced field ecologist and has a diverse ecological survey profile, including habitats and flora, mammals, birds and terrestrial/aquatic invertebrates.

Úna has worked with MWP for four years and is an experienced field ecologist. She is familiar with various ecological survey methodologies including habitat/survey mapping and zoological surveys and has worked on research teams both in Ireland and abroad. She has undertaken assessments for a wide variety of projects including renewable energy developments, and infrastructural and coastal development projects. Úna has designed and carried out several Collision Risk Models for proposed wind farms and has authored many ecological reports including Screenings for Appropriate Assessment Reports (Stage 1), Natura Impact Statements (Stage 2), and Ecological Impact Assessments.

This report was reviewed by Gerard Hayes. Gerard is a Senior Ecologist with MWP and has over 15 years' experience in environmental consultancy. He is a member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and the Freshwater Biological Association (FBA). Gerard has a diverse ecological profile, with Phase 1 habitat, mammal (including bats), bird, amphibian, macroinvertebrate and tree survey experience. He is co-author and/or carried out surveys for NPWS Irish Wildlife Manual Nos. 15, 24, 26, 37, 45.

2.3 Project Overview

Ballycar Green Energy Limited is submitting a planning application for developing and operating a commercially viable 12-turbine wind farm project on lands at Ballycar in County Clare. For the purposes of this assessment, the 'proposed development' refers to all elements of the proposed wind energy project including all wind farm infrastructure and new underground 110kV collector cable – see Section 4.5, below, for further details on the characteristics of each element of the proposed development. It is envisaged that the project will exceed a 50-megawatt (MW) capacity scale and therefore will be a Strategic Infrastructure Development (SID) for which an application for planning permission must be made directly to An Bord Pleanála (ABP).

MWP was commissioned by Ballycar Green Energy to complete a Screening for Appropriate Assessment Report and Natura Impact Statement (NIS). An Environmental Impact Assessment Report (EIAR) has also been prepared by MWP and is submitted with the planning application.

3. Methodology

3.1 Appropriate Assessment Guidance

This NIS has been prepared in accordance with the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC (EC, 2021), the European Commission Guidance '*Managing Natura 2000 sites*' (EC, 2019), the Office of the Planning Regulator (OPR) Practice Note '*Appropriate Assessment Screening for Development Management*' (OPR, 2021) and guidance prepared by the NPWS (DoEHLG, 2010).

3.2 Consultation

Two pre-application stage meetings were held with An Bord Pleanála. The first, held on 23rd February 2022, involved the introduction of the proposed Ballycar wind development to the Board by Ballycar Green Energy Limited and MWP. The grid connection, NIS, and the EIAR were discussed. A second meeting with An Bord Pleanála took place on 1st September 2022 where the discussion focussed on project progress and the EIAR and NIS. An Bord Pleanála confirmed the project would be Strategic Infrastructure in correspondence dated the 4th November 2022 and advised on the list of prescribed bodies.

Ballycar Green Energy and MWP held a preliminary meeting with members of Clare County Council (CCC) Planning Department on 2nd March 2022 to discuss the site and its suitability for a wind farm project. Additionally, the turbine delivery route, potential visual impacts, public consultation and environmental impacts were discussed.

On 14th December 2021, the following statutory and non-statutory bodies were consulted, amongst others, in relation to the proposed project:

- Department of Housing, Local Government and Heritage;
- Department of Agriculture, Food and the Marine;
- National Parks and Wildlife Service;
- Environmental Protection Agency Ireland;
- Geological Survey Ireland;
- An Taisce – The National Trust for Ireland;
- Bat Conservation Ireland;
- Inland Fisheries Ireland;
- BirdWatch Ireland;
- Irish Whale and Dolphin Group;
- Irish Wildlife Trust;
- Irish Aviation Authority; and
- Transport Infrastructure Ireland (formerly National Roads Authority (NRA)).

A full list of the organisations/groups consulted, copies of the consultation documents and the responses received are provided in Volume III, Appendix 1B of the EIAR.

3.3 Data Requests

The study area for the proposed development lies within the Ordnance Survey National Grid hectad[2] R56. Concise and site-specific information on species records available in this hectad was retrieved from the NBDC on-line database and reviewed.

A request was made to NPWS for Sensitive Data Access for hectad R56 on 17th November 2021. A data request for records of rare or protected species from this hectad was submitted to NPWS on the 13th October 2022.

A data request was also submitted to Bat Conservation Ireland (BCI) for the provision of bat records within a 10-kilometre radius of the proposed development site. All available records were provided by BCI on the 05th May 2023.

A request was made to BirdWatch Ireland on the 18th July 2023 for the results of annual waterbird counts at specific subsites as part of the Irish Wetland Bird Survey (I-WeBS). Information was provided by BirdWatch Ireland on 29th July 2023.

Information received via the NPWS, BCI, NBDC, and BirdWatch Ireland was used to help inform the impact assessment in relation to the proposal.

The responses to these data requests can be viewed in **Volume III**, **Appendix 1B** of the **EIAR**.

3.4 Desktop Study

To complete the NIS, certain information on the existing environment is required. A desktop study was carried out to collate information available on the proposed development site's natural environment. This comprised a review of relevant publications, data and datasets from the following sources:

- Ordnance Survey Ireland (OSI) aerial photography, 1:50,000 mapping, GeoHive and online satellite imagery sources;
- National Parks and Wildlife Service (NPWS);
- National Biodiversity Data Centre (NBDC) (online map-viewer);
- Central Statistics Office (CSO) – Census of Agriculture (online);
- BirdWatch Ireland;
- Bat Conservation Ireland (BCI);
- Teagasc soil area maps (NBDC website);
- Geological Survey Ireland (GSI) area maps;
- Environmental Protection Agency (EPA) water quality data;
- Shannon International River Basin District (ShIRBD) datasets (Water Framework Directive);
- Inland Fisheries Ireland (IFI) online fish sampling reports and fish data;
- Review of requested records from NPWS Rare and Protected Species database;
- Clare County Development Plan (2023 – 2029)3, adopted by Clare County Council on 9th March 2023; and
- Other sources and research listed in **Section 11**, below, and as footnotes throughout the report.

[2] Unit of land area measuring 10 km x 10 km
For this [3] Stage 3 - Adoption of Plan | Stage 3: Amendments | Clare County Council (clarecoco.ie) Accessed: 16th June 2023

3.5 Study Area and Zone of Influence (ZOI) of the Proposed Project

The zone of influence (ZOI) for the proposed development is the geographical area over which construction and/or operation and/or decommissioning of the proposed wind farm has the potential to affect the receiving environment in such a manner as to significantly affect the Qualifying interests (QI) of a European site. The area over which ecological features may be affected by biophysical changes because of the proposed project and associated activities is likely to extend beyond the project site where, for example, there are ecological or hydrological links beyond the site boundaries (CIEEM, 2018). Consequently, and to ensure completion of an integrated assessment, the study area for this project included the entire proposed development site, adjoining habitats and watercourses located downstream of the site (see **Figure 3-1**, below).

For details on the Zone of Influence (ZOI) of the proposed development and the use of the Source-Pathway-Receptor (SPR) model in determining which European sites are further assessed, refer to **Section 6.1**, below.

3.6 Field Surveys

Field surveys carried out on-site in support of the development application include the following:

- Habitat surveys and mapping;
- Non-volant mammal[4] surveys;
- Invasive alien plant species (IAPS) surveys;
- Freshwater aquatic ecology surveys;
- Breeding bird surveys, including Vantage Point surveys; and
- Wintering bird surveys, including Vantage Point surveys;

Full details of all surveys and survey methodologies have been presented in **Chapter 6 Biodiversity**, and **Chapter 7 Ornithology**, in **Volume II** of the **EIAR**. The results of the surveys listed above are summarised in **Section 4.4**, below.

Ecological field surveys and aquatic ecology surveys were undertaken at the proposed development site on multiple dates between 2019 and 2023 to establish the site's ecological features and resources, particularly for any rare or protected species and habitats present within the study area. Multidisciplinary walkover surveys were carried out to identify any ecological features and resources that may potentially be impacted by the proposed development.

Habitats recorded were classified according to Fossitt '*A Guide to Habitats in Ireland*' (2000). Non-volant mammals and/or evidence of their activity such as prints, faecal pellets/droppings, burrow-holes/dens and food caches, activity trails and disturbed vegetation were looked for during walkover surveys. In general, the Mammal Society publication '*How to Find and Identify Mammals'* by Muir *et al.* (2013) was followed. Evidence of otter was looked for at any watercourse/drain crossings encountered and '*Monitoring the Otter* Lutra lutra' (Chanin, 2003a) and '*Ecology of the European Otter*' by Chanin (2003b) were consulted for guidance on identification of otter signs including spraints, footprints, tracks, couches, and holts.

[4] Non-volant mammals are land-based mammals incapable of flight i.e. all land-based mammals excluding bats.

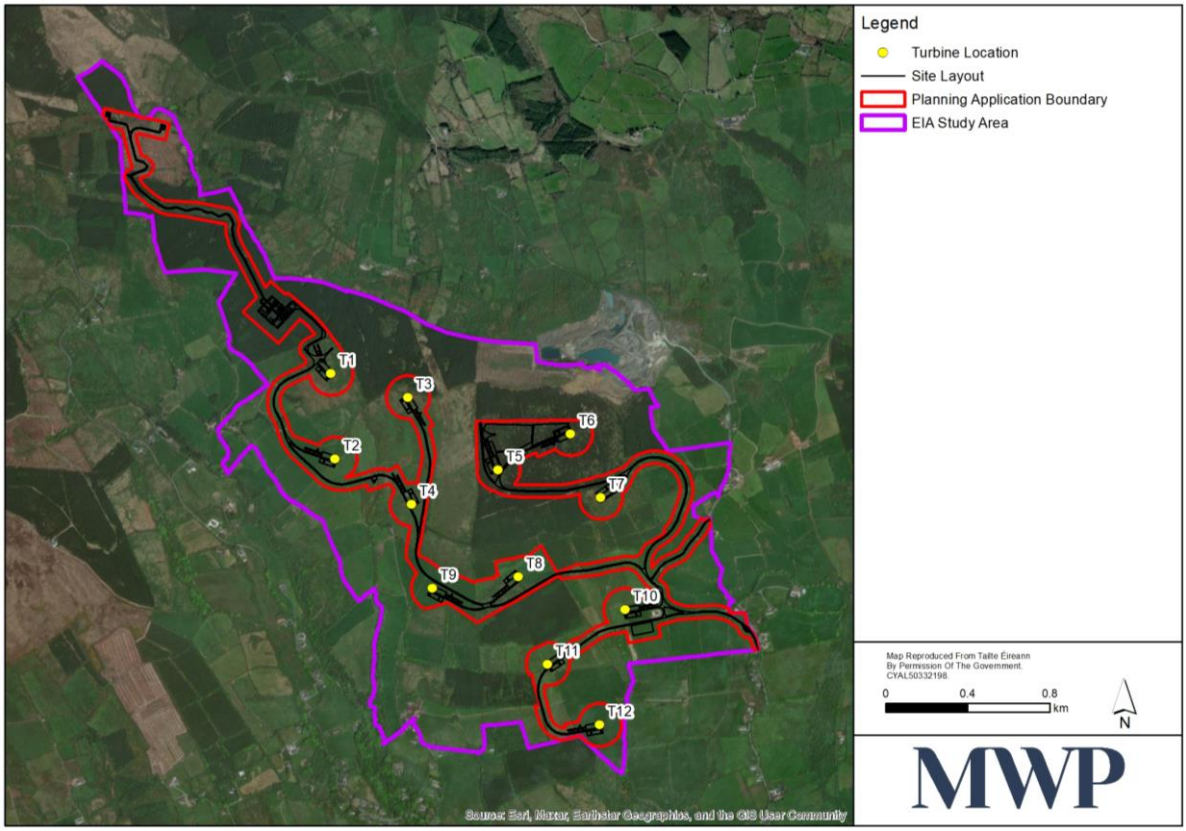

Figure 3-1: Study area and proposed development site boundary at Ballycar in County Clare.

3.6.1 Freshwater Aquatic Surveys

The freshwater aquatic ecology field surveys involved aquatic assessments of several representative sites on watercourses within and outside the study area at locations detailed in Table 1 and Figure 3-2, below.

The following were all completed at Sites 1 to 11:

- Evaluation of aquatic habitats;
- Fish survey;
- Biotic assessment using aquatic macroinvertebrates; and
- Water sampling for analysis of physico-chemical water quality parameters.

Surveys listed above were completed at Sites 1 to 10 in June and August 2021. Biotic assessment and water sampling for physico-chemical analyses was repeated at Sites 1 to 10 on 21st and 22nd June 2023.

Following a revised grid connection route, the footprint of the proposed development was extended into the Blackwater (Clare) catchment and as a result, survey Sites 11 and 12 were added to the assessment. Results of aquatic surveys undertaken by MWP at the R465 Bridge in August 2018 within the Blackwater (Clare) catchment were used in this report and referenced as Site 11.

In the same catchment, survey Site 12 at Kilnacreagh Stream was visited in June 2023 and a habitat survey only was carried out due to the insufficient size of the watercourse and because of difficulty accessing the survey site.

Table 1. Details of freshwater aquatic ecology survey locations on watercourses draining the proposed development site at Ballycar.

Hydrometric Area	Sub-basin	River catchment	Site	Watercourse	River Segment Code	Stream Order	Coordinates	
							X	Y
Shannon Estuary North	Crompaun (East)_010	Crompaun (East)	Site 1	Crompaun	27_755	2	553790	663975
			Site 2	Glennagross	27_431	2	554084	663753
			Site 3	Cappateemore East	27_277	1	554792	663405
			Site 4	Crompaun East	27_1129	3	555000	662040
Lower Shannon	North Ballycannan _ 010	North Ballycannan	Site 5	North Ballycannan	25_866	1	556531	663068
			Site 6	North Ballycannan	25_185	2	556445	661639
			Site 7	West Ballycannan	25_1699	2	556084	661408
			Site 8	South Ballycar	25_1694	1	556538	664031
			Site 9	South Ballycar	25_181	3	557344	661790
			Site 10	West Roo	25_1150	2	558026	662034
	Blackwater (Clare)_010	Blackwater(Clare)	Site 11	Blackwater (Clare)	25_3209	3	559355	665585
			Site 12	Kilnacreagh	25_3206	1	553630	665468

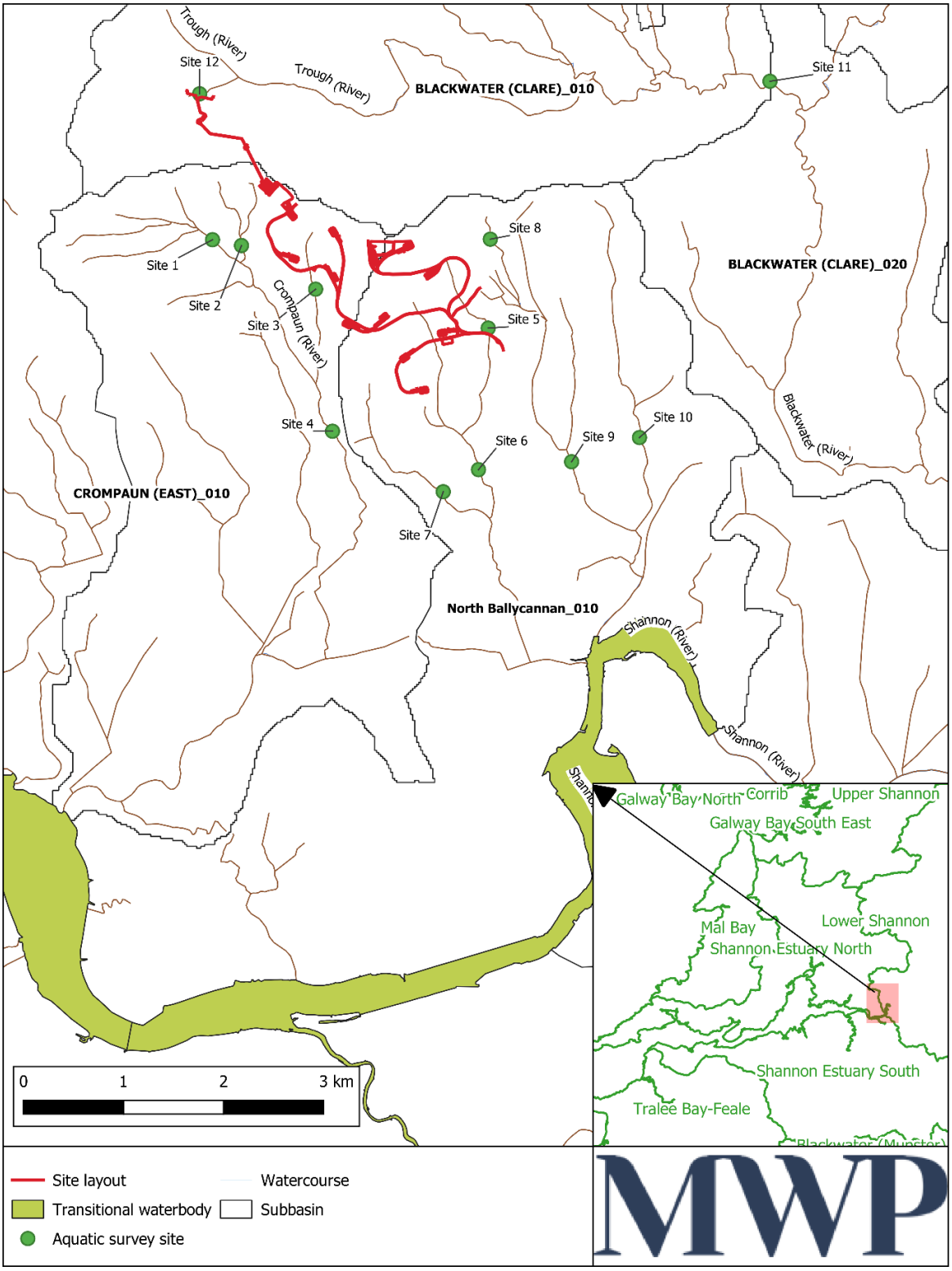

Figure 3-2: Locations of watercourses and survey sites 1 to 12 examined as part of the aquatic ecology studies for the proposed development at Ballycar.

3.6.2 Ornithological Surveys

Ornithological field surveys were undertaken at the site from October 2019 to September 2023, inclusive. The survey periods used for assessment within this report are as follows:

- Winter 2019/20 (October to March, inclusive);

- Breeding (summer) 2020 (April to September, inclusive);
- Winter 2020/21 (October to March, inclusive);
- Breeding (summer) 2021 (April to September, inclusive);
- Winter 2021/22 (October to March, inclusive);
- Breeding (summer) 2022 (April to September, inclusive);
- Winter 2022/23 (October to March, inclusive); and
- Breeding (summer) 2023 (April to September, inclusive).

There were two main elements to the bird surveys –

1) Vantage point (VP) surveys, and

2) Targeted abundance and distribution surveys that included:

- Walkover transect surveys;
- Breeding hen harrier (Circus cyaneus) surveys;
- Hen harrier winter roost surveys;
- Breeding woodcock (Scolopax rusticola) and nightjar (Caprimulgus europaeus) surveys;
- Breeding wader surveys;
- Breeding raptor surveys;
- Breeding peregrine (Falco peregrinus) / kestrel (Falco tinnunculus) surveys;
- Wintering waterfowl distribution surveys; and
- Hinterland surveys.

Prior to the commencement of survey work, a list of target species was determined, and these became the focus of the surveys. Target species are typically those species that are afforded a higher level of legislative protection, or which are more sensitive to potential impacts from wind farm developments by virtue of their behaviour (SNH, 2017). The target species list was drawn from:

- Annex I of the Birds Directive (2009/147/EC);
- Special Conservation Interests (SCI) of Special Protection Areas (SPA) within a 15-kilometre radius of the development site;
- Fourth Schedule species protected under the Wildlife Acts 1976-2012 (buzzards, eagles, falcons, harriers, hawks, kites, osprey, owls); and
- Red-listed Birds of Conservation Concern (BoCCI) 2020-20265.

Full details of the survey methodologies have been presented in **Chapter 7 Ornithology**, of **Volume II** of the **EIAR**. The results of the surveys are summarised in **Section 4.4**, below.

3.6.2.1 Vantage Point Surveys

Monthly vantage point (VP) surveys were carried out by suitably qualified personnel for the winter and breeding seasons (October 2019 to September 2023, inclusive). Three VP locations were chosen to ensure maximum visibility over the survey area. The viewshed coverage of each VP is illustrated in **Figure 3-3**, below, and the Irish

[5] Factor determined by most recent listing of species on the BOCCI list (Gilbert *et al.*, 2021). All commonly occurring species are given a status of Red (high concern), Amber (medium concern) or Green (all other species), depending on a combination of threat categories.

Transverse Mercator (ITM) grid co-ordinates for each VP location are listed in **Table 2,** below. The VP survey design was based on the guidelines '*Recommended bird survey methods to inform impact assessment of onshore wind farms*' (SNH, 2017).

The aim of the VP surveys was to quantify flight activity levels of target species within the flight activity survey area. The flight activity survey area was taken to be the proposed development site together with the area extending 500 metres beyond the turbine locations - refer to **Figure 3-3**, below.

Table 2. Irish Transverse Mercator (ITM) grid co-ordinates of Vantage Point (VP) locations at the proposed Ballycar Wind Farm site.

Vantage Point	ITM Grid Co-ordinates
1	556727, 662659
2	554466, 662835
3	553323, 664214

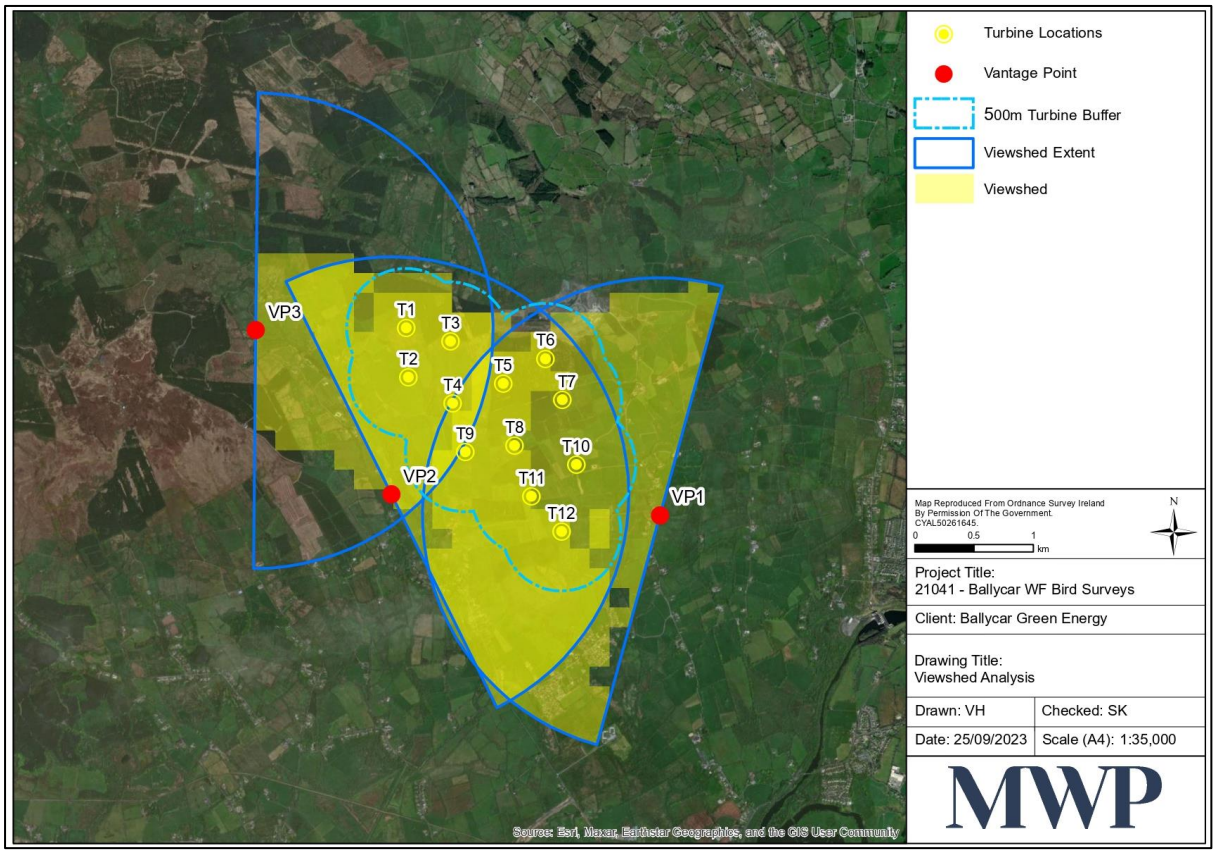

Figure 3-3: The 500-metre buffer zone around the turbines, three Vantage Pont (VP) locations, and the viewshed coverage of each VP.

During VP surveys the flight behaviour of target species was recorded. At the time of each individual observation the following information was recorded:

- The time at which the bird(s) was first detected;
- Duration (seconds) of the flight spent within various flight height categories/bands (0-20m, 20-50m, 50-100m, 100-180m and >180m) (if observed not flying e.g. perched, the location and length of time it was visible was recorded);
- Sex and age of the bird(s) (adult/juvenile), where possible to determine;

- Number of birds observed within the flight;
- Type of activity/behaviour exhibited by the bird(s) e.g. hunting, flying, displaying, perched, etc;
- Estimation of actual flight height in metres; and
- Habitat(s) in which the bird(s) was present.

Once an initial sighting was made, the individual(s) was observed until lost from view and the flight path mapped on enlarged Discovery series maps. All other non-target species were also recorded during the VP surveys, where it did not infringe on recording of target species flight data.

3.6.2.2 Distribution and Abundance Surveys

3.6.2.2.1 *Transect Surveys*

A transect survey is a survey along a defined route within the study area. The overall aim of the transect surveys was to assess general bird distribution throughout the site and gather data on bird usage of the site. Transect surveys were completed for breeding birds in summers 2020, 2021, 2022 and 2023 and for wintering birds in winters 2019/20, 2020/21, 2021/22 and 2022/23.

Transects were selected in order to survey areas of suitable breeding/foraging habitat, in areas where access was not an issue. In survey years where access was an issue, transects were confined to an existing farm access track through the west of the proposed development site where most of the site's principal habitats were present. Therefore, the transects undertaken across the study area during the period 2019 to 2023 are considered to be representative of the overall study area (see **Figure 3-4,** below).

During each transect survey, all bird species seen or heard, typically within 100 metres of the route, were recorded, although the topography of the landscape often allowed for the detection of birds at greater distances.

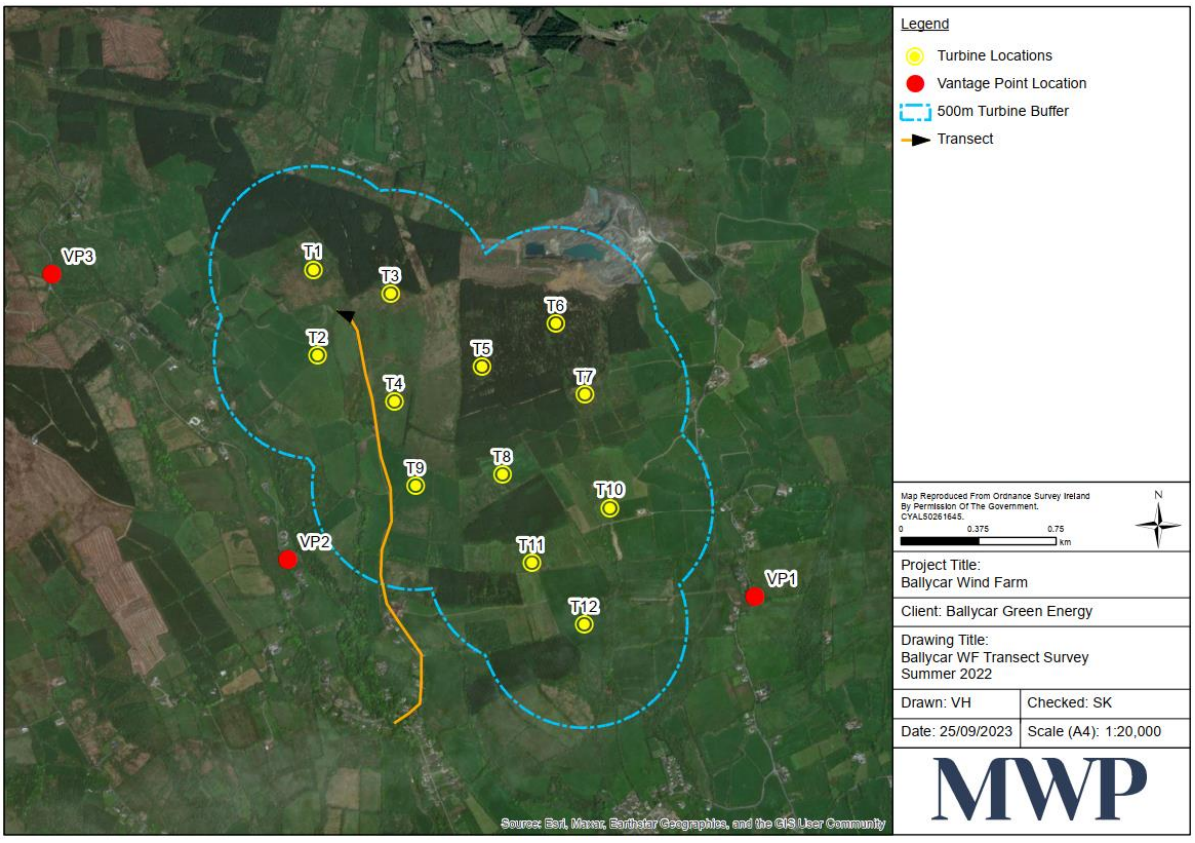

Figure 3-4: Transect survey route for the period 2019 to 2022.

3.6.2.2.2 *Wintering Waterfowl Distribution Surveys*

Counts of waterbird species were undertaken along four representative sections of the River Shannon Estuary located south and southwest of the proposed development site to provide information on the distribution and abundance of waterbird species along the section of the River Shannon closest to the proposed development site.

Based on I-WeBS survey methodology[6], the surveys were carried out at suitable estuarine waterfowl habitat including suitable foraging and roosting habitat stretching from an area upstream of Thomas Island at the Shannon Banks to Bunlicky Lake and Coonagh Point. The winter 2019/20 counts were carried out at various locations along the stretch of the Shannon Estuary shown in **Figure 4-7**, below, while for the 2022/23 winter counts, the stretch of estuary was divided into four survey areas – A, B, C, and D.

3.6.2.2.3 *Hinterland Surveys*

Hinterland surveys were undertaken within a 5km radius of the site boundary to determine the suitability of the surrounding habitats for target species with particular focus on birds of prey, and whether large assemblages of birds (e.g. wildfowl, waders) occurred regularly in the locality (see **Figure 3-5**, below), surveyors travelled roads and regularly stopped at locations with optimal views over potentially suitable habitats for birds of conservation importance, particularly waterbird species and birds of prey. However, all bird species of interest encountered around the proposed development area were recorded during the surveys. The purpose of the hinterland counts was to establish a better understanding of which bird species utilise the surrounding habitats and to gather data on whether species frequenting the region traverse the proposed development site.

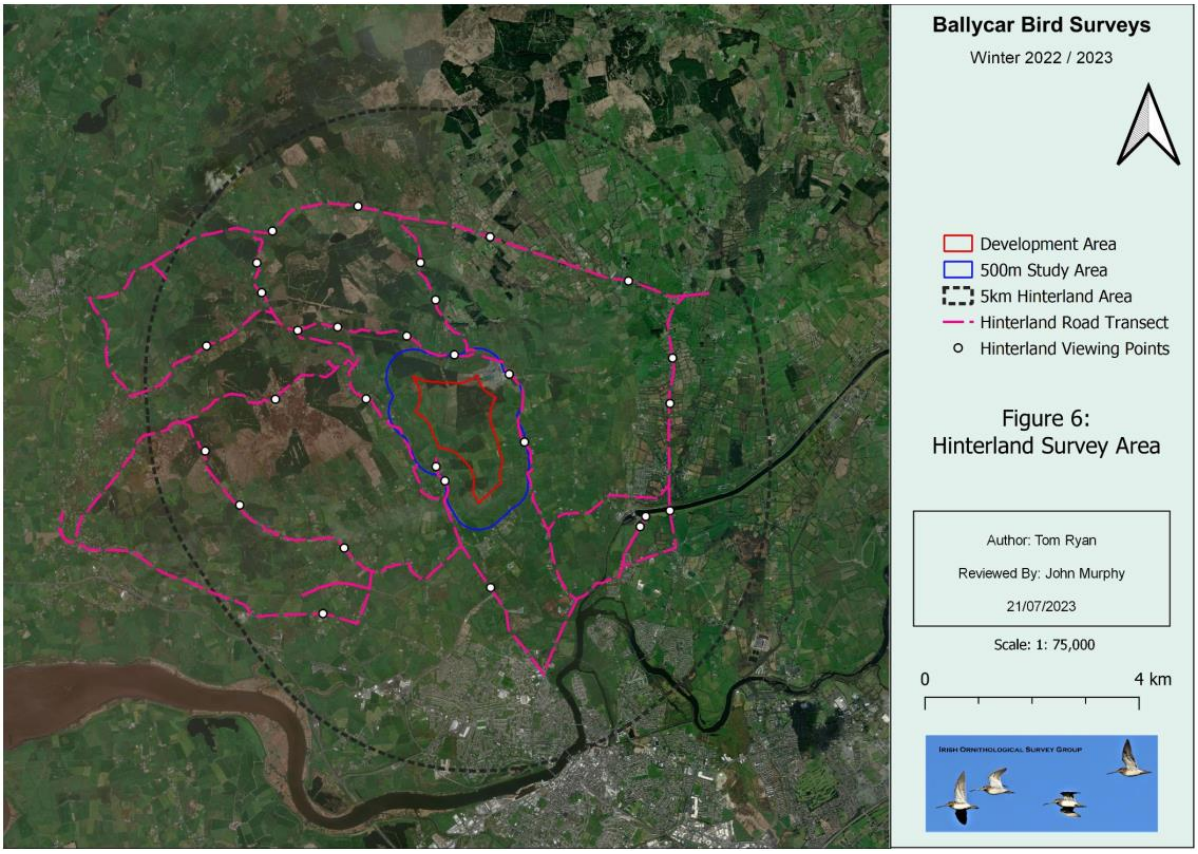

Figure 3-5: Route driven during the hinterland surveys within approximately 5 kilometres of the proposed development site.

[6] Irish Wetland Bird Survey Training Resources - BirdWatch Ireland Accessed: 30th August 2023

3.6.2.2.4 *Breeding Wader Surveys*

A breeding wader survey was carried out once in each of the months April, May and June 2023 (3 surveys in total) at suitable areas within the 500-metre buffer study area shown in **Figure 3-4**, above. The survey method was adapted from the O'Brien and Smith methodology for censusing lowland breeding wader populations as described in Gilbert *et al*., (1998).

3.7 Assessment of Potentially Significant Effects

Upon completion of the Screening for Appropriate Assessment report (see **Appendix 1**), it was concluded that the project could have significant effects, or significant effects could not be ruled out, for the following two European sites:

- Lower River Shannon SAC (002165); and
- River Shannon and River Fergus Estuaries SPA (004077).

On this basis, it was necessary to proceed to Appropriate Assessment, and an NIS was required for the proposed project. Consequently, an evaluation was undertaken to determine which of the qualifying interests (QI) of the SAC and the Special Conservation Interest (SCI) species of the SPA potentially lie within the zone of influence of the proposed project and required further assessment in the NIS (see **Section 6,** below). This was done through a scientific examination of the ecological evidence and data from the resources listed above in **Section 3.4** or referenced within the text, together with the ecological field survey results (**Section 4.4**).

The conservation objectives of a European site are site specific, are based on the ecological requirements of the species and habitats present and define the desired conservation condition of these species and habitat types for the site. For defining favourable status, conservation objectives are identified using attributes and targets that are based on parameters as set out in the Habitats Directive, namely area, range, structure and function. The conservation objectives may either be to maintain or to restore the favourable conservation condition of a habitat.

The effects of the proposed wind farm project on the QI of the SAC and the SCI species of the SPA that are potentially within the zone of influence were assessed against the measures designed to achieve the conservation objectives. This was done by way of a focussed and detailed examination, analysis, and evaluation of the implications of the project, alone and in combination with other plans and projects, on the integrity of the relevant European sites in view of the sites' conservation objectives (see **Section 6**, below).

4. Description of the Project

4.1 Site Location and Context

The proposed development site encompasses approximately 104.7 hectares and is located approximately 3 kilometres northwest of Limerick City and suburbs and 6.7 kilometres east of Sixmilebridge in southeast County Clare. Moving west to east, the site encompasses the townlands of Glennagross, Ballycar North, Cappateemore East, Ballycannan West, Ballycannan East and Ballycar South.

The elevated site is situated within a rural landscape and comprises mainly hilly and undulating terrain, with height above sea level ranging from approximately 60 metres above ordnance datum (AOD) in southwestern areas to 262 metres AOD in northern and northeastern areas of the site. The site topography generally slopes southwards giving panoramic views of Limerick City and the Shannon Estuary to the south. A series of hills form a ridgeline along the northern boundary of the site. Refer to **Figure 4-1**, below. Heading north from the R464, the site is accessed from Limerick City via two Local Roads - one to the west and one to the east - running parallel on either

side of the proposed development site. Access to the west section of the site is via a local road connected to Meelick/Knockalisheen Road (Local Road) to the south, and access to the east section of the site is via a private farm track connected to Ballycar South Road (Local Road) to the east.

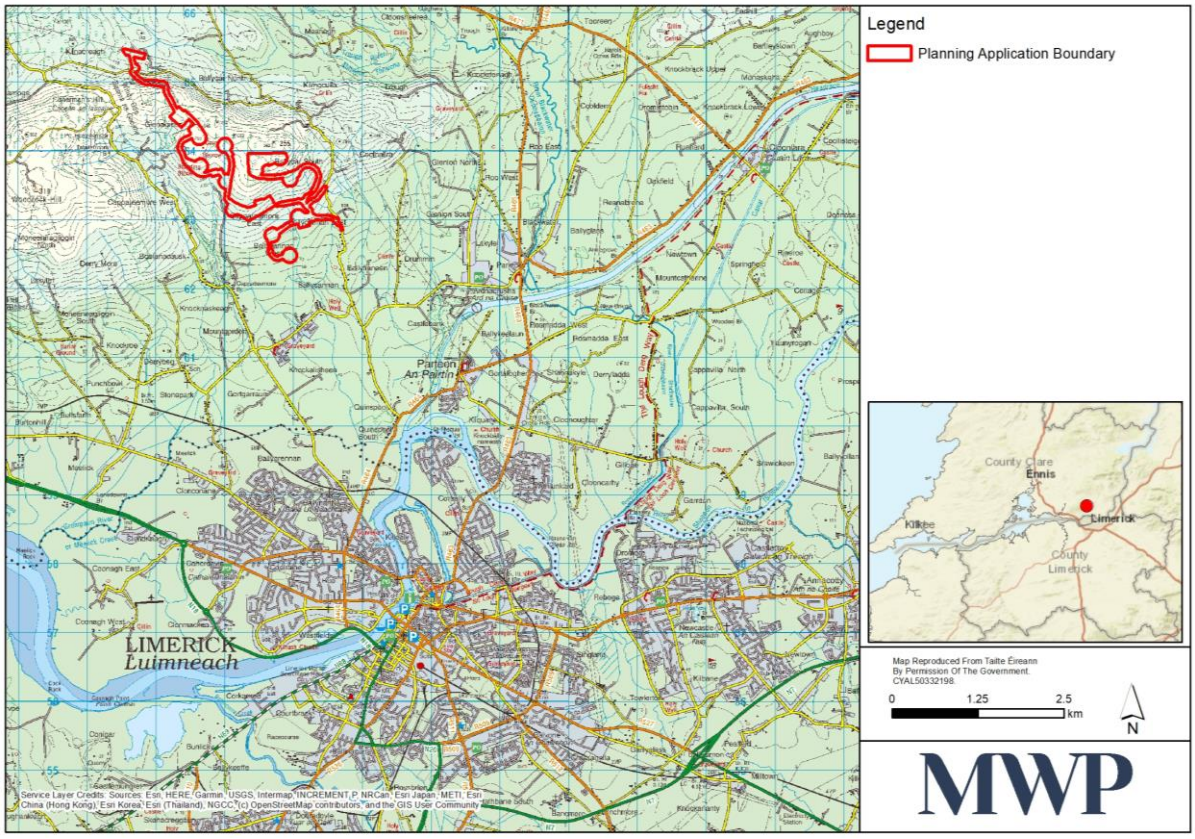

Figure 4-1: Location of proposed development site at Ballycar in County Clare.

4.2 Brief Project Description

It is proposed to erect a twelve (12) No. turbine wind farm at a location in southeast County Clare, approximately 3 kilometres northwest of Limerick City and suburbs. The total footprint of the site encompassing twelve wind turbines, access tracks, crane hardstand areas, underground high voltage collector circuit cables, substation compound, permanent meteorological mast, borrow pit, material deposition areas and temporary construction compound is approximately 104.7 hectares.

Electrical energy generated by the proposed windfarm will be exported to a new substation located approximately 340 metres northwest of T1 via the installation of an underground network of cables throughout the development. A new underground 110kV collector cable measuring approximately 1.5 kilometres will run northwestwards from the new substation and connect to National Electricity Grid (NEG) via an existing 110kV overhead line.

The characteristics of the project and the project design are described in detail in **Section 4.4,** below, in **Chapter 3 Civil Engineering**, in **Volume II** of the **EIAR**, and **Planning Drawings 22156-MWP-00-00-DR-C-5005** to **5006,** and **22156-MWP-00-00-DR-C-5401** to **5412**.

The proposed development lands include lands under the ownership of forestry companies and privately-owned lands under agreement with Ballycar Green Energy. All proposed turbine locations are within areas that have been

designated as strategic for wind energy development in the Clare County Development Plan (2023 – 2029)[7] (see **Figure 4-2**, below).

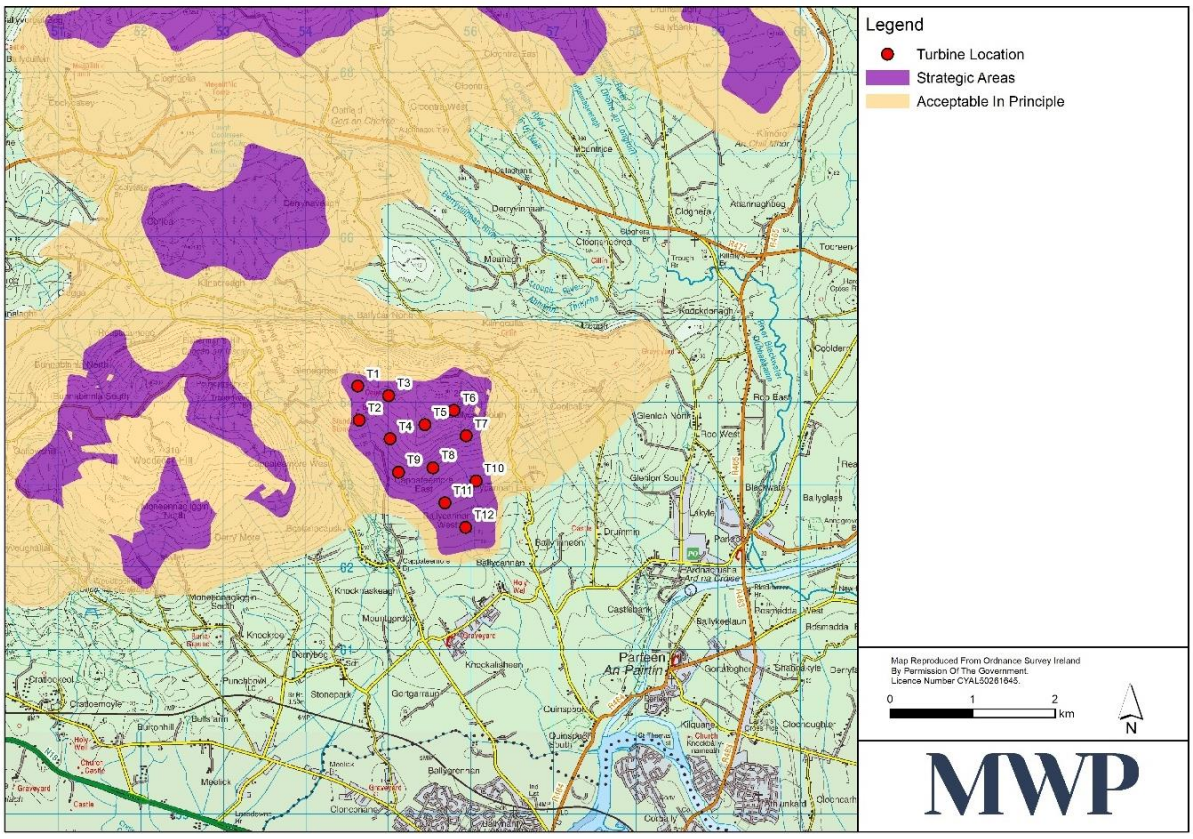

Figure 4-2: Wind energy zoning of lands within and around the proposed development site as designated in the Clare Wind Energy Strategy 2023 – 2029.

4.3 Purpose of the Proposed Project

The purpose of the project is to generate electrical energy from a renewable resource by means of a commercially viable 12-turbine wind farm which will supply electricity to the National Electricity Grid (NEG).

4.4 Description of the Existing Site

4.4.1 General Site Description

The wind farm site is located within the Electoral Divisions (EDs) of 'Ballycannan' (ED 16105) and 'Cloontra' (ED 16110). During the 2016 census, 'Ballycannan' ED was found to have a total population of 1,166 residents, occurring primarily within the small rural settlements of Meelick and Ballycannan. The 'Cloontra' ED was found to have a total of 270 persons resident and comprised mainly of one-off housing and ribbon development along the local road network[8].

The proposed development site comprises predominantly farmland (a mixture of both marginal and more improved areas), used primarily as grazing for cattle. Commercial forestry plantations also occurs within the site boundary and makes up a considerable portion of the northern part of the site.

[7] Stage 3 - Adoption of Plan | Stage 3: Amendments | Clare County Council (clarecoco.ie) Accessed: 6th July 2023
[8] Central Statistics Office - Census 2016 Small Area Population Statistics (arcgis.com) Accessed: 9th December 2022

Lands surrounding the site are predominantly used for agricultural purposes, interspersed with conifer plantations and single residential dwellings. An operational quarry is located directly north of the site, comprising an existing working area of 16.9 hectares with planning approval for a 10-hectare extension, and an existing concrete batching plant. Ardnacrusha hydroelectric power station is located approximately 2.5 kilometres southeast of the site.

The CORINE[9] (2018) land cover categories for the development site are comprised mainly of 'Pastures' and 'Coniferous forests' (refer to **Figure 4-3**, below). To the west and south-west of the site, linear riparian woodland occurs along the route of the Crompaun (East) River, set within a predominantly agricultural landscape. This band of woodland comprises 'Broadleaved forests'. Extending away from the site, 'Pastures' make up the dominant land cover category with large areas of 'Land principally occupied by agriculture with significant areas of natural vegetation', as well as pockets of 'Transitional woodland scrub'. Woodcock Hill, situated approximately 2.2 kilometres west of the site, comprises 'Peat bogs'[10].

A review of bedrock mapping determined that the geological units underlying the site are identified as 'Palaeozoic, Silurian' to the west, 'Palaeozoic, Upper Devonian – Carboniferous' within central and eastern sections and 'Palaeozoic, Carboniferous, Mississippian' to the south of the site. Soils within the site are categorised as 'Lithosols, Regosols' (shallow well-drained mineral - mainly acidic), 'Podzols (Peaty), Lithosols, Peats' (predominantly shallow soils derived from non-calcareous rock or gravels with/without peaty surface horizon), 'Surface water Gleys (Shallow), Ground water Gleys (Shallow)' (derived from mainly non-calcareous parent materials) and 'Surface water Gleys, Ground water Gleys' (derived from mainly non-calcareous parent material)[11].

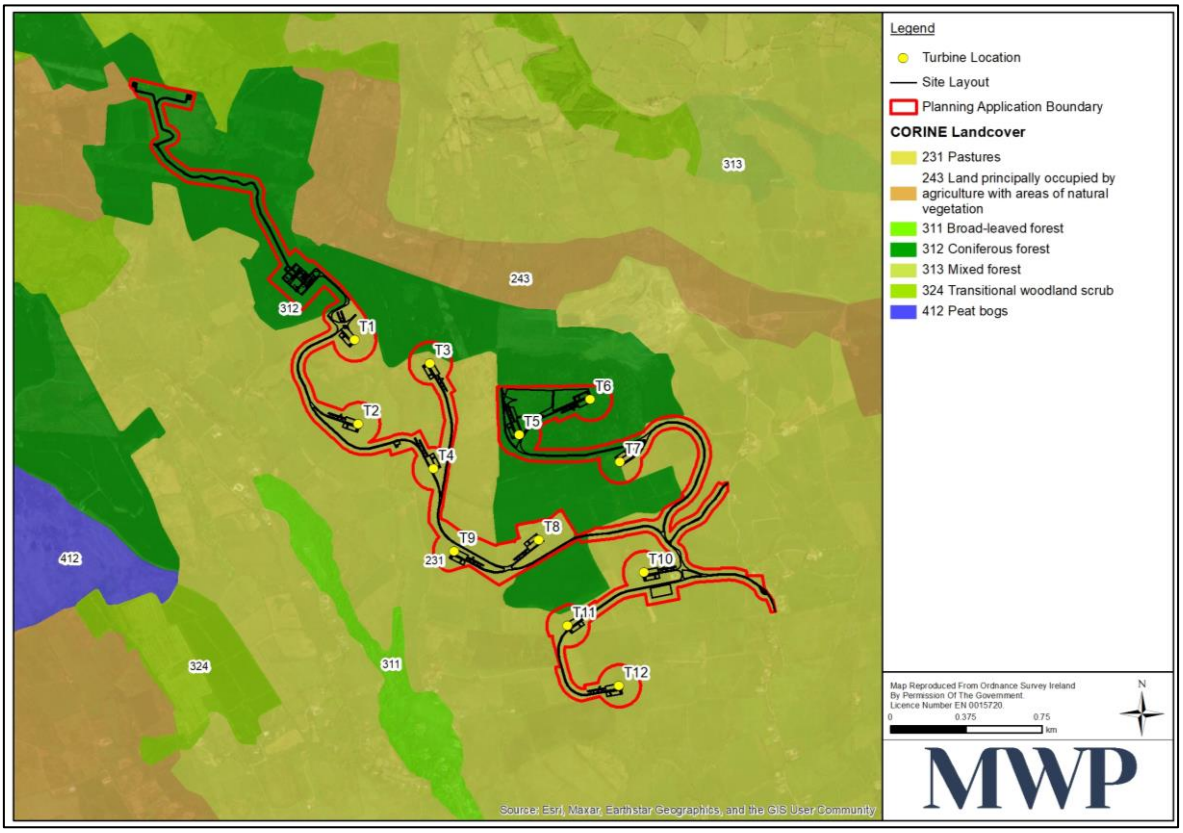

Figure 4-3: CORINE landcover of the proposed Ballycar Wind Farm site in County Clare.

[9] **C**o-**OR**dinated **IN**formation on the **E**nvironment – data series initiated in 1985 by the European Commission to gather environmental data.
[10] EPA Maps Accessed: 9th December 2022
[11] https://www.heritagemaps.ie Accessed: 9th December 2022

4.4.2 Hydrology and Hydrogeology

The five westernmost turbines – T1, T2, T3, T4, and T9 – of the proposed development are located within the Water Framework Directive (WFD) Owenogarney_SC_020 sub-catchment which are in turn situated within the Shannon Estuary North Catchment (27).

A review of the EPA map-viewer determined that the 1st Order Cappateemore East Stream is mapped within the western section of the subject site. A constituent of the Crompaun (East)_010 River Waterbody[12], the source of the Cappateemore East Stream is located to the northwest of the study area between T1 and T3. From here, the stream travels southwards for approximately 1.6 river kilometres[13] through farmland, briefly passing through the proposed development boundary near T2 and T4, before merging with the 3rd Order Crompaun (East) River (see **Figure 4-4,** below).

The upper reaches of the Crompaun (East) River and its tributaries (including the Glennagross Stream and an unnamed stream whose source lies adjacent to the proposed substation location) lie further to the west, outside the proposed development boundary. After being joined by the Cappateemore East Stream, the Crompaun (East) River continues southwestwards, eventually draining to the Upper Shannon Estuary Transitional Waterbody[14] west of Limerick City. The lower reach of the Crompaun (East) River and the estuary into which it drains are encompassed within the boundary of both the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). The Lower River Shannon SAC is located approximately 1.6 river kilometres downstream from watercourse crossing WC6 and WC7[15] while the River Shannon and River Fergus Estuaries SPA is located approximately 6.6 river kilometres downstream of WC1. See **Figure 4-4,** below.

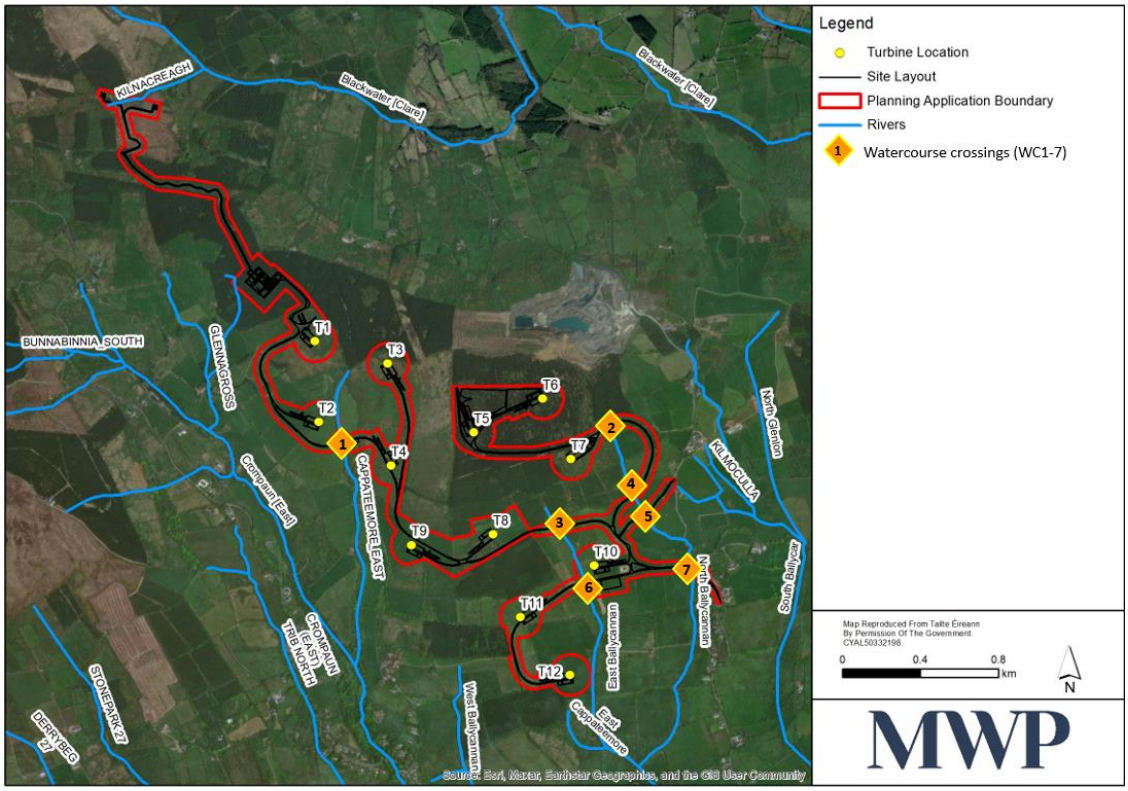

Figure 4-4: Watercourses at the proposed development site and locations of the seven watercourse crossings necessary to accommodate internal access tracks.

[12] EPA River Waterbody Code: IE_SH_27C090600
[13] River kilometres (rkm): measure of the distance in kilometres along the path of a watercourse (as opposed to a linear measure such "as the crow flies").
[14] EPA Transitional Waterbody Code: IE_SH_060_0800
[15] WC – Watercourse Crossings. See **Figure 4-4**, above, and **Table 20**, below, for locations.

The seven easternmost turbines – T5, T6, T7, T8, T10, T11, and T12 – are situated in the Shannon [Lower]_SC_100 sub-catchment which in turn is situated within the Lower Shannon Catchment (25D). There are four watercourses mapped within this catchment including the North Ballycannan River and three of its tributaries - the 1st Order East Cappateemore and East Ballycannan Streams, and the 2nd Order West Ballycannan River (see **Figure 4-4,** above). All four watercourses are part of the North Ballycannan_010 River Waterbody[16].

The East Ballycannan Stream flows southwards past T10 and T12 and merges with the North Ballycannan River south of T12. The North Ballycannan Stream then continues southwards away from the proposal site eventually veering east and draining to the estuarine waters of the Shannon Estuary north of Limerick City. This stretch of the estuary is identified as the Limerick Dock Transitional Waterbody[17]. The lower reaches of the North Ballycannan Stream and this section of the Shannon River are also encompassed within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

Approximately 1.3 kilometres of the northern end of the proposed underground collector cable (UGC) is also located within the Shannon [Lower]_SC_100 sub-catchment (see **Figure 4-4**, above), and approximately 0.11 kilometres from where it joins the overhead lines of the National Grid, the UGC will cross the 1st Order Kilnacreagh Stream. The Kilnacreagh Stream rises at a location approximately 1.1 kilometres northwest of the proposed substation location and is part of the Blackwater (Clare)_010 River Waterbody[18]. It runs from southwest to northeast before merging with the 2nd Order Blackwater [Clare] River approximately 0.55 river kilometres downstream from the Stream's source. The Blackwater [Clare] River continues eastwards before veering southwards and eventually draining into the River Shannon near Ardnacrusha Power Station approximately 18 river kilometres downstream of where the 1st Order Kilnacreagh Stream first joined the Blackwater [Clare].

Internal site tracks will require the crossing of seven minor watercourses at locations shown in **Figure 4-4,** above, and in **Table 20**, below. These crossings are located between 1.6 and 6.6 river kilometres upstream of the Lower River Shannon SAC, and between 6.6 and 8.7 river kilometres upstream of the River Shannon and River Fergus Estuaries SPA. These watercourse crossings are discussed further in **Section 4.6.4.1**, below, and in full in Section 3.13.3 in **Chapter 3 Civil Engineering**, in **Volume II** of the **EIAR**.

Compliance with the reporting requirements of the WFD (Directive 2000/60/EC) obliges each member state to publish reports providing summary information about individual waterbodies relating to their status, risks and objectives. The WFD Status (2016 – 2021) of the Crompaun (East)_010 River Waterbody is 'Poor'. The nearest downstream EPA water quality monitoring station to the proposed development site is located at 'Cappateemore Bridge'[19], approximately 1.5 river kilometres downstream of the proposed site boundary at T9. The latest river Q value at this location is 'Q3-4, moderate', recorded by the EPA in 2022. The Crompaun (East)_010 waterbody has been assigned a WFD risk status of 'At risk'[20]. A review of the '*Owenogarney_SC_020 Sub-catchment Assessment WFD Cycle 2*' report[21] determined that the following pressures have been identified with regard to this waterbody: channelisation, forestry, embankments, wastewater discharge and agriculture. The Transitional Waterbody WFD latest status (2016 – 2021) of the Upper Shannon Estuary, into which the Crompaun (East) River drains, is 'Poor'.

The WFD Status (2016 – 2021) of the North Ballycannan_010 River Waterbody is 'Good'. There are no EPA water quality monitoring stations located along this waterbody. The North Ballycannan_010 River Waterbody has been assigned a WFD risk status of 'Not at risk'. The WFD Status (2016 – 2021) of the Blackwater (Clare)_010 River Waterbody is 'Good'. The nearest downstream EPA water quality monitoring station to the proposed development site is located at the 'Bridge southeast of Cappanagh'[22], approximately 4 river kilometres

[16] EPA River Waterbody Code: IE_SH_25N170970
[17] EPA Transitional Waterbody Code: IE_SH_060_0900
[18] EPA River Waterbody Code: IE_SH_25B060120
[19] EPA Station Code: RS27C090300
[20] *At risk* - either the waterbody is currently not achieving its WFD environmental objective of Good or High Ecological Status, or there is an upward trend in nutrients/ammonia and should this trend continue, the waterbody Status will decline by the end of Cycle 3 and will fail to meet its environmental objective (EPA, 2021a).
[21] Subcatchment Assessment (catchments.ie) Accessed: 9th December 2022
[22] EPA Station Code: RS25B060030

downstream from where the Kilnacreagh Stream rises. The latest river Q value at this location is 'Q4, good', recorded by the EPA in 2006. The Blackwater (Clare)_010 River Waterbody has been assigned a WFD risk status of 'At risk'. A review of the '*Shannon [Lower]_SC_100 Sub-catchment Assessment WFD Cycle 2*' report[23] determined that agriculture has been identified as a pressure on the waterbody. The WFD latest status (2016 – 2021) of the Limerick Dock Transitional Waterbody into which the North Ballycannan Stream drains, is 'Poor'.

The five westernmost proposed turbines overlie the 'Tulla-Newmarket-on-Fergus' ground waterbody (GWB)[24] while the rest of the proposed development overlies the Lough Graney GWB[25]. Both are described on the EPA website as 'Poorly productive bedrock' with latest Ground Waterbody WFD status (2016–2021) of 'Good'.

4.4.3 Habitats

Refer to **Appendix 2** for a habitat map of the entire proposed development site and study area, the extent of which is indicated in **Figure 3-1**, above.

The dominant habitats[26] occurring at the subject site comprise **Conifer plantation (WD4)** and **Improved agricultural grassland (GA1)** (refer to **Plate 1**, below). Dominant species of the **Conifer plantation (WD4)** are Sitka spruce (*Picea sitchensis*) and lodge pole pine (*Pinus contorta*). **Improved agricultural grassland (GA1)** is particularly common at lower elevations to the southwest and southeast and is typically species-poor and dominated by rye grasses (*Lolium* spp.) due to intensive management of pasture for cattle grazing and silage harvesting. Species recorded include creeping buttercup (*Ranunculus repens*), dock (*Rumex* spp.), white clover (*Trifolium repens*), ribwort plantain (*Plantago lanceolata*), daisy (*Bellis perennis*), and dandelion (*Taraxacum* spp.).

Plate 1. The two predominant habitats at the proposed development site – 'Conifer plantation (WD4)' (left) and 'Improved agricultural grassland (GA1)', (right).

Dry-humid acid grassland (GS3) occurs in mosaic with **Improved agricultural grassland (GA1)** in pockets within the northern half of the site. Overall, these areas, comprise marginal, rush-dominated farmland exhibiting signs of extensive cattle activity (trampling, over-grazing, exposed soil) with increased moss cover, devil's bit scabious (*Succisa pratensis*), and sheep's sorrel (*Rumex acetosella*) also apparent. **Wet grassland (GS4)** also occurs in mosaic with **Improved agricultural grassland (GA1)** in central and southern areas of the site (see **Plate 2**, below). A species-rich area of **Wet grassland (GS4)** is located within a field north of the proposed location for T9, comprising grass species such as Yorkshire fog (*Holcus lanatus*), crested dog's-tail (*Cynosurus cristatus*), rough meadow-grass (*Poa trivialis*), and sweet vernal grass (*Anthoxanthum odoratum*).

[23] Subcatchment Assessment (catchments.ie) Accessed: 9th December 2022
[24] EPA GWB Code: IE_SH_G_229
[25] EPA GWB Code: IE_SH_G_157
[26] Habitats as categorised by Fossitt (2000), available at A Guide to Habitats in Ireland - Fossitt.pdf (npws.ie) Accessed: 9th December 2022

Wet heath (HH3) was recorded in the north of the site bordered by **Conifer plantation (WD4)** to the northwest, northeast and east and **Dry-humid acid grassland (GS3)** to the west and south (see **Plate 2**, below). The heath habitat comprised three heather species - ling heather (*Calluna vulgaris),* bell heather (*Erica cinerea*), and cross-leaved heath (*Erica tetralix*) - with ling being the most abundant. Other species present included Purple moor grass (*Molinia caerulea*), deergrass (*Trichophorum caespitosum*), heath rush (*Juncus squarrosus*), bilberry (*Vaccinium myrtillus*), tormentil (*Potentilla erecta*), bugle (*Ajuga reptans*), heath milkwort (*Polygala serpyllifolia),* and green-ribbed sedge (*Carex binervis*) with pockets of *Sphagnum* mosses also recorded.

Plate 2. 'Wet grassland (GS4)' (left) within central areas of the site, and 'Wet heath (HH3)' surrounded by 'Conifer plantation (WD4)' within the mid-northern part of the site (right).

Treelines (WL2) and **Hedgerows (WL1)** within the study area delineate field boundaries and border access tracks while also adjoining drainage ditches (see **Plate 3**, below). **Treelines (WL2)** habitat mainly comprises single rows of sitka spruce, likely planted as wind breakers and field boundaries. **Hedgerows (WL1)** are typically comprised of willows (*Salix* spp.), blackthorn (*Prunus Spinosa*), hawthorn (*Crataegus monogyna),* bramble (*Rubus fructicosus*) and gorse (*Ulex europaeus*). Large mature trees were more frequent in the well-established species-rich hedgerows located in the centre, southwest and northeast sections of the study area. These tree species included ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*), oak (*Quercus robur*), beech (*Fagus sylvatica*) and hazel (*Corylus avellana*), with the occasional rowan (*Sorbus aucuparia*) and holly (*Ilex aquifolium*) tree.

Plate 3. 'Mixed broadleaved woodland (WD1)' along the banks of East Ballycannan stream within the site (left), and 'Treelines (WL2)' delineating field boundaries, often occurring with 'Hedgerows (WL1)', (right).

Mixed broadleaved woodland (WD1) occurs throughout the study area either as individual stands or bounding watercourses such as the 'East Ballycannan' watercourse, located at the southeast extent of the study area (see Plate 3, above) where the dominant broadleaf species were hazel and ash, with some willow and sycamore. The ground flora in the area was lush with fern species such as shield ferns (*Polystichum* spp.), hart's tongue (*Asplenium* spp.), and scaly male fern (*Dryopteris affinis*). Other ground flora recorded included lords and ladies (*Arum maculatum*), common dog violet (*Viola riviniana*), wood avens (*Geum urbanum*), sanicle (*Sanicula europaea*), bluebell (*Hyacinthoides non-scriptus*), and ivy (*Hedera hibernica*).

Several patches of Dense bracken (HD1) also occur throughout the site. Most existing farm tracks are classified as Spoil and bare ground (ED2) while farm buildings and yards are classified as Buildings and artificial surfaces (BL3). The watercourses draining the study area are classified as Eroding/upland rivers (FW1) with details of their physical characteristics outlined in the Aquatic Ecology Report in Appendix 6C of Volume III of the EIAR.

The proposed substation location is within an area of Conifer plantation (WD4) northwest of T1. The substation access track and grid connection route are located mainly within stands of Conifer plantation (WD4) and along existing forestry firebreaks and tracks comprised of Scrub (WS1).

4.4.4 Rare and Protected Flora

No rare or protected flora species were recorded during any of the ecological surveys.

4.4.5 Invasive Alien Plant Species (IAPS)

Documented NBDC records of high-impact invasive species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 exist within the hectad R56 encompassing the study area for giant hogweed (*Heracleum mantegazzianum)*, Himalayan balsam (*Impatiens glandulifera)* and Japanese knotweed (*Fallopia japonica).* Documented records of medium-impact invasive species listed on the Third Schedule also exist for Himalayan knotweed (*Persicaria wallichii).* Invasive species recorded in the NBDC database that are not listed on the Third Schedule include sycamore (*Acer pseudoplatanus)* and winter heliotrope (*Petasites fragrans)*.

During the multidisciplinary ecological field surveys of the site carried out between 2021 and 2023, two invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 were recorded; Japanese knotweed and Himalayan balsam. Cherry laurel (*Prunus laurocerasus)* was also recorded within the study area. No other invasive plant species were recorded during ecological surveys. Himalayan balsam was the most frequently encountered IAPS and was recorded at 22 locations. There were extensive infestations within the study area, mainly in central and southeastern sections (see Plate 4, below).

Japanese knotweed was recorded growing in the centre of a farm track along the boundary of an improved agricultural grassland field in the west section of the study area. It was noted that the infestation was not established since only three plants measuring no more than 20 centimetres high were recorded, and it is likely that it was introduced to the site in contaminated material used to build the farm track. A second infestation of Japanese knotweed was recorded within a hedgerow at a farm track near the farm holding southeast of the study area. The infestation comprised of a single but established plant measuring approximately 15 metres in height growing outwards from the hedgerow (see Plate 4, below).

Cherry laurel was recorded at six locations along hedgerows and field boundaries towards the centre and north of the study area. Although not listed under the Third Schedule of the European Communities Regulations, cherry laurel is also considered to be a high-impact invasive species.

No other invasive plant species were recorded during ecological surveys.

For more details, refer to the **IAPS Report and Management Plan** in **Appendix 6F** of **Volume III** of the **EIAR**, and to **Chapter 6 Biodiversity**, of **Volume II** of the **EIAR**.

Plate 4. Extensive Himalayan balsam infestations along drainage ditches within the study area (left), and Japanese knotweed growing outwards from the hedgerow over farm track (right).

4.4.6 Non-volant Mammals

The importance of the proposed development site is discussed hereunder with respect to otter (*Lutra lutra*). However, badger (*Meles meles*), pine marten (*Martes martes*) and several other terrestrial mammals were also recorded within the study area - for more details on all mammals documented during the MWP surveys, refer to the **Non-volant Mammal Survey Report** in **Appendix 6B** of **Volume III** of the **EIAR**, and to **Chapter 6 Biodiversity**, in **Volume II** of the **EIAR**.

4.4.6.1 Otter

No evidence of otter was recorded during any of the ecological field surveys and no otter breeding/resting places were identified within the study area nor were any prints or spraints found. There are records of otter in the greater area extending away from the site, none of which are hydrologically connected to the development site.

There are no documented records of otter held by the NBDC within the proposed development site. However, there are records of otter in the surrounding area[27]. The closest otter record is located on a 'stream south of Cappateemore' approximately 0.4 river kilometres downstream from where the Cappateemore East River merges with the Crompaun [East] River south of the subject site boundary. This record, identified by the EPA in 1980, pertains to two counts of droppings. Another record exists for otter from the 'stream east of Ballycannon House', identified as the South Ballycar river by the EPA, located approximately 1.2 kilometres from the closest point of the wind farm site boundary. Again, this record pertains to droppings at this location, recorded in 1980.

There are no suitable fish habitats within the proposed development site as all waterbodies are too small. Although minor watercourses within the subject site may have some potential as foraging or commuting habitat, they do not support any notable fish populations that would make it energetically feasible for foraging otter and are considered to comprise sub-optimal habitat for the species.

The lower reaches of the watercourses draining the proposed development site support fish species such as brown trout (*Salmo trutta*) and European eel (*Anguilla anguilla*), making it more likely that these larger watercourses located further downstream are more suitable for foraging, and potentially breeding otter.

[27] https://maps.biodiversityireland.ie/Map Accessed: 13th November 2022

4.4.7 Freshwater Aquatic Ecology

4.4.7.1 Aquatic Habitats

The physical characteristics of each survey site are listed in **Table 3**, below.

The watercourses within the boundary of the proposed development site and indeed the upper reaches of all watercourses draining the proposed development site are high gradient streams considered prone to drying out during prolonged dry spells, based on the water levels observed in June 2021. These upper reaches therefore were deemed to have limited lotic[28] carrying capacity. These reaches are generally fast flowing and of a spate[29] nature thereby exhibiting a fast response to rainfall. They are categorised as eroding/upland rivers (FW1) (Fossitt, 2000). The only aquatic vegetation recorded at the aquatic survey sites were (collectively) bryophytes *Leptodictyum riparium, Conocephalum* sp., *Chiloscyphus polyanthos,* and filamentous algae. Cyanobacteria *Lyngbya* were recorded at Site 10 (see **Plate 5**, below). At lower elevations, streams have lower gradients with generally finer particle sizes and smoother flows.

Excessive siltation and algal growth were observed at several survey sites (see **Plate 5**, below). This is considered a result of land management practices associated with activities such as agriculture and commercial forestry. For example, cattle access to the Cappateemore East Stream was found to be adversely affecting substrate quality and water quality because of excessive sedimentation. Water level and flow at Sites 5 to 8 were very low during the surveys - such flows can lead to loss of sensitive macroinvertebrate taxa and biomass due to the decreased buffering capacity i.e. rapid changes in temperature, oxygenation, etc.

Table 3. Physical characteristics of the twelve aquatic survey sites (see Figure 3-2, above, for locations).

Physical characteristics	Aquatic Survey Site											
	1	2	3	4	5	6	7	8	9	10	11	12
Wetted width (m)	1.5	1	1.2	3	0.5	0.8	1	0.4	1.3	1.7	4	0.3
Mean depth (cm)	5	5	3	10	2	3	4	2	5	5	20	<5
Max depth (cm)	40	30	10	60	15	5	15	4	20	35	80	5
Bedrock	5	0	5	0	0	0	0	0	20	10	0	0
Boulder (%)	15	55	25	60	5	5	30	0	20	20	5	5
Cobble (%)	20	20	30	25	15	55	30	50	25	35	50	35
Gravel (%)	40	20	30	10	70	25	20	30	20	30	30	45
Sand (%)	20	5	10	5	10	5	15	5	15	5	10	10
Silt (%)	0	0	0	0	0	10	5	15	5	0	5	5
Overlying silt (%)	30	10	50	55	20	30	60	75	30	50	40	10
Plume^	M	M	H	H	M	H	H	H	M	M	H	H
Riffle (%)	55	70	60	45	35	30	25	35	25	50	30	25
Glide (%)	10	5	15	20	0	10	5	5	25	20	40	25
Pool (%)	35	25	25	35	65	60	75	60	50	30	30	50
Algal cover (%)	2	0	0	10	0	55	0	0	0	<1	45	0
Instream vegetation (%)	5	0	5	10*	0	0	0	0	0	0	5	0
Shade (%)	95	90	80	55	85	30	95	75	85	50	70	100
Bank cover (%)	60	100	50	95	100	25	45	100	90	95	75	75

^ **H**eavy, **M**oderate, **S**light, **N**one
* In-stream vegetation of bryophytes

[28] Of organisms or habitats inhabiting or situated in rapidly moving fresh water.
[29] Fed by rainwater from overland flow.

Plate 5. Cyanobacteria *Lyngbya* (left), and siltation/algal growth at Site 4 on Crompaun East Stream (right).

4.4.7.2 Macroinvertebrates

4.4.7.2.1 *Macroinvertebrate Habitat*

Based on the physical attributes of the survey sites and assessment criteria, the sites are generally rated between marginal and suboptimal. This rating was applied to sites mainly due to the domination of substrates by one size class (rock/cobble), owing to their high gradient, suboptimal habitat complexity, coupled with mainly marginal pool quality (<1m deep), bank stability (eroding in some instances) and canopy conditions (excessive shade). Habitats of this classification can limit taxa richness as there are fewer ecological niches available. The physical habitat suitability assessment of survey sites for macroinvertebrate production is provided in Table 4, below.

Table 4. Physical habitat assessment of the survey sites regards suitability for macroinvertebrate production (adapted from Barbour & Stribling, 1991).

Site	Watercourse	Bottom substrate	Habitat complexity	Pool quality	Bank Stability	Bank Protection	Canopy	Score	Overall Assessment*
1	Crompaun	20	15	10	20	20	15	100	suboptimal
2	Glennagross	10	5	5	5	5	10	40	poor
3	Cappateemore East	20	20	10	15	15	15	95	suboptimal
4	Crompaun East	15	5	5	15	10	10	60	marginal
5	North Ballycannan	10	5	5	15	15	10	60	marginal
6	North Ballycannan	10	5	5	10	10	10	50	marginal
7	West Ballycannan	15	5	5	15	15	10	65	marginal
8	South Ballycar	20	15	10	20	15	15	95	suboptimal
9	South Ballycar	20	15	10	20	20	20	105	suboptimal/optimal
10	West Roo	20	15	10	20	20	15	100	suboptimal
11	Blackwater (Clare)	20	15	15	20	15	15	100	suboptimal
12	Kilnacreagh	10	10	0	5	4	5	35	marginal

** Scale: poor (0-25); marginal (26–50); suboptimal (51-75); optimal (75-100)*

4.4.7.2.2 *Macroinvertebrate Diversity and Abundance*

Most macroinvertebrates recorded belong to pollution sensitivity group C (pollution tolerant) (Toner *et al.*, 2005).

Mayfly (Ephemeroptern) larvae of pollution-tolerant (Group C) *Baetis rhodani* were among the most widespread and abundant macroinvertebrate and abundance ranged from 'common' to 'numerous'[30] where encountered. Larvae of Group B *Baetis muticus* were less common. Pollution-sensitive (Group A) mayfly larvae were limited to *Ecdyonurus* spp., which was sparse throughout the study area and *Rhithrogena semicolorata* (moderate distribution, 'few – common'). Larvae of less sensitive stonefly *Leuctra* sp. and pollution sensitive *Chloroperla* sp. were generally 'few' throughout the study area and occurred at less than 50% of sites. The Trichoptera were a well-represented group with three cased (Group B) taxa and four caseless (Group C) taxa recorded (see Plate 6, below). Cased caddisfly larvae of Limnephelidae and caseless caddisfly larvae of *Hydropsyche* sp., trumpet-net caddisflies (Polycentopodidae), finger-net caddisflies (Philopomatidae) and *Rhyacophila* sp. were well distributed across the survey sites but were generally scarce.

Dipteran larvae accounted for a significant proportion of the macroinvertebrate community at the survey sites. The most abundant true fly larvae were pollution-tolerant Simulidae (common-numerous) and *Chironomous* spp. ('few – common'). Across the entire study area, the crustacean *Gammarus deubeni* was deemed the most widespread and abundant macroinvertebrate, while *Asellus aquaticus* was recorded at Site 3 only.

Plate 6. Larvae of the caseless Hydropsychidae, Polycentropodidae and Philopotamidae caddisflies (left), and Stonefly larvae of *Chloroperla* spp. (right).

Site 11 on the Blackwater River had several macroinvertebrate taxa not recorded at Sites 1 – 10 including the pollution-sensitive large pale stonefly *Perla bipunctata, Dinocras cephalotes,* and two species of brown stoneflies (Nemouridae), the cased caddis *Athripsodes* spp., the whirligig beetle *Gyrinus substriatus*, *Brychius elevatus* and *Hydraena* spp. as well as the wandering snail *Radix balthica.* This increased diversity at Site 11 (when compared to Sites 1 to 10) can be attributed to the larger size of the watercourse combined with improved water quality.

4.4.7.3 Freshwater Pearl Mussel

The freshwater pearl mussel (FPM) (*Margaritifera margaritifera*) life cycle involves an adult stage living as a filter feeder, a juvenile stage living interstitially in sediment, and a larval (glochidial) stage living attached to the gills of trout or salmon (*Salmo salar*). All life stages therefore need consideration, as does the viability of the host species of fish. FPM are flagship, keystone and umbrella[31] species (Geist, 2005) that are a key indicator of river ecosystem

[30] Few (<5%), Common (6-20%), Numerous (21-50%), Dominant (51-74%), Excessive (>75%)
[31] Protecting the pearl mussel has a positive impact on the entire river ecosystem. The most important features of an effective umbrella species are a large range size and complex habitat requirements (Caro, 2010).

quality so protecting the pearl mussel has a positive impact on the entire river ecosystem. Adults are more tolerant of a wider range of in-river conditions than juveniles (Hastie *et al.,* 2000).

'Ecological Quality Ratio' (EQR) is an expression of the relationship between the values of the biological parameters observed for a given body of surface water and the values for those parameters in the reference conditions applicable to that body. The ratio is expressed as a numerical value between zero and one, with high ecological status represented by values close to 1 and bad ecological status by values close to 0. The Freshwater Pearl Mussel Objectives (2009)[32] requirement for an EQR ≥0.90 relates to 'high status' watercourses, that is those classified as Q4-5 or Q5, as per the EPA Q-rating system[33]. Regarding the ecological quality objectives for FPM habitat, the watercourses within and adjacent to the proposed development site generally fail on criteria for macroinvertebrates, macroalgae and siltation[34] (see **Section 4.4.7.2**, above). Additionally, the study area is not within a catchment listed in the NPWS *Margaritifera* Sensitive Areas Map (refer to **Figure 4-5**, below).

[32] S.I. No. 296/2009 - The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (irishstatutebook.ie) Accessed: 5th July 2023

[33] Quality Rating (Q) System devised by Toner *et al.* (2005). This method categorises invertebrates into one of five groups (A-E), depending on their sensitivity to pollution. Q values range from Q1-Q5 with Q1 being the poorest quality and Q5 being pristine/unpolluted conditions. The system is used by the EPA and, under the WFD, is the standard biological assessment technique used when surveying rivers in Ireland.

[34] The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 to 2018.

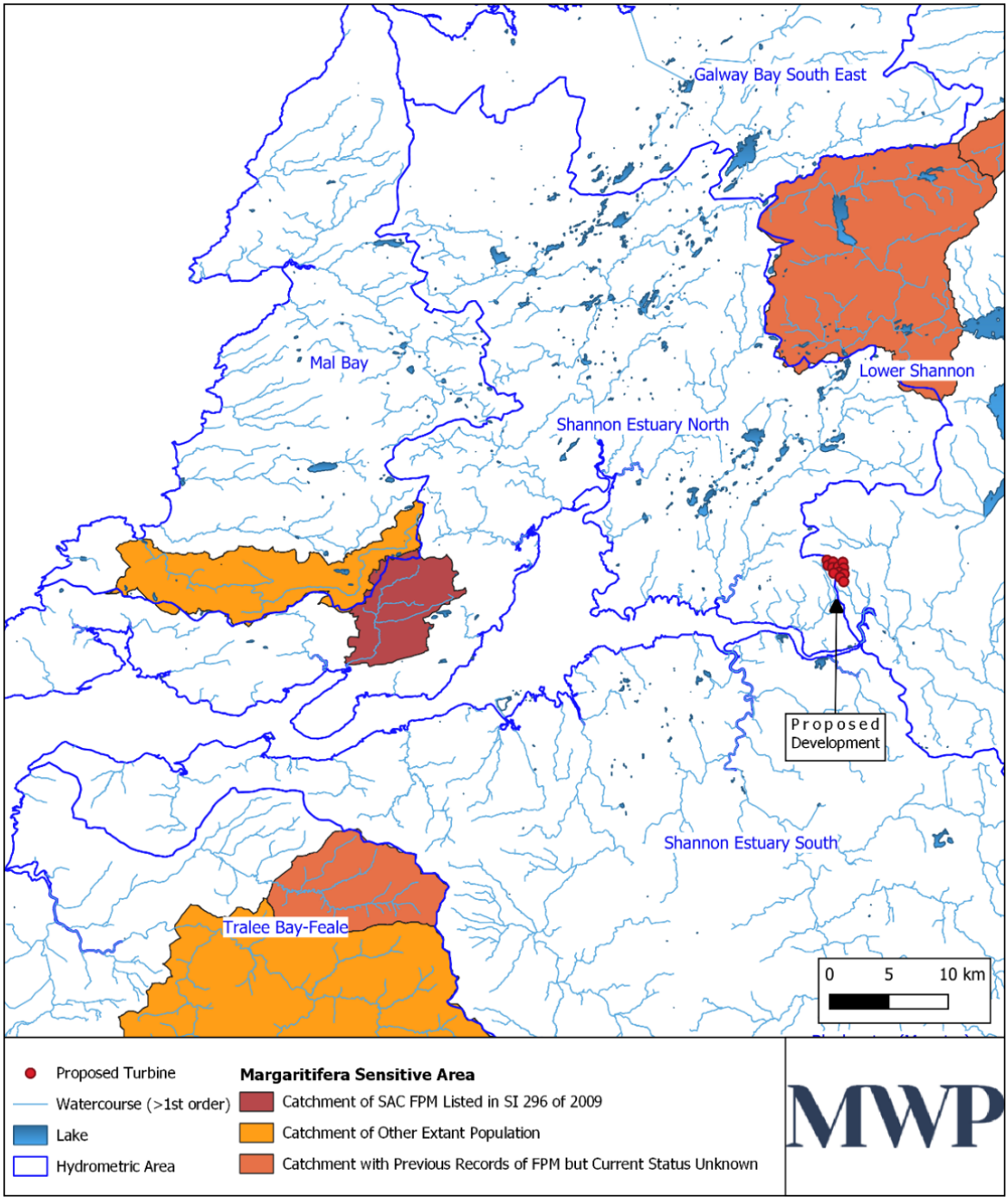

Figure 4-5: Proposed development location in the context of NPWS mapped *Margaritifera* sensitive areas.

Drainage from the proposed development site is to the Crompaun, North Ballycannan and Blackwater (Clare) Rivers, none of which have previous FPM records. Alteration in a river's flow regime, such as that caused by drainage for forestry or agriculture, may result in summer flows being insufficient to support FPM (Moorkens *et al.*, 1992). The lower reaches of watercourses in the Crompaun and Ballycannan subbasins have been drained/modified where they occur on the floodplain, a pressure on FPM noted by Moorkens (1999), while the middle to upper reaches of channels in these catchments have insufficient base flows to support FPM.

The only watercourses considered large enough to support FPM were the North Ballycannan and the Blackwater Rivers. However, no live FPM or evidence of FPM (e.g. shells) were recorded during surveys carried out on the North Ballycannan River in 2021 nor during surveys carried out at the Blackwater (Clare) River in 2018. Findings

of the surveys carried out in the North Ballycannan Catchment are presented in Table 5, below. The sedimentation levels recorded were generally indicative of artificially induced siltation with conditions considered unfavourable in terms of the species' habitat. The lower reaches of the North Ballycannan River are modified because of drainage practises which almost certainly precludes the presence of any FPM. Water quality can negatively influence FPM habitat and the reduced macroinvertebrate diversity owing to degraded water quality at upstream locations would be a limiting factor for FPM presence.

The likelihood of FPM occurring in either the North Ballycannan River or the Blackwater (Clare) River is deemed very low considering the habitats present at each and the absence of live FPM or evidence of FPM encountered during surveys at both rivers.

Table 5. Results of FPM surveys on the North Ballycannan River draining the proposed development site

River Catchment	Segment code	Stream order	Approx. length of channel surveyed (m)	Environmental Quality Objectives (EQO)[35]			FPM population
				Filamentous algae	Macrophytes	Siltation	
North Ballycannan	25_3896	3	500	Rare	Rare	A lot of visible silt	Absent
Survey notes:	Entire channel length examined. Downstream reach deemed too sluggish and silted for FPM. Reach does not pass on the EQO's for silt. Degree of shade a likely factor in the volume of algae recorded since heavy shade reduces algal growth.						

4.4.7.4 Fish

The distribution and range of protected fish species that have previously been recorded within the hectad R56 are detailed in Table 6, below, based on Article 17 (2013-2018) Assessments in NPWS (2019).

Table 6. Distribution and range of aquatic Annex II habitats and species* listed within the hectad R56.

Annex II habitat/species	Code	Current distribution	Current range	Likely reason for distribution within hectad R56
Floating river vegetation	3260	Yes	Yes	The extent of this habitat has not been mapped and the area is based on the distribution of rivers. There are no particularly important watercourses draining the proposed development site with respect to 3260.
Sea lamprey (*Petromyzon marinus*)	1095	No	No	n/a
River lamprey (*Lampetra fluviatilis*)	1099	Yes	Yes	Part of the River Shannon, which supports this species occurs within R56.
Brook lamprey (*Lampetra planeri*)	1096	No	Yes	n/a
Atlantic salmon (*Salmo salar*)	1106	Yes	Yes	Part of the River Shannon, which supports this species occurs within R56.
White-clawed crayfish (*Austropotamobius pallipes*)	1092	No	Yes	Part of the River Shannon, which supports this species occurs within R56.

**Only fish known to occur in the region have been included*

Three fish species - brown trout, European eel, and brook lamprey - were recorded during the June 2021 electrical fishing surveys of watercourses draining the proposed development site within the Crompaun (East)_010 and the North Ballycannan_010 sub-basins. Salmon, brown trout, brook lamprey, three-spined stickleback (*Gasterosteus aculeatus*), stone loach (*Barbatula barbatula*) and minnow (*Phoxinus phoxinus*) were recorded in the September

[35] Ecological Quality Objectives for FPM habitat

2018 surveys in the Blackwater River within the Blackwater (Clare)_010 sub-basin. See **Table 7** and **Plate 7**, below, for summary of results. Frog (*Rana temporaria*) was recorded at Sites 7 and 10 during electrical fishing surveys.

Apart from a small section of the UGC, the proposed development site is located within two sub-basins, namely Crompaun East_010 and North Ballycannan_010, lying adjacent to the upper transitional zone of the Shannon Estuary. The carrying capacity for fish of both sub-basins is limited due to their small drainage areas in a somewhat coastal context with watercourses that are classified as being no larger than 3rd Order. The South Ballycar and West Roo Streams at the eastern part of the North Ballycannan_010 sub-basin do not appear to support any fish.

Overall, within the Crompaun East_010 and North Ballycannan_010 sub-basins, the streams draining the proposed development site are considered sub-optimal trout habitats, poor in terms of lamprey and highly unlikely to support migratory fish populations. The Blackwater Catchment to the north of the proposed development site is important for salmon and possibly lamprey downstream of its intersection with the Ardnacrusha headrace.

Table 7. Length descriptive statistics for fish captured during the 2021 electrofishing surveys at Sites 1 to 10, and during the 2018 electrofishing surveys at Site 11.

Sub-basin	Watercourse	Site	Stream Order	Fish Species	N	Length (cm)			
						Mean	Min	Max	St. Dev.
Crompaun (East)_010	Crompaun	Site 1	2	Brown trout *(S. trutta)*	30	6.9	3.9	14	3.07
	Glennagross	Site 2	2	-	-	-	-	-	-
	Cappateemore East	Site 3	1	European eel (*A. anguilla*)	1	15	15	15	-
	Crompaun East	Site 4	3	Brown trout (*S. trutta*)	130	6.68	4.5	21	2.17
				European eel (*A. anguilla*)	4	15.05	8.2	22.5	7.15
North Ballycannan_ 010	North Ballycannan	Site 5	1	-	-	-	-	-	-
	North Ballycannan	Site 6	2	Brown trout (*S. trutta*)	25	10.87	6.7	21	4.22
				Brook lamprey (*L. planeri*)	1	13.5	13.5	13.5	-
				European eel (*A. anguilla*)	1	35	35	35	-
	West Ballycannan	Site 7	2	European eel (*A. anguilla*)	1	20	20	20	-
	South Ballycar	Site 8	1	-	-	-	-	-	-
	South Ballycar	Site 9	3	-	-	-	-	-	-
	West Roo	Site 10	2	-	-	-	-	-	-
Blackwater (Clare)_010	Blackwater (Clare)	Site 11	3	Brown trout (*S. trutta*)	19	14.7	7	16.5	4.9
				Atlantic salmon (*S. salar*)	7	10.8	6.6	13.1	2.7
				Stone loach (*B. barbatula*)	5	7.2	6.2	8.5	1
				Three-spined stickleback (*G. aculeatus*)	5	2.6	2.1	3	0.3
				Minnow (*P. phoxinus*)	2	2.6	2	3.2	0.8
				Brook lamprey (*L. planeri*)	17	3.7	3.1	4.3	0.6

4.4.7.4.1 European Eel (*Anguilla anguilla*)

Rocks in the watercourses draining the proposed development site are considered important refuges for European eel and the species is subject to European Council Regulation 1100/2007 establishing measures for the recovery of the stock of European eel. Recruitment of glass eels is 5% of the pre-1980's levels[36]. European eel is listed as 'Critically endangered' and is now red-listed according to King *et al*. (2011) in the '*Red List No. 5: Amphibians, Reptiles & Freshwater Fish*'.

European eel (see **Plate 7**, below) was recorded at Sites 3, 4, 6, and 7 within the Crompaun (East)_010 and North Ballycannan_010 sub-basins, but none were recorded within the Blackwater (Clare)_010 sub-basin at Site 11.

4.4.7.4.2 Brook Lamprey (*Lampetra planerii*)

One brook lamprey was captured at Site 6 in North Ballycannan_010 subbasin but none were recorded within the Crompaun (East)_010 subbasin. There is only a small proportion of suitable habitat for juvenile lamprey within the streams of the North Ballycannan and Crompaun East subbasins draining the proposed development site and it is considered that any lamprey in the subject watercourses occur in low densities and are brook lampreys. At Site 11 on the Blackwater River, 17 brook lamprey were captured with a mean length of 3.7 centimetres.

Lamprey likely occur in low densities in low gradient reaches of the surveyed rivers, in areas where flows are sufficiently slow to allow accumulation of fine substrates. Any lamprey species that do occur within the freshwater receiving environment of the proposed development site are deemed to be brook lamprey. Habitat for juvenile lampreys is unsuitable along high gradient reaches close to the proposed development site where there is a general lack of sand/silt deposits, a requirement for lamprey larvae (also known as ammocoetes) but improves in lower reaches of the watercourses where gradient is low.

Within the Blackwater River, migratory lampreys (sea and river lampreys) are highly unlikely to occur above the Ardnacrusha headrace where there is a steep artificial incline and, according to Reinhardt *et al. (*2009), lamprey are poor swimmers and cannot jump or climb. A perched bridge foundation on the lower reach of the Crompaun River at the R445 is also a likely barrier for migratory lampreys.

Plate 7. Fish captured during electrofishing survey: European eel, Site 7 (left), and brown trout (right), Site 6.

4.4.7.4.3 *Salmonids*

Salmonidae is the family of ray-finned fish species that includes salmon, trout and chars (*Salvelinus* spp.), known collectively as salmonids.

[36] European eel (Anguilla anguilla) | Inland Fisheries Ireland Accessed: 1st September 2023

Within the streams surveyed, a small proportion of the fluvial habitat is classified as suitable for salmonid spawning. This habitat occurs at the transitional areas between pool and riffle where flow accelerates, and depth decreases over gravel beds due to a marked change in hydraulic head over the gravel. The gravel substrates at the end of pools provide spawning areas where trout may spawn in small gravel patches between larger stones Crisp (2000). The higher gradient reaches of watercourses draining the proposed development site are considered suitable for the early life stages of salmonids. However, these reaches do not extend to within the proposed development site itself where the watercourses are smaller and considered unsuitable for holding salmonids.

The abundance of riffle (broken water), in-stream rocks, stream bed irregularities, overhanging banks and dappled shade, or combinations thereof, generally provide good salmonid nursery habitat in lower reaches of the subject watercourses. Furthermore, there are some deeper pools at the lower gradients of the watercourses that are also suitable for adult salmonids. However, many of these reaches are impacted by siltation and enrichment associated with in-stream works and denuded banks resulting in watercourses of uniform shape with reduced biodiversity. The degraded morphological character of lower reaches of the watercourses and the associated water quality problems reduces the quality of suitable salmonid spawning and nursery habitat rendering it sub-optimal.

4.4.7.4.3.1 Brown Trout (*Salmo trutta*)

With a total of 204 individuals captured across all three sub-basins, brown trout was the most encountered fish species during the electrofishing surveys. There were 160 individuals within the Crompaun (East)_010 sub-basin at Site 1 (n = 30) and Site 4 (n = 130); 25 individuals within the North Ballycannan_010 sub-basin at Site 6 (see Plate 7, above); and 19 individuals at Site 11 within the Blackwater (Clare)_010 sub-basin. These trout ranged in length (fork length) from 3.9 centimetres at Site 1 to 16.5 centimetres at Site 11 (mean length range 6.9 cm to 14.7 cm). Refer to Table 7, above.

Within the Crompaun (East)_010 and Ballycannan_010 sub-basins, the 1st Order streams draining the proposed development site are deemed too small to be of importance to trout. For example, trout were detected at Site 1 on a 2nd Order reach of Crompaun Stream but were not recorded at Site 2 on its 1st Order tributary the Glennagross Stream (see Table 7, above). There is a perched culvert on the Glennagross Stream more than 200 metres upstream of the Crompaun Stream which likely blocks the upstream passage of trout and limits their penetration into the middle reaches of the stream – see Plate 8, below.

Plate 8. A perched culvert that likely limits the upstream passage of trout located at Site 2 on the 1st Order Glennagross Stream, a tributary of the Crompaun Stream.

4.4.7.4.3.2 Atlantic Salmon (*Salmo salar*)

The watercourses within the Crompaun (East)_010 and Ballycannan_010 sub-basins that drain the proposed development site are deemed unsuitable for salmon due to their insufficient size and because of the presence of various types of impediments to fish movement, either in the form of barrages associated with tidal sluices in the Crompaun subbasin or as steep inclines as is the case within the Ballycannan subbasin. No salmon were recorded within either subbasin during the 2021 electrofishing surveys - refer to Table 7, above. Based on the rivers' characteristics and electrofishing survey results, it is concluded that salmon do not occur within the watercourses of the subbasins Crompaun (East)_010 and Ballycannan_010 draining the proposed development site.

However, the Blackwater (Clare) River within the Blackwater (Clare)_010 subbasin is suitable for salmon because it is sufficiently large and connected to the River Shannon with no barriers to species migration. During the August 2018 electrofishing surveys at Site 11 on the Blackwater River, seven individual salmon were captured ranging in length (fork length) from 6.6 centimetres to 13.1 centimetres (mean length 10.8 cm). Refer to Table 7, above.

4.4.7.5 Biological Water Quality

Biological water quality surveying determined that the watercourses within the study area are of a quality adequate to support some pollution-sensitive mayfly and stonefly larvae, and trout. Biological water quality at Site 1 and Site 4 was rated 'Slightly polluted (Q3-4)', equivalent to Water Framework Directive (WFD) 'Moderate status' due to the paucity of pollution-sensitive taxa. Sites 3 and 10 were rated 'Unpolluted Q4' and equivalent to WFD 'Good status'. Sites 2, 4, 9 and 11 were rated 'Unpolluted (Q4-5)' equivalent to WFD 'High status'.

The Average Score Per Taxa (ASPT)[37] scores ranged from 4.6 (Site 5) to 8.1 (Site 2). The values at all locations except Site 5 were indicative of good water quality, where a value of > 5.5 is deemed to signify same. The EPT (Ephemeroptera, Plecoptera, Trichoptera)[38] index of water quality varied between 0 (Site 5) to 11 (Sites 9 and 11). Therefore, based on the EPT index, macroinvertebrate richness is highly variable. Summaries of the Q-ratings and EPT indices derived from the diversity and relative abundance of the macroinvertebrates at the study sites are given in **Table 8**, below.

Table 8. Biological water quality results and interpretations of surveys carried out in 2021 at study sites on watercourses potentially affected by the proposed Ballycar Wind Farm.

Site	Watercourse	Q-rating & Quality Status	Corresponding WFD Status	ASPT	EPT	St. Dev
1	Crompaun	3-4, slightly polluted	Moderate	Clean but slightly impacted	7.4	8
2	Glennagross	4-5, unpolluted	High	Unpolluted, unimpacted	8.1	10
3	Cappateemore East	4, unpolluted	Good	Clean but slightly impacted	6.6	8
4	Crompaun East	3-4, slightly polluted	Moderate	Clean but slightly impacted	6.7	7
5	North Ballycannan	3, moderately polluted	Moderate	Heavily polluted	4.6	0
6	North Ballycannan	3, moderately polluted	Moderate	Moderately impacted	5.9	3
7	West Ballycannan	3, moderately polluted	Moderate	Moderately impacted	6.3	4
8	South Ballycar	3, moderately polluted	Moderate	Clean but slightly impacted	6.5	6
9	South Ballycar	4-5, unpolluted	High	Unpolluted, unimpacted	7.4	11
10	West Roo	4, unpolluted	Good	Unpolluted, unimpacted	6.9	10
11	Blackwater[39]	4-5, unpolluted	High	Unpolluted, unimpacted	6.8	11

Q-ratings for the 2023 sampling are presented in **Table 9,** below. There was no change to the ecological status of Sites 1, 3, 4, 5, 7 and 8. From 2021, there was a decline in biological water quality at Site 2 on the Glennagross Stream (Q3-4 to Q3), at Site 9 on the South Ballycar Stream (Q4-5 to Q3-4), and at Site 10 on the West Roo Stream (Q4 to Q3-4). This was linked to a reduction in the relative abundance of Group A pollution sensitive taxa at these locations with excessive siltation thought to be the reason for these declines. There was an improvement in biological water quality at Site 6 on the North Ballycannan Stream (Q3 to Q4).

[37] Based on average value of each taxa sampled - calculated by summing indicator values and then dividing by number of taxa sampled. Index values range from 0 to 10 - a high ASPT index value (greater than 5.5) indicates high ecological status and low values indicate bad/degraded ecological status.
[38] Uses three orders of easily identifiable aquatic insects: mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera), and is commonly used as an indicator of water quality (Lenat, 1988) - calculated by summing the number of taxa represented by the three insect orders. Index is based on premise that many aquatic insect species are pollution-intolerant and will not be found in polluted waters meaning that the greater the pollution, the lower the species richness expected.
[39] Survey at Site 11 carried out in 2018.

Table 9. Biological water quality results and interpretations of surveys carried out in 2023 at study sites on watercourses potentially affected by the proposed Ballycar Wind Farm.

Survey site	Watercourse	Q-rating	Quality status	Corresponding WFD status
1	Crompaun	3-4	Slightly polluted	Moderate
2	Glennagross	3	Moderately polluted	Moderate
3	Cappateemore East	4	Unpolluted	Good
4	Crompaun East	3-4	Slightly polluted	Moderate
5	North Ballycannan	3	Moderately polluted	Moderate
6	North Ballycannan	4	Unpolluted	Unpolluted
7	West Ballycannan	3	Moderately polluted	Moderate
8	South Ballycar	3	Moderately polluted	Moderate
9	South Ballycar	3-4	Slightly polluted	Moderate
10	West Roo	3-4	Slightly polluted	Moderate

4.4.7.6 Physico-chemical Water Quality

Results of the on-site physico-chemical measurements at survey sites are presented in **Table 10,** below, while the laboratory test results for the 2021 surveys and the 2023 surveys are provided below in **Table 11** and **Table 12,** respectively. The **Aquatic Ecology Survey Report** in **Appendix 6C** of **Volume III** of the **EIAR** gives full details of the laboratory test report and provides discussion on each parameters' results.

Table 10. Physico-chemical water quality results from on-site measurements (samples taken 24th June 2021).

Parameter	Survey Site Number									
	1	2	3	4	5	6	7	8	9	10
Dissolved Oxygen (%)	82.1	78.6	77.4	100.9	43.7	64.6	56.4	37.9	76.4	82.1
Dissolved Oxygen (ppm)	8.85	8.38	8.28	11.23	4.62	6.49	6.05	4.01	8.29	8.86
Time	9.47	13.23	12.20	15.08	15.54	16.33	14.23	15.23	10.54	11.20
Conductivity (µS/cm)	269	321	291	334	302	495	399	558	444	470
Temp (°C)	10.8	12.05	11.1	11.25	12.58	16.2	12.48	12.4	12.63	13.15
pH	6.77	7.43	7.34	7.35	7.42	7.32	7.42	7.25	7.36	7.56
Turbidity (NTU - 1st)	1.35	1.8	7.32	0.81	1.02	0.99	3.17	9.16	2.05	1.31
Turbidity (NTU - 2nd)	2.22	1.53	7.09	0.94	0.82	0.86	3.82	9.07	1.36	1.06
Turbidity (NTU - 3rd)	1.04	1.5	7.28	0.95	0.85	0.71	3.56	8.62	1.48	0.71
Turbidity (NTU - average)	1.54	1.61	7.23	0.90	0.90	0.85	3.52	8.95	1.63	1.03

Table 11. Physico-chemical water quality results from laboratory analysis (samples collected 24th June 2021).

Parameter	Unit	Survey Site Number									
		1	2	3	4	5	6	7	8	9	10
B.O.D	mg/L	2.3	1	0.7	0.4	0.6	0.5	0.9	0.3	0.2	<0.1
Total Ammonia	mg/L N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Dissolved Solids	mg/L	128	216	122	192	148	280	200	336	224	242
Total Hardness	mg/L $CaCO_3$	82	123	75	111	75	191	147	201	129	149
Total Organic Carbon	mg/L	4.2	<2	2.8	2	3	3.1	6	3.3	4.6	5.2

Parameter	Unit	Survey Site Number									
		1	2	3	4	5	6	7	8	9	10
Total Phosphorus (as P)	mg/L P	<0.1	0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Suspended Solids	mg/L	<5	<5	<10	<10	<10	<10	<10	<10	<10	<10
Nitrate (as NO_3)	mg/L NO_3	1.5	5.6	3.9	2.3	1.3	2.3	0.57	3.3	2	2.9
Nitrite (as NO_2)	mg/L NO_2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ortho-Phosphate (as P)	mg/L P	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Table 12. Physico-chemical water quality results from laboratory analysis (samples taken on 26th June 2023).

Parameter	Unit	Survey Site Number									
		1	2	3	4	5	6	7	8	9	10
Conductivity	µS/cm	66	62	61	66	15	62	63	62	64	74
B.O.D	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Suspended Solids	mg/L	<4	<4	<4	<4	<4	<4	6	<4	<4	<4
Total Ammonia	mg/L N	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate (as NO_3)	mg/L NO_3	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Nitrite (as NO_2)	mg/L NO_2	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Orthophosphate (as P)	mg/L P	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Hardness	mg/L $CaCO_3$	16	16	16	17	29	16	16	16	18	22
Chemical Oxygen Demand (COD)	mg/l	<10	<10	10	<10	<10	11	<10	13	13	12
Total Phosphorus (as P)	mg/L P	0.08	0.06	0.07	0.04	0.08	0.06	0.06	0.04	0.05	0.06
Total Organic Carbon	mg/L	4.6	4.9	5.3	5.4	5	6	6	5.9	6.8	8.4
Total Dissolved Solids	mg/L	47	35	34	37	54	35	35	35	36	42

4.4.8 Ornithology

4.4.8.1 Vantage Point (VP) Surveys and Transect Surveys Results

Table 13, below, lists the primary and secondary target species recorded during VP and transect surveys at the proposed site (species listed on Annex I of the Birds Directive[40] are highlighted in **bold**). Two Special Conservation Interest (SCI) species for which the River Shannon and River Fergus Estuaries SPA is designated were recorded during VP surveys, namely black-headed gull and cormorant, and their flightpaths are shown in Figure 4-6, below.

[40] Annex I lists 194 species and sub-species of birds that are particularly threatened. EU Member States must designate Special Protection Areas (SPAs) for them and all migratory bird species.

Table 13. Primary and secondary target species recorded during VP and transect surveys carried out at the proposed Ballycar Wind Farm site between October 2019 and September 2023, inclusive.

Species	Winter 2019/20	Summer 2020	Winter 2020/21	Summer 2021	Winter 2021/22	Summer 2022	Winter 2022/23	Summer 2023
Black-headed gull (*Chroicocephalus ridibundus*)*			✓		✓		✓	
Buzzard (*Buteo buteo*)	✓	✓	✓	✓	✓	✓	✓	✓
Common gull (*Larus canus*)							✓	
Cormorant (*Phalacrocorax carbo*)*	✓							✓
Great black-backed gull (*Larus marinus*)						✓		
Grey heron (*Ardea cinerea*)					✓	✓		✓
Grey wagtail (*Motacilla cinerea*)			✓			✓		✓
Hen harrier (*Circus cyaneus*)	✓	✓			✓		✓	
Herring gull (*Larus argentatus*)		✓					✓	
Kestrel (*Falco tinnunculus*)	✓	✓	✓	✓	✓	✓	✓	✓
Lesser black-backed gull (*Larus fuscus*)		✓		✓		✓	✓	✓
Little egret (*Egretta garzetta*)		✓						
Mallard (*Anas platyrhynchos*)						✓		✓
Peregrine (*Falco peregrinus*)				✓		✓	✓	✓
Snipe (*Gallinago gallinago*)			✓		✓	✓	✓	✓
Sparrowhawk (*Accipiter nisus*)	✓	✓	✓	✓	✓	✓	✓	✓
Whimbrel (*Numenius phaeopus*)				✓				
Woodcock (*Scolopax rusticola*)	✓		✓					

*Special Conservation Interest (SCI) species for which the River Shannon and River Fergus Estuaries SPA (004077) is designated. The SPA is located 4.4 km southwest of proposal site. Refer to **Section 6.3**, below.

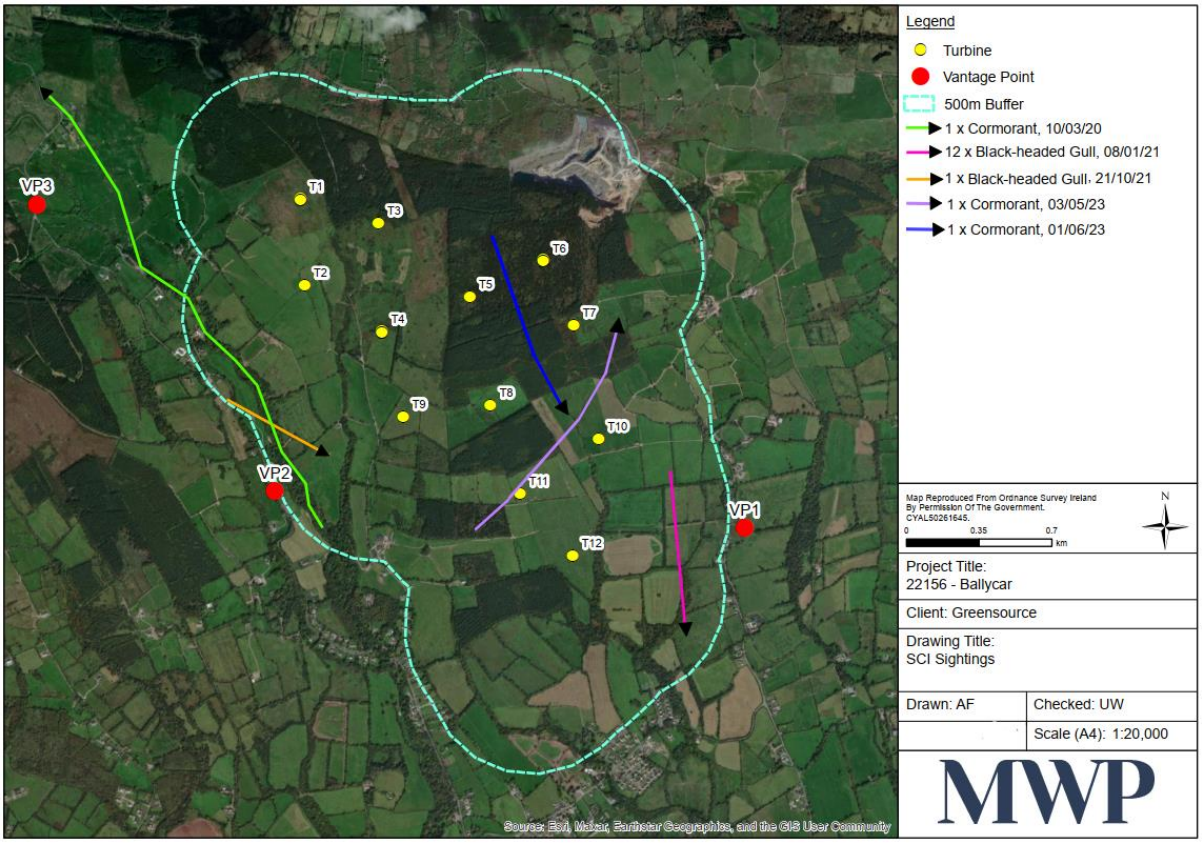

Figure 4-6: Flightpaths of the SCI species for which the River Shannon and River Fergus Estuaries SPA is designated recorded during VP surveys at the proposed development site.

4.4.8.2 Wintering Waterfowl Distribution Surveys

The species recorded were typical estuarine species which are associated with the River Shannon and River Fergus Estuaries SPA (see description of site and associated waterbirds in **Section 6.3.1**, below) and the entire Shannon and Fergus estuarine complex. The winter 2019/20 counts were carried out all along the stretch of Shannon Estuary shown in **Figure 4-7**, below, while for the 2022/23 winter counts, the stretch of estuary was divided into four survey areas – A, B, C, and D.

As the winter 2019/20 counts were carried out without the specificity of fixed locations, a peak count for the entire surveyed area per season was obtained. **Table 14**, below, details the collective peak counts for the Special Conservation Interest (SCI) wintering waterfowl species for which the River Shannon and River Fergus Estuaries is designated that were counted in the winter 2019/20 season. Black-headed gull (*Larus ridibundus*) was recorded in moderately large numbers while cormorant (*Phalacrocorax carbo*), teal (*Anas crecca*) and lapwing (*Vanellus vanellus*) were the only other SCI species counted during the 2019/20 winter counts.

Cooperhill Lake is located within Survey Section D shown in **Figure 4-7**, below, approximately 6.5 kilometres southwest of the proposed development site on the southern side of the River Shannon where each year, a population of whooper swan return to use as a regular roost. Flocks of the species were observed at Section D during every winter 2022/23 count but only once in Section A and never in Sections B or C. A peak flock count of 154 whooper swan (*Cygnus cygnus*) occurred in Section D at Cooperhill on 17th January 2023. On the same date, a flock of 14 whooper swan were recorded in Section A at King's Island, approximately 4 kilometres southeast of the proposed development site. Black-headed gull was recorded in large numbers at all four Sections A, B, C, and D with a peak count of 870 at Section D on the 7th March 2023. All wintering waterfowl Special Conservation Interest (SCI) species for which the River Shannon and River Fergus Estuaries is designated that were counted during wintering waterbird counts are summarised in **Table 14**, below.

Full results of the winter waterbird distribution surveys along the River Shannon are presented in **Appendix 7I** for winter 2022/23 and **Appendix 7F** for winter 2019/20 in **Volume III** of the **EIAR**.

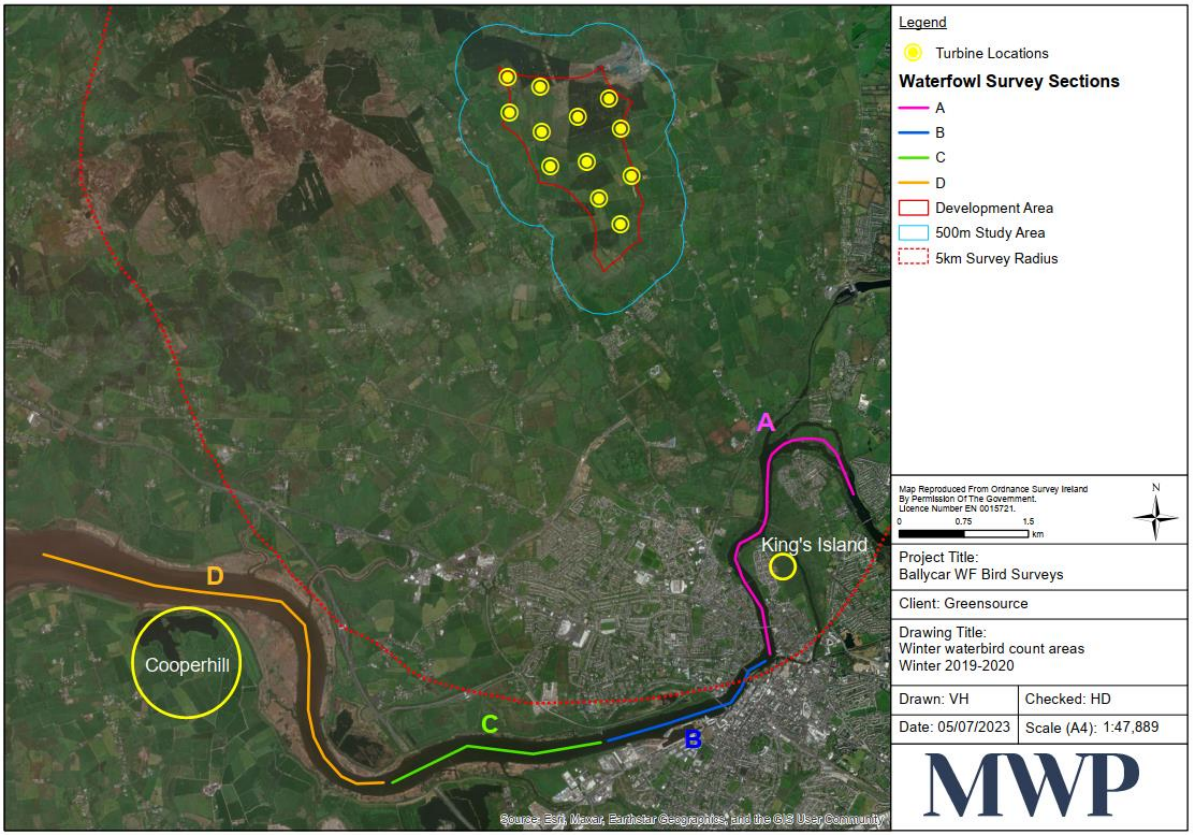

Figure 4-7: Locations of wintering waterbird counts undertaken at four sections along the Shannon Estuary.

Table 14. Peak counts along the River Shannon Estuary of any Special Conservation Interest (SCI) species for which the River Shannon and River Fergus Estuaries SPA is designated.

SCI Species	Peak Count for Winter 2019/20	Peak Count for Winter 2022/23			
		Section A	Section B	Section C	Section D
Cormorant *Phalocrocorax aristotelis*	4	34	11	406	32
Whooper Swan *Cygnus cygnus*		14			154
Wigeon *Anas penelope*					48
Teal *Anas crecca*	4	10	28	235	52
Pintail *Anas acuta*			1		
Shoveler *Anas clypeata*		6	2		14
Grey Plover *Pluvialis squatarola*			3	3	
Lapwing *Vanellus vanellus*	51	6			27
Dunlin *Calidris alpina*				1	
Curlew *Numenius minimus*				11	1
Redshank *Tringa totanus*		1	1	21	
Black-headed Gull *Larus ridibundus*	242	421	495	357	870

4.4.8.3 Breeding Wader Surveys

Three breeding wader walkover surveys were carried out during the 2023 summer season at suitable locations within the 500-metre buffer survey area. The only target species recorded during these surveys was one snipe flushed from an area of wet grassland between T10 and T11 to the southeast of the site in April 2023.

4.4.8.4 Hinterland Surveys

Two flocks of black-headed gull were observed on 16th February 2023 at locations to the southeast of the proposed development site – see **Figure 4-8**, below. The first observation involved 80 individuals at Ardnacrusha Bridge approximately 3.5 kilometres from the proposed T12 location while the second, smaller group comprised four black-headed gulls at a location approximately 3.2 kilometres south of T12. No other SCI species for which the River Shannon and River Fergus Estuaries SPA is designated were observed during the hinterland surveys.

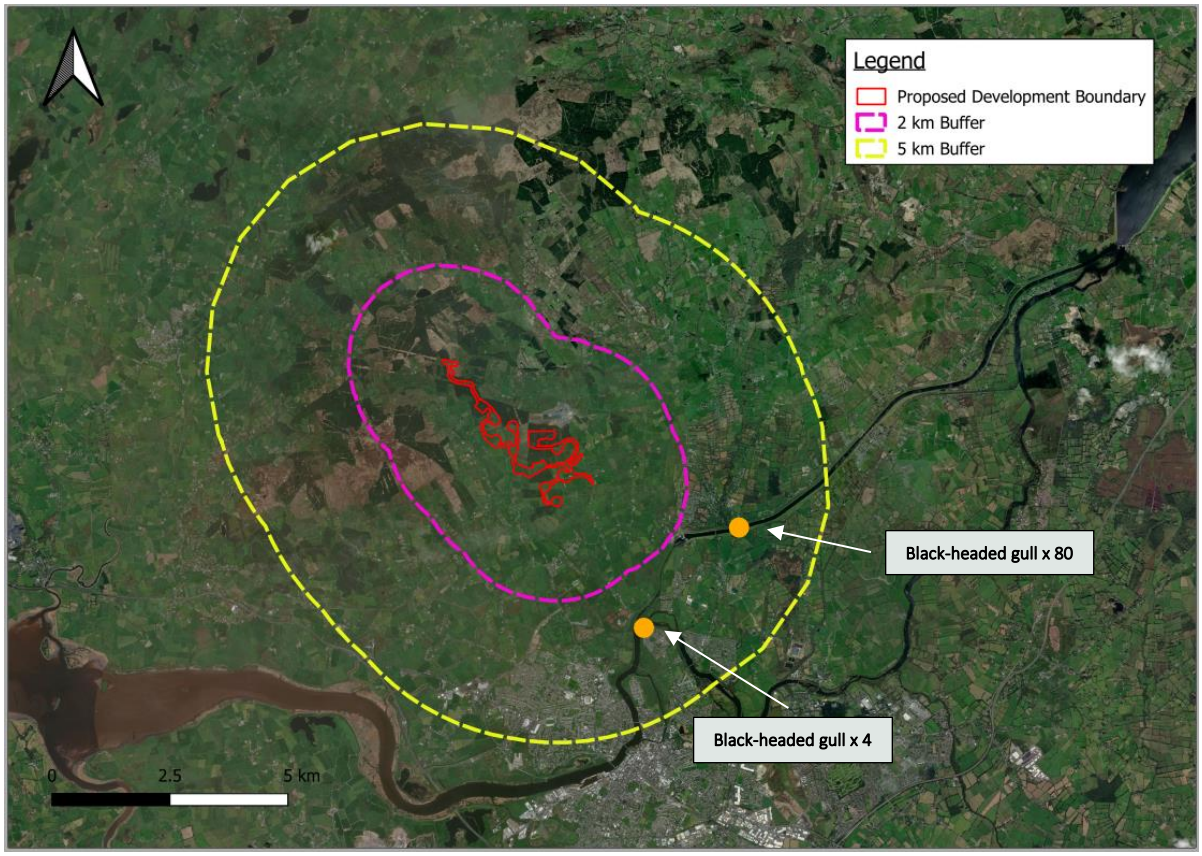

Figure 4-8: Locations of black-headed gull observed on 16th February 2023 during hinterland surveys.

4.5 Characteristics of the Project

4.5.1 Project Components and Infrastructure

The proposed wind farm will comprise twelve wind turbines and associated infrastructure including electrical cable connection to the National Energy Grid (NEG), within a total site area of 104.7 hectares, refer to map in **Figure 4-9**, below.

Table 15 sets out the elements of the project for which development consent is being sought and all other associated project components:

Table 15. Characteristics of the proposed Ballycar Wind Farm development in County Clare.

Proposed Development for which consent is sought	Core Wind Farm Components ▪ 12 No. Wind Turbines (blade tip height up to 158m. ▪ 12 No. Wind Turbine foundations and hardstand areas. ▪ 1 No. permanent Meteorological Mast (90m height) and foundation and associated hardstand areas. ▪ 1 No. Electrical Substation (110kV) including associated ancillary buildings, security fencing and all associated works. ▪ Grid connection to existing 110kV overhead line. ▪ 2 No. Developed Site Entrances, one temporary entrance to facilitate construction traffic and one permanent entrance. ▪ New and upgraded internal site access tracks. ▪ Provision of an on-site visitor cabin and parking. Associated Components of the Proposed Development ▪ All associated underground electrical and communications cabling connecting the proposed turbines to the proposed onsite substation. ▪ Turbine Delivery. ▪ Laying of approximately 1.5km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation to connect to an existing 110kV overhead line. ▪ Temporary works on sections of the public road network along the turbine delivery route (including hedge or tree cutting, relocation of powerlines/poles, lampposts, signage, and local road widening). ▪ 1 No. Temporary construction site compound and additional mobile welfare unit. ▪ 1 No. Borrow pit to be used as a source of stone material during construction. ▪ 3 No. spoil deposition areas (one at borrow pit location). ▪ Associated surface water management systems. ▪ Tree felling required for wind farm infrastructure.

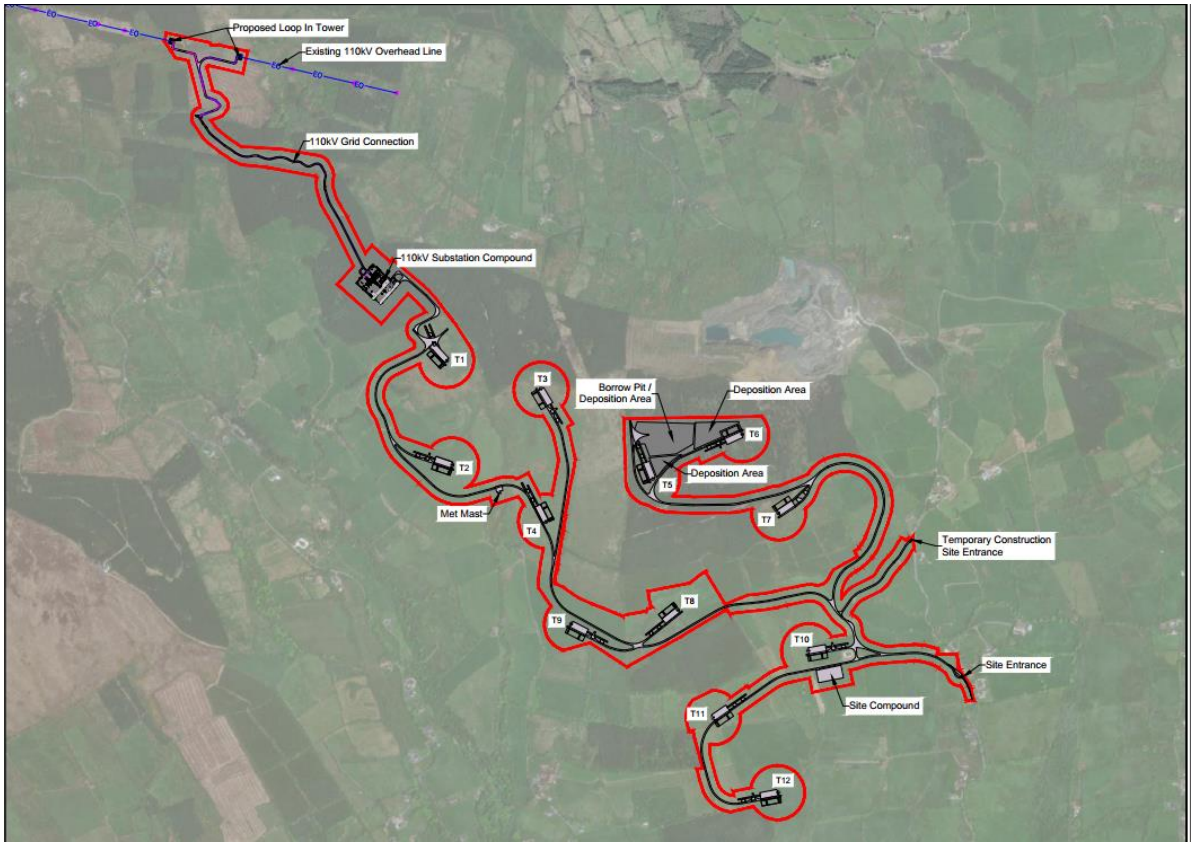

Figure 4-9: Site layout of the proposed Ballycar Wind Farm in County Clare.

4.5.2 Site Access

Primary access to the proposed development site will be provided from the local public road the L7062 (refer to Figure 4-9, above). There will be two site entrances – one temporary to facilitate construction traffic delivering material from a local quarry (Entrance Point A), and one permanent to facilitate turbine deliveries, materials originating from other sources and operations/maintenance vehicles (Entrance Point B).

Entrance Point A to the north-east of the site is proposed as a temporary access to be used during the construction phase only for the delivery of materials sourced from a local quarry, approximately one kilometre north of this entrance point. Entrance Point A will be reinstated to its original condition once the construction phase is completed. Entrance Point B will be from the south-east of the site from the L7062. This site access point will be for turbine deliveries, materials other than those sourced from the local quarry, and for operations and maintenance vehicles. This will be a permanent access point but will be scaled back, landscaped, and fenced and gated as the wind farm becomes operational. Refer to Figure 4-9, above.

4.5.3 Wind Turbines

It is proposed to install twelve (12) No. wind turbines each with a maximum tip height of up to 158 metres. Eleven (11) No. turbines will have a hub height of 90 metres and a blade length of 68 metres, and one (1) No. turbine (T10) will have a hub height of 82 metres and a blade length of 68 metres. Turbine layout has been designed to achieve the most suitable layout based on the site's specific environmental and physical characteristics. The dimensions and co-ordinates of the proposed turbines are set out in Table 16, below.

The turbine model selected will be certified under the International Electrotechnical Commission IEC 61400-1 safety standards and will be designed to withstand the environmental conditions encountered on site. The

proposed turbines will be of a typical modern design, incorporating tubular towers and three blades attached to a nacelle. The tower supports a nacelle and rotor hub. Commercial wind turbine hubs and towers are typically made of steel, while the blades can be made of a matrix of glass-fibre reinforced polyester or wood-epoxy or a similar composite material. It is proposed to install lighting on the turbines in a pattern that is acceptable to the Irish Aviation Authority/AirNav Ireland for aviation visibility purposes.

Table 16. Dimensions and ITM co-ordinates for the 12 turbines at the proposed Ballycar Wind Farm.

Turbine Number	Hub Height (m)	Blade Length (m)	Max Tip Height (m)	Grid Co-ordinates (ITM)	
T1	90	68	158	554589	664237
T2	90	68	158	554609	663823
T3	90	68	158	554964	664122
T4	90	68	158	554981	663600
T5	90	68	158	555405	663769
T6	90	68	158	555757	663943
T7	90	68	158	555904	663633
T8	90	68	158	555503	663247
T9	90	68	158	555084	663192
T10	82	68	150	556023	663087
T11	90	68	158	555645	662822
T12	90	68	158	555899	662525

4.5.4 Wind Turbine Foundations

Each wind turbine will have a reinforced concrete base pad foundation with a central plinth above the base to support the turbine tower. Each turbine base will bear onto rock or other suitable bearing stratum and will be constructed using a wide and shallow spread foundation (see **Plate 9**, below). A typical foundation will be approximately 28 metres in diameter and will usually be installed to a depth of approximately 3 metres below ground level (BGL). Approximately 900 metres^3 of concrete and 100 tonnes of steel will be used to construct each turbine base. If poor ground conditions are encountered during excavation and a significant depth to sub-formation is necessary, piled foundation may be required. Final dimensions of the turbine bases will be confirmed as part of detailed engineering. Refer to **Planning Drawing 22156-MWP-00-00-DR-C-5402** for further details.

Plate 9. Typical construction of a wind turbine base.

4.5.5 Turbine Hardstands

Turbine hardstands are required to accommodate the delivery of the turbine components prior to their erection and to support the cranes during erection. Hardstands are also used for maintenance during the operation of the turbine. The hardstands will be rectangular in shape with additional hardstand set down areas to lay the turbine blades across once delivered (see Plate 10, below). The area of a single hardstand is approximately 68 metres long by 25 metres wide. Due to the significant loads that will be imposed by the outriggers of the main lifting crane during the turbine erection process, it is intended that the hardstands will be constructed using excavation methods over the footprint of the hardstand area/turbine base.

The hardstand areas will be excavated and bear onto rock (or other suitable bearing stratum) with a foundation of 0.5 to 1.5 metres, depending on the local bedrock profile. The hardstand areas will remain in place during the lifetime of the wind farm to facilitate turbine maintenance and final decommissioning.

Each turbine will generate electricity at a nominal voltage and will have its own transformer to step-up to an on-site distribution voltage. The transformer and associated switchgear will be located within the turbine tower. The turbines will be connected via underground cables which will then link back to the substation compound.

Plate 10. Example of typical finished hardstand on a wind farm.

4.5.6 Internal Underground Cables

A network of underground cables serving each turbine with electrical power and signal transmission will be installed along internal service tracks to electrically connect the wind turbines to the new onsite substation located northwest of T1. There will be no overhead power lines constructed within the site.

4.5.7 Substation

The proposed 110kV substation will be located approximately 340 metres northwest of T1 and will occupy an area of approximately 13,500 m^2 (1.35 ha). The substation compound will comprise an outdoor electrical yard and two single storey buildings - one for the system operator and one for the wind farm operator. The system operator building will contain a control room, a storeroom, an office/canteen and a toilet. The wind farm operator building (or Independent Power Producer (IPP) substation building) will contain a storeroom, a communications room, a control room, a staff room, an office, a switchgear room and a toilet. Both substation buildings will be approximately 6.1 metres high with pitched roofs and an external blockwork and plastered finish.

Since the requirement for water will be limited to toilet-flushing and handwashing, it is proposed that water from the roofs of the buildings be harvested. The discharge from the toilet within each building will go to a holding tank located within the substation compound where the effluent will be temporarily stored and removed at regular intervals by an approved contractor. Vehicular parking for each building will be located within the compound area. The substation buildings and associated compound will be contained within a 2.6-metre-high galvanised steel palisade fence. It is proposed to topsoil and revegetate the cut and fill slopes required for the substation site.

During the operational phase, access to the proposed 110 kV substation compound from within the site will be via the permanent site entrance.

Full details of construction methodologies to be used for the substation buildings and substation compound can be found in Section 3.8 in Chapter 3 Civil Engineering, in Volume II of the EIAR. Layout drawings of the proposed

substation compound and buildings are provided in planning application **Drawings No. 05923-DR-130 to 05923-DR-142.**

4.5.8 Grid Connection Route and Grid Connection Point

Electrical energy generated by the proposed wind farm will be exported to the new loop-in substation via a 110kV underground collector cable running from the main wind farm site. From the substation, the underground cable (UGC) will run northwestwards before connecting to the National Electricity Grid (NEG) via an existing 110kV overhead line located approximately 1 kilometre northwest (straight line distance) of the proposed substation. Refer to **Figure 4-10**, below.

In total, the 110kV connection cable route will measure approximately 1.5 kilometres – 1 kilometre will be installed along existing forestry tracks and 0.5 kilometres will be routed through stands of conifer plantation. Approximately 100 metres from where the UGC terminates at the existing overhead line, it will cross the Kilnacreagh Stream – refer to **Section 7.2.6.11,** below, for further details.

The proposed grid connection cable will be carried within a single cable trench measuring approximately 1.3 metres deep and 0.8 metres wide.

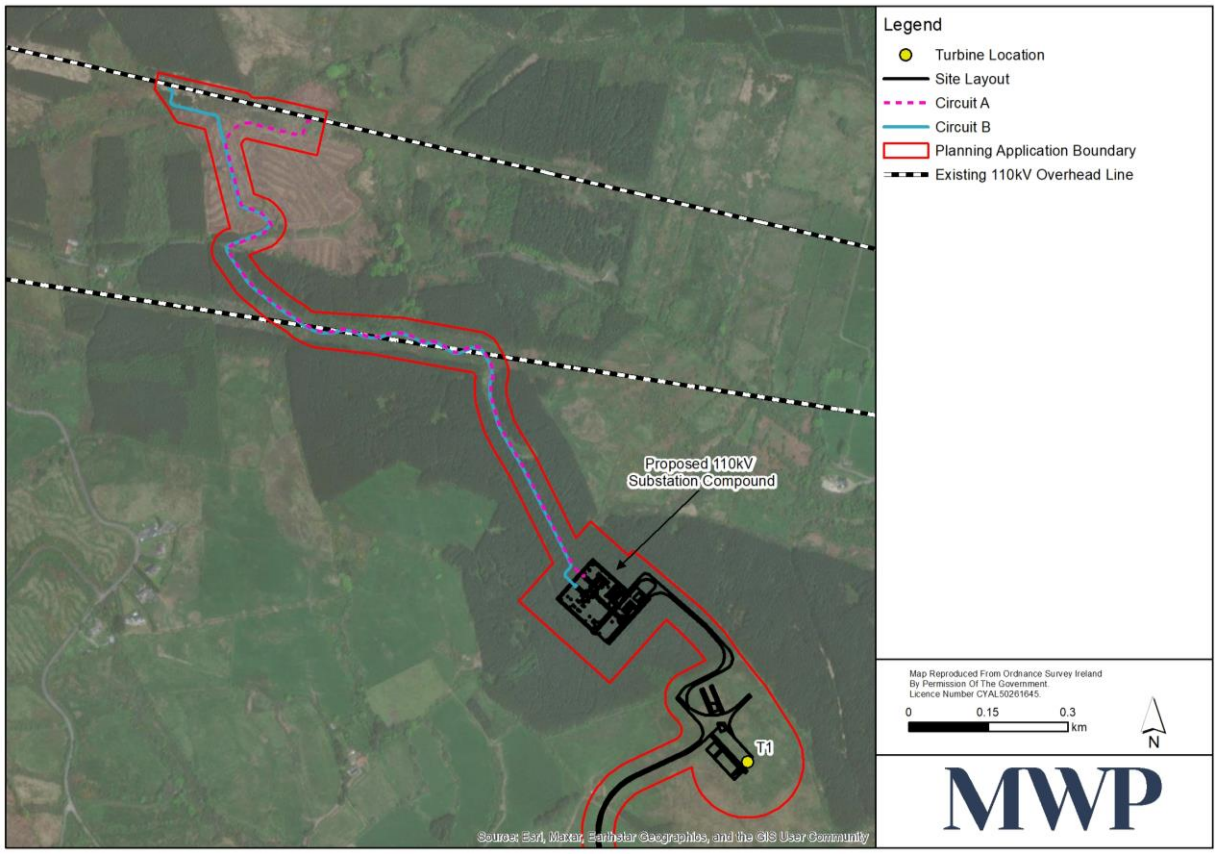

Figure 4-10: Proposed underground cable grid connection route from new substation to overhead line.

4.5.9 Communication Links

To provide communication links between the wind turbines, meteorological mast and substation, ducted fibre-optic cables will be laid in the same trench as the network of underground electrical cables around the site. Furthermore, an antenna will be positioned on the permanent met mast at a height of approximately 40 metres for radio communications for the SCADA (Supervisory Control and Data Acquisition) equipment.

This antenna is for internal wind farm site communications only. It is not for the provision of any public telecommunications services and there is no agreement with any telecommunications service providers.

4.5.10 Borrow Pit

One (1) No. onsite borrow pit is proposed at a northern location within the proposed development site - see **Figure 4-11**, below, and **Planning Drawing 22156-MWP-00-00-DR-C-5411.** Approximately 165,000 m^3 of aggregate will be won from the borrow pit to provide most of the development's required hardcore for construction of internal access tracks, crane hardstands, passing bays, foundations and temporary construction compound.

Blasting at the borrow pit may be necessary to enable excavation of the rock and increase production rates to match the construction programme. Any blasting will be carried out by a suitably qualified specialist under licence. Blasting and mitigation measures associated with the process are discussed in further detail in **Chapter 9 Land and Soils**, and in **Chapter 10 Noise and Vibration**, in **Volume II** of the **EIAR**.

Upon completion of extraction activities at the borrow pit, it will be used for the permanent storage of some excavated material from the turbine bases, crane hardstands, internal access track construction and other associated infrastructure. The borrow pit will also be suitably landscaped following reinstatement.

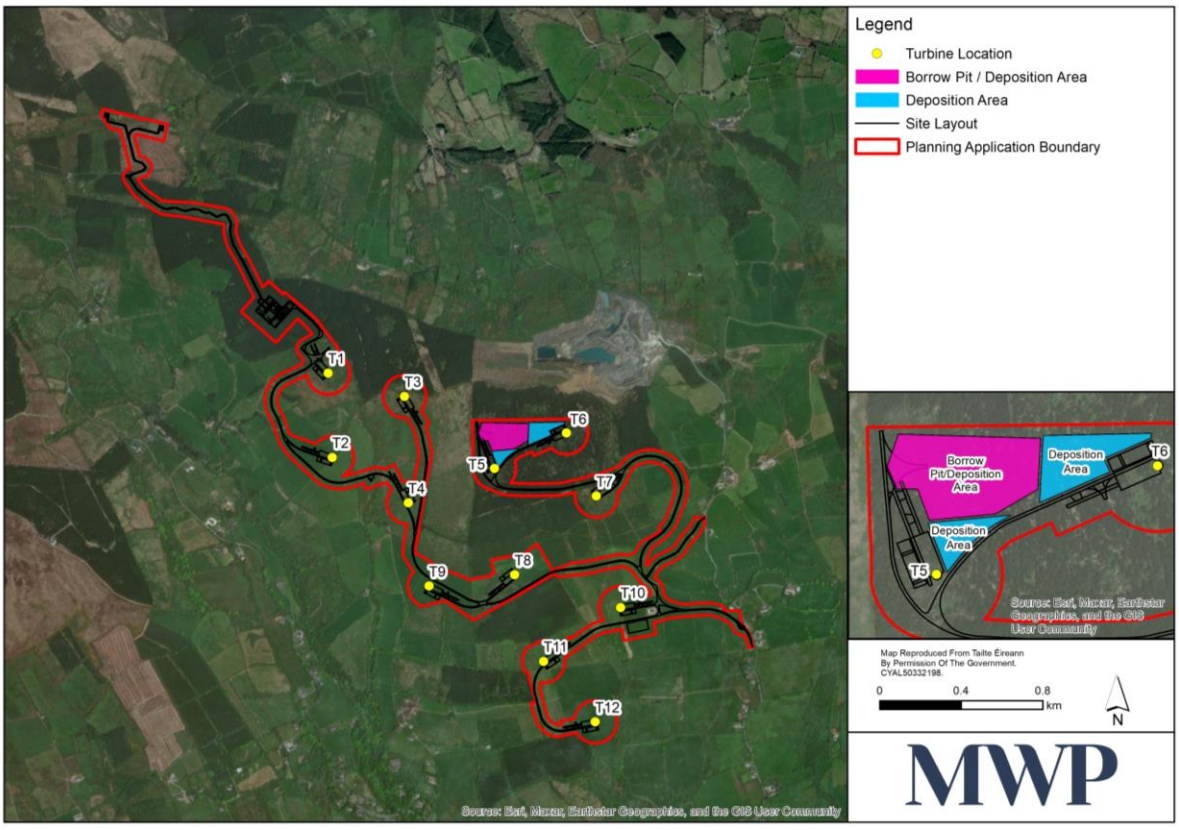

Figure 4-11: Locations of the borrow pit and deposition areas within the proposed development site.

4.5.11 Spoil Management and Material Volumes

Excavated spoil generated during construction will be reused for backfilling, landscaping, and restoration around wind farm infrastructure such as turbines and hardstands. Three dedicated spoil storage areas are proposed for the site – two adjacent to the borrow pit, and one at the borrow pit itself once rock extraction is complete. See

Figure 4-11, above, and Planning Drawing 22156-MWP-00-00-DR-C-5411. Refer to Table 17, below, for a summary of material volumes.

Although priority for storage of spoil will be given to the dedicated spoil storage areas and restoration of the borrow pit, spoil could potentially also be stored to a maximum height of one metre around the turbines and/or within some felled areas. Once extraction activities at the borrow pit have been completed, the pit will be used for the permanent storage of excavated spoil and apart from this material, there will be no permanent stockpiles left on site after construction is finished. After reinstatement works of the turbine base are complete, all remaining stockpiles are to be removed for permanent disposal.

Table 17. Summary of the construction material and spoil storage volumes for the proposed development.

Excavations	Unit	Quantity
Total volume of excavated material	m^3	418,300
Excavated Material Stored or Reused Onsite	m^3	402,000
Excavated Material Removed from Site	m^3	16,300*
Imported Stone		
Total volume of stone required	m^3	265,150
Imported Stone	m^3	100,150
Site-won Stone	m^3	165,000
Concrete and Steel		
Concrete for bases (12 @ 900 m^3 each)	m^3	10,800
Concrete for substation and met mast foundations	m^3	250
Concrete for cable route	m^3	6,700
Reinforced steel for turbine bases (12 @ 100 tonnes each)	tonnes	1,200

*This material will be reused on site as preference in trackside berms etc. however is included above as material to be removed from site as precautionary.

4.5.12 Temporary Site Construction Compound and Welfare Facilities

Upon commencement of the construction phase, one (1) No. temporary construction compound will be erected near T10 within the eastern section of the wind farm site (refer to Figure 4-9, above). The compound will have a total footprint of approximately 5,000 m² (0.5 ha) as shown on Planning Drawing 22156-MWP-00-00-DR-C-5408.

The compound will be used as a secure storage area for construction materials and contain temporary site cabins to provide welfare facilities for site personnel. Facilities will include an office space, meeting rooms, canteen area and mobile sanitary facilities. The proposed development will include an enclosed wastewater management system at the temporary compound capable of handling the demand during the construction phase. A holding tank that will be emptied by a licensed permitted contractor only is proposed at the compound for wastewater management. Upon completion of the project, the compound will be decommissioned by backfilling the area with material arising from excavation and landscaping with topsoil.

4.5.13 Permanent Meteorological Mast

A permanent meteorological mast is to be erected within the proposed wind farm to monitor the local wind regime while the wind farm is operational. The mast will be located adjacent to the turbine access track at the western side of the site between T2 and T4. The meteorological mast will be installed to a height of up to 90 metres (representative of turbine hub height) and will have a base foundation and hardstanding area.

The mast will be surrounded by a galvanised steel palisade fence measuring 2.4 metres high and will be equipped with an antenna for internal radio communications for on-site SCADA (Supervisory Control and Data Acquisition) equipment. Details of the meteorological mast are shown in Planning Drawing 22156-MWP-00-00-DR-C-5404.

4.5.14 Conifer Felling

Felling of commercial conifer forestry is required within and around the wind farm site to accommodate the construction of the substation compound, two turbine foundations and associated hardstands, access tracks, turbine assembly areas, and borrow pit and deposition areas. Refer to Figure 4-12 below, for felling locations. It is proposed to fell up to 95 metres around each turbine (required clearance distance for bat species) with approximately 15.97 hectares of forestry felling required overall.

All tree felling will be undertaken in accordance with a tree felling licence, using good working practices as outlined by the Department of Agriculture, Food, and the Marine (DAFM, 2019) in their '*Standards for Felling and Reforestation*' guidelines. These standards deal with sensitive areas, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel, and machine oils. All conditions associated with the felling licence will be complied with.

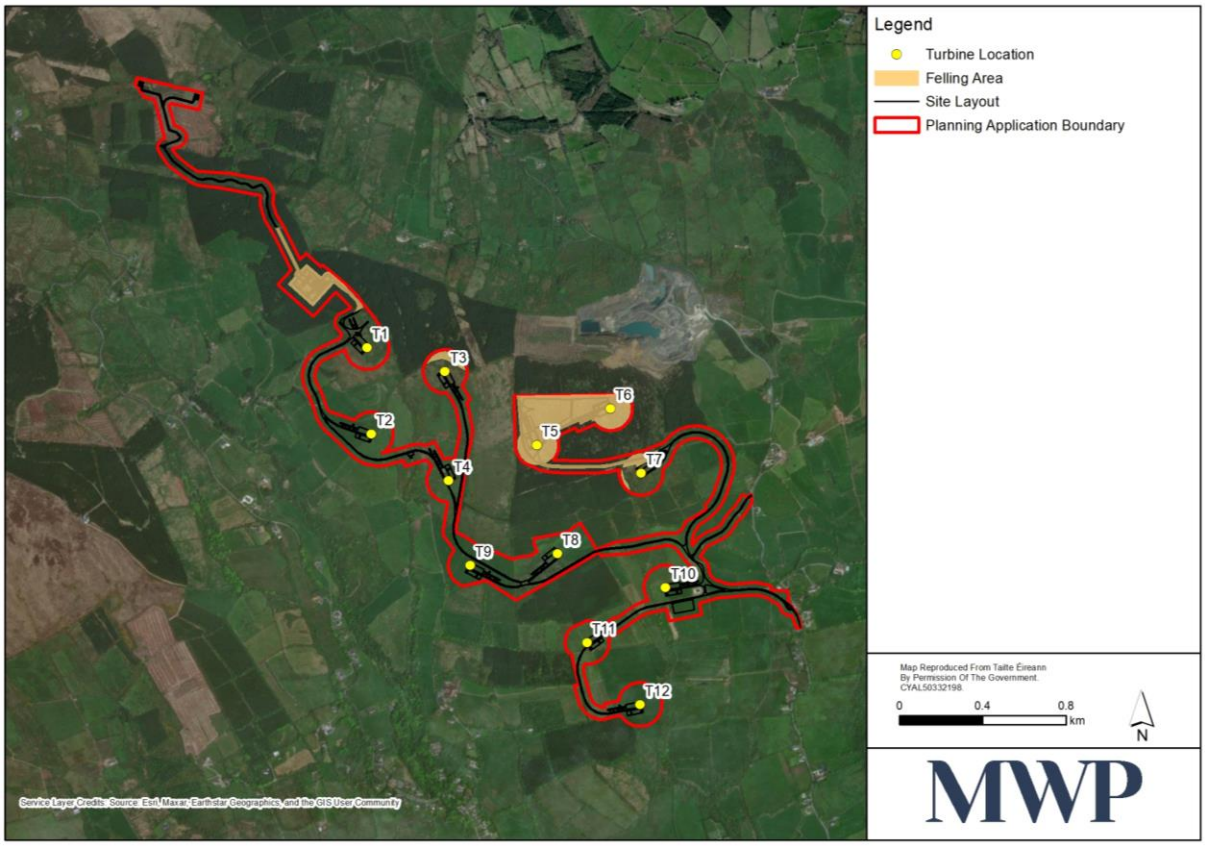

Figure 4-12: Areas within the proposed development site where tree felling is required.

4.5.15 Replant Lands

Replacement replanting of forestry in Ireland is subject to license in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by the Forestry Regulations 2017 (S.I. No. 191 of 2017).

The total amount of felling proposed for the project is 15.97 hectares. It should be noted that the clearfelling of trees in the State requires a felling licence while the associated afforestation of alternative lands equivalent in area to those lands being permanently felled is also subject to licensing ('afforestation licensing'). The Forest Service of the Department of Agriculture, Food and the Marine is Ireland's national forest authority with responsibility for issuing all forest licensing. The Applicant commits to not commencing the project until a felling licence and an afforestation licence are both in place. This ensures the afforested lands are identified, assessed and licensed appropriately by the relevant consenting authority.

4.6 Description of Construction Phase

This section describes the methods that will be implemented when constructing the turbines, associated infrastructure, substation and grid connection. Detailed method statements will be developed and implemented by the appointed Main Contractor in advance of construction works commencing. The construction phase of the development begins with site preparation works and is complete when the turbines are built and ready for commission. Refer to Chapter 2 Description of the Proposed Development, and Chapter 3 Civil Engineering, in Volume II of the EIAR for full details of the construction phase.

4.6.1 Construction Phase Land-use Requirement

Land use requirements during the construction phase will be greater than that of the permanent land take area. The temporary land take within the planning application boundary required during the construction phase is set out below, in Table 18, below.

Table 18. Temporary land-use requirements of construction phase

Item	Area Required
Construction compound	5,000 metres² (0.5 hectares) Site Compound No. 1 only
Wind turbine construction	36,000m² (3,000 m² per hardstand) Wind turbine generator (WTG) construction requires temporary workspaces during the erection of the different turbine components. These workspaces include storage areas for turbine blades and temporary areas for assembly of the auxiliary cranes and parking.

4.6.2 Proposed Works

Construction works will be carried out in a phased manner to minimise disruption to local communities, minimise environmental impact and create the safest working conditions possible, and will principally comprise the following works:

- Felling of any areas of coniferous plantation necessary to facilitate construction works;

- Construction of site entrances and any sections of internal access tracks necessary to facilitate access to the temporary construction compound and proposed on-site borrow pit location;
- Construction of temporary construction compound including fencing (for security, water and ecology, and for archaeological exclusion zones), site offices, parking, material laydown and storage areas, etc;
- Establishment of the onsite borrow pit and temporary storage of stockpiled overburden and surplus excavated materials within material storage areas;
- Earthworks and drainage infrastructure associated with construction of new and upgraded internal access tracks, crane hardstand, turbine foundations and substation compound;
- Construction of upgraded and new watercourse crossings for construction of internal access tracks and underground cables;
- Excavation of turbine bases, permanent met mast foundations, and associated turbine hardstand areas;
- Installation of sections of underground cabling between turbines;
- Installation of sections of underground cabling to the grid connection point;
- Construction of the substation compound;
- Turbine delivery, installation and commissioning; and
- Meteorological mast delivery, installation and commissioning.

4.6.3 Construction Methods

Table 19, below, provides a summary of the types of proposed construction techniques for the various elements of the project. Construction methods are fully set out in Chapter 3 Civil Engineering, in Volume II of the EIAR and in the Construction Environmental Management Plan (CEMP) in Appendix 2A in Volume III of the EIAR.

Table 19. Summary of proposed construction techniques for Ballycar Wind Farm.

Project Element	Construction Technique
Wind turbine foundations and hardstands	Wind turbine locations will be cleared, graded, and foundations will be either excavated or piled by rotary core technique. Blasting may be required at turbine locations where bedrock is present near ground surface. An engineered concrete foundation will be installed in excavated/piled structure location. Backfill will be provided and grading will be performed to allow for immediate drainage away from each tower. Construction activities include tree/vegetation clearing, topsoil stripping, excavation and/or piling, grading, foundation construction, final grading, landscaping temporary works areas.
Permanent meteorological mast	Construction includes tree removal, topsoil stripping, excavation, grading, foundation construction, final grading, and landscaping of temporary works area.
Site access	Sightline improvements of the existing site access junction will be required. Construction activities include vegetation clearing, topsoil and/subsoil stripping, aggregate placement and grading, and landscaping of temporary works areas.
Internal trackways	**Upgrading, widening and new excavated trackways:** Construction activities will include vegetation clearing, topsoil stripping, excavation, placement of geogrid/geotextile layer and aggregate, compaction, grading, berm placement and landscaping. **Floating Tracks:** Construction activities will include removal of major protrusions, placement of geogrid/geotextile layer and aggregate, compaction, grading, berm placement and landscaping.

Project Element	Construction Technique
Internal underground site electrical cables	Underground electrical collector cables will be co-located with access tracks to minimise the area of construction disturbance. Underground cable installation construction activities include topsoil stripping, trenching, installation of cables, and revegetation of disturbed areas (unless cables are under tracks).
Substation compound	Construction includes tree/vegetation removal, topsoil stripping, excavation, filling with imported suitable material, grading, foundation construction, building construction.
Construction compound/temporary local road widening	Construction includes tree removal, topsoil stripping, excavation, grading, aggregate placement, compaction, and landscaping.
Borrow pit	Construction includes topsoil stripping, excavation and/or blasting.
Watercourse crossings	No in-stream works required. Existing crossings: Widening using pre-cast piping. New crossings: Clear span crossings.
Connection cable to grid connection point (other than at water crossings)	Construction activities include excavation, trenching, backfilling, resurfacing.

4.6.4 Internal Site Service Tracks

Internal site service tracks are required to interconnect elements of the site and allow access to all wind turbines and wind farm infrastructure. Existing tracks will be upgraded where possible and new tracks will be constructed to ensure access to each turbine, substation compound and meteorological mast. The routing of internal site service tracks is shown in Figure 4-9, above. Existing or new surface water collection drains will be located on either side of the service tracks - drains on the lower side of the track will be used as part of the site's dirty water drainage system, while drains on the higher side will be retained as clean water drains (refer to Section 4.6.7, below).

Depending on the ground conditions, the new service tracks will be constructed using either excavated or floating track techniques and will have a general running width of 5 metres. The design of any length of track within the site will depend on local geotechnical, topographical, and hydrological conditions. Both excavated and floating track construction methods will be employed to achieve a service track structure appropriate to site conditions.

New excavated tracks will be constructed by placing stone aggregate, obtained from either the proposed onsite borrow pit or imported from nearby quarries, over a layer of geogrid when all organic and soft subsoil material is excavated to formation level. Geotextile material will also be laid at formation level to separate the track building material from the subsoil. The track will be finished with imported 150 mm crushed stone of Clause 804 or similar aggregate type material.

New floating tracks will be constructed by placing a combination of geogrid and geotextile over the existing surface vegetation to be traversed with the floating track. A minimum thickness of 450 mm of site-won stone will be placed over the bottom layer of geogrid/geotextile and finished with a 150 mm surface layer of Clause 804 or similar material. Where new access tracks will be constructed through forested areas, the felled trees may be used in the construction of the floating tracks as outlined in the COFORD[41] Forest Road Manual (Ryan *et al.*, 2004). This involves layering the brash generated during the felling process onto the existing ground surface before placing the felled trees perpendicular to the direction of travel to benefit from the load spread thereby provided.

[41] Council for Forest Research and Development

Finally, a combination of geogrid and geotextile will be placed on top of the felled trees and track construction completed using the same construction method as outlined above.

Existing internal tracks will be used where possible and widened by removing organic material and soft subsoil to formation level before constructing a track on a layer of geogrid or geotextile in the same manner as described in the previous paragraph. The new width of track and existing track surface, where required, will be capped with a 150 mm layer of crushed stone of Clause 804 or similar aggregate type material.

See **Planning Drawing 22156-MWP-00-00-DR-C-5405** for more details, and a full explanation of construction methods is outlined in **Section 3.4** in **Chapter 3 Civil Engineering**, in **Volume II** of the **EIAR**.

4.6.4.1 Watercourse Crossings of Internal Site Tracks

The proposed network of internal site tracks will require seven watercourse crossings. The location of each crossing and the expected crossing methodologies for each are summarised in **Table 20**, below, and in **Figure 4-4**, above, with full details provided in **Section 3.13.3** in **Chapter 3 Civil Engineering**, in **Volume II** of the **EIAR**.

All crossings will be in accordance with this application and/or conditions attached to a grant of planning permission and agreed with the Office of Public Works (OPW) and Inland Fisheries Ireland prior to construction.

Table 20. Summary of seven watercourse crossings of the internal site tracks of the proposed development.

Crossing number	Watercourse	New/existing crossing?	Crossing methodology	In-stream works?	ITM coordinates
WC1	Cappateemore_East	New	Clear span crossing	No	554724, 663713
WC2	North Ballycannan	New	Clear span crossing	No	556099, 663803
WC3	East Ballycannan	New	Clear span crossing	No	555813, 663287
WC4	North Ballycannan	New	Clear span crossing	No	556221, 663432
WC5	North Ballycannan	New	Clear span crossing	No	556284, 663353
WC6	East Ballycannan	Existing	Clear span crossing or widening using pre-cast piping	No	555977, 663004
WC7	North Ballycannan	Existing	Clear span crossing or widening using pre-cast piping	No	556532, 663071

4.6.5 Turbine Delivery

The proposed route for the delivery of the turbine components from Foynes Port in County Limerick is outlined below and illustrated in **Figure 4-13**, below, and described in detail in the **Turbine Delivery Route Assessment** in **Appendix 2C** of **Volume III** in the **EIAR**.

4.6.5.1 Route from Foynes Port to Limerick City

The route from Foynes Port to Limerick City is via the N69 to the roundabout at the N18 interchange. From here the WTG blades and any components with loaded heights of less than 4.65 metres will travel northwards along the N18 via the Limerick Tunnel to Junction 3, through the toll to and arriving at Clonmacken Roundabout from the west. Where the component loaded height is greater than 4.65 metres, the delivery vehicles will continue along the N69, through the Dock Road Roundabouts and along the Dock Road R510 to Shannon Bridge Roundabout. From here, the components will travel northwards over Shannon Bridge and along the R527 Condell Road before arriving at Clonmacken Roundabout from the south. Refer to **Figure 4-13**, below.

4.6.5.2 Limerick City to Ballycar Wind Farm

From the Clonmacken Roundabout, there are two delivery route options through Limerick City - refer to **Figure 4-13**, below.

Option 1 involves travelling northwestwards along Condell Road to Coonagh Roundabout and then using the Coonagh to Knockalisheen Distributor Road, passing through the Coonagh Cross, Cratloe Road and Moyross Road Roundabouts to reach the Knockalisheen Distributor Road Roundabout. The route will then turn southeast onto the Knockalisheen Distributor Road before reaching the existing junction with the R464 Kileely Road. Option 2 involves travelling northeastwards along the L8570 Clonmacken Road, past the Jetland Shopping Centre towards Thomond Park via the Ennis Road junction and Moylish Roundabout. The route then turns left at the junction of Cratloe Road and the R464 Kileely Road (Hassett's Cross).

The Coonagh to Knockalisheen Distributor Road is currently under construction but when complete, it will bypass the route outlined in Option 2 providing a less intrusive delivery route to the wind farm, thereby Option 1 is the preferred delivery route through Limerick City when the Distributor Road is operational.

For both Options, the route then continues northwards along the R464 Kileely Road to Parteen before turning left onto the L3056 Local Road and directly onwards to the proposed wind farm site at Ballycar. Refer to **Figure 4-13**, below.

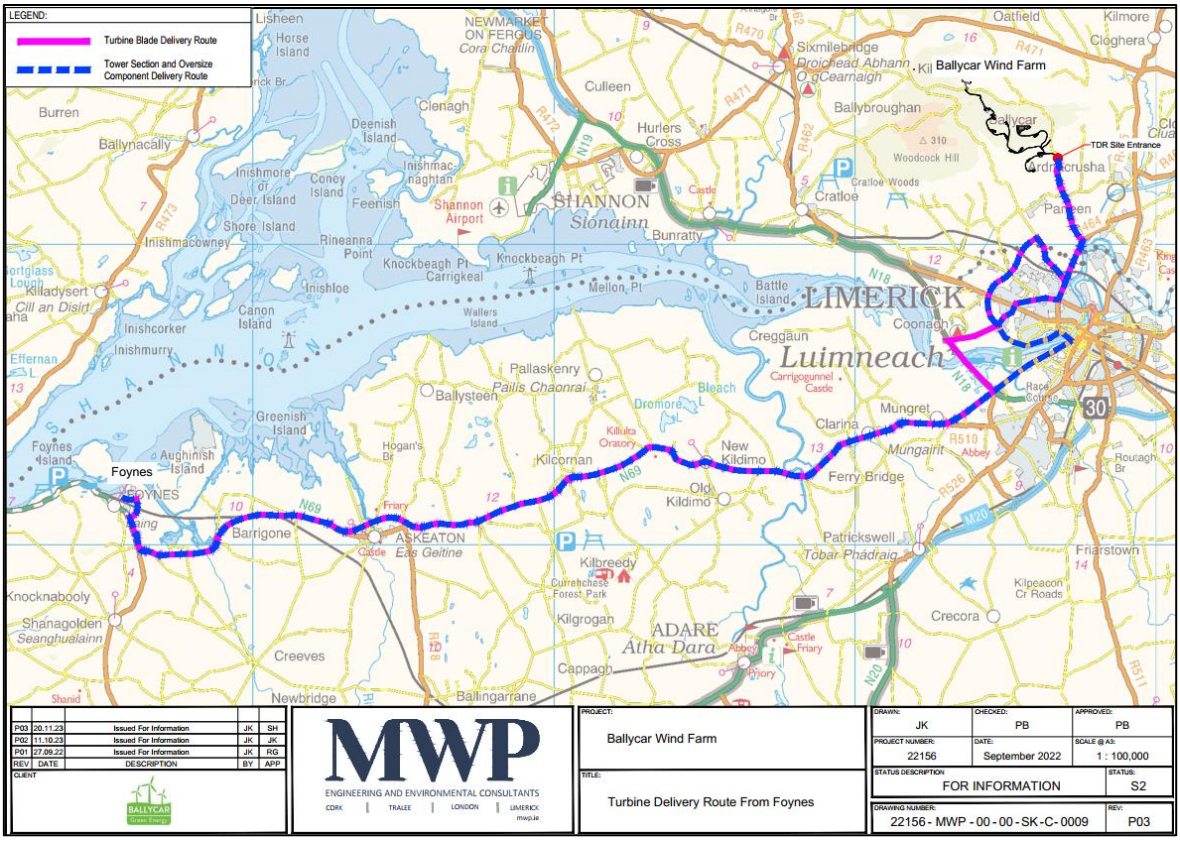

Figure 4-13: Proposed Turbine Delivery Route from Foynes Port in County Limerick to proposed development site at Ballycar.

4.6.5.3 Temporary Road Works Required for Turbine Delivery

The delivery of turbine components to the proposed development site will require temporary works on sections of the public road network along the delivery route including hedge or tree cutting, relocation of

powerlines/poles, lampposts, signage and temporary local road widening. Such works will be temporary are not included in the planning application boundary.

At Parteen, temporary road widening works will be required at the junction of the R464 Kileely Road and L3056 Sweeps Road to facilitate tower and other oversize component deliveries as the route turns northwards onto Sweeps Road. The works will involve the temporary widening of a short stretch (approximately 79 metres) of the R464 that will see the road extend into the field southeast of the junction – see **Figure 4-14**, below. The works will occur approximately 46 metres northwest of the Lower River Shannon SAC boundary and approximately 3.1 kilometres north of the River Shannon and River Fergus Estuaries SPA boundary.

Refer to **Chapter 3 Civil Engineering**, in **Volume II** and the **Turbine Delivery Route Assessment** in **Appendix 2C** of **Volume III** in the **EIAR** for further details.

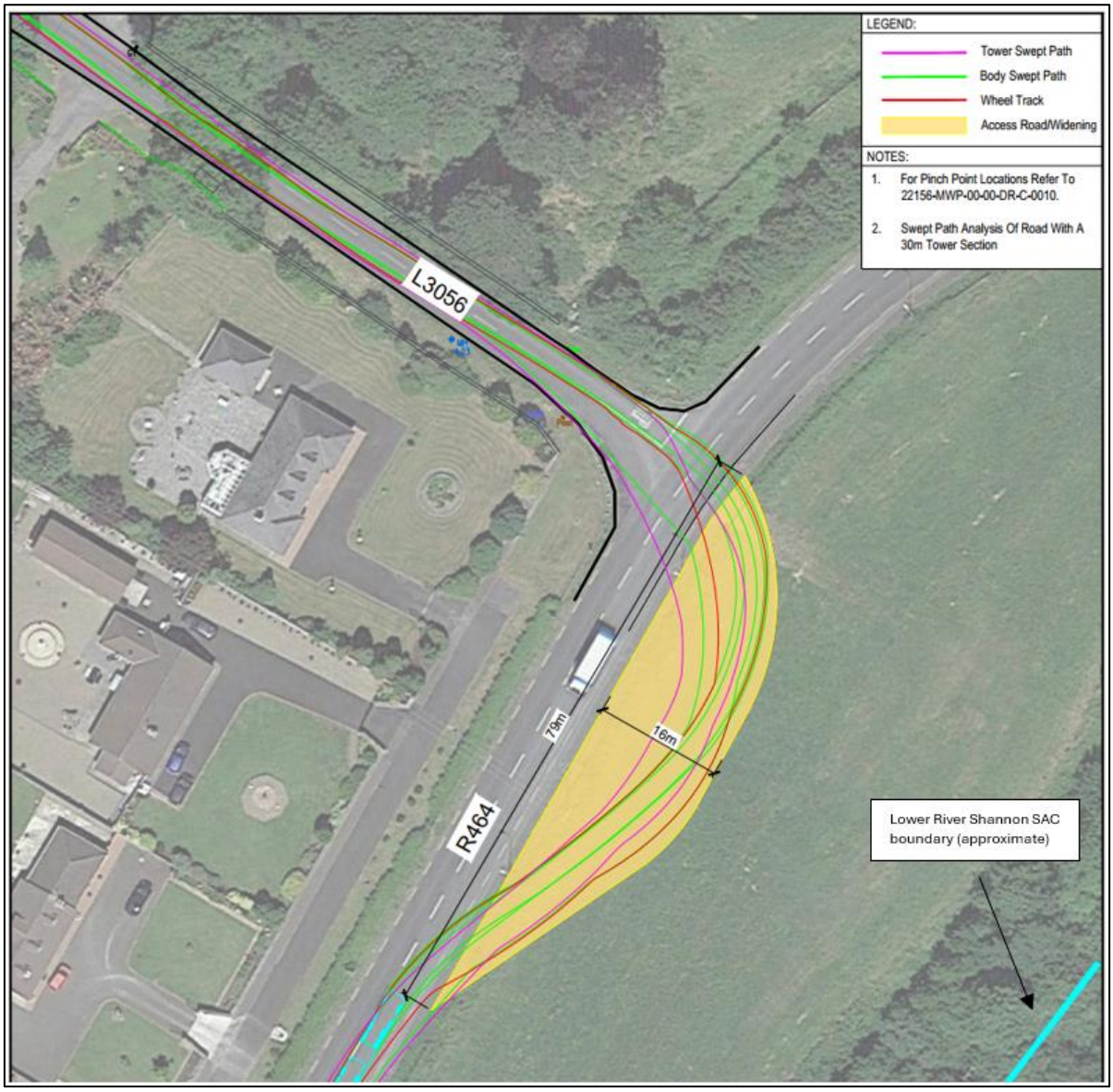

Figure 4-14: Details of temporary road widening works at the R464 / L3056 junction and their proximity to the Lower River Shannon SAC to the southeast.

4.6.6 Roads and Traffic

As discussed in Section 4.5.2 and illustrated in Figure 4-9, above, primary access to the proposed development site will be provided from the public Local Road L7062. This will be the main site entrance during both the construction and operational phases of the development. It is intended to utilise the existing public road network to the site entrance for the delivery of wind turbine components, the transportation of construction vehicles and the delivery of materials. During the construction phase, it is envisaged that aggregates required outside of those sourced from the onsite borrow pit will be sourced from the local quarries. The routes utilised by construction materials delivery vehicles are likely to include the R464 Regional Road, and L7062 and L3056 Local Roads.

Reasonable efforts will be made to minimise the impact of the works on local residents and users of the public road networks. A Traffic Management Plan (TMP) outlining the required traffic management procedures to be implemented on the public roads during the construction of the proposed development and delivery of the wind turbine components is included as Appendix 2D in Volume III of the EIAR. Should An Bord Pleanála (the Board) decide to grant approval for the proposed development, the final TMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Board. The Traffic Management Plan will be updated at the construction stage (or the update commenced during planning compliance stage) to ensure controls are in place with all suppliers coming to the project site.

4.6.7 Construction Environmental Management Plan (CEMP)

A Construction and Environmental Management Plan (CEMP) has been prepared and is included in Appendix 2A of Volume III of the EIAR. The CEMP will be a key construction contract document that will ensure all mitigation measures considered necessary to protect the environment, prior to construction, during construction and during operation of the proposed development, are implemented. The CEMP will collate and manage the proposed and agreed mitigation measures, monitoring and follow-up arrangements and management of environmental impacts. The environmental commitments of the project will be managed through the CEMP and will be secured in contract documentation and arrangements for construction and later development stages.

The CEMP will mainly address the construction phase, however, where monitoring is to continue into the operational phase, these commitments will be communicated and transcribed into operational process documentation. The CEMP will be updated as required through pre-construction and construction to address, for example, any conditions stipulated in the planning permission. The primary objective of the CEMP is to provide a framework for actions, responsibilities and protocols associated with environmental management which the Appointed Contractor(s) are required to adhere to, ensuring the construction of the proposed development in accordance with regulatory requirements and to reduce and/or avoid any adverse environmental impacts.

4.6.8 Surface Water Management

A Surface Water Management System will be constructed on the site to attenuate run-off, guard against soil erosion and safeguard downstream water quality. The drainage system will be implemented along all work areas including all internal site access tracks, storage areas, crane hardstand areas, substation, met mast and temporary site construction compound/temporary road widening works. Full details of the proposed site drainage system are described in Section 3.13 in Chapter 3 Civil Engineering, in Volume II of the EIAR, and in the Construction and Environmental Management Plan (CEMP) in Appendix 2A in Volume III of the EIAR.

The site drainage system was designed integrally with the wind farm layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from wind farm related sediment runoff. A fundamental

principle of the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being contaminated by silt from the works. This will be achieved by intercepting the clean water and conveying it to the downstream side of the works areas either by piping it or diverting it by means of new drains or earth mounds.

Settlement ponds and check dams will provide the essential mechanism for the removal of silt from construction-related runoff and the controlled return of the treated runoff to the downstream watercourses. Runoff from the internal tracks, hardstands and other wind farm infrastructure will be isolated from the clean catchment runoff by means of a series of open drains that will be constructed within the works areas. These drains will be directed to settlement ponds that will be constructed throughout the site downhill from the works areas and will be discharged from settlement ponds to vegetation or forestry rill drains. Each drain will incorporate a series of check dams that will attenuate the flow and provide storage for the increased runoff from exceptional rainfall events.

4.6.9 Duration of Construction

It is envisaged that the proposed development will commence in 2026 with an 18-month construction period. The start date is dependent on whether planning is granted, whether a grid connection offer is made by EirGrid, and if funding and all permits are in place.

A typical programme of work is outlined in **Table 21,** below. A number of these phases will run concurrently, outlined as follows:

- As the internal site access tracks are constructed up to each turbine, hardstanding areas for the crane, turbine foundations and building foundations will be prepared.
- Once the tracks are completed, the trenching and laying of underground cables will begin.
- Construction of the site substation and control houses will commence to ensure they are ready to export power when the turbines are commissioned.

Table 21. Preliminary construction programme for the proposed Ballycar Wind Farm.

	Activity	Expected Duration
Phase 1	Clearfelling (to be completed before construction site mobilisation).	2 months (prior to construction)
Phase 2	Prepare site, pre-construction activities, site entrance, temporary compound.	1 month
Phase 3	Access track construction and drainage plan implementation.	3 months
Phase 4	Hardstanding construction for turbines.	2 months
Phase 5	Turbine foundation construction.	4 months
Phase 6	Trenching and ducting (underground electrical cables).	2 months
Phase 7	Substation construction.	4 months
Phase 8	Permanent meteorological mast erection.	1 month
Phase 9	Delivery of the turbine components.	3 months
Phase 10	Erection of turbines.	4 months
Phase 11	Wind Farm commissioning	4 months, approximately

4.6.10 Major Temporary Features

Temporary onsite features will include the compound facilities, plant, and equipment along with safety fencing and building materials. Large excavators and turbine erection cranes are also a temporary feature on site during the construction phase. There will be some temporary stockpiling of soils on site. Any surplus material will be placed within the material deposition areas. There will also be temporary local road widening.

4.6.11 List of Plant and Materials Required

Mechanical machinery and electrical equipment typically used for construction projects will be required to facilitate the proposed Ballycar Wind Farm development. The following is a non-exhaustive list of plant that is typically used for wind farm construction and heavy civil engineering works:

- 30-50T excavators;
- 15-30T excavator;
- Rubber-tyre 15-20T excavator;
- 3-10T mini-diggers;
- Mobile crane for construction;
- Rebar/shuttering/precast units/conc. pipes/box culverts etc. 60t to 120t;
- Cranes (1 main, 1 assist) erection 120t to 1000t;
- Telescopic handler;
- Tractors and trailers;
- Road grader;
- Double contained fuel bowsers;
- 12T rollers;
- Diesel powered generators; and
- Water bowsers.

The following is a non-exhaustive list of materials, and approximate quantities, that are expected to be used during construction of the wind farm:

- 17,750 m^3 of concrete;
- 1,200 tonnes of reinforced steel;
- Wind turbine components;
- 100,150 m^3 of imported stone for tracks, hardstands, backfill;
- Transformers/panels/cables;
- Electrical equipment;
- Stone, blocks, roofing;
- Palisade fencing;
- Wooden poles;
- Sand for duct bedding;
- Clause 804 material; and
- Coils of 400 mm^2 XLPE insulated cable.

4.6.12 Construction Working Hours

Typically, construction will occur within the hours 07.00 am to 7.00 pm, Monday to Friday, inclusive, and 07.00 am to 2.00 pm on Saturdays. Since the concrete pours need to occur continuously, the working day may extend outside normal working hours to limit traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally completed in a single day per turbine. Turbine and crane erections may also occasionally occur outside of these times to take advantage of periods of low wind. Working hours will be confirmed at the outset of the project and any changes in hours will be agreed with the Local Authority.

Any works along public roads will be from 9.00 am to 5.00 pm Monday to Friday, inclusive, and 9.00 am to 2.00 pm on Saturdays. A permit for moving abnormal loads will be sought from An Garda Síochána for the delivery of oversized wind turbine components such as blades, nacelles and towers. There is to be no work on Sundays or Bank Holidays without pre-approval from the Local Authority.

4.6.13 Construction Personnel

During the construction phase, the number of onsite construction personnel will vary for each phase of the development. Overall, it is envisaged that the proposed development would generate employment for up to 60 persons during the construction phase to include site contractors, on-site vehicle and plant operators, engineers, materials delivery personnel, environmental personnel, health and safety personnel.

4.7 Commissioning of the Wind Farm

Wind farm commissioning can take approximately two to four months to complete from erection of the final turbine to exporting of power. It involves commissioning engineers working through an entire schedule of SCADA (Supervisory Control and Data Acquisition) and electrical testing and control measures to ensure the wind farm will perform and export power to the National Energy Grid (NEG) as designed.

4.8 Description of Operational Phase

4.8.1 Land Use Requirement

The permanent land take will be limited to the wind turbine hardstands, access tracks, permanent crane hardstand areas, control building, permanent deposition areas and substation hardstandings which account collectively for about 31% of the total area within the wind farm planning boundary.

4.8.2 Operating Hours and Operational Conditions

The proposed development is expected to have a lifespan of approximately 35 years. The proposed development is designed to operate when wind speeds at the hub height are within the operating range of the wind turbines. Most turbine models have a cut-in wind speed of 3 metres per second (m/s) with optimum generation at approximately 12.5 m/s. The turbines are expected to have a cut-out wind speed of 25 m/s.

Each wind turbine will be computerised to control critical functions, monitor wind conditions, and report data back to a SCADA system. An anemometer mounted to the top of the wind turbine nacelle provides wind speed information which is then used to automatically set blade pitch to control the wind turbine. A windvane mounted on top of the nacelle provides information needed to yaw the wind turbine into the wind. The SCADA system

monitors problems and diagnoses failures. If a problem causes a wind turbine to shut down, the wind turbine will either be restarted by the SCADA system operator or service personnel will perform the necessary repairs and manually restart the turbines. The wind turbine can also be controlled manually at the nacelle from a panel inside the base of the tower or from a remote computer via the SCADA system. Using the tower top control panel, the turbine can be stopped, started, and turned out of the wind.

Shadow flicker control modules will be installed on the appropriate turbines which can be programmed to shut down during periods when shadow flicker is predicted to occur to eliminate the occurrence of shadow flicker at a particular dwelling. The draft revised "*Wind Energy Development Guidelines*" (December 2019)[42] proposes that no existing dwelling or affected property should experience shadow flicker because of a wind energy development. Fitting turbines with shadow flicker control modules ensures that the proposed wind farm can comply with existing guideline thresholds and the draft revised guidelines on shadow flicker. This is detailed in Chapter 11 Shadow Flicker, in Volume II of the EIAR.

4.8.2.1 Turbine Maintenance

During the operational phase of the wind farm, the turbine manufacturer, the Developer, or a service company will carry out regular maintenance of the turbines, thereby creating at least two permanent jobs in the form of maintenance personnel or operators. Additionally, operation and monitoring activities may be carried out remotely with the aid of computers connected via a telephone broadband link. However, routine inspection and preventive maintenance visits will be necessary to ensure the efficient running of the wind farm and require a minimal presence.

There may also be a requirement for unscheduled maintenance that could include anything from resetting alarms to undertaking component changes that require a crane. Typically, maintenance traffic will consist of four-wheel drive vehicles/vans. The electricity substation components and site tracks will require periodic maintenance in accordance with appropriate operation maintenance plans, procedures and a health and safety plan.

4.8.2.2 Grid Maintenance

It is unlikely that the network of underground cables will require much maintenance during its operation, but should a fault occur, inspection of the fault can be carried out to determine what works may be required.

4.9 Description of Decommissioning Phase and Restoration

4.9.1 Wind Farm

At the end of the estimated 35-year lifespan of the proposed development, the Developer will make the decision to either repower or decommission the turbines. Any further proposals for development at the site during or after this time will be subject to a new planning permission application. If planning permission is not sought after the end of life of the turbines, the site will be decommissioned and reinstated with all 12 No. wind turbines and towers removed. Removal of infrastructure will be undertaken in line with landowner and regulatory requirements and best practice applicable at the time. The information below outlines the likely decommissioning tasks based on current requirements and best practice.

Prior to the decommissioning work, the following will be provided to Clare County Council for approval:

[42] gov.ie - Draft Revised Wind Energy Development Guidelines December 2019 (www.gov.ie) Accessed: 5th September 2023

- A plan outlining measures to ensure the safety of the public workforce and the use of best available techniques at the time; and
- A comprehensive reinstatement proposal, including the implementation of a programme that details the removal of all structures and landscaping.

If the site is to be decommissioned, cranes of similar size to those used for construction will disassemble each turbine, and the towers, blades and all components will be removed. Hardstand and turbine foundation areas will be left *in situ* and covered with soil to match existing landscape. Access tracks will be left for use by landowners.

At present it is anticipated that underground cables connecting the turbines to the proposed new substation will be cut back and left underground. The cables will not be removed if an environmental assessment of the decommissioning operation demonstrates that this would do more harm than leaving them *in situ*. This assessment will be carried out closer to commencement of the decommissioning operation so that any environmental changes incurred over the project's life can be considered.

Wastes generated during the decommissioning phase will be removed from site and disposed of at an authorised waste facility. Any materials suitable for recycling will be disposed of in an appropriate manner.

4.9.2 Grid Connection Cable

The grid cable will remain a permanent part of the national grid and therefore its decommissioning is not foreseen. If decommissioning should occur, it will involve removing the cable from the ducting but leaving the ducting and associated supporting structure in place. It is also likely the substation will remain in place and will previously have been taken charge of by the system operator after the wind farm is connected to the NEG.

4.10 Identification of Other Plans, Projects and Activities

4.10.1 Introduction

A cumulative impact arises from incremental changes caused by other past, present or reasonably foreseeable actions, together with the project. The surrounding environment is dominated by conifer plantation, agricultural land, and a quarry. A review was undertaken of relevant existing and proposed projects, activities and plans occurring in the environs of the proposal site that could act in combination with the proposed wind farm development to determine whether any potential significant cumulative effects may arise, and the results are presented in the following sections. In-combination impacts will be considered in Section 6.7, below.

The main pressures that could act in combination with the proposed wind farm development in its various phases (construction, operation and decommissioning) relate to land management. The lands at the proposed development site and within the surrounding area are mainly managed for forestry and agriculture, and to a lesser extent for wind energy, hydroelectric energy and mineral extraction.

4.10.2 Plans

The Clare County Development Plan 2023-2029 was adopted by the Elected Members of Clare County Council at a Special Meeting on 9th March 2023 and came into effect on 20th April 2023[43].

[43] Clare County Development Plan 2023-2029 | Planning, heritage and conservation | Services | Clare County Council (clarecoco.ie) Accessed: 12th December 2023

Within Volume 6 of the Development Plan (2023 – 2029) is the Clare Wind Energy Strategy which seeks to facilitate 'the development of onshore wind farms in Clare by maximising the wind resources of the County having regard to recent technological advances in turbine design, updated information on wind speeds, proximity and availability to grid connections and to changing energy and grid connection regulations, while minimising any environmental and visual impacts'[44].

4.10.3 Other Wind Energy Developments

Within a 25-kilometre radius of the proposed development site, there are two single wind turbines currently in operation, one permitted 19-turbine wind farm, and a 16-turbine wind farm whose permission has expired. The proposed 8-turbine Fahy Beg Wind Farm was refused permission by Clare County Council and an appeal has been lodged to An Bord Pleanála with the decision pending – refer to **Table 22** and **Figure 4-15,** below.

Table 22. Status of wind energy developments located within 25 kilometres of proposed Ballycar Wind Farm

Wind farm name	Status	No. of turbines	Approximate distance and direction from proposed Ballycar development
Limerick Blow Moulding, Parteen	Operational	1	3.2 km southeast of proposal site
Vistakon	Operational	1	8.2 km southeast of proposal site
Fahy Beg[45]	Refused: 03/05/23 Appealed lodged: 31/05/23 ABP decision due: 02/10/23 (decision awaited)	8	10.5 km northeast of proposal site
Carrownagowan	Permitted (not constructed)	19	13 km northeast of proposal site
Castlewaller	Granted: 18/04/12[46] Extension granted: 05/07/16[47] Permission expired: 22/05/22	16	20 km east of proposal site

[44] Volume 5 Clare Renewable Energy Strategy-Clare County Development Plan 2023-2029 (Interim) (clarecoco.ie) Accessed 26th June 2023
[45] Clare County Council (CCC) Planning Application Number: 23148; An Bord Pleanála (ABP) Planning Application Number: 314227
[46] Tipperary County Council (TCC) Planning Application Number: 11510251
[47] Tipperary County Council (TCC) Planning Application Number: 16600472

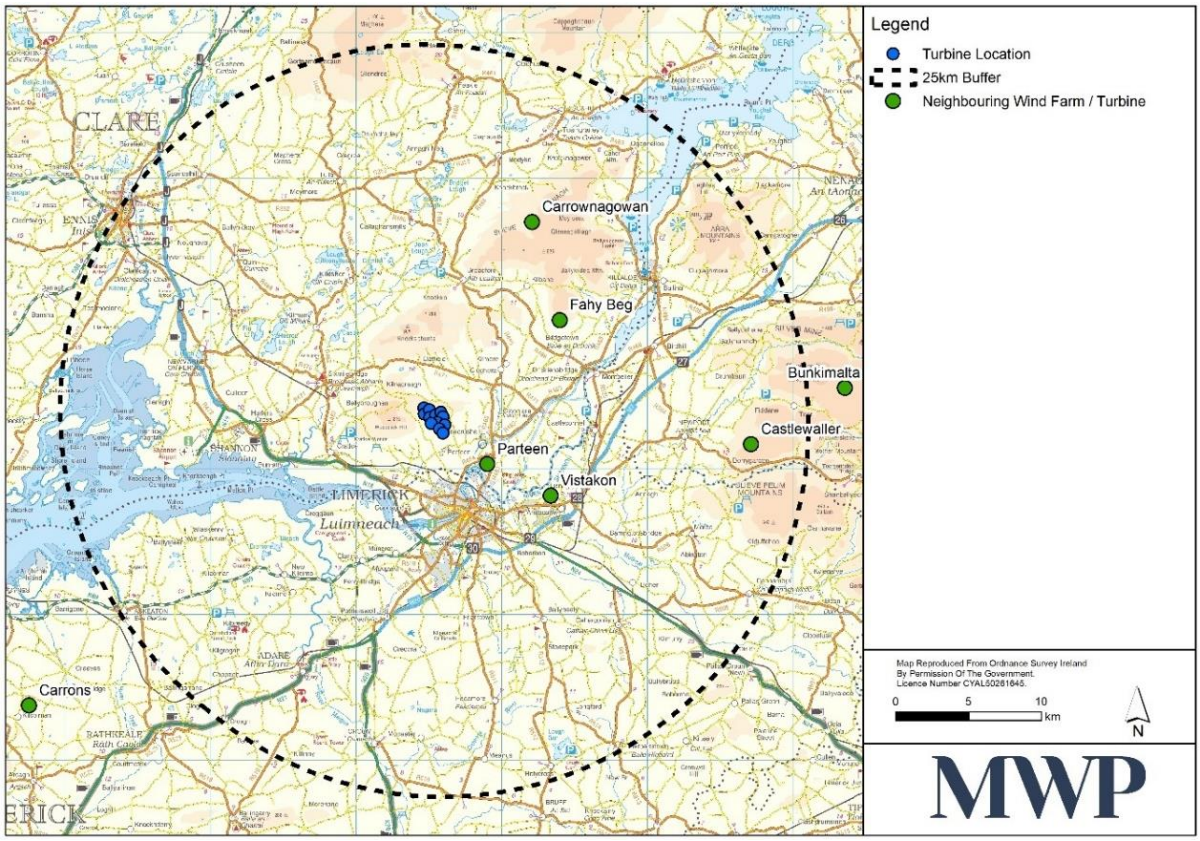

Figure 4-15: Other wind energy developments within 25 kilometres of the proposed Ballycar Wind Farm site

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4.10.4 Solar Energy Developments

A search of the online planning enquiry systems for Clare, Limerick and Tipperary County Councils for any granted or on-going planning applications for solar farm developments within a 25-kilometre radius of the proposed development site was undertaken on 8th December 2023. The results are summarised in Table 23, below.

Table 23. List of granted and/or on-going planning applications for solar energy developments within 25 kilometres of the proposed development site at Ballycar.

Planning application number	Solar Farm location	Status	Decision date	Approximate distance and direction from proposed development site
2360249	Castlebank, Drummin, Glenlon North, Glenlon South and Ballykeelaun, Co Clare.	Permitted	06/09/23	2 km east of proposal site
CCC: 2357 ABP: 316237	Castlebank, Glenlon North, Glenlon South, Drummin and Ballykeelaun, Clare.	Permitted: 03/04/23 Appealed: 14/04/23 Application withdrawn: 10/07/23	-	1.5 km east of proposal site
CCC: 22591 ABP: 316043	Ballyglass, Coolderry, Dromintobin North, Reanabrone, & Oakfield, Ardnacrusha, Co Clare.	Permitted: 17/02/23 Appealed: 14/03/23 Permitted with revised conditions	21/11/23	4.4 km northeast of proposal site
18215	Islandduane, Mungret, Co. Limerick.	Permitted	03/10/18	10.8 km southwest of proposal site
18585	Clonloghan, Caherteige, Co. Clare.	Permitted	23/08/19	14.5 km west of proposal site
22586	Ballyvonnavaum, Coolshamroge, Cloonmore, Deerpark, Manusmore, Ennis, Co Clare.	Permitted	14/04/23	18 km northwest of proposal site
20562	Manusmore, Clarecastle, Co Clare.	Permitted	12/11/20	18 km northwest of proposal site
21915	Manusmore & Carrownanelly, Clarecastle, Ennis, Co Clare.	Permitted	30/11/21	20 km northwest of proposal site
19180	Cahershaughnessy near Spancil Hill, Co Clare.	Permitted	17/08/19	22 km northwest of proposal site
19194	Knockanoura & Cranagher, Spancil Hill, Co. Clare.	Permitted	19/08/19	22 km northwest of the proposal site
171001	Lissan West, Ballaghafaddy West, Clarecastle, Co. Clare.	Permitted	06/02/19	22 km northwest of proposal site
17750	Tuogh, Cappamore, Co. Limerick.	Permitted	07/12/17	24 km southeast of proposal site

4.10.5 Other Permitted and Proposed Developments in the Locality

A search of Clare County Council's online planning enquiry system for granted or on-going planning applications for the townlands encompassed within the site boundary comprising Glennagross, Cappateemore East, Ballycannan West, Ballycannan East, Ballycar South, and Ballycar North was undertaken on 8th December 2023, the results of which are presented in Table 24, below.

Table 24. List of granted and/or on-going planning applications within the vicinity of the proposed development site.

Application No.	Applicant	Location	Proposed Development	Decision	Decision Date
23461	Edward Ryan	Ballycar, Ardnacrusha	To retain an agricultural structure and all associated site works.	Further information request: 19/10/23	Pending
23229	Ciaran O'Connell	Ballycar South, Ardnacrusha	Construct a cubicle house extension with slatted tank, cattle shed with slatted tank, dungstead, and ancillary works.	Further information request: 08/06/23	Due: 12/01/24
2313	Mark Manning	Glennagross, Meelick, Clare	Construct dwelling house, bored well, waste water treatment system, percolation area, entrance and all associated site works.	Conditional	25/05/23
22886	Bobby O'Connell	Ballycar South, Ardnacrusha	Renovation, alterations and extension of existing disused dwelling, upgrading of existing entrance, change of use from residential to office use, all ancillary works.	Conditional	15/03/23
21935	Bobby O'Connell	Ballycar South, Ardnacrusha	Proposed concrete batching plant, storage shed, precast concrete yard, product storage area, office/canteen, dispatch office, new site entrance, all ancillary works.	Further information request: 28/10/21	Withdrawn: 06/05/22
21454	Kieran O'Connell	Ballycar North, Sixmilebridge	Two story extension with habitable space, open shed and balcony to west, boot room to south, addition of two windows to east elevation, replacement of two windows at front with one picture window on west elevation with double doors, and replacement of two windows on south elevation with one window.	Conditional	10/08/21
CCC: 18818 ABP: 304690	Bobby O'Connell and Sons Ltd	Ballycar, Ardnacrusha	Quarrying area of 10 hectares located adjacent to existing working quarry including extraction of rock by blasting to 150m OD; Extracted rock will be processed at existing working quarry; Landscaping of quarry during operational phase and restoration of quarry on completion of extraction; All associated ancillary facilities/works.	Conditional	13/12/19
19728	Jack & Siobhán Keane	Cappateemore East, Meelick	Retain existing sunroom, all existing elevations; conversion of garage to storage room and ancillary site works.	Conditional	25/11/19
1929	Lisa Hurley	Cappateemore West, Meelick	Rebuild and extend existing burned down dwelling house and replace existing septic tank with new wastewater treatment system and percolation area along with ancillary site works.	Conditional	25/08/19

4.10.6 Environmental Protection Agency (EPA) Facilities

A review of the EPA online mapping tool[48] determined that there are no IPPC, IPC or IEL[49] facilities within the immediate vicinity of the subject site. The nearest EPA licensed facility is Longpavement Landfill (Active Waste Licence Number: W0076-01), located approximately 4.5 kilometres southwest of the proposed development site. There are two other licensed waste facilities and five active licensed Industrial Pollution Control (IPC) sites within 10 kilometres of the proposed development site, refer to **Table 25,** below.

Table 25. Licensed waste facilities and active licensed Industrial Pollution Control (IPC) sites within 10 km of the proposed development site

License type	Name	Active license number	Facility address	Approximate distance from nearest point of proposed development site
Waste	Former Racecourse	W0259-01	Greenpark, Dock Road, Limerick	6 km southwest of site
	Bunlicky	W0051-01	Limerick	6.7 km southwest of site
Integrated Pollution Control (IPC) (formerly IPPC)	Cook Ireland Ltd.	P0973-01	O' Halloran Road, National Technology Park, Limerick	5.5 km southeast of site
	Analog Devices International Unlimited Company	P0224-04	Raheen Ind. Estate, Raheen, Limerick	8.6 km southwest of site
	Adhesives Research Ireland Limited	P0452-01	Raheen Industrial Estate, Raheen, Limerick	9.5 km south of site
	James McMahon Limited	P0329-01	Corcanree, Dock Road, Limerick	5.4 km southwest of site
	IMAG Optical Storage Limited	P0265-01	MC Infonics Ireland Limited, Raheen Industrial Estate, Limerick	9.2 km south of site

Within 10 kilometres of the proposed development site, there are twelve Industrial Emissions Licence (IEL) facilities located within and around Limerick City and listed in **Table 26**, below.

Table 26. Industrial Emissions Licenced (IEL) facilities located within 10 km of proposed development site.

Facility name	Active license number	Facility address	Approximate distance from nearest point of proposed development site
Stabright Limited	P0356-01	Clondrina, Ennis Road, Limerick	4.5 km southwest of site
Limerick Gasworks	W0281-01	Dock Road, Limerick	5.3 km south of site
Galvotech Ireland Limited	P0291-01	Unit 15/16, Childers Road Industrial Estate, Childers Road, Limerick	5.7 km southeast of site
Johnson & Johnson Vision Care Ireland Unlimited Company	P0818-04	National Technology Park, Plassey, Limerick	6.4 km southeast of site

[48] EPA Maps Accessed: 19th December 2022
[49] Integrated Pollution Control (IPC) Licence (formerly IPPC Licence), and Industrial Emissions Licence (IEL)

Facility name	Active license number	Facility address	Approximate distance from nearest point of proposed development site
J.H. Roche and Sons Limited	P1048-02	Roche's Feeds, Dock Road, Limerick	5.8 km southwest of site
Starrus Eco Holdings Limited (Dock Road)	W0082-03	Ballykeefe Townland, Waste Management Section, Dock Road, Limerick	6.2 km southwest of site
Valcroft Unlimited Company	P1136-01	Dock Road, Bunlicky, Limerick	6.4 km southwest of site
Irish Cement Limited (Limerick)	P0029-06	Castlemungret, Limerick	7.5 km southwest of site
Verbatim Ltd	P0036-02	Raheen Industrial Estate, Raheen, Limerick	8.5 km southwest of site
Howmedica International S.de R.L. Trading as Stryker Orthopaedics	P0023-03	Raheen Business Park, Raheen, Limerick	8.8 km southwest of site
Regeneron Ireland Designated Activity Company	P0991-02	Regeneron Ireland, Raheen Business Park, Raheen, Limerick	9.2 km south of site
Zinc Processors Limited Trading as Shannonside Galvanizing	P0650-03	Four Elms, Drombana, Limerick	9.4 km southeast of site

There are eleven urban wastewater treatment plants (UWWTP) located within the Lower Shannon (25D) Catchment and thirteen within the Shannon Estuary North (27) Catchment - details of the ten closest to the proposal site are listed in **Table 27,** below, along with approximate distances and locations.

Table 27. Summary of the ten urban wastewater treatment plants within the Lower Shannon (25D) Catchment and the Shannon Estuary North (27) located closest to the proposed development site.

Facility name	Facility type[50]	Active license number	WFD Catchment	Approximate distance and location from proposed development site
Castletroy	> 10,000 p.e.	D0019-01	Lower Shannon	4.1 km southeast of site
Sixmilebridge	2,001 to 10,000 p.e.	D0076-01	Shannon Estuary North	6.3 km west of site
Kilkishen	500 to 1,000 p.e.	D0420-01	Shannon Estuary North	9.2 km northwest of site
Shannon Town	> 10,000 p.e.	D0045-01	Shannon Estuary North	11.4 km southwest of site
Newport	2,001 to 10,000 p.e.	D0325-01	Lower Shannon	12.8 km east of site
Newmarket on Fergus	2,001 to 10,000 p.e.	D0079-01	Shannon Estuary North	15.2 km northwest of site
Caherconlish	1,001 to 2,000 p.e.	D0308-01	Lower Shannon	15.5 km southeast of site
Tulla	1,001 to 2,000 p.e.	D0320-01	Shannon Estuary North	15.5 km northwest of site
Murroe	1,001 to 2,000 p.e.	D0306-01	Lower Shannon	16.2 km southeast of site
Ballina	2,001 to 10,000 p.e.	D0189-01	Lower Shannon	17 km northeast of site

[50] Defined using population equivalent value (p.e.)

There are also several smaller sewage treatment plants within the area that treat sewage produced by less than 500 people. The nearest two such plants are 'Ballycannon' (Reg No. A0081-01) located approximately 0.8 kilometres south of the proposed development site, and 'Brookhaven, Montpelier' (Reg No. A0499-01) located 9.7 kilometres to the northeast. Ballycannon has a plant design capacity of 279 with an agglomeration p.e. of 188 while Brookhaven, Montpelier has a plant design capacity of 50 with an agglomeration p.e. of 49.

4.10.7 Existing Land-use and On-going Activities

Agriculture and forestry are the chief land-use activities in both the Shannon Estuary North (27) and Lower Shannon (25D) Catchments that could act in combination with the proposed project to negatively affect water quality. Other land-uses include peat/mineral extraction, village settlements, one-off housing, and urban settlements such as Limerick City, Ennis, Sixmilebridge, Clarecastle and Kilrush.

The WFD (2016–2021) ecological status of the Crompaun (East)_010 Waterbody, which includes the Cappateemore East Stream and the Crompaun (East) River, is 'At risk'[51] with a water quality status of 'Poor'. The main pressures within the subcatchment are channelisation, forestry, embankments, wastewater discharge and agriculture (EPA, 2022a). To the east of the site, the North Ballycannan_010 Waterbody is also categorised as 'At risk' with a water quality status of 'Good' (2016-21) and includes the East Ballycannan Stream and the North Ballycannan River. Agriculture and forestry, and particularly the excess sedimentation they create, are the main waterbody pressures within this subcatchment (EPA, 2022b). Refer to Figure 4-16, below.

[51] *At risk* - either the waterbody is currently not achieving its WFD environmental objective of Good or High Ecological Status or that there is an upward trend in nutrients/ammonia and if this trend continues the waterbody Status will decline by the end of Cycle 3 and will fail to meet its environmental objective (EPA, 2021a).

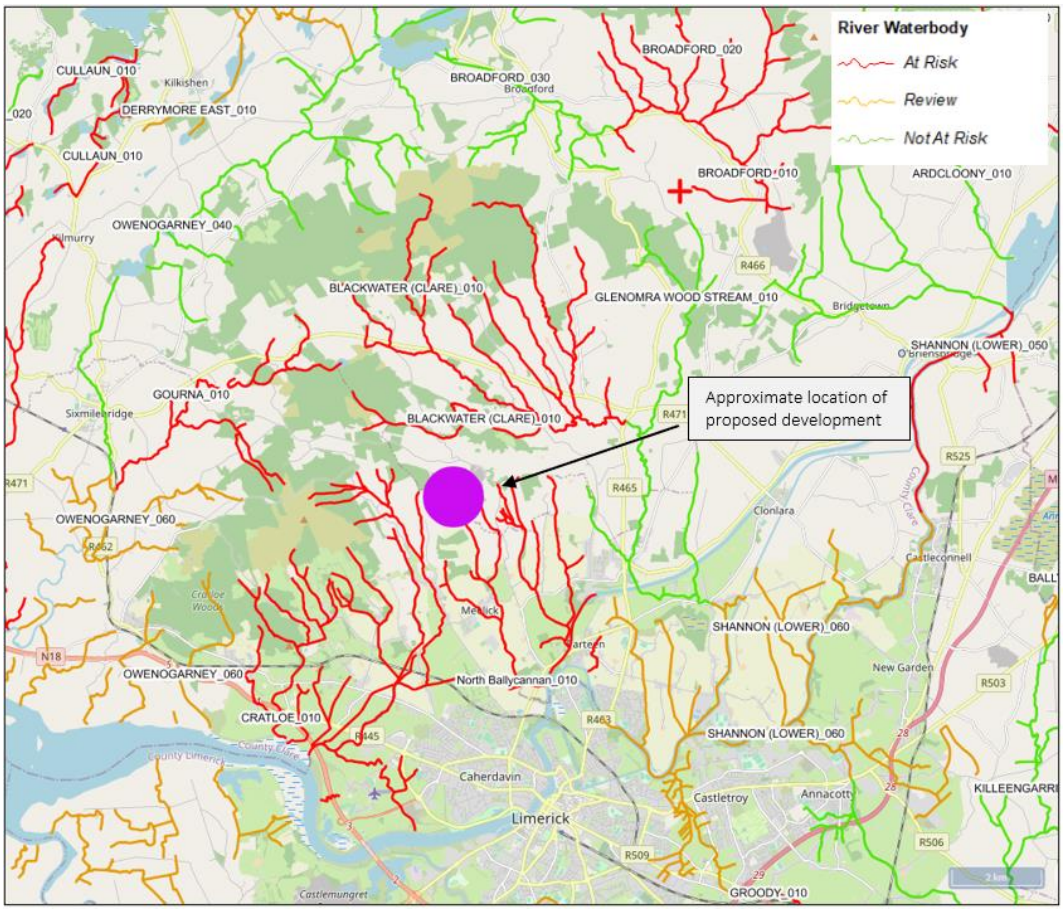

Figure 4-16: Risk status of waterbodies within the immediate vicinity of the proposed development site [adapted from EPA Maps].

Excessive nutrient loss and alteration of the hydromorphological regime is an ongoing issue for many waterbodies in surrounding sub-catchments due to the combined pressures of agricultural practices and forestry. Other significant pressures impacting waterbodies within both catchments include domestic wastewater, mines and quarries, urban wastewater/run-off and industry (EPA, 2021a; 2021b).

Within the Lower Shannon Catchment (25D), 38% of river waterbodies are classified as 'At risk' of not meeting their water quality objectives and 10% are in 'Review'. Excess nutrient levels and morphological impacts are the most prevalent issues, affecting 21% and 23% of the catchment's river waterbodies, respectively. Other significant issues impacting waterbodies within the catchment include sediment pollution, hydrological impacts, and chemical pollution (EPA, 2021a). Within the Shannon Estuary North Catchment (27), 48% of river waterbodies are classified as 'At risk' of not meeting their water quality objectives and 22% are in 'Review', while 23% of lake waterbodies within the catchment are labelled 'At risk'. Nutrient pollution and morphological impacts are also the main issues effecting waterbodies within the Shannon Estuary North Catchment (27), affecting 32% and 30%, respectively, of the river waterbodies within the catchment. Other significant issues for the catchment's rivers included sediment pollution, hydrological impacts and organic pollution (EPA, 2021b). Refer to maps of each catchment in **Figure 4-17**, below.

O'Connell Quarries (Register Number: QS0797) is located approximately 0.3 kilometres north of the proposed development site's northeast corner. This operational commercial quarry extracts and processes rock and produces ready-mix concrete. A planning application was submitted by the operator for the construction of a concrete products manufacturing facility on adjacent lands east of the existing quarry (Planning Ref No. 21935), however, the application was withdrawn on 6th May 2022 – see **Table 24**, above.

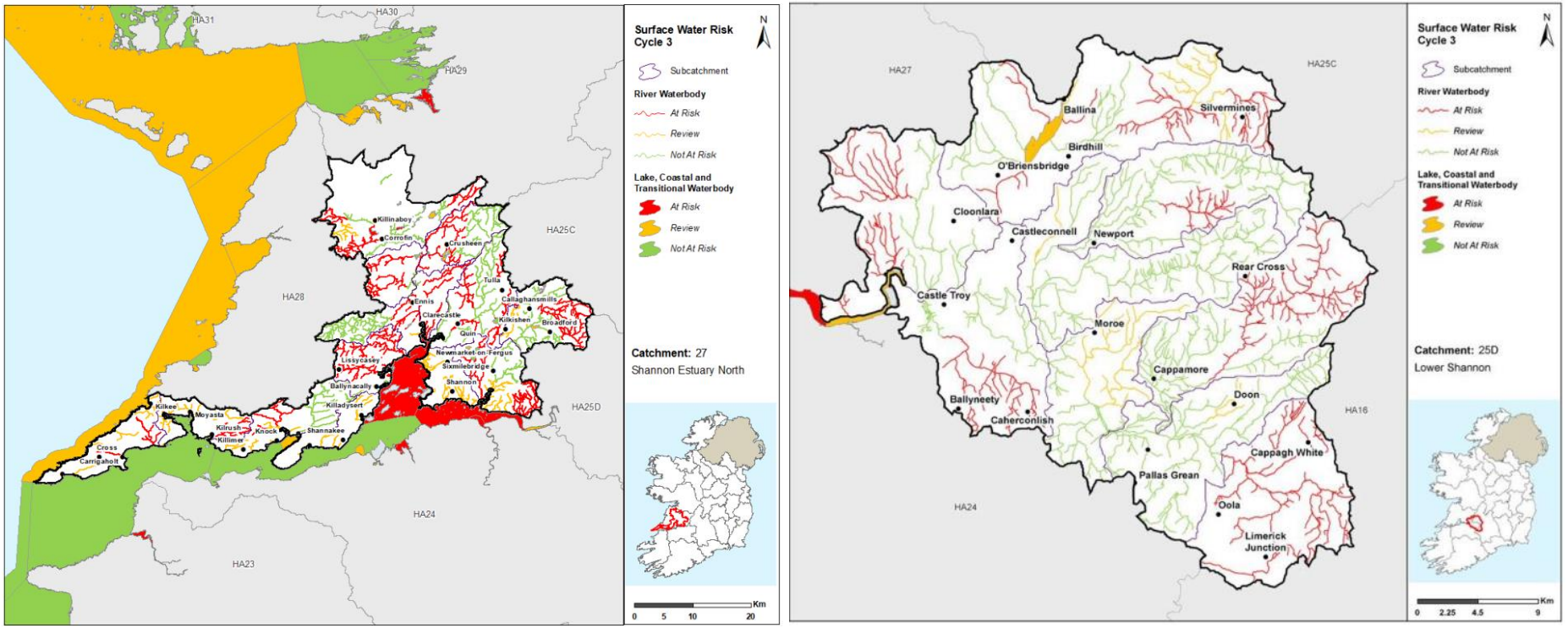

Figure 4-17: Risk status of waterbodies within the Shannon Estuary North Catchment (27) (left) and Lower Shannon Catchment (25D) (right) of not meeting water quality objectives (adapted from EPA, 2021b; EPA, 2021a, respectively).

4.10.8 Hydromorphology and Drainage

After agriculture, the most significant pressure to watercourses within the Shannon Estuary North (27) and Lower Shannon (25D) Catchments is hydromorphological modification due to the presence of drainage schemes that have created high levels of siltation (EPA, 2021b). Practices intended to improve the land for agricultural purposes and prevent flooding, such as the deepening of drains and channelisation, can change the morphological character of watercourses and result in an alteration of flows and substrate composition. Impacts to water quality resulting from dams, barriers, locks, weirs, bank erosion and embankments have also been noted within both catchments (EPA, 2021a). These hydromorphological changes to drainage channels in the area may act in combination with the proposed project to negatively affect water quality of watercourses and/or physically alter their integrity.

4.10.9 Climate Change

Climate change is an important environmental influence on ecosystems. Changing climate affects ecosystems in a variety of ways and could act in-combination with the project.

4.10.10 Potential for Significant In-combination Effects

It is considered that agriculture, forestry, on-going and future potential quarrying operations and to a lesser extent one-off rural residential developments comprise the land-uses and activities which could potentially interact synergistically with the proposed development to result in significant cumulative or in-combination effects.

The potential in-combination effects are discussed further in Section 6.7, below.

5. Identification of Potential Effects

Potential likely direct, indirect or secondary ecological impacts arising from the proposed development (either alone or in combination with other plans or projects) are identified in Table 28 and Table 29, below.

Table 28. Description of elements of the project likely to give rise to potential ecological impacts.

Construction Phase
▪ Excavations, clear felling, ground moving, and heavy engineering required to construct windfarm tracks & hardstands, sub-station, underground cabling, grid connection, surface water drainage system, permanent met mast, buildings & fencing. ▪ Machinery: The presence and sustained use of heavy and light plant machinery on site, albeit at variable rates and numbers, during daylight hours for the duration of the works. ▪ Use of fuels/oils/lubricants, concrete and other such substances considered harmful to the aquatic environment. ▪ Human presence: Sustained increase in human activity, albeit at variable rates and numbers, during daylight hours for the duration of the works. ▪ Increased noise and air emissions associated with construction activity. ▪ Erection of turbines. Introduction of large physical structures in a previously unoccupied/uninterrupted air space. ▪ Temporary storage of excavated spoil. ▪ Permanent deposition of excavated spoil at specific areas on site. ▪ Temporary site compound, local road widening. ▪ Temporary surface water flow management systems for specific engineering elements at various locations.
Operational Phase

- Operation of wind turbines at 12 locations (rotation of turbine blades).
- Operation of substation.
- Operational maintenance works.
- Human presence (wind farm staff).

Decommissioning Phase

- Decommissioning of wind farm infrastructure including excavation and heavy engineering works, ground moving, use of machinery, temporary storage of spoil, temporary site drainage.
- Increased human activity, increased noise and air emissions.
- Permanent disassembly and removal of wind farm components including turbines.
- Permanent disposal and storage of excavated materials.
- Temporary site compound.

Table 29. Description of potential direct, indirect or secondary ecological impacts of the construction, operational and decommissioning phases (either alone or in combination with other plans or projects).

Describe any likely direct, indirect or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: o *Size and scale* o *Land-take* o *Distance from Natura 2000 Site or key features of the Site* o *Resource requirements* o *Emissions* o *Excavation requirements* o *Transportation requirements* o *Duration of construction, operation etc.* o *Other.*	**Construction Phase** ▪ There is no spatial overlap between the subject site and any Natura 2000 site; therefore, there will be no direct habitat loss/alteration/land-take from within any Natura 2000 site. ▪ There will be loss and direct alteration of habitats (comprising mainly mature conifer forestry and agricultural grassland) within the construction footprint and because of spoil deposition. ▪ Potential for direct species disturbance/displacement impacts due to construction activity including fugitive noise emissions from machinery, human activity. ▪ The subject site is hydrologically connected to two European sites - Lower River Shannon SAC [002165] and the River Shannon and River Fergus Estuaries SPA [004077] - via watercourses draining the site. ▪ Potential for water quality impacts through erosion and run-off of silt, and/or ingress of fuels/oils, cementitious material, or other such substances via overland flow and/or the existing/proposed drainage network to local watercourses and estuarine waters of River Shannon into which they drain. ▪ Potential for groundwater contamination via spillage of oils/fuels/chemicals. ▪ Potential for indirect alteration of habitats outside of but hydrologically linked to the development site. ▪ Potential for indirect species disturbance/displacement due to *in-situ* or *ex-situ* habitat loss/alteration impacts, impairment of water quality and/or impacts on prey availability. ▪ Potential for spread of invasive alien species. **Operational Phase** ▪ Risk of bird mortality through collision or interaction with turbine blades or other wind farm infrastructure. ▪ Potential for species disturbance and displacement (indirect habitat loss) due to operation and on-going maintenance of wind turbines and substation. ▪ Potential for species displacement because of 'barrier effects' whereby birds are deterred from using normal routes to access breeding, foraging or roosting habitats elsewhere. For example, behavioural responses to the presence of turbines could cause some species to stop using or reduce their use of foraging grounds in proximity to the turbine envelope. ▪ Potential for water quality impacts through erosion and silt run-off, and/or ingress of fuels/oils via overland flow and/or the drainage network to local watercourses and estuarine waters of River Shannon into which they drain. ▪ Potential for groundwater contamination via spillage of oils/fuels/chemicals.

	▪ Potential for indirect alteration of habitats outside of but hydrologically linked to the development site. ▪ Potential for indirect species disturbance/displacement due to impairment of water quality and/or impacts on prey availability.
	Decommissioning Phase
	▪ Potential for water quality impacts, as above. ▪ Potential for groundwater contamination, as above. ▪ Potential for direct species disturbance/displacement due to fugitive noise emissions associated with disassembly and/or removal of wind farm components and human activity. ▪ Potential for indirect alteration of habitats outside of but hydrologically linked to the development site. ▪ Potential for indirect species disturbance/displacement due to impairment of water quality and/or impacts on prey availability. ▪ Potential for spread of invasive alien species.

6. European Sites Selected for Further Assessment

6.1 Stage 1 of the Appropriate Assessment Process

To establish which European sites are located within the ZOI, the Source-Pathway-Receptor (SPR) model was applied during the screening stage of AA, since according to the Office of the Planning Regulator guidelines (OPR, 2021), 'a European site will only be at risk from likely significant effects where the Source-Pathway-Receptor link exists between the proposed development and the European site'.

The SPR model firstly considered the nature, size and location of the proposed development and identified characteristics that may provide a source of direct (e.g. water, habitat loss) or indirect (e.g. collision risk, impact to prey species of a QI) ecological impacts. Secondly, any pathways (e.g. watercourses) linking the proposed development site to the European sites were identified before, finally, 'the location, nature and sensitivities of the qualifying species/habitats, the ecological conditions underpinning their survival and the conservation objectives specified to maintain or restore favourable conservation status' were established (OPR, 2021).

Following this, in view of best scientific knowledge, an assessment was made to ascertain whether the proposed development, individually or in combination with other plans/projects, was likely to have a significant effect on the European sites in view of the sites' conservation objectives. It could not be objectively concluded during the screening stage of AA for the proposed construction, operation and decommissioning of a 12-turbine wind farm at Ballycar in County Clare that significant effects on two European sites listed in Table 30, below, could be ruled out. It was, therefore, advised that the project proceed to Stage 2 of the AA process and an NIS be produced.

The Screening for Appropriate Assessment Report is included in Appendix 1 of this report.

Table 30. European sites included for Stage 2 Appropriate Assessment.

Designated site & Code	Approximate distance of designated site to nearest point of subject site	Hydrological/Ecological connection?
Lower River Shannon SAC (002165)	Located 1 km to southeast (46 m southeast of temporary road works at R464 / L3056 junction)	Yes (1.6 rkm downstream from WC6 and WC7)
River Shannon and River Fergus Estuaries SPA (004077)	Located 4.4 km to southwest (3.1 km south of temporary road works at R464 / L3056 junction)	Yes (6.6 rkm downstream from WC1)

Identifying a risk that could, in theory, cause an impact does not automatically mean that the risk event will occur or that it will cause or create an adverse impact. However, identification of the risk does mean that there is a latent possibility of ecological or environmental damage occurring, with the level and significance of the impact depending upon the nature of the risk, the extent of the exposure to the risk and the characteristics of the receptor. Therefore, bearing in mind the scope, scale, nature and size of the project, its location relative to the distribution of the species and habitats listed, and the degree of connectedness that exists between the project and potential receptors, it is considered that not all are within the zone of potential impact of the proposal.

An evaluation based on these factors to determine which species and habitats are the plausible ecological receptors for potential impacts of the unmitigated proposal has been conducted in **Section 6.2.2** and **Section 6.3.2,** below, for the proposed development in County Clare. This evaluation determined the specific qualifying features of the SAC and SPA (listed below in **Table 31** and **Table 32,** respectively), that should be selected for further assessment as plausible ecological receptors.

6.2 Lower River Shannon SAC [002165]

6.2.1 Description of the European Site

The following text summarises the Natura 2000 Standard Data Form for the site[52]. Refer to **Figure 6-1**, below.

The Lower River Shannon SAC is a large, narrow site that measures approximately 14 kilometres wide and 120 kilometres long. It encompasses the Shannon River Estuary, the broader River Fergus Estuary and several smaller estuaries such as Poulnasherry Bay along with the freshwater lower reaches of the Shannon River between Killaloe and Limerick and some freshwater stretches within the Feale and Mulkear catchments. The SAC also includes a marine area at the mouth of the Shannon estuary with high rocky cliffs to the north and south; ericaceous heath on Kerry Head and Loop Head; and several lagoons. Refer to **Figure 6-1**, below.

The underlying geology ranges from Carboniferous limestone (east of Foynes) to Namurian shales and flagstones (west of Foynes) to Old Red Sandstone (at Kerry Head). The ebb and flood of the tide and annual seasonal rainfall fluctuations ensure that the salinity of the system varies daily.

The Lower River Shannon SAC contains many Annex I habitats including the most extensive area of estuarine habitat in the country. A wide range of Annex II species are also present within the SAC including all three Irish species of lamprey, a good population of Atlantic salmon, and the only known resident population of Common bottlenose dolphin in Ireland. Many bird species listed on the EU Birds Directive either winter or breed at the site. The site is internationally important for waterfowl with more than 50,000 individuals occurring in winter. Several plant species listed in the Irish Red Data Book are also found within the SAC including two species of stonewort (*Chara canescens* and *Chara cf. connivens*) at Shannon Airport Lagoon, and the only known Irish populations of triangular club-rush (*Scirpus triqueter*).

The Lower River Shannon SAC is designated for the protection of the following qualifying features of conservation interest:

Habitats

- 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];

[52] N2K IE0002165 dataforms (europa.eu) Accessed: 6th June 2023

- 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]; and
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0].

Species

- 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] (QI status pertains only to freshwater phases of life cycle);
- Tursiops truncatus (Common Bottlenose Dolphin) [1349]; and
- Lutra lutra (Otter) [1355].

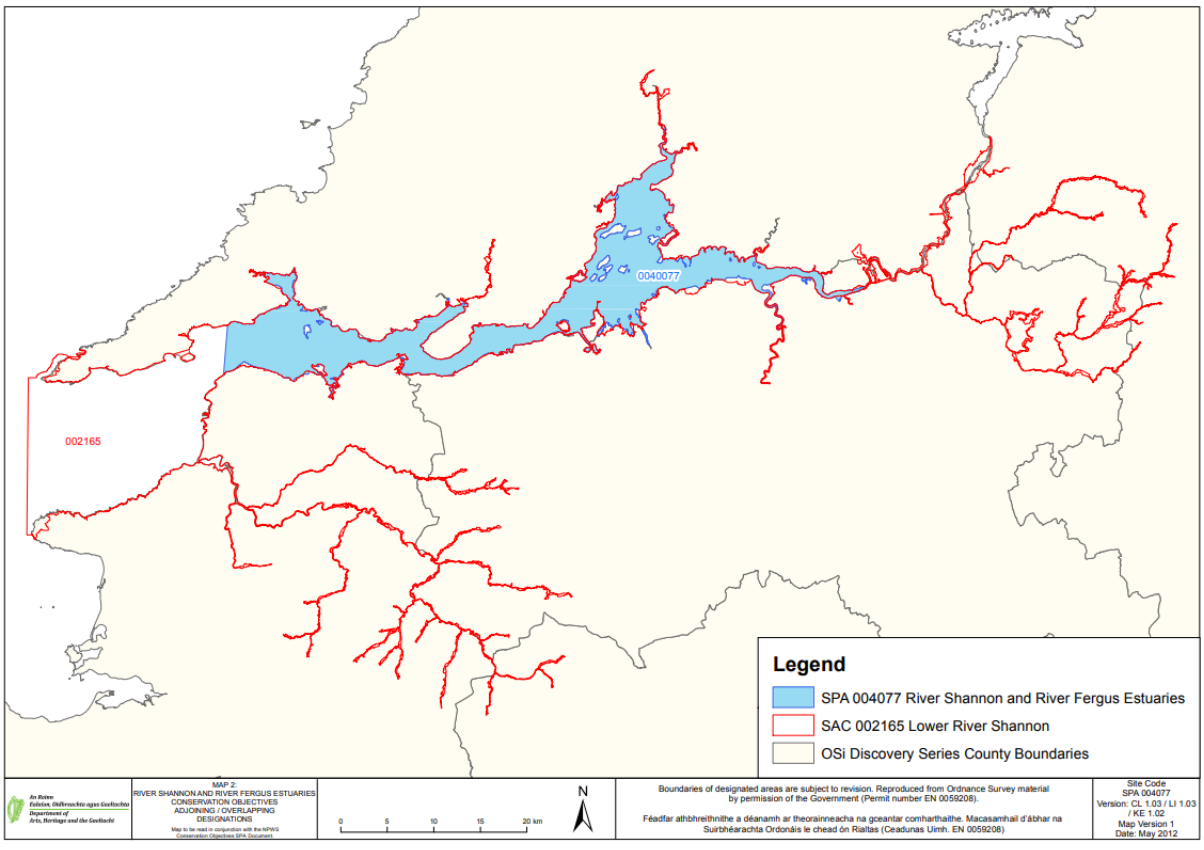

Figure 6-1: Extent of Lower River Shannon SAC (002165) and River Shannon and River Fergus Estuaries SPA (004077) (adapted from NPWS, 2012c).

6.2.2 Identification of Potentially Significant Impacts to Qualifying Features

Table 31, below, lists the qualifying features of the Lower River Shannon SAC and evaluates through a scientific examination of evidence and data whether these features should or should not be selected for further assessment in the NIS.

Table 31. Selection of qualifying features of the Lower River Shannon SAC (002165) for impact assessment

Qualifying features	Potential for significant impacts	Rationale
Sandbanks which are slightly covered by seawater all the time [1110]	No	The likely extent of sandbanks within the SAC has been mapped as south of Rinevella Point, Co. Clare and west of Ballybunion, Co. Kerry within the mouth of the Shannon Estuary (NPWS, 2012b), over 70 km from the proposed development site. Given the intervening distance between the proposal site and this marine/coastal habitat, it is considered that the project does not have potential for significant effects on sandbanks. The Shannon Estuary is approximately 45 km long and is well-connected to the Atlantic Ocean, meaning that exchange rates of water within the estuary can be expected to be very high with an almost constant movement of water into and out of the estuary. Any change to the water quality of the watercourses draining into the estuary from the proposed development site would be considered imperceptible/undetectable given the volumes of freshwater entering the estuary (from Rivers Shannon, Maigue, Fergus, and Deel) at each low tide, and the volume of saline/brackish water filling the estuary on each flooding tide. Thus, the project will not affect the conservation objectives for 'sandbanks which are slightly covered by seawater all the time' and the habitat is not considered further in the NIS.
Estuaries [1130]	**Yes**	The extent of the estuary has been mapped as occurring eastwards from Carrig Island on the southern shores of the Shannon Estuary to Aylevarroo Point on the northern shore (NPWS, 2012b). Distribution mapping for the SAC shows the closest estuarine habitat to the proposed development site is located approximately 4.2 river km downstream from WC6 and WC7 (refer to **Figure 4-4** and **Table 20**, above, for watercourse crossing locations). Additionally, via the existing drainage network at the site, there is an indirect hydrological connection to mapped estuarine habitat located approximately 3.6 river km downstream from the proposed development boundary adjacent to the North Ballycannan River at T12. Surface water drainage from all parts of the proposed wind farm site eventually drains into the Shannon Estuary. The boundary of the SAC is approximately 46 m from the temporary works at the junction of the R464 and L3056. Although the very high exchange rates of water within the estuary are noted, and it is considered that any potential water quality impacts during the construction phase will be localised in view of the nature, extent and scale of the proposed works, a precautionary approach will be taken due to the hydrological link and relatively short distance between the proposal site and the QI downstream. Therefore, the potential for significant impacts to occur cannot be ruled out and 'Estuaries' will be considered further in the NIS.

Qualifying features	Potential for significant impacts	Rationale
Mudflats and sandflats not covered by seawater at low tide [1140]	**Yes**	Both the Fergus and inner Shannon Estuaries feature vast expanses of intertidal mudflats. Within the SAC, mudflats are mapped as occurring south of Ballybunion at Bunaclugga Bay, Querrin Point and Poulnasherry Bay. Other areas of mudflats occur further east within the estuary channel at Limerick City (NPWS, 2012b). The closest area of this habitat to the proposed development site is located approximately 7.7 river km downstream from WC6 and WC7 (refer to **Figure 4-4** and **Table 20**, above). Additionally, via the existing drainage network at the site, there is an indirect hydrological connection to mapped mudflat/sandflat habitat located approximately 6.9 river km downstream from the proposed development boundary adjacent to the North Ballycannan River at T12. Surface water drainage from all parts of the proposed wind farm site eventually drains into the Shannon Estuary. The boundary of the SAC is approximately 46 m from the temporary works at the junction of the R464 and L3056. While it is considered that any potential water quality impacts during the construction phase will be localised in view of the nature, extent and scale of proposed works, a precautionary approach will be taken due to the hydrological link and relatively short distance between the proposal site and the QIs downstream. Therefore, the potential for significant impacts to occur cannot be ruled out and 'Mudflats and sandflats not covered by seawater at low tide' will be considered further in the NIS.
Coastal lagoons [1150]	No	There are four coastal lagoons within the SAC, namely Quayfield and Poulaweala Loughs, Shannon Airport Lagoon, Scattery Lagoon, and Cloonconneen Pool (NPWS, 2012b). Coastal lagoons are areas of shallow, coastal salt water, wholly or partially separated from the sea by sandbanks, shingle or rocks. Given the intervening distance of almost 30 river km between the proposed development site and the nearest area of this habitat at Shannon Airport, and as this habitat type is confined to coastline above the high tide mark and is therefore outside the zone of influence of any potential impact arising from the proposed wind farm construction/operation, there will not be a significant impact to 'coastal lagoons' and this habitat type is not considered further in the NIS.
Large shallow inlets and bays [1160]	No	The habitat 'large shallow inlets and bays' is a large physiographic feature that may wholly or partly incorporate other Annex I habitats including reefs, sandbanks and mudflats and sandflats within its area. In contrast to estuaries, large shallow inlets and bays have limited freshwater influence. The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and in areas extremely sheltered from wave action (NPWS, 2012b). The entire mouth of the Shannon Estuary extending eastwards as far as Carrig Island is mapped as large shallow inlets and bays. This habitat, with an estimated area of approximately 25,000 ha, is mapped as occurring west of Shannon towards the mouth of the estuary and more than 45 km west of the proposed development site. Given the intervening distance between the proposal and this habitat, in conjunction with very high exchange rates of water within Shannon Estuary, it is considered that

Qualifying features	Potential for significant impacts	Rationale
		the project does not have potential for significant effects on this habitat. Thus, the project will not affect the conservation objectives for 'large shallow inlets and bays' and the habitat is not considered further in the NIS.
Reefs [1170]	**Yes**	The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps, to ridged bedrock with gullies of sand between the ridges, to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. The communities found are tolerant to sand scour and tidal streams. 'Reefs' occur throughout the estuary, mainly as scattered and isolated pockets within the inner estuary and covering extensive areas at the mouth of the Shannon Estuary (NPWS, 2012b). A review of available mapping determined that there are numerous small patches of reefs located to the eastern extent of the estuary towards Limerick City. Furthermore, the Annex I habitat 'Estuaries [1130]' 'may wholly or partly incorporate other Annex I habitats including reefs…. within its area' (NPWS, 2012e). Consequently, and since there is a hydrological link between the proposal site and the downstream reefs habitat, the potential for significant impacts to occur cannot be ruled out at this stage so 'Reefs' are to be considered further in the NIS.
Perennial vegetation of stony banks [1220]	No	This habitat type occurs along the coast where shingle (cobbles/pebbles) and gravel have accumulated to form elevated ridges or banks above the high tide mark. This habitat is mapped as occurring in nine locations along the Shannon River and Estuary scattered throughout the hard coastline of the River Shannon (NPWS, 2012b). The nearest area of this habitat to the proposal site occurs at Ballymacrinan Bay, more than 53 km to the west. Given the characteristics of the project and the distance intervening, it is not considered that the proposal has any potential to significantly impact on this habitat-type. Thus, the project will not affect the conservation objectives for 'perennial vegetation of stony banks' and the habitat is not considered further in the NIS.
Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	No	Vegetated sea cliffs are steep slopes fringing hard or soft coasts, created by past or present marine erosion, and supporting a wide diversity of vegetation types with variable maritime influence. Most of the designated site west of Kilcredaun Point/Kilconly Point is bounded by high rocky sea cliffs, including Kilclogher, Loop Head, Ballybunion and Kerry Head. Cliff-top vegetation usually consists of either grassland or maritime heath. The boulder clay cliffs further up the estuary tend to be more densely vegetated (NPWS, 2012b). The nearest area of this habitat to the proposed development site occurs at Burrane, more than 48 km to the west. Given the characteristics of the project and the distance intervening, it is not considered that the proposal has any potential to significantly impact on this habitat-type. Thus, the project will not affect the conservation objectives for 'Vegetated sea cliffs of the Atlantic and Baltic coasts' and the habitat is not considered further in the NIS.

Qualifying features	Potential for significant impacts	Rationale
Salicornia and other annuals colonising mud and sand [1310]	No	This is a coastal habitat where pioneer salt-marsh vegetation colonises intertidal mud and sandflats in areas protected from strong wave action. It is an important precursor to the development of more stable saltmarsh vegetation and develops at the lower reaches of saltmarshes where the vegetation is frequently flooded by the tide. Within Lower River Shannon SAC the areas of *Salicornia* habitat are limited (NPWS, 2012b). A review of habitat mapping and supporting document available for the SAC determined that of the ten sub-sites surveyed as part of the Saltmarsh Monitoring Project (McCorry & Ryle, 2009) the closest occurring area of *Salicornia* habitat is the 'Inishdea, Owenshere' sub-site, located 25 km west of the proposed development site. Within the sub-site, *Salicornia* habitat is not well-developed occupying a single patch of ground of 0.003 ha (NPWS, 2012b). Given the characteristics of the project including the nature, extent and scale of the proposed works, and the distance intervening, it is not considered that the proposal has any potential to significantly impact on this habitat-type. Thus, the project will not affect the conservation objectives for '*Salicornia* and other annuals colonising mud and sand' and the habitat is not considered further in the NIS.
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	No	'Atlantic salt meadows' (ASM) generally occupy the widest part of the saltmarsh gradient and develop when halophytic vegetation colonises soft intertidal sediments of mud and sand in areas protected from strong wave action. This vegetation forms the middle and upper reaches of saltmarshes where tidal inundation still occurs but with decreasing frequency and duration. A review of habitat mapping and the SAC's coastal habitats supporting document determined that of the ten sub-sites surveyed for the Saltmarsh Monitoring Project (SMP) (McCorry & Ryle, 2009), the closest mapped area of ASM habitat is the 'Bunratty' sub-site (SMP code: 0081) (NPWS, 2012b). 'Bunratty' saltmarsh is located within the upper part of the Shannon Estuary in Co. Clare, approximately 9.5 km southwest of the proposal area. ASM is the dominant saltmarsh habitat at the site and measures approximately 27 ha. Typically, it occurs within this sub-site as a narrow band at the landward side of the brackish vegetation. Given the characteristics of the project including the nature, extent and scale of the proposed works, and the distance intervening, it is not considered that the proposal has any potential to significantly impact upon this habitat-type. Thus, the project will not affect the conservation objectives for 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' and the habitat is not considered further in the NIS.

Qualifying features	Potential for significant impacts	Rationale
Mediterranean salt meadows (*Juncetalia maritimi*) [1410]	No	'Mediterranean salt meadows' (MSM) occupy the upper zone of salt marshes and usually occur adjacent to the boundary with terrestrial habitats. They are widespread on the Irish coastline; however, they are not as extensive as Atlantic salt meadows. This habitat includes salt marshes in the Mediterranean basin dominated by *Juncus* (rushes), especially *Juncus maritimus* (sea rush) tolerant of saline soils. Although Mediterranean salt meadows are more restricted in their distribution and size, a review of habitat mapping and the coastal habitats supporting document available for the SAC determined that of the ten sub-sites surveyed, mapped and assessed as part of the Saltmarsh Monitoring Project (SMP) (McCorry & Ryle, 2009), the closest occurring area of MSM habitat is mapped as the 'Bunratty' sub-site (SMP code: 0081) (NPWS, 2012b). 'Bunratty' saltmarsh is located within the upper part of the Shannon Estuary, approximately 9.5 km southwest of the proposal area. MSM is not particularly well developed at this site and is confined to narrow, fragmented patches. With an area measuring approximately 0.87 ha, MSM represents less than 0.2% of the total marsh area surveyed (McCorry & Ryle, 2009). Given the characteristics of the project including the nature, extent and scale of the proposed works, and the distance intervening, it is not considered that the proposal has any potential to significantly impact on this habitat-type. Thus, the project will not affect the conservation objectives for 'Mediterranean salt meadows (*Juncetalia maritimi*)' and it is not considered further in the NIS.
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	**Yes**	This annexed habitat has a broad definition, covering from upland, flashy, oligotrophic, bryophyte- and algal-dominated rivers, to tidal reaches dominated by higher plants. Floating river vegetation characterised by species of water-crowfoot (*Ranunculus* spp.), pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. In Ireland, this particular sub-type is associated with tidal reaches of rivers and other periodically disturbed watercourses (e.g. canals and drains) (NPWS, 2012b). Since the full distribution of this habitat and its sub-types within the SAC is currently unknown, a precautionary approach will be taken. The watercourse crossings, the closest of which is 1.6 river km upstream of the SAC (see **Figure 4-4** and **Table 20**, above), create several hydrological links between the proposed development site and the SAC. Additionally, the existing drainage network at the site empties into watercourses that ultimately merge with the SAC, thereby creating an indirect hydrological connection between the proposal site and the SAC. The boundary of the SAC is approximately 46m from the temporary works at the junction of the R464 and L3056. Through these hydrological links there is potential for water quality impacts to occur, particularly during the construction phase of the proposed development. This QI habitat may occur in the freshwater reach of the River Shannon at Limerick, within the potential ZOI of the proposed development. Therefore, the project has potential to affect the conservation objectives for 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' and the habitat will be considered further in the NIS.
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]	No	*Molinia* meadows are found mainly on moist, moderately base-rich, peats and peaty gley soils, often with fluctuating water tables. They usually occur as components of wet pastures or fens, and often form mosaics with dry grassland, heath, mire and

Qualifying features	Potential for significant impacts	Rationale
		scrub communities. The current full extent of this habitat within the SAC is not mapped within the conservation objectives mapping; however, the site synopsis states that *Molinia* meadows occur in several parts of the site with an especially noteworthy example at Worldsend on the River Shannon (NPWS, 2012b). As this habitat type is confined to terrestrial locations above the high tide mark and outside of the ZOI of any potential impact arising from the construction/operation of the wind farm, there will not be a significant impact to *Molinia* meadows on calcareous, peaty or clavey-silt-laden soils.
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]	No	Alluvial woodland occurs on the banks of the Shannon, in the valley bottoms of the tributaries and on seepage zones on valley sides within the site (NPWS, 2012a). The most prominent woodland type is gallery woodland where white willow (*Salix alba*) dominates the tree layer with occasional alder (*Alnus glutinosa*). This habitat can occur on islands in river channels or low-lying wetlands alongside the channels and is characterised by periodic inundation of water. As there is no hydrological connection between areas of this habitat within the SAC and the proposed development site, and since the habitat type is confined to restricted terrestrial locations above the high tide mark, it is outside of the ZOI of any potential impact arising from the proposed wind farm. Therefore, no significant impact to the conservation objectives for 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*', is anticipated and this habitat is not considered further in the NIS.
Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]	No	The freshwater pearl mussel is a large, long-lived bivalve mollusc found in clean, fast-flowing, well-oxygenated rivers with unconsolidated substrates. Stable, clean gravel and sand with adequate availability of dissolved oxygen provides ideal habitat for juveniles. Water pH and hardness is also important with distribution mainly restricted to acidic, soft waters over-lying non-calcareous rock-types. Low nutrient status is also critical such that excess macrophyte and algal growth is prevented, therefore oligotrophic waterbodies are required. Conservation objectives for this species within the SAC apply to the freshwater pearl mussel population in the Cloon River, Co. Clare. This population is confined to the main channel and distributed from Croany Bridge to upstream of Clonderalaw Bridge (NPWS, 2012a). The Cloon River enters the main Shannon Estuary at a point more than 41 km west of the proposal site. Given the characteristics and location of the project, and species' ecology, it is not considered that the proposal has any potential to significantly impact on freshwater pearl mussel. Thus, the project will not affect the conservation objectives for 'Freshwater Pearl Mussel' and the species is not considered further in the NIS.

Qualifying features	Potential for significant impacts	Rationale
River Lamprey (*Lampetra fluviatilis*) [1099] Sea Lamprey (*Petromyzon marinus*) [1095]	**Yes**	The life cycles of sea lamprey and river lamprey contain both a marine phase and a freshwater phase. Both species spend their adult life in marine and estuarine waters, living as external parasites on other fish species before migrating up rivers in spring to spawn in areas of clean gravel, after which they die. Sea lamprey and river lamprey often spawn in the lower reaches of rivers but can also migrate up to 50 miles upstream (Kurz & Costello, 1999). Sea and river lampreys are poor swimmers (Reinhardt *et al*., 2009) and are generally considered unable to navigate past weirs and other barriers meaning that both lamprey species are restricted to the lower reaches of the SAC. Neither lamprey species occurred at any of the sites surveyed (see **Figure 3-2,** above, for sampling locations) and it is unlikely that either are to be found within the study area. However, the watercourse crossings, the closest of which is 1.6 river km upstream of the SAC (see **Figure 4-4** and **Table 20**, above), create several hydrological links between the proposed development site and the SAC. Additionally, the existing drainage network at the site empties into watercourses that ultimately merge with the SAC, thereby creating an indirect hydrological connection between the proposal site and the SAC. The boundary of the SAC is approximately 46m from the temporary works at the junction of the R464 and L3056. Through these hydrological links there is potential for water quality impacts to occur, particularly during the construction phase of the proposed development. Therefore, based on this and the precautionary principle, it is deemed that there is potential for significant impacts to the conservation objectives for sea and/or river lamprey so both species will be considered further in the NIS.
Brook Lamprey (*Lampetra planeri*) [1096]	**Yes**	Brook lamprey is the smallest of the three lamprey species native to Ireland. Unlike sea and river lamprey, it is not parasitic and is non-migratory, spending its entire life in freshwater. Species distribution within river catchments is dependent on the availability of suitable habitat; adults require fine sand/gravel areas in which to spawn while the juvenile form needs clean, fine sediment into which to burrow (King *et al*., 2011). The watercourse crossings, the closest of which is 1.6 river km upstream of the SAC (**Figure 4-4** and **Table 20**, above), create several hydrological links between the proposed development site and the SAC. Additionally, the existing drainage network at the site empties into watercourses that ultimately merge with the SAC, thereby creating an indirect hydrological connection between the proposal site and the SAC. The SAC boundary is approximately 46 m from the temporary works at the junction of the R464 and L3056. Through these hydrological links there is potential for water quality impacts to occur, particularly during the construction phase. Since brook lamprey was recorded at the North Ballycannan Stream and the Blackwater (Clare) River, whose lower reaches are located within the SAC, there is potential for significant impacts to the conservation objectives of brook lamprey should any water quality impacts arise because of the proposed development. Therefore, the species will be considered further in the NIS.
Atlantic Salmon (*Salmo salar*) [1106]	**Yes**	Salmon is an anadromous species, living in freshwater for at least the first two or three years of life before migrating to sea. Salmon has been observed spawning in the lower Shannon and its tributaries. Adult salmon occur in the Shannon Estuary prior

Qualifying features	Potential for significant impacts	Rationale
		to returning to natal streams to spawn, and smolts occur in the estuary on their journey from influent rivers to the sea (NPWS, 2012b). Salmon was recorded at Survey Site 11 on the Blackwater (Clare) River during the aquatic ecology surveys carried out by MWP in 2018. The watercourses at each of the other sites surveyed were deemed sub-optimal due to siltation and enrichment of the water at higher reaches and the morphologically degraded nature of watercourses in lower reaches. The watercourse crossings, the closest of which is 1.6 river km upstream of the SAC (see **Figure 4-4** and **Table 20**, above), create several hydrological links between the proposed development site and the SAC. Additionally, the existing drainage network at the site empties into watercourses that ultimately merge with the SAC, thereby creating an indirect hydrological connection between the proposal site and the SAC. The SAC boundary is approximately 46 m from the temporary works at the junction of the R464 and L3056. Through these hydrological links there is potential for water quality impacts to occur, particularly during the construction phase of the proposed development. Therefore, based on this, it is deemed that there is potential for significant impacts to the conservation objectives for salmon so the species will be considered further in the NIS.
Common Bottlenose Dolphin (*Tursiops truncatus*) [1349]	No	The only known resident population of bottlenose dolphin in Ireland are found in the Shannon Estuary. Most of the estuary comprises suitable habitat for this Annex II species, apart from the inter-tidal areas of the Fergus Estuary and the inner estuary channel near Shannon town stretching east towards Limerick - a review of on-line species records shows that sightings are concentrated in the outer channel. Within the SAC two 'critical areas' of habitat used preferentially by the species have been identified – one near Tarbert/Killimer and the second further west near Ballybunion and Kilcredaun Point (NPWS, 2012a). Given the characteristics and location of the project including the nature, extent and scale of the proposed works, the dilution potential of the River Shannon and Estuary, the distribution of bottlenose dolphin habitat and records within the estuary, it is not considered that the proposal has the potential to significantly impact on this species. Thus, the project will not affect the conservation objectives for bottlenose dolphin and the species is not considered further.
Otter (*Lutra lutra*) [1355]	**Yes**	Otter has a widespread distribution throughout Ireland and can be found in a variety of aquatic habitats such as lakes, rivers, streams, estuaries, and along the coast. They are mainly solitary animals and highly territorial preying on a wide variety of vertebrate and invertebrate species, although their diet primarily comprises fish. The amount of time spent within different parts of an individual's home range is related to prey abundance. No evidence of otter was recorded during the ecological field surveys and there are no documented records of otter held by the NBDC for the proposed development site. However, the watercourse crossings, the closest of which is 1.6 river km upstream of the SAC (see **Figure 4-4** and **Table 20**, above), create several hydrological links between the proposed development site and the SAC. Additionally, the existing drainage network at the site empties into watercourses that ultimately merge with the SAC, thereby creating an indirect hydrological connection between the proposal site and the SAC. The boundary of the SAC is approximately 46 m from the temporary works at the junction of the R464 and L3056. Through these hydrological links there is potential for water quality impacts to occur, particularly during the construction phase, creating potential for otter to be

Qualifying features	Potential for significant impacts	Rationale
		indirectly affected through a reduction in prey source and habitat availability. Thus, there is potential for significant impacts to the conservation objectives for otter so the species will be considered further.

It has been determined (see **Table 31**, above) that the proposed development has the potential to result in significant effects to the conservation objectives of the following Qualifying Interests (QIs) of the Lower River Shannon SAC:

- Estuaries [1130];
- Mudflats and sandflats not covered by seawater at low tide [1140];
- Reefs [1170];
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260];
- River Lamprey (*Lampetra fluviatilis*) [1099];
- Sea Lamprey (*Petromyzon marinus*) [1095];
- Brook Lamprey (*Lampetra planeri*) [1096];
- Atlantic Salmon (*Salmo salar*) [1106]; and
- Otter (*Lutra lutra*) [1355].

6.3 River Shannon and River Fergus Estuaries SPA (004077)

6.3.1 Description of the European Site

The following text summarises the Natura 2000 Standard Data Form for the site[53]. Refer to **Figure 6-1**, above.

The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The SPA comprises the entire estuarine habitat from Limerick City and Ennis town westwards as far as Doonaha in County Clare and Dooneen Point in County Kerry. Also included are several areas in the outer Shannon Estuary, such as Clonderalaw Bay and Poulnasherry Bay. The site has vast expanses of intertidal flats containing a diverse macro-invertebrate community, e.g. *Macoma-Scrobicularia-Nereis*, which provides a rich food resource for wintering birds. Eelgrass (*Zostera* spp.) is also present in places. Salt marsh vegetation frequently fringes the mudflats, and this provides important high tide roost areas for the wintering birds. Elsewhere in the site the shoreline comprises stony or shingle beaches. The tidal channels and creeks within the most inner parts of the estuaries are fringed with species such as common reed (*Phragmites australis*) and sedges (*Scirpus* spp.). Common cordgrass (*Spartina anglica*) is frequent in parts.

This is the most important coastal wetland site in Ireland and regularly supports more than 50,000 wintering waterfowl including internationally important numbers of redshank, black-tailed godwit and dunlin, and nationally important numbers of 16 other species. The site is of particular importance for dunlin (11% of national total), grey plover (7.5% of national total), lapwing (6.5% of national total), redshank (6.1% of national total), and shelduck (6.0% of national total), with significant numbers of whooper swan, golden plover and bar-tailed godwit also occurring at the site. A population of Greenland white-fronted goose (*Anser albifrons flavirostris*) once frequented the site but have since abandoned the area. The site provides both feeding and roosting areas for the wintering birds while the quality of estuarine habitats at the site is generally good.

The River Shannon and River Fergus Estuaries SPA is designated for the protection of the following qualifying features of conservation interest:

- Cormorant (*Phalacrocorax carbo*) [A017] Breeding & Wintering
- Whooper Swan (*Cygnus cygnus*) [A038] Wintering

[53] N2K IE0004077 dataforms (europa.eu) Accessed: 6th July 2023

- Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Wintering
- Shelduck (*Tadorna tadorna*) [A048] Wintering
- Wigeon (*Anas Penelope*) [A050] Wintering
- Teal (*Anas crecca*) [A052] Wintering
- Pintail (*Anas acuta*) [A054] Wintering
- Shoveler (*Anas clypeata*) [A056] Wintering
- Scaup (*Aythya marila*) [A062] Wintering
- Ringed Plover (*Charadrius hiaticula*) [A137] Wintering
- Golden Plover (*Pluvialis apricaria*) [A140] Wintering
- Grey Plover (*Pluvialis squatarola*) [A141] Wintering
- Lapwing (*Vanellus vanellus*) [A142] Wintering
- Knot (*Calidris canutus*) [A143] Wintering
- Dunlin (*Calidris alpine*) [A149] Wintering
- Black-tailed Godwit (*Limosa limosa*) [A156] Wintering
- Bar-tailed Godwit (*Limosa lapponica*) [A157] Wintering
- Curlew (*Numenius arquata*) [A160] Wintering
- Redshank (*Tringa tetanus*) [A162] Wintering
- Greenshank (*Tringa nebularia*) [A164] Wintering
- Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Wintering
- Wetlands [A999]

6.3.2 Identification of Potentially Significant Impacts to Qualifying Features

Table 32, below, lists the qualifying features of the River Shannon and River Fergus Estuaries SPA and evaluates through a scientific examination of evidence and data whether these features should or should not be selected for further assessment in the NIS. When explaining the rationale behind each selection, results of the 2010/11 Waterbird Survey Programme (NPWS, 2012d)are used and subsites are referenced – a map indicating the subsite locations is included in Figure 6-2, below, at the end of this section. Additionally, the waterbird counts undertaken in winter 2019/20 and winter 2022/23 along the Shannon Estuary and as discussed in Sections 3.6.2.2.2 and 4.4.8.2, above, are also used in this section to determine if further assessment of the SPA's qualifying features is necessary.

Table 32. Selection of qualifying features of the River Shannon and River Fergus Estuaries SPA (004077) for impact assessment.

Qualifying features	Potential for significant impacts?	Rationale
Cormorant (*Phalacrocorax carbo*) [A017]	**Yes**	A review of waterbird distribution for cormorant within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that cormorant was recorded within sub-sites 0I444 and 0I445, approximately 10 km southwest of the proposed development site (see **Figure 6-2,** below, for subsite locations). Furthermore, cormorant was seen regularly during waterbird counts of the estuary (see **Section 4.4.8.2**, above). Additionally, cormorant was recorded flying within the study area on three occasions during VP surveys (see **Figure 4-6**, above). The SPA also supports a nationally important breeding population of cormorant (93 pairs in 2010) (NPWS, 2012d). The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the SPA's water quality, and thus, potentially to the habitat, distribution and feeding opportunities of the cormorant population there. Additionally, since an individual was observed during the VP surveys, there is also potential that once the turbines are built, they could become a collision risk or possibly create a barrier to movement resulting in species displacement. Based on this, the species is deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Whooper Swan (*Cygnus cygnus*) [A038]	**Yes**	The SPA is designated for wintering whooper swan that usually forage on low-lying grasslands, estuaries (NPWS, 2012d) and improved pasture (Burke *et al*., 2021). The improved agricultural grassland at the proposed development site may have some potential as foraging grounds for the species but there were no observations reported during the VP surveys undertaken at the site from October 2019 to September 2023, inclusive, with a survey effort of 864 hours. During the 2022/23 waterbird surveys, the species was counted regularly within Survey Section D at Cooperhill, approximately 6.5 kilometres southwest of the proposed development site and outside the core foraging range of 5 km for the species (SNH, 2016). However, 14 whooper swan were recorded at Survey Section A at King's Island during the waterbird counts, more than 4 km southeast of the proposed T12 location. According to the sub-site assessments carried out for the 2010/11 Waterbird Survey Programme, (NPWS, 2012d), whooper swan was recorded foraging within sub-sites 0I457, 0I427, 0I446 and 0I445 between the Maigue Estuary and Limerick City, approximately 6.8 km southwest of the proposed development site (see **Figure 6-2,** below, for subsite locations). Although no whooper swan were observed within the proposed development site or within 500 metres of it, the site is located within the core foraging range of the 14 whooper swan counted at King's Island (refer to **Section 6.4.2.2**, below). Furthermore, the proposed development site is hydrologically linked to the SPA and to King's Island, and there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the whooper swan population there. Additionally, if the agricultural grassland at the proposed development site is used as foraging grounds, there is potential that once the turbines are built, they could become a collision risk or possibly create a barrier to

Qualifying features	Potential for significant impacts?	Rationale
		movement resulting in displacement of the species. Based on this, the species is deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	No	The site is designated for wintering light-bellied Brent goose. This species is amber-listed as the majority of the population winter at less than ten sites and the Irish population is also internationally significant. It winters on coastal estuaries during the autumn and early winter as well as on grasslands from mid-winter before departing to breeding grounds in Canada in late April. Brent geese are grazers and are known for their preference for foraging in intertidal areas with the Eelgrass *Zostera* sp. (Robinson *et al*. 2004). Where this food source is absent the birds feed upon algae and saltmarsh plants and the species also grazes terrestrially. A review of waterbird distribution for light-bellied brent goose within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme, determined that brent geese at the SPA had a relatively restricted distribution occurring in only seven sub-sites that were mostly located at the outer western section of the site (NPWS, 2012d). There were no records of foraging or roosting brent geese anywhere within the zone of potential influence of the proposal during the ornithological surveys. Based on this, this species is not considered to be within the zone of potential influence of the proposal and will not be considered further in the NIS.
Shelduck (*Tadorna tadorna*) [A048]	**Yes**	A review of waterbird distribution for shelduck within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that shelduck were recorded foraging and roosting intertidally at sub-sites 0H419, 0I431 and 0H514 (see **Figure 6-2,** below, for subsite locations), located approximately 10 km southwest of the proposed development site (NPWS, 2012d). The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the shelduck population there. Based on this and the precautionary principle, the species is deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052]	**Yes**	A review of waterbird distribution for wigeon and teal within the SPA carried out as part of the subsite assessment for the 2010/11 Waterbird Survey Programme determined that they were both relatively widespread over the SPA. They were both recorded foraging and roosting intertidally at sub-sites 0I445 and 0I446 (see **Figure 6-2,** below, for subsite locations), approximately 8.5 km southwest of the proposed development site (NPWS, 2012d). During wintering waterbird counts, teal was recorded in all surveys while wigeon was counted in 2022/23 in Section D only (see **Section 4.4.8.2**, above). The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the wigeon and teal populations

Qualifying features	Potential for significant impacts?	Rationale
		there. Based on this, both species are deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Pintail (*Anas acuta*) [A054]	**Yes**	A review of waterbird distribution for pintail within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme (NPWS, 2012d) determined that the species was recorded at two subsites only – 0H519 and 0K509 (see **Figure 6-2,** below, for subsite locations) located at the western extreme of the SPA at some distance from the proposed development site. However, during the waterbird counts, one pintail was counted at Section B and since the proposed development is hydrologically linked to the SPA and to Section B, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the pintail population there. Based on this and the precautionary principle, the species is deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Shoveler (*Anas clypeata*) [A056]	**Yes**	No shoveler was recorded at the proposed development site during the surveys, but the species was recorded at Sections A, B, and D during the waterbird counts (see **Figure 4-7**, above, for Survey Sections locations). A review of waterbird distribution for shoveler within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme (NPWS, 2012d) determined that there were four shoveler records from subsite 0I431 located approximately 10.5 km to the southwest of the proposed development site (see **Figure 6-2,** below, for subsite locations). However, an I-WeBS report by Fitzgerald *et al.,* (2021) lists shoveler as a species occurring in numbers of national importance at the site based on counts from 2013/14 to 2017/18 (mean 2,311). The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the shoveler population there. Therefore, based on this and bearing in mind the precautionary principle, the species is deemed to be within the zone of potential influence of the proposed development and will be considered further in the NIS.
Scaup (*Aythya marila*) [A062]	No	Scaup are a winter visitor to Ireland, arriving from northern breeding sites between November and April to coastal areas, estuaries, brackish lagoons and freshwater lakes close to the coast. They forage in sub-tidal areas, diving to hunt for molluscs and crustaceans as well as feeding on marine plants in areas typically with a depth of less than 10 m. Scaup is red-listed for its small breeding population and its localised wintering range. During waterbird counts, no scaup were recorded at any of the four Survey Sections nor were they recorded at the proposed development site during the other bird surveys. Furthermore, a review of waterbird distribution for scaup within the SPA carried out as part of the subsite assessments for the 2010/11 Waterbird Survey Programme (NPWS, 2012d) determined that the species was recorded foraging at three subsites only - 0H519, 0H521 and 0H522 (see **Figure 6-2,** below, for subsite locations). Since all three sites are located at the western extreme of the SPA at some distance from the proposed development site and

Qualifying features	Potential for significant impacts?	Rationale
		because no scaup were observed at the proposal site during the ornithological surveys, this species is deemed to be outside the zone of potential influence of the proposal and will not be considered further in the NIS.
Ringed Plover (*Charadrius hiaticula*) [A137]	No	Ringed plovers are 'visual foragers' searching the sediment surface for signs of prey such as worms, crustaceans and insects. A substantial proportion of ringed plovers occur on non-estuarine coasts, exhibiting a degree of plasticity in habitat choice such as shingle shores, saltmarsh and short grassland as well as artificial habitats. Ringed plover is amber-listed as internationally important numbers winter in Ireland. They breed on shingle and sandy beaches (Dempsey & O'Clery, 2002) and rough ground near the coast. During waterbird counts, no ringed plover were recorded at any of the four Survey Sections nor were they recorded at the proposed development site during the other bird surveys. A review of waterbird distribution for ringed plover within the SPA carried out as part of the subsite assessments for the 2010/11 Waterbird Survey Programme (NPWS, 2012d) determined that the species was found predominantly in the outer section of the estuary, towards the mouth, on intertidal mudflats. There was a single individual recorded roosting in subsite 0I427 in February 2011 (see **Figure 6-2,** below, for subsite locations). Since all but one record of ringed plover occurred within the western extent of the SPA away from the proposed development site, and because no ringed plover was observed at the proposal site during the ornithological surveys, this species is deemed to be outside the zone of potential influence of the proposal and will not be considered further in the NIS.
Golden Plover (*Pluvialis apricaria*) [A140]	**Yes**	A review of waterbird distribution for golden plover within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that the species are relatively widespread over the SPA foraging and roosting. They were recorded foraging and roosting intertidally at sub-sites 0I445 and 0I444 (see **Figure 6-2,** below, for subsite locations), located approximately 8.5 km southwest of the proposed development site (NPWS, 2012d). The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the golden plover population there. Based on this and bearing in mind the precautionary principle, the species are deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Grey Plover (*Pluvialis squatarola*) [A141]	**Yes**	Grey plover is a red-listed species in Ireland as the majority spend winter at less than ten sites. The SPA is designated for wintering grey plover. They feed on various marine molluscs, crustaceans and worms, foraging on intertidal mudflats within the estuary and on beaches. There were no grey plover observed at the proposal site during the surveys but there were 3 individuals seen at both Sections B and C. The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the grey plover population

Qualifying features	Potential for significant impacts?	Rationale
		there. Based on this, the species are deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Lapwing (*Vanellus vanellus*) [A142]	**Yes**	A review of waterbird distribution for lapwing within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that the species are widespread over the SPA. They were recorded foraging and roosting intertidally at sub-sites 0I427 and 0I445 (see **Figure 6-2,** below, for subsite locations), approximately 5 km southwest of the proposed development site (NPWS, 2012d). Additionally, during the 2019/20 winter waterbird counts, a peak count of 51 lapwing were recorded, while during the 2022/23 counts, lapwing were recorded at Sections A and D. The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the lapwing population there. Based on this, the species are deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Knot (*Calidris canutus*) [A143]	No	Knot are a winter visitor to Ireland, arriving from northern Greenland and Arctic Canada between October and February to coastal areas and estuarine sites with extensive muddy sand. They are specialist intertidal foragers and use sensors on their bill to detect buried prey. Preferred prey includes different species of bivalve molluscs and crustaceans. Knot is red-listed in Ireland due to falling numbers and its relatively localised wintering range. A review of waterbird distribution for SCI species within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme, as outlined in NPWS (2012b) found knot to have a relatively restricted foraging/roosting distribution within the site and were not recorded further east than subsite 0I430 (Black Rock to Mellon Pt.) (see **Figure 6-2,** below, for subsite locations). They were not recorded in any of the subsites in the vicinity of the proposal site. Furthermore, knot were not observed during the ornithological surveys and the proposed development site is considered to be sub-optimal roosting/foraging habitat for the species. Based on these reasons, this species is not considered to be within the zone of potential influence of the proposal and will not be considered further in the NIS.
Dunlin (*Calidris alpina*) [A149]	**Yes**	A review of waterbird distribution for dunlin within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that the species are widespread within the SPA. They were recorded foraging and roosting intertidally at sub-sites 0I427 and 0I445 (see **Figure 6-2,** below, for subsite locations), approximately 5 km southwest of the proposed development site (NPWS, 2012d). The proposed development is hydrologically linked to the SPA so there is potential for significant impacts to the water quality of the SAC and thereby to the habitat, distribution and feeding opportunities of the dunlin population there. Therefore, the species are deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.

Qualifying features	Potential for significant impacts?	Rationale
Black-tailed Godwit (*Limosa limosa*) [A156]	No	Black-tailed godwit is a red-listed species in Ireland as the majority winter at less than ten sites within the country. The SPA is designated for wintering black-tailed godwit. They are large, long-billed wading birds that forage within intertidal flats for their preferred prey of bivalves such as *Macoma balthica*, *Scrobicularia plana* and *Mya arenaria*. At some sites, polychaete worms form a larger proportion of the diet, and the species is relatively adaptable, utilising other habitats for foraging where available, such as terrestrial grassland, coastal marshes or freshwater callows. A review of waterbird distribution for black-tailed godwit within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that black-tailed godwit activity was predominantly concentrated within the middle of the site in an area between the Maigue Estuary and Aughinish. Apart from a small number of foraging birds recorded at subsites 0I445 and 0I446, there were no records of black-tailed godwit west of the Maigue Estuary within the vicinity of the proposed development site (see **Figure 6-2,** below, for subsite locations). This provides an intervening distance between the proposed development site and the Maigue Estuary of approximately 11 km over land or 14.5 river km, where potential adverse water quality impacts can be avoided, reduced or offset. Based on this, this species is not considered to be within the zone of potential influence of the proposal and will not be considered further in the NIS.
Bar-tailed Godwit (*Limosa lapponica*) [A157]	No	Bar-tailed godwits forage by probing intertidal sediment for invertebrate species, predominantly large polychaete worms such as *Arenicola marina* and *Nepthys* sp. They often feed at the tide's edge with their heads in water. The species is characteristic of sites with sandy substrates (Hill *et al*., 1993) or sections of a site that have sandy (as opposed to muddy) sediment. The dominant intertidal benthic community type across the site is 'intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans' (NPWS, 2012d). This broad community type has a wide variability in sediment type from gravel to fine sand to muds. Of note are high abundances of *Nephtys hombergii* occurring from the lower Fergus Estuary westwards and is a known prey species of bar-tailed godwit. The bar-tailed godwit is amber-listed in Ireland as the majority winter at less than ten sites. A review of waterbird distribution for SCI species within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme, as outlined in NPWS (2012b) found bar-tailed godwits to have a relatively restricted foraging distribution within the site. They were not recorded in any of the sub-sites in the vicinity of the proposal site (see **Figure 6-2,** below, for subsite locations). Based on this, this species is not considered to be within the zone of potential influence of the proposal and will not be considered further in the NIS.
Curlew (*Numenius arquata*) [A160]	**Yes**	A review of waterbird distribution for curlew within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that the species are widespread throughout the SPA. They were recorded foraging and roosting intertidally at sub-sites 0I446 and 0I457 (see **Figure 6-2,** below, for subsite locations), approximately 5 km southwest of the proposed development site (NPWS, 2012d). The proposed development is hydrologically linked to the SPA so there is potential for significant impacts to water quality of the SAC, and potentially to the habitat, distribution and feeding

Qualifying features	Potential for significant impacts?	Rationale
		opportunities of the curlew population there. Based on this, the species are deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Redshank (*Tringa totanus*) [A162] Greenshank (*Tringa nebularia*) [A164]	**Yes**	During the waterfowl counts, redshank was recorded at Survey Sections A, B, and C but there were no records of greenshank. A review of waterbird distribution for redshank and greenshank within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that both species are widespread throughout the SPA, particularly redshank. They were both recorded foraging and roosting intertidally at sub-sites 0I427, 0I457 and 0I448 (see **Figure 6-2,** below, for subsite locations), approximately 5 km southwest of the proposed development site (NPWS, 2012d). The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SAC, and thus, potentially to the habitat, distribution and feeding opportunities of the redshank and greenshank populations there. Based on this, both redshank and greenshank are deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Black-headed Gull (*Chroicocephalus ridibundus*) [A179]	**Yes**	A review of waterbird distribution for SCI species within the SPA carried out as part of the sub-site assessments for the 2010/11 Waterbird Survey Programme determined that black-headed gull was recorded within subsites 0I446 and 0I447 (see **Figure 6-2,** below, for subsite locations), approximately 5 km southwest of the proposed development site. Furthermore, the innermost subsite 0I448 recorded peak numbers during the October and November 2010 low tide surveys (NPWS, 2012d). Additionally, there were three separate black-headed gull flights recorded during bird surveys carried out – one sighting of a flock of twelve in January 2021, one sighting of an individual gull in October 2021, and one sighting of a flock of nine in March 2023. Furthermore, during the wintering waterbird counts, black-headed gull was observed in large numbers during all surveys. The proposed development is hydrologically linked to the SPA. Therefore, there is potential for significant impacts to the water quality of the SPA, and thus, potentially to the habitat, distribution and feeding opportunities of the black-headed gull population there. Additionally, since there were three separate records of the species during the VP surveys, there is also potential that once the turbines are built, they could become a collision risk or possibly create a barrier to movement resulting in disturbance/displacement of the species. Based on this, the species is deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.
Wetlands [A999]	**Yes**	There is a hydrological connection between the SPA and the proposal site via the various watercourses that drain the site and ultimately merge with the River Shannon and the SPA, located approximately 6.6 rkm downstream from WC1 via the Crompaun [East] River, merging with the Shannon at Meelick Rock (see **Figure 4-4**, above). The SPA is approximately 3.1 km from the temporary works at the junction of the R464 and L3056. Based on this, the habitat 'Wetlands' is deemed to be within the zone of potential influence of the proposal and will be considered further in the NIS.

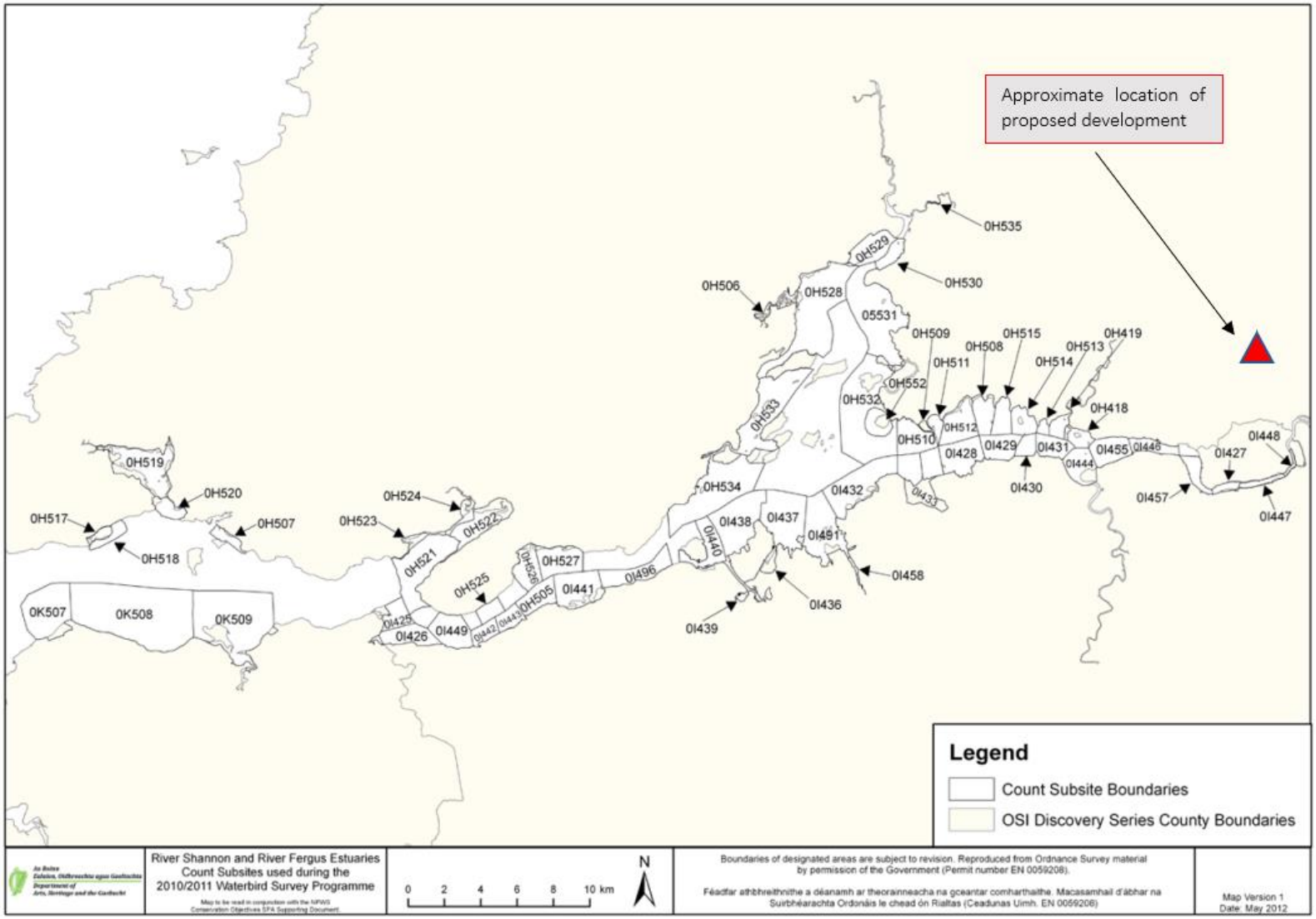

Figure 6-2: Locations of the subsites used for the 2010/11 Waterbird Survey Programme surveys within the River Shannon and River Fergus Estuaries SPA [adapted from NPWS, 2012c].

It has been determined (see **Table 32**, above) that the proposed development has the potential to result in significant effects to the conservation objectives of the following Special Conservation Interest (SCI) species of the River Shannon and River Fergus Estuaries SPA:

- Cormorant (*Phalacrocorax carbo*) [A017] Breeding & wintering
- Whooper Swan (*Cygnus cygnus*) [A038] Wintering
- Shelduck (*Tadorna tadorna*) [A048] Wintering
- Wigeon (*Anas penelope*) [A050] Wintering
- Teal (*Anas crecca*) [A052] Wintering
- Pintail (*Anas acuta*) [A054] Wintering
- Shoveler (*Anas clypeata*) [A056] Wintering
- Golden Plover (*Pluvialis apricaria*) [A140] Wintering
- Grey Plover (*Pluvialis squatarola*) [A141] Wintering
- Lapwing (*Vanellus vanellus*) [A142] Wintering
- Dunlin (*Calidris alpina*) [A149] Wintering
- Curlew (*Numenius arquata*) [A160] Wintering
- Redshank (*Tringa totanus*) [A162] Wintering
- Greenshank (*Tringa nebularia*) [A164] Wintering
- Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Wintering
- Wetlands [A999]

6.4 Assessment of Potentially Significant Effects

There follows an evaluation of potentially significant effects which may arise because of the proposed development on the qualifying features that have been selected for impact assessment in **Sections 6.2.2** and **6.3.2,** above, together with the potential effects identified in **Section 5,** above. Following this, a determination is made as to whether the proposal is likely to have adverse effects on the integrity of the European sites selected for assessment.

The likelihood of adverse effects to a European site from the proposed development has been determined based on the following indicators:

- Water quality;
- Habitat loss or alteration;
- Disturbance and/or displacement of species; and
- Habitat or species fragmentation.

The likelihood of significant cumulative/in-combination effects is assessed in **Section 6.7,** below.

6.4.1 Water Quality

As discussed in **Section 4.4.2** and illustrated in **Figure 4-4**, above, there are several watercourses draining the proposed development site and surrounding area that ultimately drain into two European sites downstream – firstly, the Lower River Shannon SAC, located approximately 1.6 river kilometres downstream from WC6 and WC7, and secondly, the River Shannon and River Fergus Estuaries SPA located approximately 6.6 river kilometres downstream of WC1. The existing drainage network within the development site, together with the network of drains within the surrounding area, create the potential for a hydrological link between the proposed wind farm

site and the SAC and SPA downstream. Additionally, although there will be no direct hydrological connection between the proposed temporary road widening works at the R464 / L3056 junction (see **Figure 4-14**, above) and either the SAC or the SPA, the proximity of the SAC (46 metres to the southeast of the junction) creates the potential for a tenuous indirect hydrological connection via run-off and overland flow. This in turn has the potential to create an equally as tenuous hydrological link between the proposed temporary works at the R464 / L3056 junction and the SPA located approximately 3.1 kilometres further downstream.

During a wind farm's construction phase, and in the absence of any pollution prevention controls, earthworks have the potential to adversely impact water quality due to soil erosion. The subsequent suspension of soil sediment particles in site run-off and overland flow can eventually reach the natural watercourses draining the site. Nutrients such as phosphorous can be bound to soil from past fertilisation of forestry crop and can become transported in overland flow. The presence of felled trees and brash at a site can increase the risk of such phosphorous release to local drains and watercourses. Potential also exists for accidental ingress of fuel and oils, concrete and cementitious material and other such substances considered harmful to the aquatic environment that could enter the streams draining the proposed development site - including the Cappateemore East River, the East Ballycannan Stream, the North Ballycannan River, and the South Ballycar River - via run-off, overland flow or the existing forestry drainage network and tributary streams.

Water quality is a key environmental factor underpinning the conservation condition of the complex of wetland habitats and aquatic species and birds that the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA are selected for. Several watercourses drain the study area and their proximity to the proposed development site boundary provides a hydrological pathway between the proposed development site and the two European sites located downstream. Given the pollution risk associated with the construction phase of the works and the identified hydrological pathways, it is considered that there is potential for some localised reduction in water quality of the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

Potential sedimentation, nutrient-enrichment, or other aquatic pollution, which could arise in the absence of effective water quality protection measures, would impact on freshwater ecology of watercourses within the vicinity of the works. There is also potential for significant water quality impacts within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA in the absence of appropriate mitigation measures as these sites include waterbodies that are downstream receptors with respect to the streams draining the site.

Based on the characteristics and scale of the proposed development, no significant impacts to water quality are foreseen during the operational phase; however, based on the precautionary principle, mitigation measures are recommended.

In conclusion, there is a risk that without a programme of mitigation measures the proposed development may potentially result in adverse water quality impacts within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA during construction, with the potential for operational impacts also possible, though highly unlikely. Adverse water quality impacts, should they arise, could then exert indirect impacts on aquatic/water-dependant habitats and species protected within the SAC and SPA, which could adversely affect the integrity of these sites.

Section 7, below, outlines a programme of mitigation measures designed to control and eliminate the point and diffuse pollution sources identified and to avoid, reduce or offset the potential adverse water quality impacts that might ensue because of the proposed development. Mitigation measures for the decommissioning phase will be similar to those of the construction phase but will be of a considerably lesser scale since excavations will not be required. Residual impacts are assessed in **Section 9,** below.

6.4.2 Habitat Loss/Alteration

There is no spatial overlap between the proposed development and either of the European sites located downstream, namely the Lower River Shannon SAC, and the River Shannon and River Fergus Estuaries SPA, so there will be no direct habitat loss within either. However, as has already been stated in **Section 6.4.1,** above, there is potential for significant water quality effects to both the SAC and SPA during the construction phase of the project via the hydrological links provided by watercourses draining the area and the proximity of the temporary road widening works. This creates potential for significant indirect alteration/loss of the aquatic habitats within the designated sites in the absence of mitigation.

6.4.2.1 Lower River Shannon SAC

Contaminated water entering the SAC creates potential for habitat alteration (or indirect habitat loss) of riverbeds downstream from sediments suspended in overland flows that may clog up gravels suitable for spawning salmon or lamprey because of the unmitigated proposal. Otter habitat may be indirectly affected by a reduction in water quality which can significantly alter the suitability of a site for otters and their requirements. Furthermore, the construction works may temporarily displace commuting or foraging otters. However, this impact is deemed to be limited given the localised and temporary nature of the works and the wide availability of similar suitable habitat in the vicinity of the works and the fact that the site is of relatively little ecological value to otter.

Four habitats within the SAC - 'Estuaries', 'Mudflats and sandflats not covered by seawater at low tide', 'Reefs' and 'Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' - also have the potential to be indirectly affected by a decrease in water quality. The habitats of the subtidal and intertidal animal communities living within the different regions of sediment, silt, mud and rock of estuaries, mudflats and reefs have the potential to be altered or lost should there be a reduction in water quality.

In conclusion, there is a risk that without a programme of mitigation measures, the proposed development may potentially result in indirect alteration of 'Estuaries [1130]', 'Mudflats and sandflats not covered by seawater at low tide [1140]', 'Reefs [1170]' and 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]' habitat within the Lower River Shannon SAC during construction, with the potential for operational impacts also possible, though highly unlikely. This could adversely affect the integrity of the Lower River Shannon SAC, and thus mitigation measures in relation to protection of water quality are recommended and are discussed in **Section 7**, below.

6.4.2.2 River Shannon and River Fergus Estuaries SPA

As discussed in **Section 6.4.1**, above, during the proposed development's construction phase, there is the potential for water quality within the River Shannon and River Fergus Estuaries SPA to be indirectly affected via contamination of watercourses draining the proposed development site which ultimately drain into the SPA downstream. This creates potential, via a reduction in water quality, for significant indirect alteration/loss of the 'Wetlands [A999]' habitat for which the SPA is designated. This wetland habitat is a critical resource for the regularly occurring migratory waterbirds that use it and is of particular importance to many of the SPA's SCI bird species listed in **Table 32**, above.

However, the risk of this occurring can be adequately prevented through the implementation of standard best management practices and controls and, therefore, certain mitigation measures are recommended with regards to protection of water quality. **Section 7,** below, outlines a programme of mitigation measures designed to avoid, reduce or offset the potential adverse water quality impacts and thus indirect habitat impacts that might ensue from the proposed development.

There is no spatial overlap between the proposed development site and the SPA so there will be no direct loss/alteration of habitat within the SPA. The proposal site contains large areas of agricultural grassland as well as

smaller areas of wet grassland and upland peat (refer to **Section 4.4.3**, above) which may have the potential to be utilised by foraging/grazing SCI bird species such as curlew, whooper swan, lapwing or black-headed gull. However, none of the SPA's designated SCI bird species listed in **Table 32**, above, were recorded foraging or grazing at the study area. During the 48 months of VP surveys at the site, only black-headed gull and cormorant were recorded at the site twice and three times, respectively, but each flight was completed without the birds grounding – refer to **Figure 4-6**, above, for flightpaths.

6.4.2.2.1 *Whooper Swan*

The guidance document '*Assessing Connectivity with Special Protection Areas (SPAs)*' (SNH, 2016) provides species-specific foraging distances for wintering geese and swan species which may be considered to connect bird populations to SPA sites. For whooper swan, the 'core range' with regards to foraging distances of the species from SPAs during winter is within 5 kilometres. This 'core range' is the buffer area around relevant SPAs within which whooper swan could reasonably be expected to regularly commute to outlying foraging areas from roost sites within the SPA boundary. This places the proposed development site within the core foraging range of the 14 individuals recorded at King's Island (as detailed in **Section 4.4.8.2**, above) and although not located within the River Shannon and River Fergus Estuaries SPA, King's Island is located less than two kilometres from the SPA's boundary. Consequently, it could reasonably be assumed that the 14 whooper swan observed at King's Island may be part of the SPA's whooper swan population. The SNH (2016) guidance does not provide information on the core foraging distances during winter for other species relevant to this site.

The majority of whooper swan counted (73.6%) as part of the 2020 International Swan Census[54] were observed on grassland habitats. This is consistent with previous years' findings (72.6% in 2015 and 79.2% in 2010) (Burke *et al*., 2021) and the increasing preference shown by foraging whooper swan in Ireland for dry, improved pastures (Brides *et al*., 2021) first noted in the mid 1990's (Crowe, 2005). The reason for this may be partly due to the general overall increasing numbers of whooper swan within Ireland every winter and their current conservation status in Ireland as 'Favourable' (NPWS, 2012c). In County Clare, for example, there was a 38.4% increase in the county's whooper swan population when the 2020 Swan Census results were compared with those of the 2015 Census, while in January 2020, whooper swan were recorded for the first time in all 32 counties during the census count (Burke *et al*., 2021).

Whooper swan belong within two trophic (foraging) guilds, namely 'surface swimmer' (meaning it can dabble/up-end on the water) and 'terrestrial walker' (meaning it can graze and/or probe in areas such as grassland and marsh) (NPWS, 2012c). These characteristics ensure the species has a wide prey/food range and, although displaying a relatively high level of site fidelity during winter, they can be highly mobile in relation to food supply utilising alternative habitats outside the SPA boundaries if necessary (Bowler, 2021). Considering this and the fact that the proposed development site lies within the core foraging range of 5 kilometres for the SPA's whooper swan population (SNH, 2016), there is potential for them to utilise the agricultural grassland areas within and around the proposed development site as foraging grounds.

However, over the 48-month survey period from October 2019 to September 2023, inclusive, whooper swan was never observed at the proposed development site nor within 4 kilometres of the proposed development site's boundary. During the wintering waterfowl counts at areas of suitable estuarine habitat along the River Shannon Estuary, flocks of whooper swan were regularly counted at the Cooperhill area within Section D, approximately 6.5 kilometres southwest of the proposed development site. The closest whooper swan record to the proposed development site was a flock of 14 individuals observed at King's Island within Section A, approximately 4 kilometres southeast of the proposed development site. Refer to **Section 4.4.8.2** and **Figure 4-7**, above, for survey details and locations.

[54] Internationally coordinated censuses carried out every five years over a single weekend - 2020 marked the 8th such census. They are coordinated in the Republic of Ireland by BirdWatch Ireland under contract to the National Parks and Wildlife Service.

Furthermore, whooper swan roost within wetland habitats such as lagoons, intertidal mudflats or shallow subtidal areas (NPWS, 2012c), and there are no significant bodies of standing water within the proposed development site or its immediate surroundings and therefore, no suitable whooper swan roost sites within the area. This is likely to be a significant factor in explaining the absence of whooper swan records from the proposed development site during the 48 months of bird surveys carried out there since 'the importance of permanent waterbodies as roost sites, near to suitable feeding habitat, should not be underestimated' (Burke *et al*., 2021). Similarly, Brides *et al.* (2021) noted that the existence of permanent standing water habitat 'in close proximity to feeding areas…..is vital as roosting habitat'.

This fact has already been confirmed in Section 4.4.8.2, above, with the details of the winter 2022/23 waterbird survey results where flocks of whooper swan were frequently observed at Cooperhill in survey Section D approximately 6.5 kilometres southwest of the proposed development site (refer to Figure 4-6, above). The permanent standing waterbody at the Cooperhill site is surrounded to the south, west and east by large swathes of agricultural fields, and to the north by the estuarine waters of the River Shannon which ensures the site is used by returning whooper swan every winter. Additionally, information obtained from BirdWatch Ireland on the waterbird species recorded at the closest I-WeBS subsites confirmed the presence of whooper swan at lakes surrounded by agricultural grassland approximately 10 kilometres northwest of the proposed development site and at southern estuarine areas near Cooperhill such as Coonagh Ponds and Bunlicky Lake. There are no I-WeBS sites within 5.5 kilometres of the proposed development site.

It has been established in the preceding paragraphs that whooper swan can and do frequently utilise habitat outside the boundaries of an SPA. However, upon completion of the entire suite of ornithological surveys carried out over 48 months (see Section 3.6.2, above) no evidence was found to indicate that any whooper swan population, whether from the River Shannon and River Fergus Estuaries SPA or elsewhere, utilised the grassland habitats within the proposed development site as feeding habitat. It has also been established that whooper swan roost within wetland habitats that preferably are near suitable foraging areas. The absence of any significant permanent standing waterbodies within the proposed development site or its environs decreases the optimality of grasslands in the area for foraging. Furthermore, the proposed development site is an already highly disturbed region due to relatively intense agricultural practices and activities associated with conifer plantations.

Therefore, in the context of the greater landscape containing more suitable foraging habitat and considering the absence of any whooper swan recorded within or around the proposed development site over 48 months of surveys, the loss of any potential foraging habitat to facilitate construction of the wind farm is not considered to have the potential to adversely impact the River Shannon and River Fergus Estuaries SPA in light of the whooper swan conservation objectives of the SPA – see also Section 6.4.3.2.2, below.

6.4.3 Disturbance and/or Displacement of Species

6.4.3.1 Lower River Shannon SAC

The Lower River Shannon SAC is designated for the protection of several aquatic species, and the semi-aquatic species, otter. Table 33, below, outlines the qualifying interest species for the SAC which have been selected for impact assessment.

Table 33. Qualifying Interest (QI) species of the Lower River Shannon SAC selected for impact assessment.

Qualifying Interest (QI) Species	Distribution within the SAC
Sea lamprey (*Petromyzon marinus*) [1095]	Freshwater aquatic
Brook lamprey (*Lampetra planeri*) [1096]	Freshwater aquatic
River lamprey (*Lampetra fluviatilis*) [1099]	Freshwater aquatic
Salmon (*Salmo salar*) [1106]	Freshwater aquatic
Otter (*Lutra lutra*) [1355]	Freshwater/coastal/terrestrial [semi aquatic]

There is potential for indirect disturbance or displacement of salmon and lamprey arising from potential pollutants entering watercourses during the construction phase of the proposed development. Spawning salmon and lamprey, in this case confined to brook lamprey, need a clean, well-aerated riverbed substrate to survive. Siltation of the substrate and eutrophication leading to increased biomass of filamentous algae could reduce the availability of suitable habitat. A reduction in water quality in the water column can reduce the suitability of the river for adult salmon and lamprey, resulting in disturbance/displacement of the species. There is potential for significant indirect effects to salmon and lamprey due to a reduction in water quality.

Regarding otter and the potential for disturbance or displacement impacts because of noise and/or human activity associated with construction of the development, it is noted that the drains in the vicinity of the proposed development site are considered to comprise marginal/sub-optimal foraging habitat for otter. No evidence of otter was recorded during the ecological site surveys. Although there is some potential for otter to occur, any disturbance or displacement impacts that arise due to fugitive noise from machinery and/or human activity during site preparation and construction will be temporary and will be restricted to the immediate vicinity of the proposed development site. In relation to possible otter disturbance or displacement impacts arising from the temporary road widening works that are to occur at the R464 / L3056 junction approximately 46 metres northwest of the SAC boundary, it is noted that works will be confined to the busy R464 Regional Road and adjacent areas that are already heavily modified and anthropogenically impacted with near constant levels of traffic. Therefore, any temporary road widening works at the junction are highly unlikely to significantly disturb or displace otter from the area when existing disturbance levels are considered.

Furthermore, otter is unlikely to use the 1st Order streams within the surrounding area given the small size and relatively low biomass of suitable prey species within the streams. However, larger watercourses downstream from the proposed development site can provide otter with a potential food source due to the wide variety of aquatic species present as described in Section 4.4.7, above. Therefore, while the proposed development is unlikely to result in any direct displacement of otter, there is potential for indirect displacement of the species through a reduction in water quality and suitability of the main channel for aquatic fauna and, consequently, reducing the available prey biomass for otter.

It has been determined in Section 6.4.1, above, that there is a risk, without a programme of mitigation measures to control any potential emissions from site preparation works and construction activity, that point or diffuse sources of pollution that could ensue from the proposed development could exert an impact on water quality. Section 7, below, outlines a programme of mitigation measures designed to avoid, reduce or offset potential adverse water quality impacts and thus indirect disturbance or displacement of aquatic species that might ensue because of the proposed development. Residual impacts are assessed in Section 9, below.

6.4.3.2 River Shannon and River Fergus Estuaries SPA

As described in SNH Guidance (2017), wind farms present three main potential risks to birds (Drewitt & Langston 2006, 2008; Band *et al*., 2007). These include:

- Direct habitat loss through construction of wind farm infrastructure.
- Indirect effects such as displacement (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement due to disturbance during the construction and operational phase may occur. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds.
- Direct effect of mortality caused by collisions with turbine blades and other infrastructure.

6.4.3.2.1 *Direct Habitat Loss*

There will be no direct loss of habitat within the SPA because of the proposed project. Furthermore, it is considered that the habitats contained within the footprint of the proposed turbine area do not comprise optimal foraging/roosting habitat for the SCI bird species in the context of other more suitable habitats within the surrounding areas – see more details in Section 6.4.2.2, above.

6.4.3.2.2 *Displacement Effects (Indirect Habitat Loss)*

While the SPA is more than 4 kilometres southwest of the wind farm site (3.1km from the temporary works at the junction of the R464 and L3056), there is potential for indirect displacement effects on the SCI species that may use habitats outside of the SPA boundary. It is noted, however, that monthly VP surveys carried out over 48 months at the proposed development site did not record any SCI species foraging, roosting or nesting within the footprint of the proposed development or its environs. The proposed development site and its environs are an already relatively disturbed region due to ongoing agricultural practices and conifer plantations and do not include any standing water or habitats that are preferentially selected by the populations of waterfowl and seabirds listed in Table 32, above, for which the SPA is designated.

These SCI species' preference is for large bodies of water such as the estuarine regions of the Shannon, Fergus and Maigue Rivers located further west towards the Atlantic. The terrestrial habitats available at the development site are not similar or ecologically analogous to the habitats preferred by these species and therefore, the site does not have the ecological resources required to attract nor support these qualifying interest (QI) species. While most of the species are generalists that can exploit alternative habitats, all are expected to, and based on the survey data appear to, preferentially select the range of coastal and estuarine habitats of higher ecological value abundantly available within the SPA site. As a result, it is considered that the wind farm construction will not disturb or displace foraging or roosting SCI species for which the River Shannon and River Fergus Estuaries SPA is designated.

There is potential for disturbance and displacement effects due to fugitive noise emissions generated during the construction phase of the proposal. It is considered that groundworks to prepare the wind farm site prior to installation of turbines and associated infrastructure will comprise the main activities with the potential to generate noise emissions greatly over and above ambient noise levels. However, such activities will be restricted to within the main footprint of the wind farm and at some distance from the SPA. Similarly, in terms of visual intrusion, the project's human resource requirement of work crews and other personnel will be located within the main wind farm site for the duration of the works.

It has already been noted in Section 6.4.1, above, that adverse water quality effects have the potential to arise during the construction phase of the project due to run-off from materials or through the accidental release of pollutants such as fuels, oils, silt, chemicals or hydrocarbons associated with construction activities. Siltation of the substrate and eutrophication leading to increased biomass of filamentous algae would reduce the available

suitable habitat. Therefore, without mitigation, poor water quality brought about by the proposed works has the potential to significantly impact River Shannon and River Fergus Estuaries SPA and the SCI bird species for which it is designated.

6.4.3.2.3 *Collision Risk*

Wind farms create the potential for avian disturbance/displacement effects through collision of the birds with wind turbine structures and the rotating blades. The risk of collision is dependent on a wide range of factors including bird species, number of birds, weather conditions, topography and the character of the wind farm itself (Drewitt & Langston, 2006) and collision rates can vary greatly between different wind farms. Raptors have been reported as being more susceptible to turbine collision than many other species due to their morphology and flight behaviour (Gove *et al.*, 2013) while conversely, the risk of collision for waders is generally considered to be low 'due to a relatively low cursory flight path, coupled with high flight manoeuvrability' (McGuinness *et al*., 2015). None of the SCI species for which the River Shannon and River Fergus Estuaries SPA is designated were observed within the proposed development site boundary during the 48 months of ornithological surveys carried out onsite by experienced ecologists and ornithologists. Indeed, only two SCI species were recorded within the flight activity survey area (see Section 4.4.8, above), namely cormorant and black-headed gull (see Figure 4-6, above).

Although larger bird species such as cormorant and swans have reduced manoeuvrability when compared with smaller birds (McGuinness *et al*., 2015; Drewitt & Langston, 2006), the observed collision rate for cormorant has appeared to remain low. A review of the number of bird collision victims at fourteen wind farms in Germany since 1989 by Hötker *et al*., (2006) found only two cormorants among the fatalities, while a review of data from wind farms in seven other European countries did not find any additional cormorant collision victims. At offshore wind turbines near Blyth in northeast England, 'no collision mortality was witnessed during 352 hours of daytime watches post-construction' (Rothery *et al*., 2009) and 'cormorants did not appear to be at risk and were observed to avoid flying critically close to the turbines' (Lowther, 2000).

In general, gull species are reportedly killed by turbine strikes more frequently than would initially be expected based on their abundance (Rydell *et al.*, 2017; Hötker *et al*., 2006; Everaert *et al*., 2002) and they appear not to display any avoidance measures, thereby making them more prone to collision (Gove *et al*., 2013). The only gull species designated an SCI species for the River Shannon and River Fergus Estuaries SPA is the black-headed gull and, as already discussed in Section 4.4.8, above, it was one of two SCI species observed during the Vantage Point surveys carried out at the proposed development site. Although gull fatalities because of wind farms can be relatively high, black-headed gulls display less susceptibility to turbine strikes than most other gull species. As noted in the previous paragraph, Rothery *et al* (2009) did not observe any turbine collisions at Blyth in the UK and reported that only 4% of black-headed gull flights at the site were within the height band of the rotor blades (above 26.4 metres). Furthermore, also at Blyth, black-headed gull flight heights occurred predominantly at heights of less than 15 metres making the species less vulnerable to turbine collisions than other larger gull species (Langston & Pullan, 2003).

As illustrated in Figure 4-6, above, only two of the River Shannon and River Fergus Estuaries SPA's qualifying interest bird species - cormorant and black-headed gull - were observed within the proposed development site boundary's 500 metre buffer (or flight activity survey area) throughout the suite of ornithological surveys carried out at the site over 48 months. Black-headed gull flights occurred close to the western and southeastern boundaries of the flight activity survey area and did not traverse the footprint of the proposed development. Similarly, a single cormorant was observed in-flight on only three occasions during the 48 months of bird surveys. Although two cormorant flights did pass through the airspace of the proposed development, the paucity of cormorant and black-headed gull activity at the site indicates that it is highly unlikely that either species regularly uses the proposed development site to fly between habitats. This conclusion has also been reached in relation to

the SPA's other SCI bird species since none were recorded within the proposed development site or the surrounding areas during the ornithological surveys.

As mentioned above, swans cannot manoeuvre themselves as efficiently as smaller birds due to their comparatively much bigger size. However, despite this, the collision rate reported for whooper swan has remained low. Hötker *et al*., (2006) reviewed collision data from wind farms in six European countries and found that birds such as geese and swans 'were only rarely found among the victims' and when compared to other birds, they 'were killed relatively infrequently'. Data on bird carcasses found under turbines was systematically collected in Germany since 1989 and revealed that duck, geese and swans made up only 5% of fatalities (or 65 birds) from 1989 to 2010 (Rydell *et al*., 2012). Furthermore, species such as geese and swans react to wind turbines at greater distances than most birds due to their heavier bodies and slower flight speed. This quicker reaction time coupled with the 'good eyesight' of geese and swans (Rees, 2012) means that the species have extremely high levels of avoidance rates for wind turbines – 99.5% for swans and 99.8% for geese (SNH, 2018).

Finally, the proposed turbines will have a relatively large blade length measuring 68 metres (see Table 16, above) and a greater rotor sweep resulting in increased power output at a wider range of wind speeds. Turbines with larger blades generally have a lower rotor speed than smaller turbines and, despite the larger rotor surface and higher altitude-range, it has been reported that the risk of collision with the larger blades is less than that of smaller blades. Krijgsveld *et al.* (2009) studied the collision rates of birds with large, modern turbines in the Netherlands and found that the 'risk was threefold lower than for smaller turbines'. Similarly, in Japan, Shimada (2021) used simple collision risk models to analyse collision rates and turbines of differing sizes and concluded that 'the number of collisions per MW decreases as the blade lengths or blade swept area increases'.

Consequently, for the reasons outlined in the preceding paragraphs, the potential for turbine collision to result in displacement or disturbance of the SCI bird species for which the River Shannon and River Fergus Estuaries SPA is designated is considered low.

6.4.3.2.4 *Barrier Effects*

Wind energy developments also have the potential to create 'barrier effects' where a barrier to movement is created that can disturb or displace a species from an area. This effect is of particular concern due to the possibility of increasing a bird's energy expenditure should they be required to fly further distances than they would otherwise need do to avoid turbines and/or access feeding, roosting and/or breeding areas. As is the case with collision risk, barrier effects are dependent on many different factors such as, amongst others, species of bird, flight height, wind force/direction, and time of day (Drewitt & Langston, 2006). Indeed, the actual barrier effect itself can vary hugely ranging from a slight change in flight direction, height or speed to a considerable diversion that may significantly affect an individual's energy budget (Gove *et al*., 2013).

A review of publications and reports on the issue of barrier effects carried out by Hötker *et al*. (2006) determined a barrier effect for 104 out of 168 cases (81 species), indicating that it is a relatively common occurrence but does not seem to affect all species equally. The review also established that geese, kites, cranes and some smaller passerines exhibited a particularly high level of sensitivity to barrier effects while birds such as cormorants, ducks, gulls, terns and some raptors 'were all less sensitive or less willing to change their original migration direction when approaching wind farms….and their local populations were less influenced by wind farms'.

Daytime observations at the East dam in the port of Zeebrugge, in Belgium, and at Maasvlakte in the port of Rotterdam, in The Netherlands, found that wind turbines did not act as a barrier for the daily migration routes of local breeding gull and tern colonies, with the birds flying between the turbines as they moved to and from their marine feeding areas (Everaert *et al*., 2002; Langston & Pullan, 2003). Similarly, at Blyth in Northumberland in northwest England with globally significant numbers of overwintering purple sandpipers (*Calidris maritima*), the

wind turbines did not appear to act as a barrier to movement and the species displayed an apparently high level of tolerance to the turbines (Lowther, 2000).

As discussed in Section 6.4.3.2.3, above, and illustrated in Figure 4-6, above, only two of the SCI bird species for which the River Shannon and River Fergus Estuaries SPA is designated were recorded within the flight activity survey area – cormorant on three occasions and black-headed gull on two occasions. This dearth of activity recorded over 48 months of surveys suggests that the potential for either species, or indeed any other of the SPA's SCI bird species, to regularly use the proposed development site as an ecological link to fly between habitats is low.

Considering the information outlined in the preceding paragraphs, the potential for disturbance and/or displacement of the SCI bird species of the River Shannon and River Fergus Estuaries SPA due to barrier effects is considered low.

6.4.4 Habitat or Species Fragmentation

Habitat fragmentation has been defined as 'reduction and isolation of patches of natural environment' (Franklin *et al*., 2002; Morrison *et al*., 2012) usually due to an external disturbance that alters the habitat and 'create[s] isolated or tenuously connected patches of the original habitat' (Wiens, 1989). This results in spatial separation of habitat units which had previously been in a state of greater continuity. Negative effects of habitat fragmentation on species or populations can include increased isolation of populations or species which can detrimentally impact on the resilience or robustness of the populations reducing overall species diversity and altering species abundance.

The proposed development will not result in any habitat loss within either of the relevant European sites - Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA – and significant habitat or species fragmentation impacts are not envisaged. However, a programme of mitigation measures pertaining to protection of water quality is recommended (see Section 7, below). Residual impacts are assessed in Section 9, below.

6.5 Assessment of Effects on the Conservation Objectives of the Lower River Shannon SAC [002165]

An evaluation was undertaken to determine which of the Qualifying Interests (QIs) of the Lower River Shannon SAC (see Section 6.2.2, above) potentially lie within the zone of influence of the proposed development and required further assessment in the NIS. This was done through a scientific examination of ecological evidence and data listed above in Section 3, above, or referenced, as well as the results of the ecological field survey (Section 4.4, above).

In this case, certain qualifying aquatic habitats and certain qualifying aquatic/water-dependant species were selected for further assessment. The remaining QI habitats and species were deemed to be outside of the zone of influence of the proposed development and were not selected for further assessment in the NIS. The effects of the project on the qualifying interests potentially within the zone of influence of the proposed development have been assessed against the measures designed to achieve the conservation objectives of the site. The outcome of the assessment has been presented in the following sections.

6.5.1 Estuaries [1130]

The conservation objective for 'Estuaries' is to maintain the favourable conservation condition of this habitat in the Lower River Shannon SAC. The specific habitat Attributes and Targets for this QI defined in relation to the achievement of the Conservation Objectives for the SAC are presented in **Table 34,** below. An assessment of the effects of the proposed development against these measures is also included.

Table 34. Attributes and targets for 'Estuaries [1130]' within the Lower Shannon SAC (NPWS, 2012b)

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Habitat area/ Hectares	The permanent habitat area is stable or increasing, subject to natural processes. Habitat area estimated as 24,273 ha.	There will be no reduction in habitat area within the SAC. Thus, this attribute will not be adversely affected by the project.	No
Community distribution/ Hectares	Conserve the following community types in a natural condition: Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; Estuarine subtidal muddy sand to mixed sediment with gammarids community complex; Subtidal sand to mixed sediment with *Nucula nucleus* community complex; Subtidal sand to mixed sediment with *Nephtys* spp. community complex; Fucoid-dominated intertidal reef community complex; Faunal turf-dominated subtidal reef community; and Anemone-dominated subtidal reef community.	Sediment-laden run-off may arise from exposed areas during groundworks or from construction vehicles/plant. These are potential sources of nutrients which could discharge into watercourses. Accidental fuel/oil spills or uncontrolled emissions of cementitious material/wastewater or other harmful substances also pose a risk to water quality, conservation of communities and habitat distribution.	Yes Refer to **Section 7**

6.5.2 Mudflats and sandflats not covered by seawater at low tide [1140]

The conservation objective for 'Mudflats and sandflats not covered by seawater at low tide' is to maintain the favourable conservation condition of this habitat in the Lower River Shannon SAC. The specific habitat Attributes and Targets for this QI defined in relation to the achievement of the Conservation Objectives for the SAC are presented in **Table 35,** below. An assessment of the effects of the proposed development against these measures is also included.

Table 35. Attributes and targets for 'Mudflats and sand flats not covered by sea water at low tide' within the Lower River Shannon SAC (NPWS, 2012b)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Habitat area/Hectares	The permanent habitat area is stable or increasing, subject to natural processes. Habitat area estimated using OSI data as 8,808 ha.	There will be no reduction in habitat area within the SAC. Thus, this attribute will not be adversely affected by the project.	No
Community distribution/ Hectares	Conserve the following community types in a natural condition: Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community; and Intertidal sand to mixed sediment with polychaetes, molluscs and crustacean community complex.	Sediment-laden run-off may arise from exposed areas during groundworks or from construction vehicles/plant. These are potential sources of nutrients which could discharge into watercourses. Accidental fuel/oil spills or uncontrolled emissions of cementitious material/wastewater or other harmful substances also pose a risk to water quality, conservation of communities and habitat distribution.	Yes Refer to **Section 7**

6.5.3 Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]

The conservation objective for 'Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' is to maintain the favourable conservation condition of this habitat in the Lower River Shannon SAC. The specific habitat Attributes and Targets for this QI defined in relation to the achievement of the Conservation Objectives for the SAC are presented in **Table 36,** below. An assessment of the effects of the proposed development against these measures is also included.

Table 36. Assessment of effects on conservation objectives of 'Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]' (NPWS, 2012b).

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Habitat area/Kilometres	Area stable or increasing, subject to natural processes. Three sub-types of high conservation value are known to occur in the SAC.	There will be no reduction in habitat area within the SAC. Thus, this attribute will not be adversely affected by the project.	No
Habitat distribution/ Occurrence	No decline, subject to natural processes.	There will be no decline in habitat distribution within the SAC. Thus, this attribute will not be adversely affected by the project.	No
Hydrological regime: river flow/ metres per second	Maintain appropriate hydrological regimes	A natural flow regime is required for both plant communities and channel geomorphology to be in favourable condition. There will be no alteration of hydrological regime within the habitat within the SAC. Thus, this attribute will not be adversely affected by the project.	No
Hydrological regime: tidal influence/ Daily water level fluctuations - metres	Maintain natural tidal regime	There will be no alteration of hydrological regime or natural tidal influence within the habitat within the SAC. Thus, this attribute will not be adversely affected by the project.	No
Hydrological regime: freshwater seepages/ metres per second	Maintain appropriate freshwater seepage regimes	There will be no alteration of hydrological regime or the freshwater seepages regime of the habitat within the SAC. Thus, this attribute will not be adversely affected by the project.	No
Substratum composition: particle size range/ Millimetres	The substratum should be dominated by the particle size ranges, appropriate to the habitat sub-type (frequently sands, gravels and cobbles)	Sediment laden run-off may arise from disturbed areas during groundworks or from construction vehicles/plant. When combined with heavy rainfall these activities pose a risk of silt runoff into waterways, including the North Ballycannan Stream and River Shannon downslope of the site and within the SAC. Such impacts may occur via the existing drainage network around the site in the absence of appropriate controls.	Yes Refer to **Section 7**

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Water quality: nutrients/ Milligrams per litre	The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition. The specific targets may vary among sub- types	Nutrient enrichment typically leads to increased filamentous algal biomass and consequent changes in algae, bryophyte and macrophyte species composition and abundance. Excess algal growth can lead to oxygen depletion in aquatic environments. Sediment-laden run-off may arise from exposed areas during groundworks or from construction vehicles/plant. These are potential sources of nutrients which could discharge into watercourses. Accidental fuel/oil spills or uncontrolled emissions of cementitious material/wastewater or other harmful substances also pose a risk to water quality and habitat condition.	Yes Refer to **Section 7**
Vegetation composition: typical species/ Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	The sub-types of this habitat include higher plants, bryophytes and microalgae. Site preparation and construction activity could adversely affect water quality and in turn habitat condition and typical vegetation composition.	Yes Refer to **Section 7**
Floodplain connectivity/ Area	The area of active floodplain at and upstream of the habitat should be maintained	River connectivity with the floodplain is essential for the functioning of this habitat and is particularly important in terms of sediment sorting and nutrient deposition. The proposed development will not affect floodplain connectivity within the catchment. Thus, this attribute will not be adversely affected by the project.	No
Riparian habitat/ Area	The area of riparian woodland at and upstream of the bryophyte-rich sub-type should be maintained	The proposed development will not result in any loss in area of riparian woodland. Thus, this attribute will not be adversely affected by the project.	No

6.5.4 Sea Lamprey [1095]

The conservation objective for sea lamprey is to restore the favourable conservation condition of this QI species in the Lower River Shannon SAC. The specific species Attributes and Targets for sea lamprey defined in relation to the achievement of the Conservation Objectives for the SAC are presented in **Table 37,** below. An assessment of the effects of the project against these measures is also included.

Table 37. Assessment of effects on conservation objectives of 'Sea lamprey [1095]' (NPWS, 2012b)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Distribution: extent of anadromy/ % of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	The proposed development will not result in any change in distribution or accessibility of rivers from the estuary for sea lamprey. Thus, this attribute will not be adversely affected by the project.	No
Population structure of juveniles/ Number of age/size groups	At least three age/size groups present	Potential adverse water quality effects which may arise because of the proposed development could impact on the population structure of juveniles within the SAC.	Yes Refer to **Section 7**
Juvenile density in fine sediment/ Juveniles/m^2	Juvenile density at least 1/m^2	Potential adverse water quality effects which may arise because of the proposed development could impact on juvenile sea lamprey habitat condition and juvenile population structure within the SAC.	Yes Refer to **Section 7**
Extent and distribution of spawning habitat/ m^2 and occurrence	No decline in extent and distribution of spawning beds	Lampreys require areas of clean gravels to spawn. Potential adverse water quality effects which may arise because of the proposed development could impact on spawning habitat potentially located downstream of the site and could result in a decline in spawning habitat extent within the SAC.	Yes Refer to **Section 7**
Availability of juvenile habitat/ Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Juvenile lampreys require areas of clean sand and silt in which to develop and mature. Potential adverse water quality effects which may arise because of the proposed development could impact on juvenile lamprey habitat condition and availability in watercourses downstream of the site within the SAC.	Yes Refer to **Section 7**

6.5.5 River Lamprey [1099] and Brook Lamprey [1096]

The conservation objective for river and brook lamprey is to maintain the favourable conservation condition of these species in the Lower River Shannon SAC. The specific species Attributes and Targets for river and brook lamprey defined in relation to the achievement of the Conservation Objectives for the SAC are presented in **Table 38,** below. An assessment of the effects of the project against these measures is also included.

Table 38. Assessment of effects on conservation objectives of 'River lamprey [1099]' and 'Brook lamprey [1096]' (NPWS, 2012b)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Distribution/ % of river accessible	Access to all watercourses down to 1st order streams	The proposed development will not result in any change in distribution or accessibility of watercourses for river/brook lamprey. Thus, this attribute will not be adversely affected by the project.	No
Population structure of juveniles/ Number of age/size groups	At least three age/size groups of brook/river lamprey present	Potential adverse water quality effects which may arise because of the proposed development could impact on the population structure of juvenile river or brook lamprey within the SAC.	Yes Refer to **Section 7**
Juvenile density in fine sediment/ Juveniles/m^2	Mean catchment juvenile density of river/brook lamprey at least $2m^2$	Potential adverse water quality effects which may arise because of the proposed development could impact on juvenile lamprey habitat condition and mean catchment juvenile density within the SAC.	Yes Refer to **Section 7**
Extent and distribution of spawning habitat/ m^2 and occurrence	No decline in extent and distribution of spawning beds	Lampreys require areas of clean gravels to spawn. Potential adverse water quality effects which may arise because of the proposed development could impact on spawning habitat potentially located downstream of the site and could result in a decline in spawning habitat extent within the SAC.	Yes Refer to **Section 7**
Availability of juvenile habitat/ Number of positive sites in 2nd order channels (and greater) downstream of spawning areas	More than 50% of sample sites positive	Juvenile lampreys require areas of clean sand and silt in which to develop and mature. Potential adverse water quality effects which may arise because of the proposed development could impact on juvenile lamprey habitat condition and availability in watercourses downstream of the site within the SAC.	Yes Refer to **Section 7**

6.5.6 Atlantic Salmon [1106]

The conservation objective for Atlantic salmon is to restore the favourable conservation condition of this species in the Lower River Shannon SAC. The specific species Attributes and Targets for Atlantic salmon defined in relation to the achievement of the Conservation Objectives for the SAC are presented in **Table 39,** below. An assessment of the effects of the project against these measures is also included.

Table 39. Assessment of effects on conservation objectives of 'Atlantic salmon [1106]' (NPWS, 2012b)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Distribution: extent of anadromy/ % of river accessible	100% of river channels down to 2nd order streams accessible from estuary	The proposed development will not result in any change in distribution or accessibility of rivers for salmon. Thus, this attribute will not be adversely affected by the project.	No
Adult spawning fish/ Number	Conservation Limits (CL) for each system consistently exceeded	Potential adverse water quality effects which may arise because of the proposed development could impact adult salmon, fry, or smolts.	Yes Refer to **Section 7**
Salmon fry abundance/ Number of fry/ 5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling		
Out-migrating smolt abundance/ Number	No significant decline		
Number and distribution of redds/ Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon require areas of clean gravel and cobble to spawn. Potential adverse water quality effects which may arise because of the proposed development could impact on spawning habitat potentially located downstream of the site and could result in a decline in spawning habitat within the SAC.	Yes Refer to **Section 7**
Water quality/ EPA Q value	At least Q4 at all sites sampled by EPA	Potential adverse water quality effects which may arise because of the proposed development could impact on river water quality as measured by the Q-value.	Yes Refer to **Section 7**

6.5.7 Otter [1355]

The conservation objective for otter is to restore the favourable conservation condition of this species in the Lower River Shannon SAC. The specific species Attributes and Targets for otter defined in relation to the achievement of the Conservation Objectives for the SAC are presented in **Table 40,** below. An assessment of the effects of the project against these measures is also included.

Table 40. Assessment of effects on conservation objectives of 'Otter [1355]' (NPWS, 2012b)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Distribution/ percentage positive survey sites	No significant decline	The proposed development site features some small streams which are evaluated as marginal/sub-optimal potential foraging habitats for otter. Due to the nature, location and scale of the proposed development, a significant decline in distribution of otter is not likely. Thus, this attribute will not be adversely affected by the project.	No
Extent of terrestrial habitat/ hectares	No significant decline. Area mapped as 596.8 ha above high-water mark, 958.9 ha along riverbanks/around ponds	The proposed development will not result in any significant decline in the extent of terrestrial/ marine/freshwater (river) or freshwater (lake/lagoon) habitat for otter. Thus, this attribute will not be adversely affected.	No
Extent of marine habitat/ hectares	No significant decline. Area mapped as 4,461.6 ha		
Extent of freshwater (river) habitat/ kilometres	No significant decline. Length mapped as 500.1 km		
Extent of freshwater (lake/lagoon) habitat/ hectares	No significant decline. Area mapped as 125.6 ha		
Couching sites and holts/ number	No significant decline	Field surveys did not identify any suitable couching sites or breeding habitat. The proposed development will not result in any decline in the number of couching sites and holts for otter. Any otter using the proposed development site are considered transient i.e. only passing through from one catchment to another. Thus, this attribute will not be adversely affected.	No
Fish biomass available/ kilograms	No significant decline	Potential adverse water quality effects may arise because of the proposed development could impact on water quality within downstream watercourses and therefore the fish biomass available to otter.	Yes Refer to **Section 7**
Barriers to connectivity/ number	No significant increase.	The proposed development will not result in any increase in the number of barriers to connectivity for otter. Thus, this attribute will not be adversely affected.	No

6.6 Assessment of Effects on the Conservation Objectives of the River Shannon and River Fergus Estuaries SPA [004077]

An evaluation was undertaken to identify which of the Special Conservation Interest (SCI) bird species of the River Shannon and River Fergus Estuaries SPA (see **Section 6.3.2,** above) potentially lie within the zone of influence of the proposed development and require further assessment in the NIS. This was done through a scientific examination of ecological evidence and data listed above in **Section 3**, above, or referenced, as well as the results of the ecological field surveys (**Section 4.4**, above). In this case, certain qualifying SCI species were selected for further assessment. The remaining species were deemed to be outside of the zone of influence of the proposed development and were not selected for further assessment in the NIS.

Following this, an assessment of the potentially significant effects that may arise due to the proposed development was carried out in **Section 6.4**, above, and a determination was made as to whether the integrity of the SPA is likely to be adversely effected by the proposal. Potential indirect effects to the water quality of the SPA were identified along with the possible indirect ramifications this may have on the wetland habitat and species within the SPA. Displacement of SCI species that may be created by the proposed turbines due to risk of collision and/or the potential barriers to movement was also addressed in **Sections 6.4.3.2.3** and **6.4.3.2.4**, respectively, above, and the potential risk was concluded as being low.

The effects of the project on the qualifying interests potentially within the zone of influence of the proposed development have been assessed against the measures designed to achieve the conservation objectives of the site and the outcome of the assessment has been presented in the following sections. In addition to the wintering waterbird counts described in **Sections 3.6.2.2.2** and **4.4.8.2**, above, surveys carried out for the 2010/11 Waterbird Survey Programme (NPWS, 2012d) at the subsites illustrated in **Figure 6-2**, above, are referred to throughout the following assessments. Given that habitats within the SPA have not undergone any significant change in recent years, the current distribution of SCI species within the SPA can be expected to correlate to the distributions recorded during the 2010/11 Waterbird Survey Programme (NPWS, 2012d) and the most recent I-WeBS data.

6.6.1 Cormorant [A017]

Cormorant is a resident species in Ireland occurring along the coast and breeding in colonies mainly on offshore islands and rocky coastlines although there are some inland breeding populations. This diving species feeds on fish, foraging mainly in shallow waters (<30m depth) and may roost in intertidal or supratidal areas. The species is amber-listed in Ireland due to a localised breeding population. Cormorant is the only qualifying species with a breeding population within the River Shannon and River Fergus Estuaries SPA (NPWS, 2012c).

The conservation objective for cormorant is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for cormorant defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 41,** below. An assessment of the effects of the project against these measures is also included.

Table 41. Assessment of effects on conservation objectives of 'Cormorant [A017]' (NPWS, 2012c).

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Breeding population abundance: apparently occupied nests (AONs)/ Number	No significant decline	Cormorant usually breed in colonies on rocky coastlines along the SPA's outer extent or inland in suitable trees. Habitats at the proposed development site are modified/disturbed and considered unsuitable for breeding cormorant. There is ample suitable breeding habitat along the Shannon Estuary and further west to the Atlantic or east towards the Foyle Estuary. The project is not expected to cause significant decline in cormorant breeding population but water quality impacts and/or disturbance is possible which may potentially affect the breeding population and range. While no significant effects are expected, mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Productivity rate/ Mean number	No significant decline	The project is not expected to cause a significant decline on the productivity of this species. Therefore, no significant effects to this measure are expected.	No
Distribution: breeding colonies/ Number; location; area (hectares)	No significant decline	The project does not affect habitat types for which cormorant most commonly nest upon, namely rocky islets, sea stack tops and cliffs (Walsh *et al*., 1995). Cormorant can also nest in trees as is the case with the population at Bunlicky Lake, almost 7 km south of the proposal site. However, since only three cormorant observations were reported during 48 months of ornithological surveys at Ballycar and all involved a single bird travelling over the proposed development site, the species is not considered to use the area within or around the proposed development site for the purposes of a breeding colony. Therefore, no significant effects to this measure are expected.	No
Prey biomass available/ Kilogrammes	No significant decline	Cormorant are piscivorous and use subsites 0I448, 0I447 and 0I427 and surrounding areas for foraging (see **Figure 6-2,** above, for subsite locations). Impacts on water quality could therefore impact prey items of this specialist species.	Yes Refer to **Section 7**

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Barriers to connectivity/ Number; location; shape; area (hectares)	No significant increase	Applies to breeding colonies of cormorant – the species often utilise extensive areas of marine waters for foraging. Since only three cormorant flights were recorded during the 48 months of bird surveys and all involved a single bird, and because the nearest proposed turbine location (T12) is at least 4.5 km north of the SPA and almost 7 km from the nearest known breeding colony at Bunlicky Lake (Gerard Hayes, pers. Comm.), the species is not considered to use the proposed development area as a connecting corridor to foraging grounds. Therefore, no significant barrier effects to connectivity are expected and the proposed project is unlikely to impact this measure.	No
Disturbance at breeding site/ Level of impact	Human activities should occur at levels that do not adversely affect the breeding cormorant population	Key habitats include sandy areas, rocky and vegetated substrate. There is ample suitable breeding habitat along the Shannon Estuary and further west towards the Atlantic or east towards the Foyle Estuary. The project is not expected to cause a significant decline in the breeding population of cormorant but water quality impacts and/or disturbance of this species is possible which could potentially affect the breeding population and range. While no significant effects to this measure are expected, mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Population trend/ Percentage change	Long term population trend stable or increasing	The most recent cormorant population status assessment for the SPA reports a species decline within the 'Intermediate' range (1.0% - 24.9% decline). This range allows for natural fluctuations and represents a range within which population declines are relatively small and potentially reversible and are less likely to influence the species' long-term conservation status. An all-Ireland trend for the period 1994/95 to 2008/09 is an increase of 31.5% (NPWS, 2012d). This attribute applies to non-breeding cormorant only and while the proposed project is not expected to cause a significant decline in the cormorant population, water quality impacts and/or disturbance of this species is possible which could potentially affect population trend. While no significant effects to this measure are expected, mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by cormorant other than that occurring from natural patterns of variation	Cormorant was recorded only three times during the 48 months of VP surveys and each observation involved a single bird flying over the proposed development site. Cormorant were recorded relatively frequently at subsites nearest the proposed development site (see **Figure 6-2,** above, for subsite locations). The waterbird counts recorded cormorant during both 2019/20 and 2022/23 winters with a peak count of 406 in Section C (see **Section 4.4.8.2**, above). This attribute applies to non-breeding cormorant only, and while the proposed project is not expected to cause a significant decline in the distribution of the cormorant population, water quality impacts and/or disturbance is possible which could potentially affect population distribution. While no significant effects to this measure are expected, mitigation will be applied as a precaution.	Yes Refer to **Section 7**

6.6.2 Whooper Swan [A038]

Whooper swan is an Annex I species and is amber-listed in Ireland as the country hosts more than 20% of the European wintering population with birds usually arriving in late autumn and departing by mid-April. Flood plains and grassland areas adjacent to rivers provide optimal foraging/roosting habitat for whooper swan during the winter months when they can be seen in estuaries and other wetland habitats as well as lowland agricultural areas. Flooded areas of cutaway bog are also regularly utilised by whooper swans as foraging grounds. They forage diurnally, primarily on agricultural grasses and grains although aquatic plants in inter-tidal areas are also taken. This is a highly mobile species whose movement is dependent upon the degree of flooding in suitable foraging habitats; they also exhibit a high level of site fidelity to wintering areas (Wilson *et al*., 1991; Warren *et al*., 1992; Stroud *et al.*, 2012).

The conservation objective for whooper swan is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for whooper swan defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 42,** below. An assessment of the effects of the project against these measures is also included.

Table 42. Assessment of effects on conservation objectives of 'Whooper Swan [A038]' (NPWS, 2012c)

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Results of the 2020 International Swan Census (Burke *et al*., 2021) showed a 'substantial increase' in numbers of whooper swan on the island of Ireland up 26.5% since the 2015 census with the entire Shannon & Fergus Estuary area supporting internationally important numbers of the species. The project is not expected to cause a significant decline in the whooper swan population but water quality impacts and/or disturbance of this species is possible which could potentially affect population trend. While no significant effects to this measure are expected, mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by whooper swan other than that occurring from natural patterns of variation	During the 2010/11 waterbird survey programme, there were no whooper swan recorded at the five closest subsites to the proposed development site – 0I446, 0I457, 0I427, 0I447, and 0I448 (see **Figure 6-2,** above) and none were recorded during the VP surveys at the proposed development site (NPWS, 2012c). The wintering waterbird counts did not record any whooper swan in 2019/20 but did record flocks in Section D on four occasions and in Section A on one occasion during the 2022/23 counts (see **Section 4.4.8.2**, above). Although the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of whooper swan foraging and roosting habitats within the SPA. Mitigation will, therefore, be applied as a precaution.	Yes Refer to **Section 7**

6.6.3 Shelduck [A048]

Shelduck is amber-listed in Ireland as the majority of the Irish wintering population occurs at less than ten sites. Shelduck nest in sand dune systems, and on islands and grassy parts of estuaries. Shelduck forage in a variety of ways from scything their bill through wet mud on exposed tidal flats, to dabbling and scything in shallow water and up-ending in deeper waters. They can therefore forage throughout the tidal cycle. Shelduck mainly confines itself to the intertidal area and coastlands of the SPA and feeds on mudflats.

The conservation objective for shelduck is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for shelduck defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 43,** below. An assessment of the effects of the project against these measures is also included.

Table 43. Assessment of effects on conservation objectives of 'Shelduck [A048]' (NPWS, 2012c).

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of shelduck at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), with Burke *et al*. (2018) estimating a 14% decrease in all-Ireland shelduck numbers when 2015/16 core counts were compared with the 2006/07 to 2010/11 population estimates. The project is not expected to cause a significant decline in the shelduck population, however there is potential for adverse water quality impacts and/or disturbance of this species which could potentially affect the population trends. While no significant effects to this measure are expected, mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by shelduck other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, there was very little shelduck activity recorded in the subsites located nearest the proposed development site with highest densities occurring further west near Breckinish (NPWS, 2012d). There were no shelduck recorded at all during the wintering waterbird counts (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of shelduck foraging and roosting habitats within the SPA. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**

6.6.4 Wigeon [A050]

Wigeon is amber-listed due to a decline in its non-breeding (wintering) population. Wigeon are highly migratory, arriving to Ireland in August/September and wintering in ponds and flooded fields around the SPA. Their diet is almost entirely vegetarian, and a major part of the diet comprises seagrass and algae species which are taken by grazing or dabbling in shallow water. Wigeon also forage within grasslands and agricultural crops for seeds, stems and rhizomes. A gregarious bird, they are rarely seen far from water.

The conservation objective for wigeon is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for wigeon defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 44,** below. An assessment of the effects of the project against these measures is also included.

Table 44. Assessment of effects on conservation objectives of 'Wigeon [A050]' (NPWS, 2012c)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of wigeon at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d). Burke *et al*. (2018) estimated a 12% decrease in all-Ireland wigeon numbers when 2015/16 core counts were compared with the 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the wigeon population, there is potential for adverse water quality impacts and/or disturbance of this species which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by wigeon other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, wigeon was recorded foraging and roosting in relatively high numbers in the subsites 0I445 and 0I446 near Newtown and Scarlet Reach (NPWS, 2012d), more than 8.5 river km downstream of the proposed development site via the Crompaun [East] River (see **Figure 6-2,** above, for subsite locations). The wintering waterbird counts recorded wigeon in Section D only (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging/roosting habitats within the SPA. Mitigation will, therefore, be applied as a precaution.	Yes Refer to **Section 7**

6.6.5 Teal [A052]

Teal is largely migratory, moving south of their breeding range during winter. Being highly responsive to cold spells they can show rapid and extensive movement during these periods. Teal is amber-listed due to a decline in the breeding population. Teal is a very common winter visitor to the Shannon and Fergus estuaries area. They are omnivorous and have a variety of foraging methods (e.g. dabbling and up-ending) within differing habitats. Areas of shallow water are favoured including shallow estuaries, tidal creeks and the edges of salt and freshwater marsh (NPWS, 2012d).

The conservation objective for teal is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for teal defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 45,** below. An assessment of the effects of the project against these measures is also included.

Table 45. Assessment of effects on conservation objectives of 'Teal [A052]' (NPWS, 2012c)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 6% increase in All-Ireland teal numbers when the 2015/16 core counts were compared with the 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the teal population, there is potential for adverse water quality impacts and/or disturbance of this species which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by teal other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, teal was widespread and recorded within 53 subsites with relatively high numbers recorded at subsites closest the proposed development site – 0I448, 0I447 and 0I427 (NPWS, 2012d) (see **Figure 6-2,** above). It was also noted that across the whole estuary, intertidal foraging was widespread. The wintering waterbird counts recorded teal during both 2019/20 and 2022/23 seasons with a peak count of 235 in Section C (see **Section 4.4.8.2**, above). The wintering waterbird counts undertaken recorded teal relatively frequently in all survey Sections with a peak count of 235 in Section C. While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for teal within the SPA. Mitigation will, therefore, be applied as a precaution.	Yes Refer to **Section 7**

6.6.6 Pintail [A054]

Pintail is amber-listed due to a decline in its non-breeding (wintering) population. It is an extremely rare breeding species with records from the Midlands and north (Dempsey & O' Clery, 2002). Wintering takes places primarily within estuaries or coastal brackish lagoons. Pintail feed on a variety of plant and animal material obtained from shallow water although they can be observed foraging on land.

The conservation objective for pintail is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for pintail defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 46,** below. An assessment of the effects of the project against these measures is also included.

Table 46. Assessment of effects on conservation objectives of 'Pintail [A054]' (NPWS, 2012c)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as 'undetermined' but with an all-Ireland trend of a 26.8% increase for the period 1994/95 to 2008/09 (NPWS, 2012d). However, Burke *et al*. (2018) estimated a 12.8% decrease in all-Ireland pintail numbers when 2015/16 core counts were compared with the 2006/07 to 2010/11 population estimates. Although the proposed project is not expected to cause a significant decline in the SPA's pintail population, there is potential for indirect adverse water quality impacts and/or disturbance during construction phase which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by pintail other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, pintail was recorded at only two subsites – 0H519 and 0K509 – both of which are at least 55 km west of the proposed development site. During the wintering waterbird counts, one pintail was counted at Section B in January 2023 (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly effect water quality via the watercourses draining the development site which turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for pintail within the SPA. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**

6.6.7 Shoveler [A056]

The small numbers of shoveler breeding in Ireland are largely sedentary or dispersive and are supplemented during winter by migratory birds from other locations within northwest and central Europe. Shovelers are omnivorous, and feed on a range of items from planktonic crustaceans and small molluscs to insects, larvae, plant material and seeds. A true dabbling duck, shovelers feed by surface-feeding, swimming with head and neck immersed, up-ending, and less often, by shallow dives. Shoveler is red-listed due to a decline in its non-breeding (wintering) population.

The conservation objective for shoveler is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for shoveler defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 47,** below. An assessment of the effects of the project against these measures is also included.

Table 47. Assessment of effects on conservation objectives of 'Shoveler [A056]' (NPWS, 2012c)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as 'undetermined' but with an all-Ireland trend of a 21.3% increase for the period 1994/95 to 2008/09 (NPWS, 2012d). However, Burke *et al*. (2018) estimated a 30.6% decrease in all-Ireland shoveler numbers when the 2015/16 core counts were compared with the 2006/07 to 2010/11 population estimates. Although the proposed project is not expected to cause a significant decline in the SPA's shoveler population, there is potential for indirect adverse water quality impacts and/or disturbance during construction phase which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by shoveler other than that occurring from natural patterns of variation.	During the 2022/23 wintering waterbird counts, shoveler was recorded in Sections A, B and D in relatively small numbers (see **Section 4.4.8.2**, above). There was also little shoveler activity recorded in the subsites located nearest the proposed development site during the 2010/11 Waterbird Survey Programme (NPWS, 2012d). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for shoveler within the SPA. Mitigation will, therefore, be applied as a precaution.	Yes Refer to **Section 7**

6.6.8 Golden Plover [A140]

During winter, golden plovers feed primarily within agricultural grassland and arable land. Tidal flats are used more as a roosting/resting habitat and the birds tend to favour large, open tidal flats. Consequently, golden plover tends to occur in large aggregations when observed upon tidal flats. Intertidal feeding is observed to a greater degree during cold weather periods when grassland feeding areas are frozen over. Golden plover is red-listed as a breeding species due to a decline in the breeding and non-breeding (wintering) population.

The conservation objective for golden plover is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for golden plover defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 48,** below. An assessment of the effects of the project against these measures is also included.

Table 48. Assessment of effects on conservation objectives of 'Golden Plover [A140]' (NPWS, 2012c)

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 23.5% decrease in all-Ireland golden plover numbers when the 2015/16 core counts were compared with 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the golden plover population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by golden plover other than that occurring from natural patterns of variation	The subsite 0I445 at Scarlet Reach was one of four areas that held peak numbers of roosting golden plover at low tide surveys during the 2010/11 Waterbird Survey Programme (see **Figure 6-2,** above, for subsite locations). The wintering waterbird counts did not record any golden plover at any survey locations (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for golden plover within the SPA and mitigation is required.	Yes Refer to **Section 7**

6.6.9 Grey Plover [A141]

Grey plover is a red-listed species in Ireland as the majority spend winter at less than ten sites within in the country. The SPA is designated for wintering grey plover. They feed on various marine molluscs, crustaceans and worms, foraging on intertidal mudflats within estuaries and on beaches.

The conservation objective for grey plover is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for grey plover defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 49,** below. An assessment of the effects of the project against these measures is also included.

Table 49. Assessment of effects on conservation objectives of 'Grey Plover [A141]' (NPWS, 2012c).

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 5.8% decrease in all-Ireland grey plover numbers when the 2015/16 core counts were compared with 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the grey plover population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by grey plover other than that occurring from natural patterns of variation	During the 2022/23 wintering waterbird counts, grey plover was recorded in Sections B and C in relatively small numbers (see **Section 4.4.8.2**, above). There were low levels of grey plover activity recorded in subsites located nearest the proposed development site during the 2010/11 Waterbird Survey Programme (NPWS, 2012d). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for grey plover within the SPA. Mitigation will, therefore, be applied as a precaution.	Yes Refer to **Section 7**

6.6.10 Lapwing [A142]

Lapwing are traditionally 'inland' waders. During winter they can be observed across a wide variety of habitats, principally using lowland farmland and freshwater wetlands (e.g. turloughs and callows) but also coastal wetlands where they feed on a variety of soil- and surface-living invertebrates. They are opportunistic and mobile birds and will readily exploit temporary food sources such as recently ploughed fields. Estuaries are typically used as roosting areas where large flocks may be observed upon the tidal flats. Coastal habitats tend to be used more during cold weather events when farmland and freshwater habitats freeze over. Lapwing is a red-listed species in Ireland due to a decline in both the breeding and non-breeding populations.

The conservation objective for lapwing is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for lapwing defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 50,** below. An assessment of the effects of the project against these measures is also included.

Table 50. Assessment of effects on conservation objectives of 'Lapwing [A142]' (NPWS, 2012c)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 16.4% decrease in all-Ireland lapwing numbers when the 2015/16 core counts were compared with 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the lapwing population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by lapwing other than that occurring from natural patterns of variation	During the 2019/20 winter waterbird counts, a peak count of 51 lapwing was recorded, while lapwing was recorded in Sections A and D during the 2022/23 counts (see **Section 4.4.8.2**, above). The subsite 0I445 at Scarlet Reach was one of three areas that held peak numbers of lapwing at low tide during the 2010/11 Waterbird Survey Programme (see **Figure 6-2,** above, for subsite locations). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for lapwing within the SPA and mitigation is therefore required.	Yes Refer to **Section 7**

6.6.11 Dunlin [A149]

Dunlin is a common wader along the Irish coast. Wintering populations favour coastal areas such as estuaries and mudflats with the population peaking in mid-winter. They tend to feed in groups on mudflats, often at the water's edge, taking a variety of prey including molluscs, crustaceans and worms. Dunlin is widespread within the site favouring inter-tidal foraging areas. Dunlin is a red-listed species in Ireland as the majority of the Irish population winters at less than ten sites.

The conservation objective for dunlin is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for dunlin defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 51,** below. An assessment of the effects of the project against these measures is also included.

Table 51. Assessment of effects on conservation objectives of 'Dunlin [A149]' (NPWS, 2012c)

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 23.2% decrease in all-Ireland dunlin numbers when the 2015/16 core counts were compared with 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the dunlin population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by dunlin other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, dunlin were recorded foraging at subsites 0I445, 0I446 and 0I427, approximately 8.5 river km downstream of the proposed development site via the Crompaun [East] River (see **Figure 6-2,** above), while in November 2010, a site total of 14,537 dunlin were recorded, representing numbers of international threshold (NPWS, 2012d). During the waterbird counts, one dunlin was recorded in Section C (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for dunlin within the SPA and mitigation is therefore required.	Yes Refer to **Section 7**

6.6.12 Curlew [A160]

Curlews are the largest wader to spend the non-breeding season in Ireland. Within intertidal areas they seek out larger prey items such as crabs, large worms and bivalves with their decurved bill ideally suited to extracting deep-living worms such as lugworms (*Arenicola marina*). They also take terrestrial worms in damp grasslands. Ireland supports a small and declining population of breeding curlew that are thought to make only short migrations. Many are resident during winter with their numbers enhanced by birds moving in from breeding grounds. Curlew is a red-listed species in Ireland due to a long-term decline in the breeding and wintering population and a contraction of its breeding range. Curlew spend winters in the Shannon and Fergus Estuaries and surrounding coastal grasslands feeding on intertidal mudflats.

The conservation objective for curlew is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for curlew defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 52,** below. An assessment of the effects of the project against these measures is also included.

Table 52. Assessment of effects on conservation objectives of 'Curlew [A160]' (NPWS, 2012c)

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 13.4% decrease in all-Ireland curlew numbers when the 2015/16 core counts were compared with 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the curlew population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by curlew other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, curlew was recorded roosting and foraging at the subsites 0I445 and 0I446, and foraging only at 0I447 and 0I457 (see **Figure 6-2,** above, for subsite locations), approximately 8.8 river km downstream of the proposed development site via the Crompaun [East] River (NPWS, 2012d). During the 2022/23 wintering waterbird counts, curlew was recorded in Sections C and D only (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for curlew within the SPA and mitigation is therefore required.	Yes Refer to **Section 7**

6.6.13 Redshank [A162]

Redshank feed along the upper shore of estuaries and along muddy river channels. They forage mainly by pecking at the surface or probing within intertidal mudflats, often favouring the muddier sections of sites where they prey upon species such as ragworm (*Hediste diversicolor)* and mud snail (*Hydrobia ulvae)*. A particularly favoured prey is the burrowing amphipod *Corophium volutator*, and the redshank will alter its distribution in response to depletion/changes in distribution of these mobile amphipods. Redshank is a red-listed species in Ireland due to a long-term decline in its breeding population.

The conservation objective for redshank is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for redshank defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 53,** below. An assessment of the effects of the project against these measures is also included.

Table 53. Assessment of effects on conservation objectives of 'Redshank [A162]' (NPWS, 2012c)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by more than 50% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 23.6% decrease in all-Ireland redshank numbers when the 2015/16 core counts were compared with 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the redshank population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be applied as a precaution.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by redshank other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, redshank was recorded foraging and roosting within the estuary's innermost subsites 0I448, 0I447, 0I427 and 0I457 (see **Figure 6-2,** above, for subsite locations), approximately 8.8 river km downstream of the proposed development site via the Crompaun [East] River (NPWS, 2012d). During the 2022/23 wintering waterbird counts, redshank was recorded in Sections A, B and C (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the proposal site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for redshank within the SPA and mitigation is therefore required.	Yes Refer to **Section 7**

6.6.14 Greenshank [A164]

Most of the Irish greenshank population winters at less than ten sites, mainly on estuaries with some remaining along non-estuarine coasts. It feeds in shallow water and soft mud and is an intermediate (100-200 sites) intertidal walker (in water) that requires a wide range of food prey. It is considered totally reliant on wetland habitats due to unsuitable surrounding habitats and is limited by habitat requirements.

The conservation objective for greenshank is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for greenshank defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 54,** below. An assessment of the effects of the project against these measures is also included.

Table 54. Assessment of effects on conservation objectives of 'Greenshank [A164]' (NPWS, 2012c).

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by 25% to 49% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d), while Burke *et al*. (2018) estimated a 16.8% increase in all-Ireland greenshank numbers when the 2015/16 core counts were compared with 2006/07 to 2010/11 population estimates. Although the project is not expected to cause a significant decline in the greenshank population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be applied as a precaution.	No
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by greenshank other than that occurring from natural patterns of variation.	During the 2010/11 Waterbird Survey Programme, greenshank was recorded foraging and roosting mainly within central and western subsites and was infrequently recorded in very small numbers at the subsites nearest the proposed development, namely subsites 0I445, 0I447 and 0I427 (NPWS, 2012d) (see **Figure 6-2,** above, for subsite locations). No greenshank were recorded during the wintering waterbird counts (see **Section 4.4.8.2**, above). While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via the watercourses draining the proposal site. This in turn has the potential to cause significant adverse effects to the range of foraging and roosting habitats for greenshank within the SPA. Mitigation will, therefore, be applied as a precaution.	Yes Refer to **Section 7**

6.6.15 Black-headed Gull [A179]

Black-headed gull is resident in Ireland throughout the year with numbers boosted by wintering individuals arriving from mainland Europe. The species over-winters and breeds in both coastal and inland locations, nesting in colonies, in sand dunes, coastal islands, moorland polls, bogs and on freshwater lake islands. They are opportunistic feeders and take a wide variety of food items including fish, worms, molluscs, insects and plant material, taking advantage of any available food-source including domestic/fishing waste. They have a wide distribution within the SPA, favouring inter-tidal foraging areas. Black-headed gull is an amber-listed species in Ireland due to a long-term decline in its breeding population and distribution.

The conservation objective for black-headed gull is to maintain the favourable conservation condition of this species in the River Shannon and River Fergus Estuaries SPA. The specific species Attributes and Targets for black-headed gull defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 55,** below. An assessment of the effects of the project against these measures is also included.

Table 55. Assessment of effects on conservation objectives of 'Black-headed Gull [A179]' (NPWS, 2012c)

Attribute/Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Population trend/ Percentage change	Long term population trend stable or increasing	Population status of the species at the SPA was assessed as declining by 25% to 49% when the baseline data for the period 1995/96 to 1999/00 was compared with data from the period 2006/07 to 2010/11 (NPWS, 2012d). Although the project is not expected to cause a significant decline in the black-headed gull population, there is potential for adverse water quality impacts and/or disturbance which could potentially affect the population trends. Mitigation will be required.	Yes Refer to **Section 7**
Distribution/ Range, timing and intensity of use of areas	There should be no significant decrease in the range, timing or intensity of use of areas by black-headed gull other than that occurring from natural patterns of variation	During the 2010/11 Waterbird Survey Programme, black-headed gull was recorded foraging and roosting in large numbers throughout the site, particularly innermost subsites of 0I448, 0I447 and 0I427 (see **Figure 6-2,** above, for subsite locations) (NPWS, 2012d). In subsite 0I448, 502 gulls were recorded roosting terrestrially outside the SPA border on structures such as bridges and quays, approximately 8 river km downstream of the proposed development site via the Crompaun [East] River. During VP surveys, black-headed gulls were observed on two occasions flying within the 500 m buffer but not within the airspace of the proposed development (refer to **Figure 4-6**, above). During the wintering waterbird counts, large numbers of black-headed gull were counted during both the 2019/20 and 2022/23 seasons, with a peak count of 870 at Section D (see **Section 4.4.8.2**, above) while during hinterland surveys, two flocks were observed at locations approximately 3.5 km south-southeast of the proposed T12 location – see **Figure 4-8**, above. While the project will not directly affect the water quality of the SPA, there is potential for construction phase activities to indirectly affect water quality via watercourses draining the development site. This in turn has the potential to cause significant adverse effects to the range of foraging/roosting habitats for black-headed gull within the SPA, and mitigation is therefore required.	Yes Refer to **Section 7**

6.6.16 Wetlands [A999]

The conservation objective for 'Wetlands' is to maintain the favourable conservation condition of this habitat within the River Shannon and River Fergus Estuaries SPA as a resource for the regularly occurring migratory waterbirds that utilise it. The specific Attributes and Targets for the habitat defined in relation to the achievement of the Conservation Objectives for the SPA are presented in **Table 56,** below. An assessment of the effects of the project against these measures is also included.

Table 56. Assessment of effects on conservation objectives of 'Wetlands [A999]' (NPWS, 2012c).

Attribute/ Measure	Target	Assessment of Potentially Significant Effects	Mitigation Required
Wetland habitat area/ Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 32,261 ha, other than that occurring from natural patterns of variation.	The wetland habitats contained within the River Shannon and River Fergus Estuaries SPA are identified as being of conservation importance for non-breeding (wintering) migratory waterbirds. Therefore, the wetland habitats are deemed to be an additional Special Conservation Interest. The wetland habitats of the SPA are categorised into five types – subtidal; intertidal; supratidal; lagoon and associated; and freshwater and associated (NPWS, 2012d). There is no overlap of the proposal site with the SPA so there will be no direct loss of this habitat because of the proposed development. However, there is a hydrological connection between the SPA and the proposed development site via various watercourses that drain into the River Shannon and ultimately the SPA. While the project is not expected to cause a significant decline in the permanent area of wetland habitat, there is potential for water quality of the habitat to be adversely affected which may results in habitat loss, therefore, mitigation will be applied.	Yes Refer to **Section 7**

6.7 Assessment of Potentially Significant Cumulative Effects

When in-combination impacts are assessed, it is necessary to identify the types of impacts that may ensue from the project under consideration and from other sources in the existing environment that cumulatively are likely to affect aspects of the structure and function of the relevant European sites (EC, 2021).

The EC (2021) guidelines on the provision of Article 6 of the Habitats' Directive state that the phrase 'in combination with other plans or projects' in Article 3(3) of the Habitats Directive refers to the cumulative effects due to plans or projects 'that are currently under consideration together with the effects of any existing or proposed projects or plans.' Relevant plans and projects have been identified in **Section 4.10,** above.

6.7.1 Ongoing Activities

6.7.1.1 Introduction

Irish waterbodies are frequently subjected to various anthropogenic activities and pressures that can adversely impact upon water quality. Indeed, more than half of affected waterbodies are impacted upon by more than one pressure type. Agriculture is the dominant pressure source in the country, effecting 53% of Irish waterbodies from 2013 to 2018 (O'Boyle *et al*., 2019), mainly through nutrient pollution (nitrogen and phosphorus) which can cause excessive plant growth and increase the likelihood of harmful algal blooms.

Significant issues in waterbodies classified as 'At Risk' of not meeting surface waterbody environmental objectives within the Lower Shannon and Mulkear Catchment (25D) and the Shannon Estuary North Catchment (27) by 2027 are identified in EPA (2021a) and EPA (2021b), respectively. The most significant pressure on waterbodies within both catchments is agricultural pressure due mainly to the release of excess nutrients (elevated phosphate and ammonia). Other pressures include hydromorphology, urban wastewater, urban run-off, peat extraction, domestic wastewater, industry, forestry, mines, quarries, and other impacts[55]. Additionally, the EPA Water Quality in Ireland 2016-2021 Report lists the Shannon Estuary North (27) Catchment as one of thirteen catchments 'with the lowest percentage of monitored satisfactory river water bodies' (Trodd *et al*, 2021).

Many watercourses in both catchments are also subject to significantly increased levels of sediment loading due to forestry activities, mineral/peat harvesting and bank erosion. Forestry and peat extraction can cause ecological problems through increased erosion rates, siltation and nutrient loss. Phosphorus losses come primarily from wastewater discharges, and from runoff losses from agriculture on poorly draining soils (O'Boyle *et al*., 2019). Habitat condition in both catchments is compromised due to hydrological and morphological modifications to the waterbodies, particularly within the Lower Shannon Catchment (25D) where dams, barriers, locks and weirs are in use.

The primary pressures in the sub-catchments containing the proposed development, namely the Owenogarney_SC_020 and the Shannon [Lower]_SC_100, are considered to result from forestry and agriculture. Anthropogenic activities and agricultural intensification have been identified as medium impact pressures on Lower River Shannon SAC, while forestry and peat-harvesting have been classed as low-level pressures as defined in the Natura 2000 Data Form [56] and listed in **Table 57**, below. Within the River Shannon and River Fergus Estuaries SPA, high impact pressures include fertilisation and urbanisation, while medium impact pressures include recreation, shipping lanes and discharges as defined in the Natura 2000 Data Form[57] and listed in **Table 58**, below.

[55] 'Abstractions, aquaculture, atmospheric, anthropogenic pressures, historically polluted sites, wastewater treatment and invasive species' (EPA, 2021b).
[56] N2K IE0002165 dataforms (europa.eu) Accessed: 20th January 2023
[57] N2K IE0004077 dataforms (europa.eu) Accessed: 20th January 2023

Table 57. Most important impacts and activities with high effect on the Lower River Shannon SAC as defined in the associated Natura 2000 Data Form.

Threat Level	Threats and Pressures Code	Reference
Medium	E01	Urbanised areas, human habitation
Medium	K02.03	Eutrophication (natural)
Medium	J02.01.02	Reclamation of land from sea, estuary or marsh
Low	C01.01.02	Removal of beach materials
Low	F01	Marine and freshwater Aquaculture
Medium	E03	Discharges
Low	J02.10	Management of aquatic and bank vegetation for drainage purposes
Medium	A08	Fertilisation
Medium	H04	Air pollution, air-borne pollutants
Medium	A08	Fertilisation
Low	F03.01	Hunting
Medium	A04	Grazing
Low	B	Sylviculture, forestry
Low	J02.12.01	Sea defence or coast protection works, tidal barrages
Low	G01.01	Nautical sports
Medium	J02.01.01	Polderisation
Low	D01.01	Paths, tracks, cycling tracks
Low	C01.03.01	Hand cutting of peat
Low	I01	Invasive non-native species

Table 58. Most important impacts and activities with high effect on the River Shannon and River Fergus Estuaries SPA as defined in the associated Natura 2000 Data Form.

Threat Level	Threats and Pressures Code	Reference
Medium	G01.01	Nautical sports
Medium	D03.02	Shipping lanes
High	E03	Discharges
High	E01	Urbanised areas, human habitation
High	A08	Fertilisation
High	E02	Industrial or commercial areas
Medium	E03	Discharges

6.7.1.2 Agriculture

The main impacts of farming are the loss of excess nutrients and sediment to water. Excess ammonium may also be a problem in some waterbodies. These losses arise from point sources such as farmyards or from diffuse sources such as spreading of fertilisers and manures. Excess phosphorus and sediment are typical issues for rivers and lakes, and too much nitrogen is the main issue for estuaries and coastal waters (O'Boyle *et al*., 2019).

In the 3rd Cycle Lower Shannon and Mulkear Catchment (25D) Report (EPA, 2021a), agriculture was identified as a significant pressure in 13 waterbodies within the catchment (including one transitional waterbody – Upper Shannon Estuary). Farming-related impacts within this catchment mainly involve the loss of phosphorus to surface waters from, for example, direct discharges, or runoff from yards, roadways or other compacted surfaces, or runoff from poorly draining soils. It takes only very small amounts of phosphorus to be lost, relative to the amounts used in agriculture, to cause a water quality problem. Sediment from land drainage works and bank erosion because of animal access also impact upon water quality. The Lower Shannon and Mulkear Catchment (25D) was also found to be one of two catchments in the country with the highest number of river sites with strongly increasing phosphate concentration (Trodd *et al*, 2021).

In the 3rd Cycle Draft Shannon Estuary North Catchment (27) Report (EPA, 2021b), agriculture was identified as a significant pressure in 33 waterbodies (including two transitional waterbodies – Fergus Estuary and Upper Shannon Estuary). The farming-related impacts in this catchment are similar to those of the Lower Shannon and Mulkear Catchment (25D) described in the previous paragraph with regards elevated levels of phosphate and ammonia in surface waters due to poorly draining soil and direct discharges. The report does also mention that 'land drainage for agricultural purposes has been noted by both IFI and Clare County Council as a significant pressure in several rivers' (EPA, 2021b).

Within the Owenogarney_SC_020 and Shannon [Lower]_SC_100 sub-catchments that drain the proposed development site, agriculture is one of the principal land uses. The water quality effects of the proposed development during the construction phase, together with the previously discussed effects of agricultural practices, could exacerbate potential impacts associated with the project within the catchment and undermine the conservation objectives for the qualifying features of the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA as discussed in Sections 6.2 and 6.3, above.

6.7.1.3 Hydromorphology and Drainage

Hydromorphology is the study of the physical character and processes that occur within a waterbody. Hydromorphological modification is a physical alteration to the conditions of a habitat or to the natural functioning of a waterbody that can change flow patterns and have an ecological impact. Changes may be caused by various activities such as dredging or straightening of rivers (channelisation), land drainage, or hard infrastructure such as dams, weirs, culverts, or other obstructions (O'Boyle *et al*., 2019).

According to EPA (2021b), hydromorphological modification is a significant pressure in twelve river waterbodies within the Shannon Estuary North (27) Catchment due to the presence of drainage schemes and the resulting increased levels of siltation. Modification of riverbanks due to implementation of embankment schemes effects four river waterbodies in the catchment. Furthermore, five river waterbodies within the catchment contain barriers to fish migration such as sloped concrete sills and weirs. Within the Lower Shannon (25D) Catchment, four waterbodies are deemed to be under significant pressure because of hydromorphological issues. This includes two river waterbodies – the Doonane_010 and the Grange (Tipperary)_010 – both been subjected to channelisation that impacts habitat condition due to hydrological and morphological changes. Impediments to

fish passage including locks and dams are also present and it has been noted by Inland Fisheries Ireland (IFI) that 'an impoundment has resulted in the loss of spawning grounds in Shannon (Lower)_050' (EPA, 2021a).

The water quality effects of the proposed development during the construction phase together with the effects of hydromorphological modification could exacerbate potential impacts associated with the proposed development within the Lower Shannon and Mulkear Catchment (25D) and the Shannon Estuary North Catchment (27), and undermine the conservation objectives for the qualifying features of the Lower River Shannon SAC, and the River Shannon and River Fergus Estuaries SPA as discussed in Sections 6.2 and 6.3, above.

6.7.1.4 Forestry

Poorly managed and inappropriately sited forestry operations can adversely affect water quality and aquatic habitats and species. The release of sediment and nutrients and the impacts of acidification are the most common water quality issues arising from forestry. Forestry may also bring about changes in stream flow regimes caused by associated land drainage (O'Boyle *et al*., 2019). Forestry has been identified as a significant pressure in ten waterbodies within the Shannon Estuary North (27) Catchment (EPA, 2021b) and four waterbodies within the Lower Shannon (25D) Catchment (EPA, 2021a). The significant issues are a combination of the general forestry pressures of clear-felling and an increased sediment loading that affects habitats. The proposed development will involve the construction of new tracks, turbines and other infrastructure, which give rise to earthworks that can mobilise silt and nutrients. A proportion of the proposed development occurs in and adjacent to conifer plantation.

During the construction phase of the proposed wind farm development, there is potential for negative water quality impacts on downstream waterbodies due mainly to earthworks and the release of sediment. During the later stages of construction, exposed areas will be revegetated and will then continue to revegetate within the early stage of operation, thereby eliminating the source of sediment. There is potential for the project to contribute to a cumulative impact on water quality in local watercourses, within and downstream of the site, by way of sediments and other pollutants potentially entering the watercourses. The felling of forestry to accommodate the proposed development may impact downstream water quality. These water quality effects, coupled with the abovementioned forestry effects, could exacerbate potential impacts associated with the proposed project within the Lower Shannon and Mulkear Catchment (25D) and the Shannon Estuary North Catchment (27) and thereby undermine the conservation objectives for the qualifying features of the Lower River Shannon SAC, and the River Shannon and River Fergus Estuaries SPA as discussed in Sections 6.2 and 6.3, above.

6.7.1.5 Domestic Wastewater and Diffuse Urban Run-off

Domestic wastewater discharged by households predominantly originates from human metabolism or from day-to-day human activities within single houses that are not connected to sewers and usually in rural settings and is treated on-site in septic tank systems or in individual wastewater treatment systems. If not correctly located, designed, installed and well-maintained, untreated effluent can leak into surrounding waters resulting in elevated nutrient concentrations and posing a significant ecological threat (EPA, 2013).

Within the Shannon Estuary North Catchment (27) domestic wastewater has been identified as a significant pressure in five river waterbodies due to the proximity of domestic wastewater treatment systems to those waterbodies on poorly draining soil, and the excessive volumes of nutrients entering local surface waters as a result. Three of these waterbodies are located within the Owenogarney_SC_020 subcatchment - namely Cratloe_010, Crompaun (East)_010, and Cloverhill Stream_010 (EPA, 2021b). Within the Lower Shannon and Mulkear Catchment (25D), domestic wastewater has been identified as a significant pressure in two river waterbodies, but neither are located within Shannon [Lower]_SC_100 subcatchment (EPA, 2021a).

Pollution from diffuse urban run-off can also exert significant pressure on the integrity of waterbodies. Sources include run-off from paved/unpaved areas, domestic plumbing misconnections and leaking sewers which can result in the release of untreated effluent into receiving waterbodies causing elevated nutrient levels and ecological deterioration (O'Boyle *et al*., 2019). Within the Lower Shannon and Mulkear Catchment (25D) diffuse urban run-off has been identified as a significant pressure in two river waterbodies – Groody_010 and Whitehall_010 – where nutrient and organic pollution are the significant water issues (EPA, 2021a). There are four river waterbodies within the Shannon Estuary North Catchment (27) that have been identified as being under significant pressure due to diffuse urban run-off, with nutrient and organic pollution being the significant water issues (EPA, 2021b). None of the identified river waterbodies from either catchment are located within the Owenogarney_SC_020 subcatchment or the Shannon [Lower]_SC_100 subcatchment.

The water quality effects of the wind farm during the construction and early operational phases, together with the previously discussed effects of domestic wastewater and diffuse urban run-off, could exacerbate potential impacts associated with the proposed development within the Lower Shannon and Mulkear Catchment (HA25D) and the Shannon Estuary North Catchment (HA27) and thereby undermine the conservation objectives for the qualifying features of the Lower River Shannon SAC, and the River Shannon and River Fergus Estuaries SPA as discussed in Sections 6.2 and 6.3, above.

6.7.1.6 Wastewater Treatment

Since 2013, the national population has increased by almost a quarter of a million with a resultant increase in the amount of wastewater requiring treatment. Works are ongoing by Irish Water to improve the level of wastewater treatment nationally; however, the level of treatment is still inadequate at 120 locations around the country and raw sewage from 36 towns and villages is being released into rivers at five locations and into coastal waters at 31 locations (O'Boyle *et al*., 2019). As detailed in Section 4.10.6 and Table 27, above, there are eleven urban wastewater treatment plants (UWWTP) located within the Lower Shannon (25D) Catchment and thirteen located within the Shannon Estuary North (27) Catchment. Of these 24 treatment plants, six have been identified as exerting a significant pressure on one 'At Risk' waterbody in the catchment as listed in EPA (2021a; 2021b) and presented in Table 59, below.

Table 59. Details of urban wastewater treatment (UWWT) plants identified as being a significant pressure in 'At Risk' waterbodies and the expected completion time of any upgrades (EPA, 2021a; 2021b).

WFD Catchment	Facility name	Facility type[58]	Active license no.	Waterbody impacted	2013-18 ecological status	Expected completion[59]
Lower Shannon (25D)	Cappawhite	500 to 1,000 p.e.	D0440	Cappawhite Stream_010	Poor	N/A
	Ballina	2,001 to 10,000 p.e.	D0016	Grange (Tipperary)_010	Unassigned	2024
Shannon Estuary North (27)	Ennis North	Combined sewer overflows	D0048	Fergus_060	Poor	N/A
	Ennis North	Combined sewer overflows	D0048	Fergus_070	Poor	N/A
	Tulla	1,001 to 2,000 p.e.	D0320	Liskenny_010	Poor	N/A
	Quin	1,001 to 2,000 p.e.	D0318	Rine_030	Moderate	2021

[58] Defined using population equivalent value (p.e.)
[59] Expected completion date for upgrades scheduled under Uisce Éireann's Capital Investment Programme (CIP) (2020-2024).

The water quality effects of the proposed wind farm during the construction and early operational phases, together with the previously discussed effects of urban wastewater, could exacerbate potential impacts associated with the proposed development within the Lower Shannon and Mulkear Catchment (HA25D) and the Shannon Estuary North Catchment (HA27) and thereby undermine the conservation objectives for the qualifying features of the Lower River Shannon SAC, and the River Shannon and River Fergus Estuaries SPA as discussed in Sections 6.2 and 6.3, above.

6.7.1.7 Industry, Mines and Quarries

Industry has been identified as a significant pressure for watercourses within both the Shannon Estuary North (27) and Lower Shannon (25D) Catchments. Significant pressures exerted on watercourses because of industrial practices include impacts brought about by discharges and emissions from industrial and commercial facilities leading to nutrient and organic problems and a diminution of water quality (O'Boyle *et al.*, 2019). The Moyana_010 Waterbody[60] within the Shannon Estuary North (27) Catchment is affected by nutrient and organic issues due to Section 4-licensed[61] emissions from an unidentified industrial facility. Within the same catchment (27), the 'Industrial Facility (P0012-04)' ground waterbody[62] is significantly impacted by an EPA licenced facility, Roche Ireland Limited, through excess nutrient and chemicals (EPA, 2021b). Industry is also a significant pressure for the Dead_10 Waterbody[63] within the Lower Shannon (25D) Catchment where the waterbody is affected by nutrient-related issues due to emissions from an unidentified Section 4-licensed industrial facility. Also, in this catchment (25D), the 'Industrial facility (P0331-01)' ground waterbody[64] is impacted by elevated concentrations of polycyclic aromatic hydrocarbons (PAH) in discharges from an EPA licensed facility, Spaight Timber Preservatives Limited (EPA, 2021a).

Within the wider area of the River Shannon and River Fergus estuaries, larger industrial operations that exert pressure on local watercourses and indeed, on the estuarine waterbodies themselves, include the Rusal Aughinish Alumina Plant - the largest bauxite refinery in Europe, producing two million tons of alumina per year for shipment to smelting plants throughout Europe. The plant has a bauxite residue disposal area (BRDA) that stores millions of tons of the toxic 'red mud' bauxite residue left over after production of alumina[65]. Planning permission was granted and then quashed by order of the high court (Case Reference: PA91.312146) from An Bord Pleanála to Aughinish Alumina to expand the BRDA. A new case number (318302) has generated and decision is expected in March 2024. Point source industrial discharges from the plant causing nutrient and organic issues have been identified as a significant pressure to watercourses within the Shannon Estuary South (HA24) Catchment (EPA, 2021c).

The water quality of various river habitats and waterbodies can be adversely affected by quarrying via the generation of elevated levels of silt and dust which can eventually accumulate within watercourses resulting in excessive sedimentation of river channels followed by ecological deterioration. Mining operations mainly impact on the quality of water through the dewatering process used for mineral extraction. This drainage and extraction of minerals can lead to a release of ammonia and fine-grained suspended sediments and can bring about changes to the hydromorphological condition of rivers[66]. Ecological problems caused by quarrying and mining include increased erosion rates, siltation and nutrient loss (O'Boyle *et al.*, 2019).

[60] Waterbody Code: IE_SH_27M010150
[61] Discharge licences issued under Section 4 of the Local Government (Water Pollution) Act 1977-1990, for the discharge of trade effluent to surface water or groundwater. Licences set conditions so discharge is treated and controlled in a way that protects the receiving environment.
[62] Waterbody Code: IE_SH_G_082
[63] Waterbody Code: IE_SH_25D010100
[64] Waterbody Code: IE_SH_G_219
[65] Aughinish plant gets €2m IDA grant to treat 'red mud' dump | Business Post Accessed: 25th January 2023
[66] *Draft River Basin Management Plan for Ireland 2022 – 2027* 199144_7f9320da-ff2e-4a7d-b238-2e179e3bd98a (2).pdf Accessed: 20th January 2023

Mines have been identified as exerting a significant pressure in three river waterbodies within the Lower Shannon and Mulkear Catchment (HA25D), namely Kilmastulla_010, Kilmastulla_030 and Kilmastulla_040 (EPA, 2021a). The issues arising from this pressure relate to elevated heavy metal concentrations from the historic Silvermines zinc and lead mining site.

The water quality effects of the proposed wind farm during the construction and early operational phases, together with the previously discussed effects of industry, mining and quarrying, could exacerbate potential impacts associated with the proposed development within the Lower Shannon and Mulkear Catchment (HA25D) and the Shannon Estuary North Catchment (HA27), and thereby undermine the conservation objectives for the qualifying features of the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA as discussed in Sections 6.2 and 6.3, above.

6.7.2 Other Wind Energy Developments

The potential in-combination effects of the proposed wind farm with other wind farms are those that could affect the SCI bird species of the River Shannon and River Fergus Estuaries SPA. Potential in-combination effects comprise barrier effects that can be caused when several wind farms are situated in such proximity that they disrupt the movements of birds through an area and create a possible increase in collision mortality. While both potential effects depend on the scale and distance between wind farms and on the bird species that occur in an area, mortality from collision is associated with very high numbers of turbines and densities of birds.

There are two single wind turbines currently in operation within a 25-kilometre radius of the proposed development site at Ballycar – one turbine at Limerick Blow Moulding, Parteen, approximately 3.2 kilometres southeast of the proposal site, and one at Vistakon, approximately 8.2 kilometres southeast of the proposal site (refer to Figure 4-15, above). Permission has been granted but construction has not yet begun for a 19-turbine wind farm at Carrownagowan, approximately 12 kilometres northeast of the proposed development site at Ballycar. Additionally, an application (CCC Planning Application Number: 23148) for the construction and operation of an 8-turbine wind farm at Fahy Beg, approximately 8.5 kilometres northeast of the proposed Ballycar Wind Farm site, has been refused by Clare County Council. An appeal has been lodged by the developer to An Bord Pleanála (ABP Planning Application Number: 314227). A final decision was due in early October 2023, however to date a decision has not been published (refer to Figure 4-15 and Table 22, above).

Significant separation distances intervene between the proposed Ballycar Wind Farm site and other permitted/operational/proposed wind farms in the area as shown in Figure 4-15, above. Due to this wide dispersal of individual wind farms, there is no clustering of turbines and therefore no plausible potential for synergistic interaction between the proposed Ballycar Wind Farm and other wind farms that could result in significant cumulative effects.

It is, therefore, concluded that there is no potential for synergistic interaction between the proposed wind farm development and the wind farms shown in Figure 4-15, above, that could cause in-combination barrier, disturbance or mortality effects to the SCI species for which the River Shannon and River Fergus Estuaries SPA is classified.

6.7.3 Climate Change

The Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2023) published in 2023 states that anthropogenic activities have 'unequivocally caused global warming' and altered global climactic patterns due to the continued increase in global greenhouse gas (particularly carbon) emissions arising from 'unsustainable energy use, land-use and land-use changes, lifestyles and patterns of consumption and production'. Changing climate is an important environmental influence on ecosystems and can affect them in a

variety of ways. For instance, warming may force species to migrate to higher latitudes or higher elevations where temperatures are more conducive to their survival.

As the frequency of events such as wildfires, flooding, and drought become more common, the ability of an ecosystem to temper the impacts of these extreme conditions may become restricted. Moreover, climate change not only affects ecosystems and species directly, but it also interacts with other human stressors such as development which may, cumulatively, lead to dramatic ecological changes (Settele *et al.*, 2015). Since species differ in their ability to adjust, asynchronies can develop that reduce the survival rates of species and the health of ecosystems due to mismatches in the timing of migration, breeding, pest avoidance, and food availability (Horton *et al.* 2014).

In Ireland, shifting climactic systems have resulted in higher temperatures and rainstorms of increased intensity and frequency which can have a range of ecological effects. For example, the riverbanks of watercourses draining the proposed development site (see **Figure 3-2**, above) can be left more vulnerable to erosion in times of heavy rainfall which can then be exacerbated by land 'improvement' measures and hydromorphological changes associated with agricultural activities. The resulting uncontrolled erosion of riverbanks and riparian areas, in combination with soil loss and run-off from fields, has the potential to result in unnatural sediment loads and siltation of rivers. The construction phase of the proposed project has the potential to impact downstream water quality which, when combined with the aforementioned effects of climate change, may increase the impacts' intensity and undermine the conservation objectives for the QI species and habitats of the Lower River Shannon SAC (as discussed in **Section 6.5**, above) and the SCI bird species of the River Shannon and River Fergus Estuaries SPA (as discussed in **Section 6.6**, above) located downstream.

To limit the consequences of human-caused global climate change, the achievement of net zero CO^2 emissions via a transition from fossil fuels to low- or zero-carbon energy sources, such as wind-generated, is required (IPCC, 2023). A Renewable Energy Statistics 2023 Report produced by the International Renewable Energy Agency[67] (IRENA, 2023) puts the global total amount of electricity generated from renewable sources in 2021 at 7,858 TWh (terawatt-hour), and of this, 1,838 TWh (23%) was generated by wind energy, representing a 16% increase in global wind power generation when compared to 2020.

Wind-generated electricity in Ireland has increased hugely in recent years, going from an output of 1,923 MW (megawatts) in 2013 to an output of 4,619 MW in 2022 (IPCC, 2023). As detailed in the Renewable Energy in Ireland 2020 Report (SEAI, 2020), 28% of Ireland's electricity in 2018 was wind-generated and the country is now 'a world leader at incorporating large amounts of wind-generated electricity onto the network'. Once operational, Ballycar Wind Farm will be part of Ireland's expanding renewable energy network that is set to have a huge role in ensuring the country meets its future carbon emissions reduction targets and, ultimately, in reducing the effects of climate change on the Qualifying Interests of the country's European sites.

[67] IRENA is a 'lead global intergovernmental agency for energy transformation that serves as the principal platform for international cooperation, supports countries in their energy transitions, and provides state of the art data and analyses on technology, innovation, policy, finance and investment'. About (irena.org) Accessed: 18th October 2023.

7. Mitigation

7.1 Mitigation by Design

7.1.1 Introduction

Hydrology was an important constraint during the design stage of the project. The siting of the development's infrastructure, such as turbines and access tracks, was constraint-driven to avoid or reduce adverse effects. As discussed in Section 6.4.1, above, the existing drainage network within and around the proposed development site creates the potential for a tangible impact pathway between proposal site and the two European sites downstream – firstly, the Lower River Shannon SAC, located approximately 1.6 river kilometres downstream from WC6 and WC7 (46m approximately from the temporary works at the junction of the R464 and L3056), and secondly, the River Shannon and River Fergus Estuaries SPA located approximately 6.6 river kilometres downstream of WC1 (3.1km approximately from the temporary works at the junction of the R464 and L3056). There is, therefore, a risk of potentially significant impacts to the Qualifying Interest species and habitats of both these European sites should contaminated surface water run-off enter the watercourses draining the proposed development site.

While the NIS has been conducted in the absence of water quality control measures, all measures outlined below are included in the design of the project to avoid or minimise water quality impacts arising during the construction phase of the project. Refer to Chapter 2 Description of the Proposed Development, Chapter 3 Civil Engineering, and Chapter 8 Water, in Volume II of the EIAR for full details.

7.1.2 Surface Water Drainage and Treatment System

A site-specific Surface Water Management Plan has been designed for the proposed Ballycar Wind Farm to avoid and minimise impacts to water quality within the site. Refer to Section 3.13 in Chapter 3 Civil Engineering in Volume II of the EIAR for full details. The main elements of the plan are described below.

A surface water run-off drainage system will be constructed to ensure that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being contaminated by silt generated during on-site works such as excavations for the turbine infrastructure or from movement of delivery vehicles and on-site traffic. Separating the clean and dirty water will minimise the volume of water requiring treatment and dirty water drains will be provided on one or both sides of the access tracks and along the periphery of the turbines, crane hardstands, substation compound, met mast, borrow pit and the temporary site construction compound.

Clean water will be intercepted and conveyed to the downstream side of the works areas either by piping it or diverting it by means of new drains or earth mounds that are all positioned upslope to prevent any mixing of the clean and dirty water. The outflow from these drains is then piped under the tracks at suitable intervals and at low points depending on the site topography.

Drains carrying construction site runoff (dirty water) will be directed to settlement ponds that reduce flow velocities, allow for silt settlement and removal of sediment before eventual discharge of treated water via overland dispersal across a wide area of vegetation at a location down-gradient of the proposed construction site. Each settlement pond unit has been micro-sited using contour maps and aerial photos to avail of any level areas and to ensure the outflow is spread over as much vegetation as possible before entering an aquatic buffer zone. A modular approach has been adopted for the design of the settlement ponds which have been sized to cater for a specific-sized works area. The settlement ponds have been designed as a three-stage tiered system which has

been proven to work effectively on wind farm construction sites. The three-stage system also facilitates effective cleaning with minimal contamination of water exiting the pond.

The entire drainage system will be managed and monitored at all times during the construction phase, particularly after heavy rainfall events. A programme of regular inspections and maintenance will be designed and carried out by dedicated construction personnel to ensure any failures are quickly identified and repaired to prevent water pollution. A checklist of the inspection and maintenance control measures will be developed, and records kept of inspections carried out. These drainage controls will be kept in place during the operational phase of the wind farm until vegetation is re-established.

Settlement ponds will also require regular inspection and cleaning when necessary and this will be carried out under low or zero flow conditions so as not to contaminate clean effluent. The water level will first be lowered to a minimum level by pumping without disturbing the settled sediment before the sediment is removed by mechanical excavator and disposed of in areas designated for spoil deposition. Settlement ponds will require perimeter fencing and signage to ensure that there are no health and safety risks.

Each drain will incorporate a series of check dams that will attenuate the flow and provide storage for the increased runoff generated during exceptional rainfall events and where necessary, sandbags and/or silt fences will be installed in adjacent roadside drainage ditches to ensure optimum standard of water running into adjacent streams from the roadside drainage. During periods of heavy precipitation and increased run-off, works will be halted or working surfaces/pads will be provided to minimise soil disturbance.

Silt fencing will be erected around the perimeter of temporary works to minimise run-off.

Additional water quality control infrastructure and measures will include:

- Settling out as far as reasonably practicable any silty water generated on site through drainage mitigation measures (silt traps, etc.) and channelled into suitable vegetation (as defined by Ecological Clerk of Works (ECoW)) at least 50 metres from watercourses;
- Establishing vegetation on exposed areas by using top sod or reseeding with a suitable seed mix;
- Regular road cleaning;
- Provision of wheel washes;
- Provision of check dams on drains to slow water velocity;
- Provision of silt fences on drains to reduce sediment loading;
- Daily and weekly weather forecast monitoring;
- Programme of daily, weekly and monthly water quality monitoring.

All design and works in proximity to watercourses shall follow the best practice guidance outlined in the following documents:

- *Draft Revised Wind Energy Development Guidelines* (DHLGH, 2019).
- *Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters* (IFI, 2016).
- *Control of water pollution from linear construction projects* (Murnane *et al.,* 2006).
- *Guidelines for the crossing of Watercourses during Construction of National Road Schemes* (NRA[68], 2008).

[68] National Roads Authority, now known as Transport Infrastructure Ireland (TII)

7.2 Mitigation by Management

7.2.1 Project Ecologist/Ecological Clerk of Works (ECoW)

A suitably qualified and experienced project ecologist/Ecological Clerk of Works (ECoW) will be employed during the construction phase of the project to ensure all environmental impact prevention controls relevant to construction activities occurring at the time are in place. Duties will include, but are not limited to, a review of all method statements to ensure works are undertaken in compliance with the CEMP and the Conditions of Planning; delivery of toolbox talks; and monitoring of construction phase activities to ensure all environmental controls and EIAR mitigation is implemented in full. The ECoW will be awarded a level of authority and will be allowed to stop construction activities if he/she deems it necessary. Refer to the CEMP in Appendix 2A of Volume III of the EIAR for further detail.

7.2.2 Invasive Alien Plant Species (IAPS) Management

Best Practice and mitigation measures to avoid the spread of invasive alien species are incorporated into the CEMP. All management and control measures implemented on-site during the construction phase will be carried out strictly in accordance with best practice guidance as set out in '*The Management of Noxious Weeds and Non-native Invasive Species on National Roads*' (NRA, 2010) and best practice management guidelines for various species published by Invasive Species Ireland[69].

Prior to being brought onto the site, all plant and equipment will be cleaned and free of soil/mud/debris or any attached plant or animal material. Prior to entering the site, all plant/equipment will be visually inspected by the Environmental Officer to ensure all adherent material and debris has been removed. A pre-construction survey for IAPS will be carried out by a suitably qualified ecologist prior to any works commencing. Where IAPS occur within the works footprint, the appointed Contractor will develop and implement an appropriate method statement regarding the on-site management of IAPS.

All footwear/waders and equipment that are to be placed (or could possibly be placed) within the water will be treated before using to prevent foreign flora and/or fauna entering the water, and they will be treated after use to prevent IAPS spreading to other catchments. Non-native species control will be practised according to '*IFI Biosecurity Protocol for Field Survey Work*' (IFI, 2010) noting that some works components are located at/near watercourses.

7.2.3 Tree Felling and Vegetation Removal – Protection of Birds

Felling of commercial conifer stands is required within the proposed construction site to accommodate the construction of the substation and two turbine foundations, and associated hardstands, access tracks, turbine assembly areas, borrow pit and deposition areas. Overall, felling of approximately 15.97 hectares of forestry will be required.

All tree felling will be undertaken in accordance with a tree felling licence, using good working practices as outlined by the Department of Agriculture, Food and the Marine (DAFM) Standards for Felling and Reforestation (DAFM, 2019). These standards deal with sensitive areas, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Tree felling will also comply with all measures prescribed in the CEMP and in accordance with the proposed surface water management for the project. All conditions associated with a proposed felling licence will be complied with.

[69] Resources - Invasives.ie Accessed: 25th January 2023

Where possible, forestry felling and vegetation clearance will only take place before or after the bird breeding season (1st April to August 31st, inclusive). Construction work will commence before the breeding season begins (1st April) to ensure that incubating birds or birds with young are not displaced by the disturbance work commencing during the breeding season.

Should it be necessary to remove vegetation during the breeding season, for instance where bramble and ephemeral plant species have become established on ground cleared earlier, this will be surveyed by an ornithologist up to ten days before any clearance. Should an active nest be located, the area will be restricted from works by a distance where it is considered that the works would not cause disturbance or abandonment of the nest. Such distances, which will vary according to species and local topography, will be determined by the ornithologist. The restriction will be maintained until it is established that any young birds present have fledged.

7.2.4 Otter – Protection of Species

Pre-construction surveys will be undertaken to ensure that newly established holts do not occur within the works area before the commencement of construction. Should a holt be identified, additional surveys/enabling works will only be undertaken under the appropriate NPWS licence.

7.2.5 Construction Environmental Management Plan (CEMP)

A **Construction and Environmental Management Plan (CEMP)** has been prepared (see **Appendix 2A** of **Volume III** of the **EIAR**) and will be updated throughout pre-construction and construction and will be implemented on site to reduce the risk of pollution and improve the sustainable management of resources (see **Section 2.4.9** in **Chapter 2 Description of the Proposed Development**, of the **EIAR**). The detailed CEMP will outline construction practices and environmental management measures which will be implemented during the construction phase to ensure that the entire development is constructed in accordance with best practice with minimum impact on the surrounding environment.

The CEMP will provide for systematic waste management identifying types and quantities of wastes arising, their management, documentation, treatment/disposal, and the parties responsible, at all stages of the project. The implementation of the proposed and agreed mitigation measures, monitoring and follow-up arrangements, and management of impacts will be managed through the CEMP. The CEMP will ensure that the proposed development will be carried out in accordance with any planning conditions applicable and within the agreed schedule.

The construction works will be strictly managed in line with the Contractors CEMP, which will include measures for the management of fuel, concrete, stockpiles, run-off, spills and the provision of emergency procedures. The CEMP and associated pollution control measures have been devised with reference to the following:

- *Control of water pollution from linear construction projects. Technical guidance (C648)* (Murnane *et al.,* 2006).
- *Control of water pollution from construction sites. Guidance for consultants and contractors* (Masters-Williams, 2001).
- *The management of noxious weeds and non-native invasive plant species on National Roads* (NRA, 2010).

Construction method statements will be prepared prior to commencement of construction and incorporated into the CEMP which will be submitted to Clare County Council for agreement and approval prior to commencement of any construction activity. The finalised CEMP will include, but not be limited to, the following environmental controls:

- Management of excavations;
- Surface water management plan (sediment and erosion control);
- Fuels and oils management;
- Management of concrete;
- Construction waste management plan;
- Wheel wash management procedure;
- Construction dust management;
- Construction noise management;
- Ecological management plan for the protection of habitats and fauna;
- Management of invasive species;
- Monitoring and auditing procedures; and
- Environmental accidents, incidents and corrective actions.

7.2.6 Surface Water Management and Protection of Water Quality

The main risk to water quality arises from the potential for ingress of sediment or accidental fuel/oil spillages discharging to the watercourses at the proposed development site via the site drainage system or surface flow. Any pollutants entering these watercourses could then be transferred to the downstream freshwater and/or marine waters of the Lower River Shannon SAC, located approximately 1.6 river kilometres downstream from WC6 and WC7 (46m approximately from the temporary works at the junction of the R464 and L3056), and/or the River Shannon and River Fergus Estuaries SPA located approximately 6.6 river kilometres downstream of WC1 (3.1km approximately from the temporary works at the junction of the R464 and L3056).

These risks are particularly acute during excavation and construction activities. Consequently, mitigation measures will be implemented to ensure that pollutants and sediment are not transferred to receiving watercourses via surface water and run-off on the site. Furthermore, the drainage system proposed for the construction phase of the project has been designed to cause minimal disturbance to the current hydrological regime by maintaining diffuse flows. Cross-drains are designed to facilitate existing drains and overland flow, and maintenance of the construction drainage design will be required during the operational phase.

As discussed in Section 6.4.1, above, water quality is a crucial environmental factor underpinning the conservation condition of the complex of wetland habitats and aquatic species and birds that the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA are selected for. Increased sediment levels, nutrient-enrichment, and other aquatic pollution, which could arise in the absence of effective water quality protection measures, would impact on the freshwater ecology of watercourses within the vicinity of the works.

A site-specific Surface Water Management Plan has been designed and is summarised in Section 7.1.2, above, and described in full in the CEMP of Appendix 2A in Volume III of the EIAR. The following subsections provide further detail on the various mitigation measures that will be incorporated into the proposed development to avoid or minimise any water quality impacts that could significantly affect the Conservation Objectives of the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

7.2.6.1 Drainage System Inspections and Surface Water Monitoring

The drainage and treatment system for the proposed wind farm will be managed and always monitored, particularly after heavy rainfall events during the construction phase. A programme of inspection and maintenance will be designed for dedicated construction personnel ensuring that any failures are quickly identified and repaired to prevent water pollution. A checklist of the inspection and maintenance control measures will be developed, and records kept of inspections and maintenance works. These drainage controls will be kept in place during the operational phase of the wind farm until the vegetation is re-established.

A surface water monitoring schedule will be finalised prior to construction and then followed throughout the construction phase of the project - refer to the Surface Water Management Plan in Appendix 2B in Volume III of the EIAR. Monitoring of suspended solids will be undertaken on a weekly basis and whenever else required such as after a rainfall event. Monthly monitoring of pH, metals, nitrates, and phosphates will also take place. This will be compared with the baseline data obtained prior to construction, as described in Section 4.4.7.6, above. If the measured value exceeds the baseline values, the cause will be identified, and remedial measures put in place.

Further details on the surface water quality monitoring programme for all phases of the proposed development are available in Section 8.4 in Chapter 8, Water, in Volume II of the EIAR.

7.2.6.2 Management of Concrete

There shall be the requirement for some concrete works at the site. It is extremely important to prevent any concrete from entering surface water drains within or around the site as wet concrete is silty and very alkaline (high pH) and can have a serious effect on watercourses and aquatic life if ingress occurs. Refer to the CEMP in Appendix 2A of Volume III of the EIAR for further details.

The following measures will be implemented during concrete works at the site:

- A designated trained operator, experienced in working with concrete, will be employed during the concrete-pouring phase and pouring will be supervised by the Construction Manager, a suitably qualified Engineer, and the Environmental Manager/ECoW.
- There shall be no pouring of concrete during extreme/prolonged rainfall or forecasted heavy rainfall.
- The use of concrete close to drainage features will be carefully controlled to avoid spillage.
- Any small volumes of incidental wash generated from cleaning hand tools, cement mixers or other plant, as required, will be trapped on-site to allow sediment to settle out and reach neutral pH before clarified water is released to the surface water drains or allowed to percolate to ground. Settled solids will need to be appropriately disposed of off-site.
- There will be a dedicated concrete chute washout area on site. To reduce the volume of cementitious water, washout of concrete trucks will not take place on site. Concrete trucks will be washed out off site at the source quarry.

7.2.6.3 Construction Wheel Wash

Wheel washes will be provided for heavy vehicles exiting the site to ensure that roads outside of the site boundary are clean. These can take the form of dry or wet wheel wash facilities. In the case of a wet wheel wash a designated bunded and impermeable wheel wash area will be provided, and the resultant wastewater will be diverted to a settlement pond for settling out of suspended solids. The wheel wash area will be cleaned regularly to avoid the buildup of residue.

7.2.6.4 Management of Fuel/Oil

Site management should include the checking of equipment, materials storage and transfer areas, drainage structures and their attenuation ability on a regular basis during the construction phase of the project. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations. Refer to the CEMP in Appendix 2A of Volume III of the EIAR for further details.

Appropriate fuel management will include the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas on flat ground a minimum distance of 50 metres from any watercourse or other water-conducting features e.g. drains.
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores. Chemicals will be bunded and where applicable, stored within double skinned tanks/containers with the capacity to hold 110% of the volume of chemical contents.
- Ancillary equipment such as hoses and pipes will be contained within the bund.
- Taps, nozzles or valves will be fitted with a lock system and be regularly inspected for leaks and/or signs of damage. Fuel/oil stores including tanks and drums will also be inspected regularly for the same reasons.
- Where required, refuelling on-site will only be carried out at a designated area at least 50 metres from any watercourse with the use of a delivery fuel truck, operated by appropriately trained personnel. Only designated trained operators will be authorised to refuel plant on site.
- Only mechanically sound plant will be permitted to gain access to the site.
- Controls will be regularly inspected and maintained. Regular cleaning and servicing of bunds, gullies, pipe work, oil interceptors will be carried out to ensure this system is operating at its optimum.
- Procedures and contingency plans will be set up to deal with emergency accidents or spills. An emergency spill kit with oil boom and absorbers will be kept on site in the event of an accidental spill. The contents of the spill kit will be replenished if used and they will be checked on a scheduled basis during environmental inspections and audits. All crews will be trained in the use of spill kit equipment.
- All emergency procedures and equipment will be in place prior to the commencement of any works.

7.2.6.5 Refuelling of Construction Plant On-Site

All plant, such as excavators and dumpers, will be refuelled on-site, while rigid and articulated vehicles and all site vehicles (jeeps, cars and vans) will be refuelled off-site. Refer to the CEMP in Appendix 2A of Volume III of the EIAR for further detail. The plan outlined will have regard to the following elements:

- Refuelling will be carried out using 110% capacity double-bunded mobile bowsers. The refuelling bowser will be operated by trained personnel. The bowser will have spill containment equipment which the operators will be fully trained to use.
- Plant nappies or absorbent mats to be placed under refuelling point during all refuelling to absorb drips.
- Mobile bowsers, tanks and drums will be stored in secure and impermeable storage area, 50 metres away from drains and open water.
- To reduce the potential for oil leaks, only vehicles and machinery will be allowed onto the site that are mechanically sound. An up-to-date service record will be required from the main contractor.

- Should there be an oil leak/spill, it will be contained immediately using oil spill kits. All oil and contaminated material will be removed from site and properly disposed of in a licensed facility.
- Immediate action will be facilitated by easy access to oil spill kits. An oil spill kit that includes absorbing pads and socks will be kept at the site compound and within site vehicles and machinery.
- Correct action in the event of a leak or spill will be facilitated by training all vehicle/machinery operators in the use of the spill kits and the correct containment and cleaning up of oil spills or leaks. This training will be provided by the Environmental Manager at site induction.
- In the event of a major oil spill, a company who provide a rapid response emergency service for major fuel spills will be immediately called for assistance, their contact details will be kept in the site office and in the spill-kits kept inside site vehicles and machinery.

7.2.6.6 Storage

The storage of materials, containers, stockpiles and waste, however temporary, will follow best practice at all times and be stored at designated areas. All containers will be stored upright and clearly labelled. Sufficient storage will be supplied near all working areas.

Storage will be located as follows:

- Away from drains and streams;
- On an impermeable base;
- Under cover to prevent damage from the elements;
- In secure areas;
- Well away from moving plant, machinery and vehicles.

Temporary storage of Cement Bound Granular Mixtures (CBGM) during construction of the cable trench will be on hardstand areas, or areas that are not prone to run off and where there is no direct drainage to surface waters. The area will be appropriately bunded in the form of sandbags, geotextile sheeting, or silt fencing. This method will prevent any solids run-off.

7.2.6.7 Excavations

All site excavations and construction will be supervised by a suitably qualified and experienced engineer. The Contractor's method statements for each element of work will be reviewed and approved by the engineer prior to site operations. Specific method statements will be developed for each turbine and hardstanding location within the site.

Prior to excavation, drains will be established to effectively intercept overland flow prior to earthworks. The existing network of drainage within the site will be used whenever possible.

Bulk excavations will be done during periods of dry weather to avoid run off from exposed excavation areas. Weather will be monitored during the project and no excavation works will be allowed during severe or heavy rainfall events. All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Where appropriate and necessary, cuts and excavations will be protected against ingress of water or erosion using cut-off drains around the excavation works. Temporary works will be such that they do not adversely interfere with existing drainage channels/regimes.

Plant and materials will be stored in approved locations only (such as the proposed site compound) and will not be positioned or trafficked in a manner that would surcharge existing or newly formed slopes. Vehicular

movements will be restricted to the footprint of the permitted development, particularly with respect to the newly constructed access tracks. This implies that machinery will be restricted to use on existing tracks/hardstands and, aside from advancing excavations, will not move onto areas that are not permitted for the development.

7.2.6.8 Excavated Materials and Soil Management

All soils generated from excavation works within the proposed wind farm site such as from turbine, track, substation and internal cable construction will be retained on site and reused in bunding, landscaping and restoration of borrow pit and deposition areas. No soils will be removed from the site. Stockpiling of soils will be avoided on site. After completion of the construction phase works, no permanent stockpiles will be left on site apart from material placed in the designated permanent storage area.

During grid connection excavations, excavated material will be temporarily stockpiled adjacent to the section of trench as it is removed for re-use as backfill. Excess/unsuitable material will be immediately removed to a deposition area. Appropriate siltation measures will be put in place prior to excavations. Stockpiles will be temporarily stored a minimum of 50 metres back from watercourses on level ground. Silt-retaining measures (silt fence/silt curtain or other suitable materials) employed to reduce the risk of silt run-off will be installed along the downgradient edges of stockpiled earth materials.

7.2.6.9 Dewatering

All groundwater/surface water that may enter turbine foundations or cable trenches/joint bays will be removed and treated and disposed of appropriately, in accordance with the measures outlined hereunder. Any dewatering (if/where required) will adhere to the following measures:

- Groundwater/surface water will not be pumped directly into trackside drains/watercourses;
- Groundwater/surface water within the turbine base excavations will be conveyed through drainage channels to the drainage and settlement system. High-capacity pumps will be avoided to prevent significant flow rates to the drainage and settlement system that may overload the system; and
- Where necessary, temporary storage of groundwater/surface water will be provided within the excavations and dewatering carried out at a flow rate that is within the capacity of the settlement ponds.

7.2.6.10 Borrow Pit

Prior to tree felling at the location of the proposed borrow pit, an interceptor drain will first be excavated upslope. This drain will intercept the existing overland flows, diverting them around the borrow pit prior to discharge via a buffer zone on the downslope side. Any subsoil material overlying the rock will be excavated and stockpiled. The stockpile will be sealed, and a perimeter drain installed to intercept any run-off before discharging it through an appropriately designed silt trap.

Any surface water run-off, water pumped from within the borrow pit or standing water is likely to contain an increased concentration of suspended solids. Consequently, this water will be isolated from the clean catchment run-off by means of a series of open drains (check dams) to be constructed within the area. These drains will attenuate the flow and provide storage for the increased run-off generated during exceptional rainfall events.

Borrow pit inspections will be carried out by a geotechnical engineer through regular monitoring of the opening works. The appointed Contractor will review work practices at the borrow pit and should periods of heavy rainfall be expected, work will be halted to prevent excessive run-off generation.

The backfilling of the borrow pit with excavated material from the construction works will be undertaken under the same conditions as described above.

7.2.6.11 Grid Connection Cable Works Watercourse Crossings and Land Drainage Ditches

Approximately 110 metres from where it joins the overhead lines of the National Grid, the 110kV grid connection route will cross the Kilnacreagh Stream within coniferous plantation (refer to Figure 4-4, above). An access track will be provided over the cable and the crossing point of the cable will coincide with the crossing point of the proposed access track. A new bottomless culvert will be installed to carry both the track and the cable over the crossing with no instream works required.

Where land drains are encountered on the proposed grid connection route there are two scenarios proposed:

I. If there is adequate cover, the new ducts and trench will pass over the drain without interruption and no works will be required within the drain with the trench being installed in existing public/private access track.

II. Where there is insufficient cover over a drain crossing point, the new grid connection route will be installed underneath the existing crossing using the following approach:

- Using sandbags and stable clay soil material, a sump will be formed upslope of the crossing where water will accumulate. A 50mm or 100mm submersible pump will then move the drain water across the track and back into the drain on the down flow section below the track.
- To prevent siltation/sedimentation, two silt fences and filters will be placed downslope of the crossing point. Once the sump and over-pumping mechanism is in place, the trench excavation will progress.
- A section of drain crossing (pipe or stone culvert) will be temporarily removed allowing the duct to pass under the drain. Once in place, the drain will be surrounded with lean mix concrete and the trench backfilled with suitable stone.
- Finally, the drain will be put back in place, surrounded with stone/lean mix concrete and the track restored to its finished level before the over-pumping measures are removed and normal drain flow can resume.

7.2.6.12 Temporary Local Road Widening Works

As described in Section 4.6.5.3, above, it will be necessary to undertake some temporary road widening works along the local road network at the junction of the R464 and L3056 to facilitate delivery of turbine components to the proposed development site. While there are no watercourses traversing the proposed temporary works area, the Lower River Shannon SAC is located approximately 46 metres southeast of the junction (see Figure 4-14, above). This creates the potential for ingress of sediment or accidental fuel/oil spillages discharging to the SAC via surface flow which could then be transferred downstream to the River Shannon and Fergus Estuaries SPA and the estuarine/ marine waters of the SAC. To ensure pollutants/sediment are not transferred from the temporary road widening works site to the SAC via surface water and run-off, various mitigation measures will be implemented.

Prior to works commencing, silt fencing will be erected around the perimeter of the works area to limit the potential for sediment run-off. Further management measures will include:

- No excavation of materials will take place;
- Works will not take place during periods of high rainfall;
- There will be no temporary stockpiling of material;

- There will be no refuelling of vehicles/storage of fuels;
- An oil spill kit that includes absorbing pads and socks will be kept site vehicles and machinery.

7.2.7 Risk of Accidents

Given the temporary nature of the construction stage and the scale of the proposed project, as well as the environmental controls that will be implemented from the outset, the risk of disasters (typically considered to be natural catastrophes e.g. a very severe weather event) or accidents (e.g. fuel spill, traffic accident) is considered low. To minimise environmental risk, no concrete pours will take place during severe weather events such as during flooding or heavy rainfall (10 mm/hr).

Best construction practice, including that for Health and Safety, will be employed to minimise the risk of any accidents occurring. All work on site will be carried out in compliance with the Safety, Health and Welfare at Work Act 2005, the Safety, Health and Welfare at Work (Construction) Regulations 2013, and all relevant Legislation and Work Practice to ensure that the construction areas, site environs and public roads remain safe for all users.

7.3 Operational Phase

7.3.1 Water Quality Measures

Following completion of construction, on-site levels of traffic and excavation works will be extremely low, and the risk of sediment run-off will be negligible. Sediment ponds and silt fences erected for the protection of water quality during the construction phase will remain in place, although it is proposed to partly fill in the sediment ponds with stone so that they will not present a long-term safety risk. Run-off from the tracks, hard-standings, and other works areas will continue to be directed to these ponds and from there to the outfall weirs. Check dams within the drainage channels will also remain in place. Temporary works areas and the compound will be reinstated and revegetated.

There will be increased rates of surface water run-off at the site due to the increased amount of hard surface areas of the development which could lead to an increased flood risk downgradient of the site. The retention of the drainage infrastructure will ensure that run-off continues to be attenuated and dispersed across existing vegetation before reaching downstream receiving waters. The run-off control measures for the wind farm site have been designed in the context of storm events of varying duration and intensity. The settlement ponds have been designed to cater for a maximum continuous flow rate associated with a medium intensity rainfall event. Higher intensity run-off will be attenuated by the open drain collection system which provides temporary storage and limits the rate at which the run-off enters the settlement ponds.

The surface water drainage system will be managed and appropriately maintained as per standard best practice to ensure an adequate discharge quality and to control the quantity of run-off. Regular inspections by the operational maintenance personnel will ensure culverts are free from blockages and that there is no damage or erosion of the stream crossing wing walls, particularly after storm events. Silt ponds will also be inspected and maintained before drains and verges have vegetated.

Water monitoring will continue during Years 1 and 2 of the operational phase, commencing after completion of the construction phase.

Biological water quality monitoring will be undertaken to monitor surface water quality during the operational phase. Macroinvertebrates will be sampled annually for the first three years at the aquatic survey sites summarised in Table 1 and Figure 3-2, above, and detailed in the Aquatic Ecology Report in Appendix 6C of Volume

III of the EIAR. Should it be found that there is instability within the macroinvertebrate communities, the surveys should continue beyond Year 3 until stabilisation of the communities has been achieved.

7.3.2 Lights on Turbines

Lights on turbines can reduce the potential risk of collision to birds. The use of "white lights" on the turbines will be avoided as these can attract insects, which may then attract insectivorous bird species or night-flying birds such as migrating individuals.

Any form of lighting on turbines or other structures will be agreed in advance with the Irish Aviation Authority/AirNav Ireland.

Any lighting introduced to the Proposed Development site will follow guidance in the documents:

- *Guidance Note GN 08/23. Bats and Artificial Lighting at Night* (BCT, 2023);
- *Bats and Lighting: Guidance Notes for planners, engineers, architects and developers* (BCI, 2010);
- *Bat Mitigation Guidelines for Ireland* Version 2. (Marnell *et al.,* 2022); and,
- *Bats and onshore wind turbines – survey, assessment and mitigation* (NatureScot, 2021).

7.4 Decommissioning Phase

Mitigation measures for the decommissioning phase will be like those of the construction phase; however, decommissioning will be of a significantly lesser scale, as large-scale excavations will not be required.

8. Monitoring (Avian Fauna)

A programme of post-construction bird monitoring will take place to establish whether the construction and operation of the proposed development has had effects on the bird species associated with the site prior to construction (as shown by the baseline surveys completed within the 48-month survey period as summarised in Section 4.4.8, above, and in more detail in Section 7.2.3 in Chapter 7 Ornithology, in Volume III of the EIAR).

The monitoring programme will comprise the following:

Flight Activity Surveys

Flight activity surveys will be undertaken using the Vantage Point method (SNH, 2017). The purpose of the surveys is to determine if the presence of the turbines is causing species to avoid the site. The surveys will utilise the same Vantage Point locations as used for the baseline EIAR surveys (see Figure 3-3, above) so that a valid comparison can be made between the two periods. The surveys will be undertaken monthly in Years 1, 2, 3, 5, 10 and 15 of the proposed development's lifetime (in accordance with SNH, 2009).

Transect Survey within the Site

A transect survey will be undertaken to monitor short-term and long-term effects on bird populations within the site. The transect location and the survey methodology will be the same as employed for the baseline EIAR surveys which will allow a comparison of data to be made for each monitoring year. Two surveys will be undertaken in each of the summer and winter seasons in the same monitoring years as the vantage point surveys described in the preceding paragraph.

Collision searches

The objective of collision monitoring and corpse searches is to establish whether bird fatalities are occurring as a result of collision with turbine blades. This will also provide data to determine the accuracy of the predictions from the Collision Risk Modelling carried out for the proposed development (for Collision Risk Modelling report see Appendix 7K in Volume III of the EIAR).

Carcass searches were traditionally completed by human observers whose efficiency is influenced by several factors including carcass type, environmental conditions and observer competence. Numerous studies have been conducted demonstrating that dogs have a superior ability to detect bird and bat carcasses than humans, particularly with small carcasses or in well vegetated areas (see for example Mathews, 2013). A trained dog under the control of a handler will be used.

A standard plot size will be selected at each turbine location where the search will occur. At the start of each survey, data recorded will include meteorological and ground cover information. The locations of any carcasses found will be recorded by GPS and will be photographed *in-situ*. The state of each carcass will be recorded on a corpse record card, using the following categories (after Johnson, 2003):

- Intact - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger;
- Scavenged - an entire carcass which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location such as wings, legs, skeletal remains or pieces of skin; and
- Feather Spot - ten or more feathers at one location indicating predation or scavenging. If only feathers are found, 10 or more total feathers or two or more primaries must be discovered to consider the observation a casualty.

Searcher efficiency and predation tests will be carried out at the commencement of the programme in order to calibrate the results to account for the search dog's ability to find bird corpses and to also account for scavenging of corpses by animals.

As the site is primarily of ornithological importance for breeding birds, it is proposed that the programme will be confined to the 6-month period March to August, inclusive.

9. Residual Impacts

Based on the best scientific information available, it has been determined that in the absence of mitigation, the proposed development has potential for significant adverse water quality and/or direct/indirect species disturbance/displacement impacts within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

Detailed mitigation measures have been prescribed with regards to the protection of water quality, aquatic habitats and water-dependant species during the construction phase.

With the implementation of the recommended mitigation measures, as outlined in Section 7, above, it is objectively concluded that significant adverse residual impacts on the Conservation Objectives of any of the identified European sites evaluated herein, namely the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA, will not occur as a result of the proposed development, either independently or in combination with other plans or projects.

10. Conclusion

The Habitats Directive 92/43/EEC provides legal protection for species and habitats of European importance via the selection of geographical areas considered to be of particular importance to a region's most valuable and threatened species. This pan-European Natura 2000 network of protected areas, otherwise known in Ireland as 'European sites', includes Special Areas of Conservation (SACs) designated for habitats, plants and non-avian species, and Special Protection Areas (SPAs) designated for avifauna and their habitats (under the Birds Directive (79/409/ECC as codified by Directive 2009/147/EC)). To ensure the longevity of these European sites and to maintain or restore the favourable conservation statuses of the habitats and species within them, Articles 6(3) and 6(4) of the Habitats Directive set out a series of steps/stages that must be applied to plans and projects that may have a significant effect on a European site.

A Screening for Appropriate Assessment (Stage 1) was undertaken to identify whether the proposed Ballycar Wind Farm development is likely to have significant direct or indirect impacts (or significant impacts could not be ruled out) on European sites identified as being within the zone of impact influence of the proposed development. The zone of impact was ascertained through the application of the Source-Pathway-Receptor (SPR) model and as a precautionary measure, all European sites located within 15 kilometres of the proposed development site were considered. The screening process concluded that the proposed construction, operation and eventual decommissioning of Ballycar Wind Farm was not likely to have significant direct or indirect effects, either individually or in combination with other plans or projects, on six European sites within the zone of influence. However, the same conclusion could not be reached with regards two European sites, namely Lower River Shannon SAC and River Shannon and River Fergus SPA, and significant effects because of the proposed development could not be ruled out. Consequently, the project proceeded to Stage 2 of the Appropriate Assessment process and a Natura Impact Statement was produced.

This Natura Impact Statement (Stage 2) has considered the impact of the proposed development on the integrity of two European sites, namely the Lower River Shannon SAC and the River Shannon and River Fergus SPA, either alone or in combination with other plans or projects, in relation to the structure, function and conservation objectives of each site. Following an examination, analysis and evaluation of the relevant information and best scientific knowledge, including in particular the nature of the predicted impacts from the proposed development, and with the implementation of the mitigation measures proposed, it has been determined the proposed construction, operation and eventual decommissioning of a 12-turbine wind farm at Ballycar in County Clare will not adversely affect (either directly or indirectly) the integrity of either the Lower River Shannon SAC or the River Shannon and River Fergus SPA, either alone or in combination with other plans or projects, in light of the specific conservation objectives of each site.

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Appendix 1

Screening for Appropriate Assessment Report

MWP

Screening for Appropriate Assessment Report

Ballycar Wind Farm

Ballycar Green Energy Limited

January 2024

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1. Summary of Findings

1.1 Screening for Appropriate Assessment

Project Title	Proposed Ballycar Wind Farm
Project Proponent	Ballycar Green Energy Limited
Project Location	The proposed development site is situated within the townlands of Glennagross (orse Glenagross, Glennacross – hereafter referred to as Glennagross within this document), Cappateemore East, Ballycannan West, Ballycannan East, Ballycar South, and Ballycar North in southeast County Clare, approximately 3 kilometres northwest of Limerick City and 6.7 kilometres east of Sixmilebridge.
Screening for Appropriate Assessment	The screening for Appropriate Assessment report is undertaken to determine the potential for likely significant effects of a proposed wind energy development, individually, or in combination with other plans or projects, in view of the conservation objectives of certain European sites identified within this report.
Conclusion	It has been objectively concluded during the screening process that significant effects on the following European sites are not likely to occur because of the proposed development: • Glenomra Wood SAC (001013) • Danes Hole, Poulnalecka SAC (000030) • Ratty River Cave SAC (002316) • Kilkishen House SAC (002319) • Slieve Bernagh Bog SAC (002312) • Slievefelim to Silvermines Mountains SPA (004165) However, it cannot be objectively concluded, at this stage, that the proposed Ballycar Wind Farm will not result in likely significant effects on the following designated European sites: • Lower River Shannon SAC (002165) • River Shannon and River Fergus Estuaries SPA (004077) Therefore, an Appropriate Assessment is required, and a Natura Impact Statement is necessary to assess the implications of the project alone and in-combination with other plans and projects on the integrity of the European sites in view of their conservation objectives.

2. Introduction

2.1 Purpose of the Assessment

This screening for Appropriate Assessment (AA) report has been undertaken to determine whether a proposed 12-turbine wind energy development, 'Ballycar Wind Farm', in the townlands of Glennagross, Cappateemore East, Ballycannan West, Ballycannan East, Ballycar South, Ballycar North in southeast County Clare is likely to result in significant effects on nearby European sites with conservation designations (i.e. Natura 2000 Sites)[1].

This report has been prepared in order to provide a sufficient level of information to the competent authority, in this case An Bord Pleanála (ABP), on which to base an Appropriate Assessment of the proposed wind energy development described in Section 4.2, below.

The report comprises a description of the proposed development, particularly the aspects that could interact with the receiving environment, the identification in Section 4.7 of the impacts that are reasonably foreseeable as potentially ensuing from it, and a determination as to whether these predicted impacts, either alone or in combination with the other plans or projects identified in Section 4.5, are likely to have significant direct and/or indirect effects on the European sites identified in Section 4.6, in view of those sites' conservation objectives.

2.2 Statement of Competency

This screening for Appropriate Assessment report has been prepared by Hazel Dalton (BSc.) Senior Ecologist, and Úna Williams (BSc. MSc.), Ecologist and Environmental Scientist, both of Malachy Walsh and Partners (MWP) Engineering and Environmental Consultants in County Kerry.

Hazel has over eight years' experience with MWP in ecological surveying and impact assessment for AA and Environmental Impacts Assessment Reports (EIAR) and has authored and contributed to numerous screening reports for AA, Natura Impact Statements (NIS) and Ecological Impact Assessments (EcIA). She is an appropriately qualified, trained and competent professional. She has completed numerous ecological assessments for a wide variety of projects. She is an experienced field ecologist and has a diverse ecological survey profile, including habitats and flora, mammals, birds and terrestrial/aquatic invertebrates.

Úna has worked with MWP for over four years and is an experienced field ecologist. She is familiar with various ecological survey methodologies including habitat/survey mapping and zoological surveys and has worked on research teams both in Ireland and abroad. She has undertaken assessments for a wide variety of projects including for renewable energy developments, and infrastructural and coastal developments. Úna has designed and carried out several Collision Risk Models for proposed wind farms and has authored many ecological reports including Screenings for Appropriate Assessment Reports (Stage 1), Natura Impact Statements (Stage 2), and Ecological Impact Assessments.

This report was reviewed by Gerard Hayes. Gerard is a Senior Ecologist with MWP and has over 15 years' experience in environmental consultancy. He is a member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and the Freshwater Biological Association (FBA). Gerard has a diverse ecological profile, with Phase 1 habitat, mammal (including bats), bird, amphibian, macroinvertebrate and tree survey experience. He is co-author and/or carried out surveys for NPWS Irish Wildlife Manual Nos. 15, 24, 26, 37, 45.

[1] 'European sites' are defined in Section 177R of Part XAB of the Planning and Development Act 2000 and include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) at all stages of designation.

2.3 Project Overview

Ballycar Green Energy is submitting a planning application for developing and operating a commercially viable 12-turbine wind farm project on lands at Ballycar in southeast County Clare. For the purposes of this assessment, the 'proposed development' refers to all elements of the proposed wind energy project including all wind farm infrastructure and new underground 110kV collector cable – see **Section 4.2**, below, for further details.

It is envisaged that the project will exceed a 50-megawatt (MW) capacity scale and therefore will be a Strategic Infrastructure Development (SID) for which an application for planning permission must be made directly to An Bord Pleanála. MWP was commissioned by Ballycar Green Energy to complete a Screening for Appropriate Assessment Report. An Environmental Impact Assessment (EIA) and an Environmental Impact Assessment Report (EIAR) have been prepared by MWP. This will be submitted as part of the planning application.

2.4 Legislative Context

The Habitats Directive (92/43/EEC) seeks to conserve natural habitats and wild fauna and flora through the designation of Special Areas of Conservation (SACs), while the Birds Directive (2009/147/EC) seeks to protect bird species of special importance by the designation of Special Protected Areas (SPAs). It is the responsibility of each European Union member state to designate SPAs and SACs that form part of Natura 2000, a network of protected sites throughout the European Community. The European Communities (Birds and Natural Habitats) Regulations 2011-2021 transpose the Habitats Directive and the Birds Directive into Irish law. The requirement for Appropriate Assessment of the implications of plans and projects on the Natura 2000 network of sites comes from the Habitats Directive (Article 6(3)). Further information is available at:

http://ec.europa.eu/environment/nature/legislation/habitatsdirective/

http://www.npws.ie/planning/appropriateassessment/

The current assessment was conducted within this legislative framework and in accordance with the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021), the European Commission Notice '*Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*' (EC, 2019), '*Appropriate Assessment of Plans & Projects - Guidance for Planning Authorities'* prepared by the National Parks and Wildlife Service (NPWS) (DoEHLG, 2010), and the Office of the Planning Regulator (OPR) Practice Note '*Appropriate Assessment Screening for Development Management*' (OPR, 2021). As outlined in these, it is the responsibility of the proponent of the project, in this case Ballycar Green Energy ('the Applicant'), to provide a comprehensive and objective screening for Appropriate Assessment report which can then be used by An Bord Pleanála to assist them in completing their screening exercise.

If it is determined that an Appropriate Assessment should be required in respect of the construction, operation and decommissioning of the proposed wind farm, a Natura Impact Statement (NIS) must be prepared. The NIS will assist the competent authority to conduct the Appropriate Assessment for the project.

2.5 Stages of Appropriate Assessment

The Appropriate Assessment process is a four-stage process with issues and tests at each stage. The purpose of the screening assessment is to record in a transparent and reasoned manner the likely effects on European sites of a proposed development. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required. The stages are set out in **Appendix A** of this report. This proposal has proceeded as far as Stage 2.

3. Methodology

3.1 Appropriate Assessment Guidance

A plan or project can only be authorised by a competent authority if it has made certain that it will not adversely affect the integrity of the European sites relevant to the project in view of their conservation objectives, either alone or in combination with other plans and projects. This can only be the case where "no reasonable scientific doubt remains as to the absence of such effects"[2].

As set out in the NPWS guidance, the task of establishing whether a plan or project is likely to influence a European site(s) is based on a preliminary impact assessment using available information and data, including that outlined above, and other available environmental information, supplemented as necessary by local site information and ecological surveys (DoEHLG, 2010). This is followed by a determination of whether it is likely that the effects identified could be significant. The precautionary principle approach is required.

Once the potential impacts that may arise from the proposal are identified, the significance of these is assessed using the following key indicators:

- Water quality and resource;
- Habitat loss or alteration;
- Disturbance and/or displacement of species; and
- Habitat or species fragmentation.

3.2 Consultation

Two pre-application stage meetings were held with An Bord Pleanála. The first, held on 23rd February 2022, involved Ballycar Green Energy and MWP introducing the proposed Ballycar wind development to the Board. The grid connection, Natura Impact Statement (NIS), and the Environmental Impact Assessment Report (EIAR) were discussed. A second meeting with An Bord Pleanála took place on 1st September 2022 where the discussion focussed on project progress and the EIAR and NIS. An Bord Pleanála confirmed the project would be Strategic Infrastructure in correspondence dated the 4th November 2022 and advised on the list of prescribed bodies.

Ballycar Green Energy and MWP held a preliminary meeting with members of Clare County Council (CCC) Planning Department on 2nd March 2022 to present the site and discuss its suitability for a wind farm project - the turbine delivery route, any potential visual impacts, public consultation and environmental impacts were all considered.

On 14th December 2021, the following statutory and non-statutory bodies were consulted, amongst others, in relation to the proposed project:

- Department of Housing, Local Government and Heritage;
- Department of Agriculture, Food and the Marine;
- National Parks and Wildlife Service;
- Environmental Protection Agency Ireland;
- Geological Survey Ireland;
- An Taisce - The National Trust for Ireland;

[2] European Court of Justice Case C-127/02 Landelijke Vereniging tot Behoud van de Waddenzee

- Bat Conservation Ireland;
- Inland Fisheries Ireland;
- BirdWatch Ireland;
- Irish Whale and Dolphin Group;
- Irish Wildlife Trust;
- Irish Aviation Authority; and
- Transport Infrastructure Ireland (TII)3.

A full list of the organisations/groups consulted, copies of the consultation documents and the responses received are provided in **Appendix 1B** in **Volume III** of the **EIAR**.

3.3 Desktop Study

To complete the screening for Appropriate Assessment report, certain information on the existing environment is required. A desktop study was carried out to collate information available on the proposed development site's natural environment. This comprised a review of the following publications, data and datasets:

- Ordnance Survey Ireland (OSI) aerial photography, 1:50000 mapping, GeoHive and online satellite imagery sources;
- National Parks and Wildlife Service (NPWS);
- National Biodiversity Data Centre (NBDC) (online map-viewer);
- Central Statistics Office (CSO) – Census of Agriculture (online);
- BirdWatch Ireland (online datasets);
- Bat Conservation Ireland (BCI);
- Teagasc soil area maps (NBDC website);
- Geological Survey Ireland (GSI) area maps;
- Environmental Protection Agency (EPA) water quality data;
- Shannon International River Basin District (ShIRBD) datasets (Water Framework Directive);
- Inland Fisheries Ireland (IFI) online fish sampling reports and data;
- Review of requested records from NPWS Rare and Protected Species database;
- 'Managing Natura 2000 Sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (EC, 2019);
- Interim Version of the Clare County Development Plan (2023 – 2029)4; and
- Other sources and research listed in Section 5, below, and as footnotes throughout the report.

[3] Transport Infrastructure Ireland (TII) – established in August 2015 through a merger of the National Roads Authority (NRA) and the Railway Procurement Agency under the Roads Act 2015.
[4] Stage 3 - Adoption of Plan | Stage 3: Amendments | Clare County Council (clarecoco.ie) Accessed: 6th July 2023.

3.3.1 Data Requests and Database Searches

The study area lies within the Ordnance Survey National Grid hectad[5] R56. Concise and site-specific information on species records available in this hectad was retrieved from the NBDC on-line database and reviewed.

A request was made to NPWS for Sensitive Data Access for hectad R56 on 17th November 2021. A data request for records of rare or protected species from this hectad was submitted to NPWS on the 13th October 2022.

A data request was also submitted to Bat Conservation Ireland (BCI) for the provision of bat records within a 10-kilometre radius of the proposed development site. All available records were provided by BCI on the 05th May 2023.

A request was made to BirdWatch Ireland on the 18th July 2023 for the results of annual waterbird counts at specific subsites as part of the Irish Wetland Bird Survey (I-WeBS). Information was provided by BirdWatch Ireland on 29th July 2023.

Information received via the NPWS, BCI, NBDC, and BirdWatch Ireland was used to help inform the impact assessment in relation to the proposal.

The responses to these data requests can be viewed in **Appendix 1B** in **Volume III** of the **EIAR**.

3.4 Study Area and Zone of Influence (ZOI) of the Proposed Project

The zone of influence (ZOI) for the proposed development is the geographical area over which construction and/or operation of the proposed wind farm has the potential to affect the receiving environment in such a manner as to significantly affect the Qualifying interests (QI) of a European site. The area over which ecological features may be affected by biophysical changes because of the proposed project and associated activities is likely to extend beyond the project site where, for example, there are ecological or hydrological links beyond the site boundaries (CIEEM, 2018). Consequently, and to ensure completion of an integrated assessment, the study area for this project included the entire proposed development site, adjoining habitats and watercourses located downstream of the site (see **Figure 1**).

For information on the use of the Source-Pathway-Receptor (SPR) model in determining which European sites should be further assessed, refer to **Section 4.6.1**.

[5] Hectad - unit of land area measuring 10 km x 10 km

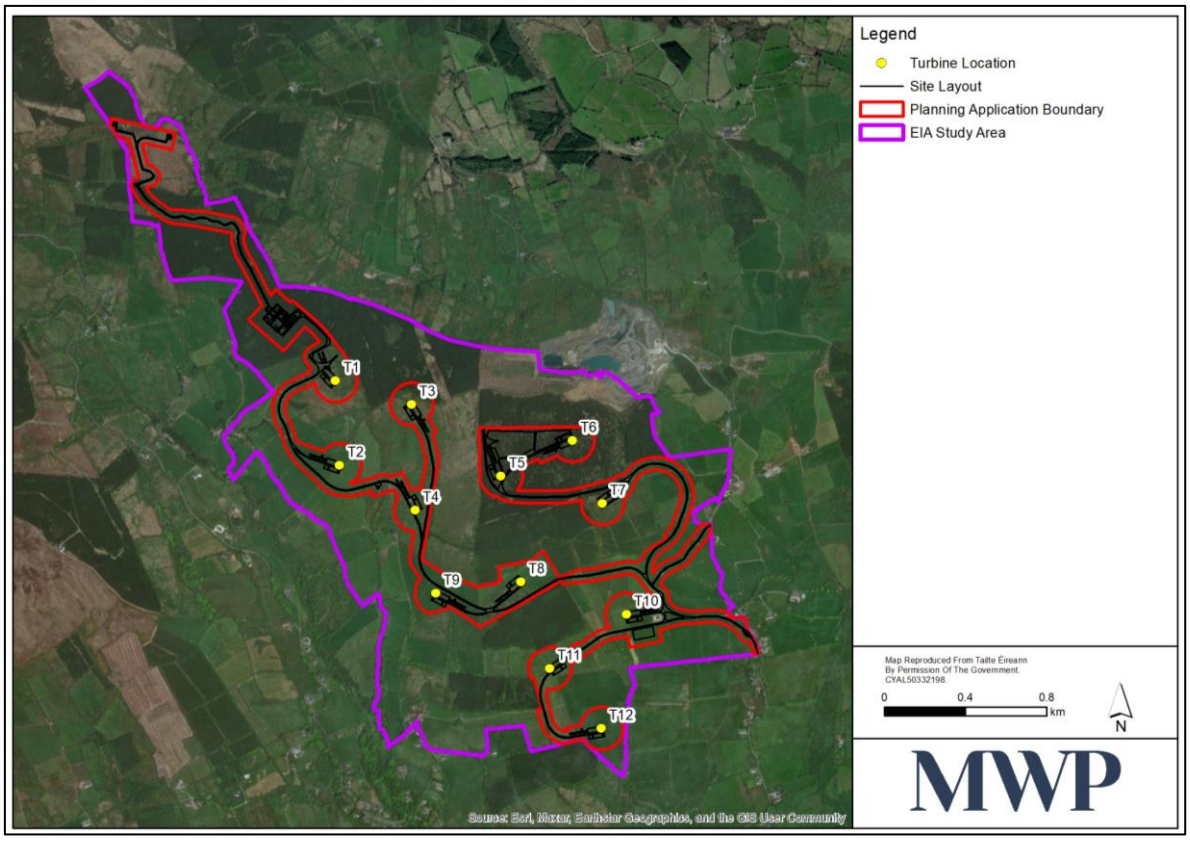

Figure 1: Study area and proposed development site boundary at Ballycar in County Clare.

3.5 Field Surveys

Ecological field surveys and aquatic ecology surveys were undertaken at the proposed development site on multiple dates between 2019 and 2023 to establish the site's ecological features and resources, particularly for any rare or protected species and habitats present within the study area. Multidisciplinary walkover surveys were carried out to identify any ecological features and resources that may potentially be impacted by the proposed development.

Field surveys carried out on-site in support of the development application and relevant to this assessment are outlined as follows:

- Habitat surveys and mapping;
- Non-volant mammal[6] surveys;
- Invasive alien plant species (IAPS) surveys;
- Aquatic surveys;
- Breeding bird surveys including Vantage Point surveys; and
- Wintering bird surveys including Vantage Point surveys.

Full details of survey methodologies have been presented in **Chapter 6 Biodiversity**, and **Chapter 7 Ornithology**, in **Volume II** of the **EIAR**.

[6] Non-volant mammals – Land-based mammals incapable of flight i.e. all land-based mammals excluding bats.

4. Screening for Appropriate Assessment

The purpose of the screening assessment is to record in a transparent and reasoned manner the direct and indirect likely effects, on relevant European sites, of the project, either alone or in combination with other plans and projects, and whether these likely effects are significant. Screening for Appropriate Assessment (Stage 1) determines the need for a full Appropriate Assessment (Stage 2) and consists of several steps, each of which is addressed in the following sections of this report:

4.1 Establish whether the project is necessary for the management of a European site(s).

4.2 & **4.3** Description of the project (construction of a 12-turbine wind energy development at Ballycar in County Clare).

4.4 Description of the existing site's ecological characteristics and a summary of the results of the field surveys.

4.5 Identification of other plans, projects and activities with which the proposed development could interact to create in-combination effects.

4.6 Identification of European site(s) potentially affected.

4.7 Identification and description of potential individual and cumulative impacts (in-combination effects) of the project.

4.8 Assessment of the significance of potential impacts on European site(s).

4.9 Conclusion of screening stage.

4.1 Management of European Sites

The proposal is not connected with or necessary to the conservation management of a European site.

4.2 Description of Project

4.2.1 Site Location and Context

The proposed development site boundary encompassing approximately 104.7 hectares is situated approximately 3 kilometres northwest of Limerick City and suburbs and 6.7 kilometres east of Sixmilebridge in southeast County Clare. Moving west to east, the site encompasses the townlands of Glennagross, Ballycar North, Cappateemore East, Ballycannan West, Ballycannan East and Ballycar South.

The elevated site is situated within a rural landscape and comprises mainly hilly and undulating terrain, with height ranging from approximately 60 metres above ordnance datum (AOD) to 262 metres AOD. The site topography generally slopes southwards giving panoramic views of Limerick City and the Shannon Estuary to the south. A series of hills form a ridgeline along the northern boundary of the site. Refer to **Figure 2**. Heading north from the R464, the site is accessed from Limerick City via two Local Roads - one to the west and one to the east - running parallel on either side of the proposed development site. Access to the west section of the site is via a local road connected to Meelick/Knockalisheen Road (Local Road) to the south, and access to the east section of the site is via a private farm track connected to Ballycar South Road (Local Road) to the east.

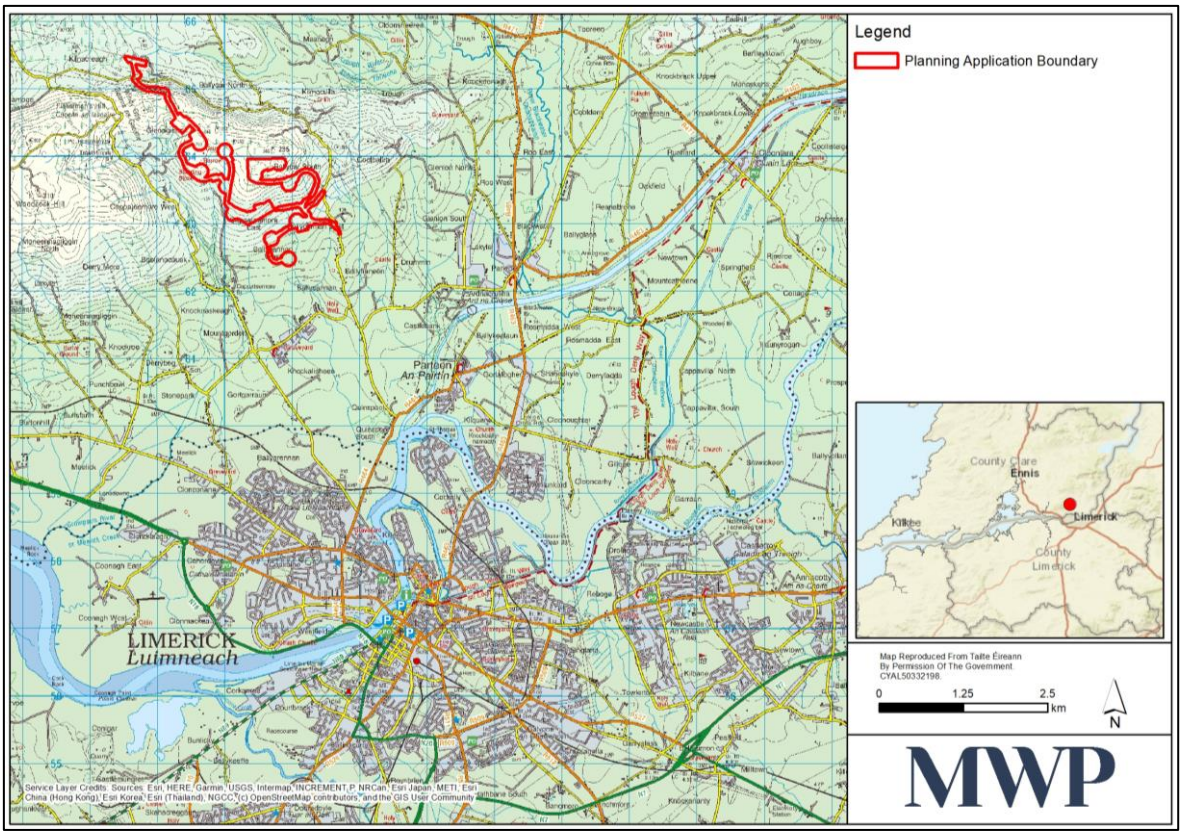

Figure 2: Location of proposed development site at Ballycar in County Clare.

4.2.2 Brief Project Description

It is proposed to erect a twelve (12) No. turbine wind farm at a location in southeast County Clare, approximately 3 kilometres northwest of Limerick City. The total planning boundary of the site encompassing twelve wind turbines, access tracks, crane hardstand areas, underground medium voltage collector circuit cables, permanent meteorological mast, borrow pit, material deposition areas and temporary construction compound is approximately 104.7 hectares (see **Figure 3**, below).

The approximate area of commercial forestry to be clear-felled is 15.97 hectares. Electrical energy generated by the proposed windfarm will be exported to a proposed new substation located approximately 0.37 kilometres northwest of T1 via a proposed new underground 110kV collector cable running from T1 to the new substation. From the substation, the collected electrical energy will be fed into a 110kV overhead electricity line and connected to the National Electricity Grid (NEG). The underground cable will measure approximately 1.5 kilometres – 1 kilometre will be installed along existing forestry tracks and 0.5 kilometres will be routed through stands of conifer plantation (refer to **Figure 3** and **Figure 4**).

The characteristics of the project and the project design have been confirmed with the project engineer and are briefly described in **Section 4.3**, and in detail in **Chapter 3 Civil Engineering,** in **Volume II** of the **EIAR**, and **Planning Drawings 22156-MWP-00-00-DR-C-5005** to **5006** and **22156-MWP-00-00-DR-C-5401** to **5412.**

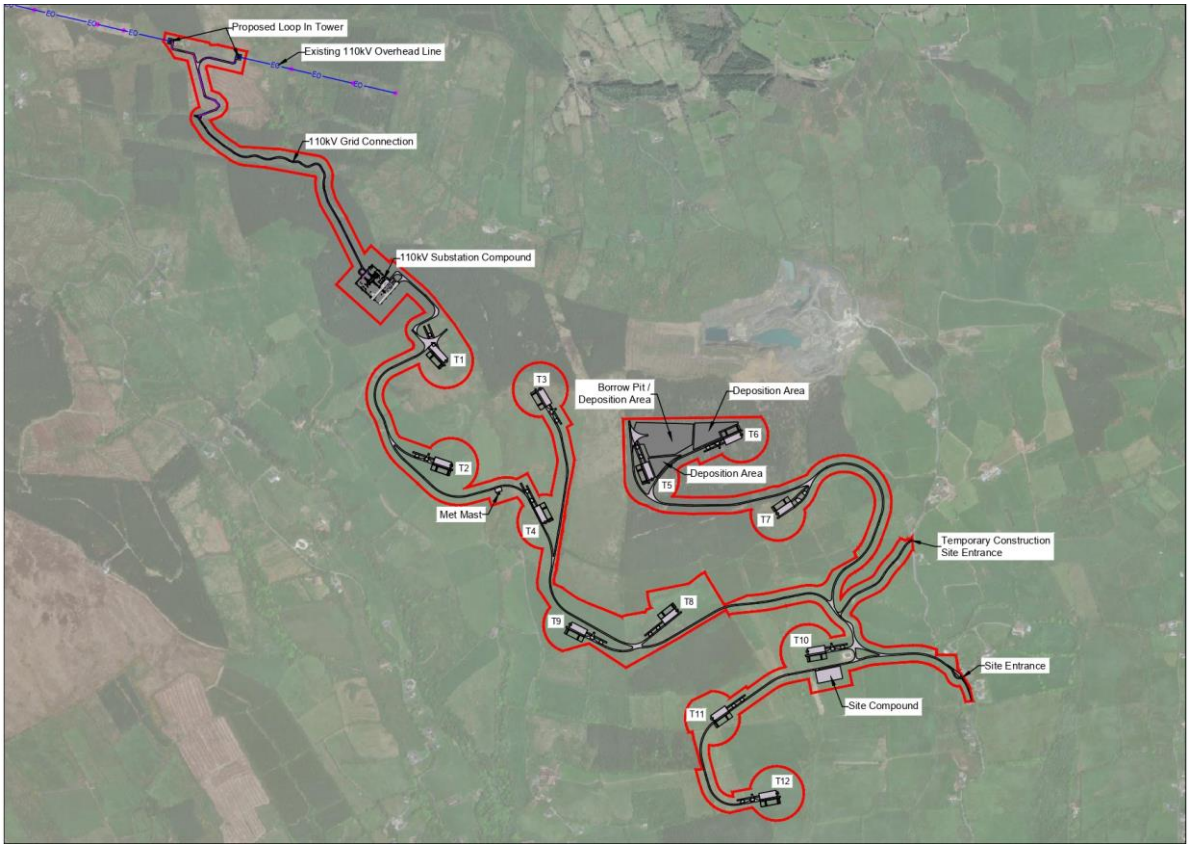

Figure 3: Site layout of proposed Ballycar Wind Farm in County Clare.

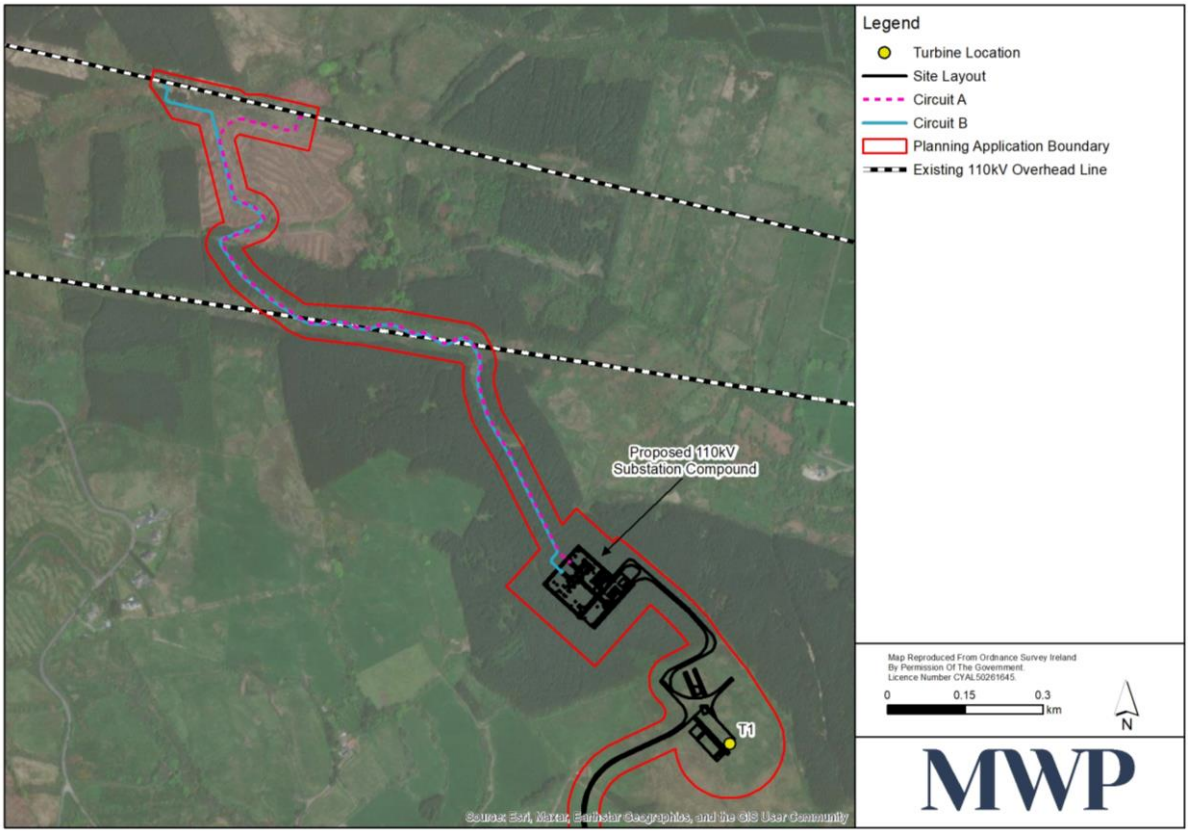

Figure 4: Proposed underground cable grid connection route from T1 to the proposed new substation.

The proposed development lands include lands under the ownership of forestry companies and privately-owned lands under agreement with Ballycar Green Energy. All proposed turbine locations are within areas that have been designated as strategic for wind energy development in the Clare County Development Plan (2023 – 2029)[7].

The proposed delivery route of wind farm components from Foynes Port in County Limerick to the proposed development site at Ballycar is shown on drawing **22156-MWP-00-00-DR-C-5009** and in **Figure 5**.

Wind farm components will be delivered from Foynes Port in County Limerick to the proposed development site via the N69 (see **Figure 5**). To avoid Limerick City centre, deliveries of turbine blades will be via the Limerick Tunnel. Components with a loaded height greater than 4.65 metres, such as the tower components, will be delivered along the R510 Dock Road and Shannon Bridge before continuing along Condell Road to Clonmacken Roundabout and rejoining the blade delivery route.

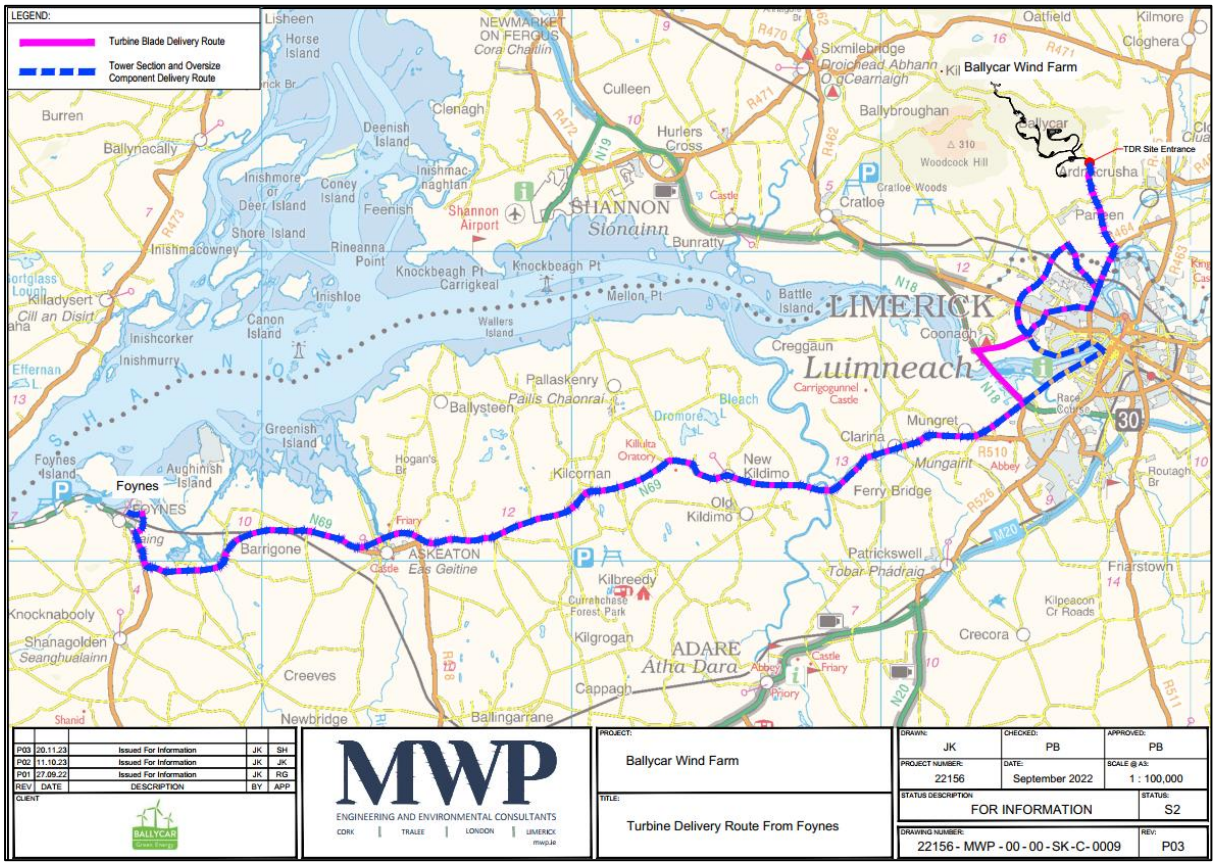

Figure 5: Proposed Turbine Delivery Route to the development site from Foynes Port in County Limerick.

Turbine delivery and access route is described further in **Appendix 2C, Turbine Delivery Route Assessment**, in **Volume III** of the **EIAR** for this project. The delivery of turbine components to the proposed development will require temporary works on sections of the public road network along the delivery route including hedge or tree cutting, relocation of powerlines/poles, lampposts, signage and temporary local road widening. Such works are temporary for the delivery of turbine components and are not included in the planning application boundary.

[7] Stage 3 - Adoption of Plan | Stage 3: Amendments | Clare County Council (clarecoco.ie) Accessed: 6th July 2023

4.2.3 Purpose of the Project

The purpose of the project is for the generation of electricity from a renewable resource by means of a commercially viable 12-turbine wind farm which will supply electricity to the National Electricity Grid (NEG).

4.3 Characteristics of the Project

The following table sets out the elements of the project for which development consent is being sought and all other associated project components:

Table 1: Characteristics of the proposed project at Ballycar in County Clare.

Proposed Development for which consent is sought	Core Wind Farm Components ▪ 12 No. Wind Turbines (blade tip height up to 158m). ▪ 12 No. Wind Turbine foundations and hardstand areas. ▪ 1 No. permanent Meteorological Mast (90m height) and foundation and associated hardstand areas. ▪ 1 No. Electrical Substation (110kV) including associated ancillary buildings, security fencing and all associated works. ▪ Grid connection to existing 110kV overhead line. ▪ 2 No. Developed Site Entrances, one temporary entrance to facilitate construction traffic and one permanent entrance. ▪ New and upgraded internal site access tracks. ▪ Provision of an on-site visitor cabin and parking. Associated Components of the Proposed Development ▪ All associated underground electrical and communications cabling connecting the proposed turbines to the proposed onsite substation. ▪ Turbine Delivery. ▪ Laying of approximately 1.5km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation to connect to an existing 110kV overhead line. ▪ Temporary works on sections of the public road network along the turbine delivery route (including hedge or tree cutting, relocation of powerlines/poles, lampposts, signage, and local road widening). ▪ 1 No. Temporary construction site compound and additional mobile welfare unit. ▪ 1 No. Borrow pit to be used as a source of stone material during construction. ▪ 3 No. spoil deposition areas (one at borrow pit location). ▪ Associated surface water management systems. ▪ Tree felling required for wind farm infrastructure.

4.4 Description of Existing Site

4.4.1 General Site Description

The wind farm site is located within the Electoral Divisions (ED) of Ballycannan (ED: 16105) and Cloontra (ED: 16110). During the 2016 census, Ballycannan ED was found to have a total population of 1,041 residents, occurring primarily within the small rural settlements of Meelick and Ballycannan. The Cloontra ED was found to have a total of 307 persons resident, comprising one-off housing and ribbon development along the local road network[8].

The proposed development site comprises predominantly farmland (a mixture of both marginal and more improved areas), used primarily as grazing for cattle. Commercial forestry plantations also occurs within the site boundary and makes up a considerable portion of the north part of the site.

Lands surrounding the site are predominantly used for agricultural purposes, interspersed with conifer plantations and single residential dwellings. An operational quarry, O'Connell Quarries, is located directly north of the site, comprising an existing working area of 16.9 hectares (with planning approval for an extension of 10 hectares) and an existing concrete batching plant. Ardnacrusha hydroelectric power station is located approximately 2.6 kilometres southeast of the proposed T12 location.

The Corine[9] (2018) land cover categories for the proposed development site comprise 'Pastures' and 'Coniferous forests'. To the west and southwest of the site, linear riparian woodland occurs along the route of the Crompaun (East) River, set within a predominantly agricultural landscape. This band of woodland comprises 'Broadleaved forests'. Extending away from the site, 'Pastures' make up the dominant land cover category with large areas of 'Land principally occupied by agriculture with significant areas of natural vegetation', as well as pockets of 'Transitional woodland scrub'. Woodcock Hill is situated approximately 2.2 kilometres west of the site and comprises 'Peat bogs'[10].

A review of bedrock mapping determined that the geological units underlying the site are 'Palaeozoic, Silurian' in the west of the site, 'Palaeozoic, Upper Devonian – Carboniferous' in the central and eastern sections of the site and 'Palaeozoic, Carboniferous, Mississippian' in the south of the site. Soils within the site are categorised as 'Lithosols, Regosols' (shallow well-drained mineral - mainly acidic), 'Podzols (Peaty), Lithosols, Peats' (predominantly shallow soils derived from non-calcareous rock or gravels with/without peaty surface horizon), 'Surface water Gleys (Shallow), Ground water Gleys (Shallow)' (derived from mainly non-calcareous parent materials) and 'Surface water Gleys, Ground water Gleys' (derived from mainly non-calcareous parent material)[11].

4.4.2 Hydrology and Hydrogeology

The proposed substation and the five westernmost turbines – T1, T2, T3, T4, and T9 – of the proposed development are located within the Water Framework Directive (WFD) Owenogarney_SC_020 sub-catchment which are in turn situated within the Shannon Estuary North Catchment (27).

A review of the EPA map-viewer determined that the 1st Order Cappateemore_East Stream is mapped within the western section of the subject site. A constituent of the Crompaun (East)_010 River Waterbody[12], the source of the Cappateemore_East Stream is located to the northwest of the study area between T1 and T3. From here, the

[8] https://cso.maps.arcgis.com/ Accessed: 9th December 2022
[9] Co-ORdinated INformation on the Environment – data series initiated in 1985 by the European Commission to gather environmental data.
[10] EPA Maps Accessed: 9th December 2022
[11] https://www.heritagemaps.ie Accessed: 9th December 2022
[12] EPA River Waterbody Code: IE_SH_27C090600

Stream travels southwards for approximately 1.6 river kilometres[13] through farmland, briefly passing through the proposed development boundary near T2 and T4, before merging with the 3rd Order Crompaun (East) River (see **Figure 6,** below).

The upper reaches of the Crompaun (East) River and its tributaries (including the Glennagross Stream and an unnamed stream whose source lies adjacent to the proposed substation location) lie further to the west, outside the proposed development boundary. After being joined by the Cappateemore_East Stream, the Crompaun (East) River continues southwestwards, eventually draining to the Upper Shannon Estuary Transitional Waterbody[14] west of Limerick City. The lower reach of the Crompaun (East) River and the estuary into which it drains are encompassed within the boundary of both the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). The Lower River Shannon SAC is located approximately 1.6 river kilometres downstream from watercourse crossings WC6 and WC7[15] while the River Shannon and River Fergus Estuaries SPA is located approximately 6.6 river kilometres downstream of WC1 – refer to **Figure 6**.

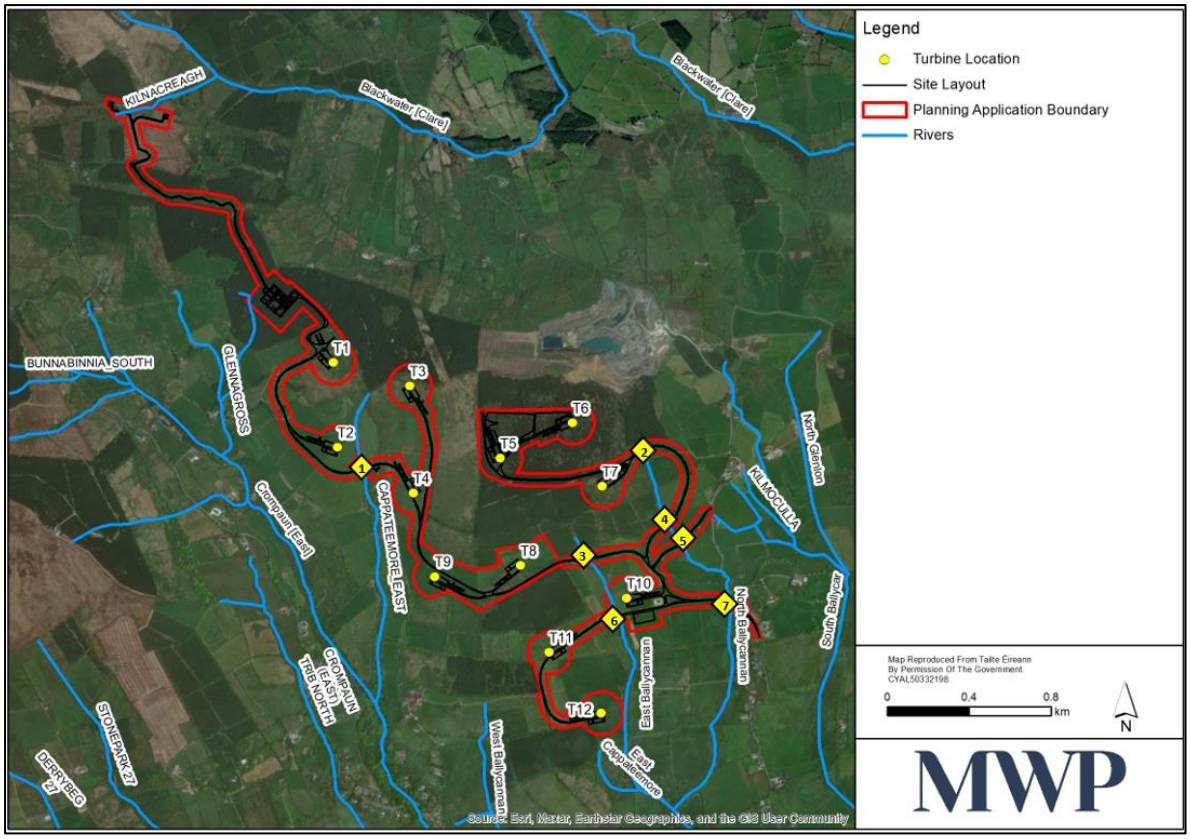

Figure 6: Watercourses at the proposed development site and the locations of the seven watercourse crossings (WC) necessary to accommodate internal access tracks.

The seven easternmost turbines – T5, T6, T7, T8, T10, T11, and T12 – are all situated within the Shannon [Lower]_SC_100 sub-catchment which in turn is situated within the Lower Shannon Catchment (25D). There are four watercourses mapped within this catchment at the eastern extent of the site including the North Ballycannan River and three of its tributaries - the 1st Order East Cappateemore and East Ballycannan Streams, and the 2nd

[13] River kilometres (rkm): measure of the distance in kilometres along the path of a river/watercourse (as opposed to a linear measure such "as the crow flies").
[14] EPA Transitional Waterbody Code: IE_SH_060_0800
[15] WC – Watercourse Crossings. See **Figure 6,** below, for locations.

Order West Ballycannan River (see **Figure 6,**). All four watercourses are part of the North Ballycannan_010 River Waterbody[16].

The East Ballycannan Stream flows southwards past T10 and T12 and merges with the North Ballycannan River south of T12. The North Ballycannan Stream then continues southwards away from the proposal site eventually veering east and draining to the estuarine waters of the Shannon Estuary north of Limerick City. This stretch of the estuary is identified as the Limerick Dock Transitional Waterbody[17]. The lower reaches of the North Ballycannan Stream and this section of the Shannon River are also encompassed within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

Approximately 1.3 kilometres of the northern end of the proposed underground collector cable (UGC) is also located within the Shannon [Lower]_SC_100 sub-catchment (see **Figure 6**), and approximately 0.11 kilometres from where it joins the overhead lines of the National Grid, the UGC will cross the 1st Order Kilnacreagh Stream. The Kilnacreagh Stream rises at a location approximately 1.1 kilometres northwest of the proposed substation location and is part of the Blackwater (Clare)_010 River Waterbody[18]. It runs from southwest to northeast before merging with the 2nd Order Blackwater [Clare] River approximately 0.55 river kilometres downstream from the Stream's source. The Blackwater [Clare] River continues eastwards before veering southwards and eventually draining into the River Shannon near Ardnacrusha Power Station approximately 18 river kilometres downstream of where the 1st Order Kilnacreagh Stream first joined the Blackwater [Clare].

Internal site tracks will require the crossing of seven minor watercourses at locations shown in **Figure 6**. These crossings are located between 1.6 and 6.6 river kilometres upstream of the Lower River Shannon SAC, and between 6.6 and 8.7 river kilometres upstream of the River Shannon and River Fergus Estuaries SPA. These watercourse crossings and drain diversion are discussed in full in Section 3.13.3 in **Chapter 3 Civil Engineering**, in **Volume II** of the **EIAR**.

Compliance with the reporting requirements of the WFD (Directive 2000/60/EC) obliges each member state to publish reports providing summary information about individual waterbodies relating to their status, risks and objectives. The WFD Status (2016 – 2021) of the Crompaun (East)_010 River Waterbody is 'Poor'. The nearest downstream EPA water quality monitoring station to the proposed development site is located at 'Cappateemore Bridge'19, approximately 1.5 river kilometres downstream of the proposed site boundary at T9. The latest river Q value at this location is 'Q3-4, moderate', recorded by the EPA in 2022. The Crompaun (East)_010 waterbody has been assigned a WFD risk status of 'At risk'. A review of the '*Owenogarney_SC_020 Sub-catchment Assessment WFD Cycle 2*' report[20] determined that the following pressures have been identified with regard to this waterbody: channelisation, forestry, embankments, wastewater discharge and agriculture. The Transitional Waterbody WFD latest status (2016 – 2021) of the Upper Shannon Estuary, into which the Crompaun (East) River drains, is 'Poor'.

The WFD Status (2016 – 2021) of the North Ballycannan_010 River Waterbody is 'Good'. There are no EPA water quality monitoring stations located along this waterbody. The North Ballycannan_010 River Waterbody has been assigned a WFD risk status of 'Not at risk'. The WFD Status (2016 – 2021) of the Blackwater (Clare)_010 River Waterbody is 'Good'. The nearest downstream EPA water quality monitoring station to the proposed development site is located at the 'Bridge southeast of Cappanagh'[21], approximately 4 river kilometres downstream from where the Kilnacreagh Stream rises. The latest river Q value at this location is 'Q4, good', recorded by the EPA in 2006. The Blackwater (Clare)_010 River Waterbody has been assigned a WFD risk status of 'At risk'. A review of the '*Shannon [Lower]_SC_100 Sub-catchment Assessment WFD Cycle 2*' report[22]

[16] EPA River Waterbody Code: IE_SH_25N170970
[17] EPA Transitional Waterbody Code: IE_SH_060_0900
[18] EPA River Waterbody Code: IE_SH_25B060120
[19] EPA Station Code: RS27C090300
[20] Subcatchment Assessment (catchments.ie) Accessed: 9th December 2022
[21] EPA Station Code: RS25B060030
[22] Subcatchment Assessment (catchments.ie) Accessed: 9th December 2022

determined that agriculture has been identified as a pressure on the waterbody. The WFD latest status (2016 – 2021) of the Limerick Dock Transitional Waterbody into which the North Ballycannan Stream drains, is 'Poor'.

The five westernmost proposed turbines overlie 'Tulla-Newmarket-on-Fergus' ground waterbody (GWB)[23] while the rest of the proposed development overlies the Lough Graney ground waterbody[24]. Both are described on the EPA website as 'Poorly productive bedrock' with a Ground Waterbody WFD latest status (201 – 2021) of 'Good'.

4.4.3 Field Surveys Results

4.4.3.1 Habitats

Refer to **Figure 7** and **Figure 8** for a habitat map for the entire proposed development site.

The dominant habitats[25] occurring at the subject site comprise **Conifer plantation (WD4)** and **Improved agricultural grassland (GA1)** (refer to **Plate 1**, below).

Wet grassland (GS4) and **Dry-humid acid grassland (GS3)** habitats occur in the northern section of the site, particularly in upland areas. **Wet grassland (GS4)** also occurs in mosaic with **Improved agricultural grassland (GA1)**, again mainly in the northern half of the site along the upper fringes of farmland, and to a lesser extent with **Scrub (WS1)**. Remnant pockets of **Upland blanket bog (PB2)** in mosaic with **Wet heath (HH3)** occur to the north where deergrass (*Trichophorum caespitosum*), *Cladonia* lichens, and *Sphagnum* mosses were frequently recorded.

Plate 1: The two predominant habitat types at the proposed development site - Conifer plantation (WD4) (left) and Improved agricultural grassland (GA1) (right).

Treelines (WL2) and **Hedgerows (WL1)** forming field boundaries and along existing farm access tracks are distributed throughout the site and consist typically of species such as willow (*Salix* spp.), hawthorn (*Crataegus monogyna)* and bramble (*Rubus fructicosus*). The well-established, species-rich hedgerows in the central, southwest and northeast regions of the study area contain tree species such as ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*), oak (*Quercus robur*), beech (*Fagus sylvatica*) and hazel (*Corylus avellana*).

Riparian woodland (WN5) occurs along the Cappateemore (East) Stream from the stream's source northwest of the site to the south beyond the confluence with the Crompaun (East) Stream. **Mixed broadleaved woodland (WD1)** occurs throughout the study area either as individual stands or bounding watercourses with scattered patches of **Dense bracken (HD1)** occurring in centrally. Most existing farm tracks are classified as **Spoil and bare**

[23] EPA GWB Code: IE_SH_G_229
[24] EPA GWB Code: IE_SH_G_157
[25] Habitats as categorised by Fossitt (2000), available at A Guide to Habitats in Ireland - Fossitt.pdf (npws.ie) Accessed: 9th December 2022

ground (ED2) while farm buildings and yards are classified as Buildings and artificial surfaces (BL3). The watercourses draining the study area are classified as Eroding/upland rivers (FW1) with details of their physical characteristics outlined in the Aquatic Ecology and Fish Survey Report in Appendix 6C in Volume III of the EIAR.

The substation, access track and grid connection route are located mainly within stands of Conifer plantation (WD4) and along existing forestry firebreaks and tracks comprised of Scrub (WS1).

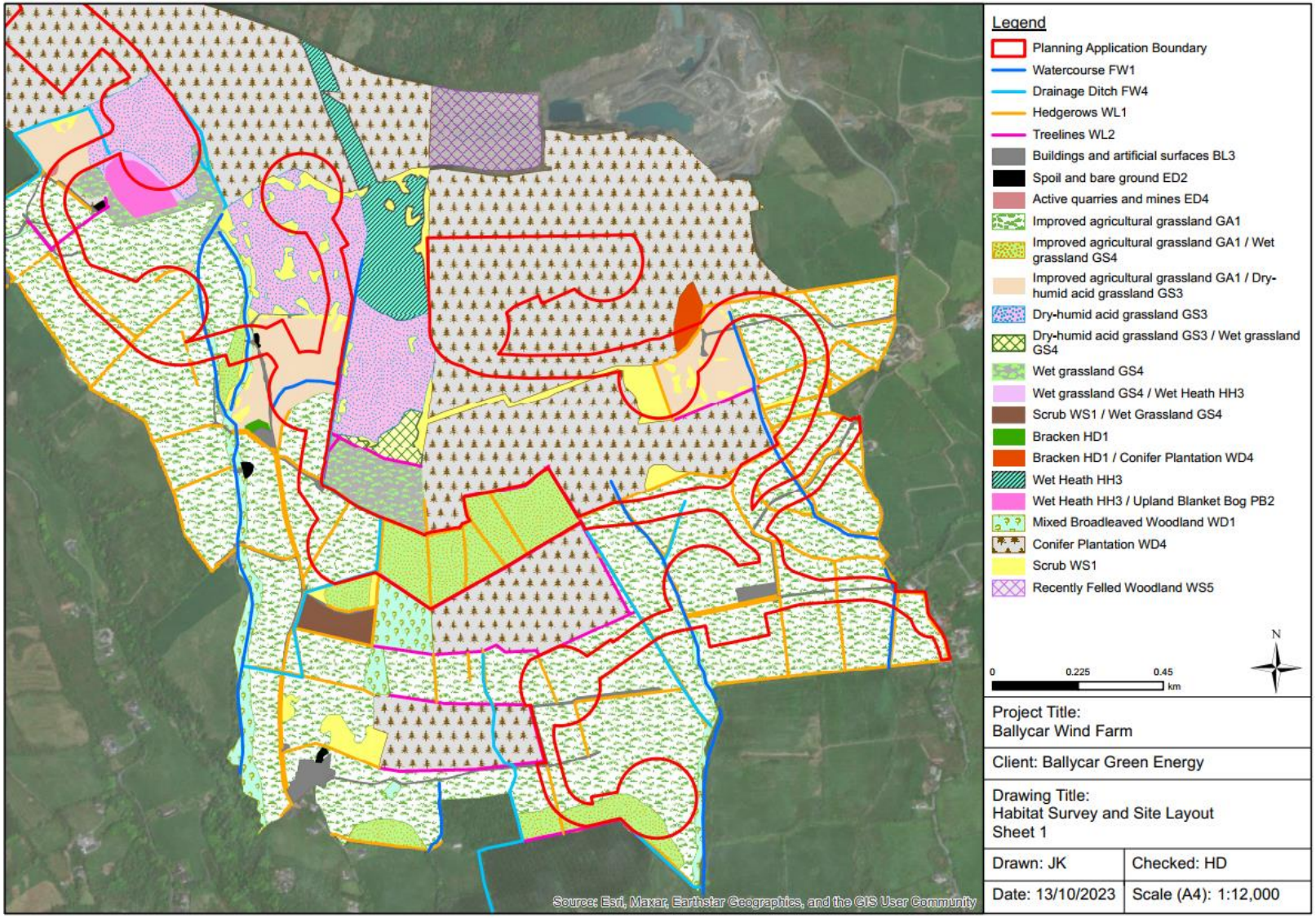

Figure 7: Habitat map of the proposed wind farm site and adjacent areas

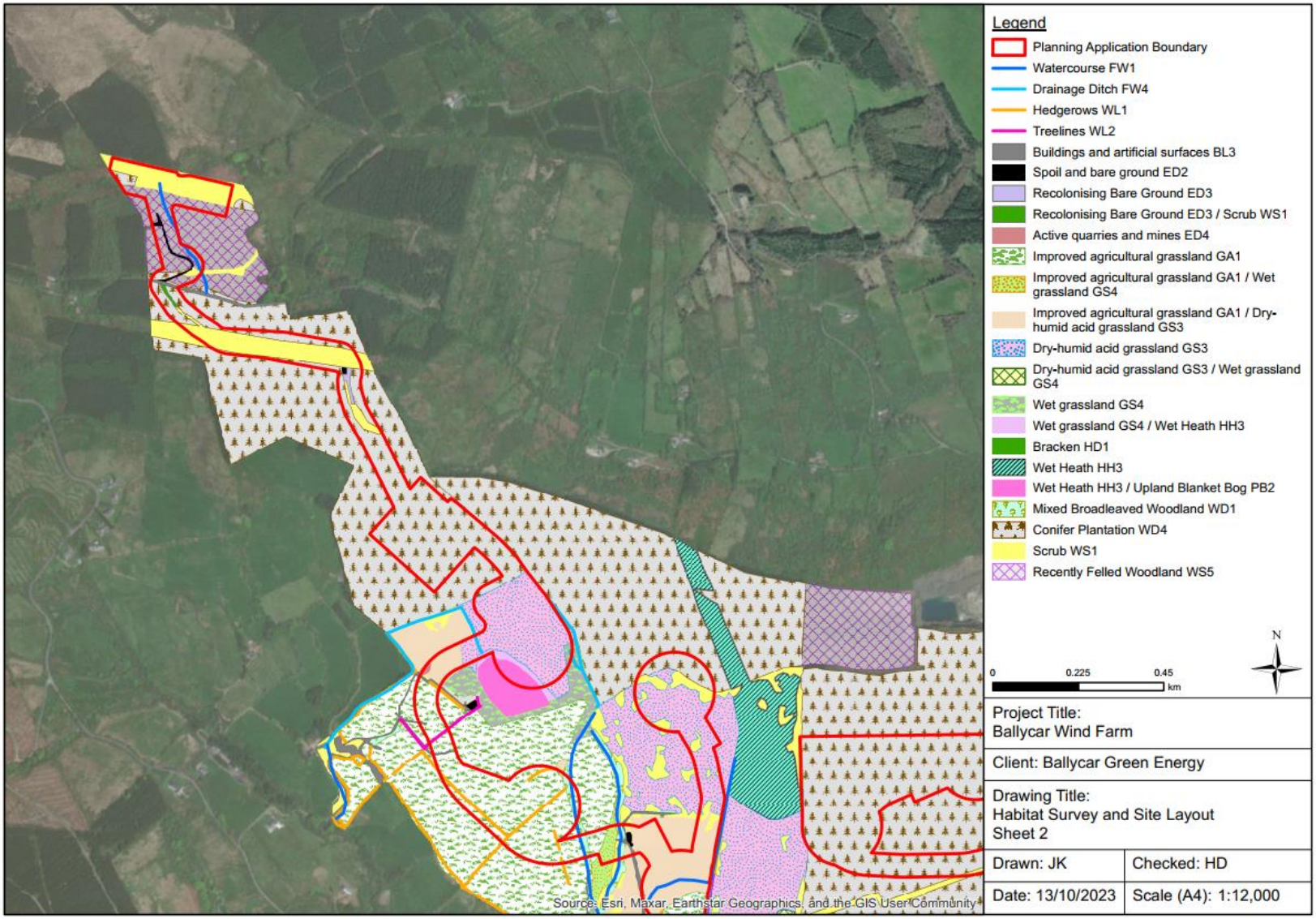

Figure 8: Habitat map for the proposed substation and grid connection cable route locations in northwesternmost corner of the proposed development site.

4.4.3.2 Rare and Protected Flora

No rare or protected flora species were recorded during any of the ecological surveys.

4.4.3.3 Invasive Alien Plant Species (IAPS)

Documented NBDC records of high-impact invasive species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011, as amended) exist within the hectad R56 encompassing the study area for giant hogweed (*Heracleum mantegazzianum)*, Himalayan balsam (*Impatiens glandulifera)* and Japanese knotweed (*Fallopia japonica).* Documented records of medium-impact invasive species listed on the Third Schedule also exist for Himalayan knotweed (*Persicaria wallichii).*

During ecological field surveys carried out between June 2021 and June 2022, two invasive species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) were recorded, namely Japanese knotweed and Himalayan balsam. Cherry laurel (*Prunus laurocerasus)* was also recorded within the study area. No other invasive plant species were recorded during ecological surveys.

Extensive infestations of Himalayan balsam were recorded mainly in central and southeastern sections of the site, and at one location along the turbine delivery route. Japanese knotweed was recorded at two locations within the study area; a minor infestation comprising three immature plants growing at the edge of a field to the west, and a single, mature plant recorded in a hedgerow in the southeast. Cherry laurel was recorded at six locations along hedgerows and field boundaries towards the centre and north of the study area.

For more details, refer to the IAPS Report in **Appendix 6F** of **Volume III** of the **EIAR**, and to **Chapter 6 Biodiversity**, of **Volume II** of the **EIAR**.

4.4.3.4 Otter

No evidence of otter was recorded during any of the ecological field surveys nor during the dedicated mammal surveys carried out in June and July 2021 and February 2022. There were no otter breeding/resting places were identified within the study area. Additionally, there are no NBDC documented records of otter within the proposed development site, and although there are NBDC records of otter in the greater area extending away from the site, none of the locations are hydrologically connected to the development site.

There are no suitable fish habitat within the proposed development site and all waterbodies are deemed too small to support any notable fish populations. Although minor watercourses within the subject site may have some potential as foraging or commuting habitat, they are considered to comprise sub-optimal habitat for otter. The watercourses draining the proposed development support fish species such as brown trout and European eel (*Anguilla anguilla*). It is likely that the larger watercourses further downstream are more suitable for foraging, and potentially breeding, otter.

For more details, refer to the Non-Volant Mammal Survey Report in **Appendix 6B** of **Volume III** of the **EIAR**, and to **Chapter 6 Biodiversity**, of **Volume II** of the **EIAR**.

4.4.3.5 Freshwater Aquatic Ecology

Apart from a small section of the UGC that lies within the Blackwater (Clare)_010 sub-basin, the entire proposed development site is located within two sub-basins - Crompaun East_010 and North Ballycannan_010 - that lie adjacent to the upper transitional zone of the Shannon Estuary. The carrying capacity for fish of both sub-basins is limited due to the small drainage areas of the sub-basins in a somewhat coastal context with watercourses classified no larger than 3rd Order. The watercourses within the boundary of the proposed development site, and

indeed the upper reaches of all watercourses draining the proposed development site, are high gradient streams that are liable to drying out during prolonged dry spells.

In June 2021, brown trout, European eel and brook lamprey (*Lampetra planeri*) were recorded during the aquatic surveys of relevant watercourses within the Crompaun East_010 and North Ballycannan_010 sub-basins. The higher gradient reaches of these watercourses are considered suitable for the early life stages of salmonids[26], but such reaches do not occur within the proposed development site itself due to the small size of the watercourses. Lower reaches are more suitable for adult fish, with some deeper pools, but these reaches were found to be impacted by siltation and were considered suboptimal for spawning due to their low gradient and/or degraded morphological character (drained). Within the streams surveyed, a small proportion of the fluvial habitat was classified as suitable for salmonid spawning, but many featured some type of impediment to fish movement.

Salmon, brown trout, brook lamprey, three-spined stickleback (*Gasterosteus aculeatus*), stone loach (*Barbatula barbatula*) and minnow (*Phoxinus phoxinus*) were recorded in September 2018 electrical fishing surveys carried out by MWP within the Blackwater (Clare)_010 sub-basin. The Blackwater (Clare) River is deemed suitable for salmon because it is sufficiently large and is connected to the River Shannon with no barriers to species migration.

Overall, within the Crompaun East_010 and North Ballycannan_010 sub-basins, the streams draining the proposed development site are considered sub-optimal trout habitats, poor in terms of lamprey and highly unlikely to support migratory fish populations. The Blackwater Catchment to the north of the proposed development site is judged to be important for salmon and, downstream of its intersection with the Ardnacrusha headrace, the river is possibly also important for lamprey.

The proposed development site is not located within a freshwater pearl mussel (FPM) catchment (*Margaritifera* Sensitive Area) according to NPWS data maps available online[27] and there was no live FPM nor evidence of FPM (e.g. shells) recorded during the surveys carried out on the North Ballycannan River. The sedimentation levels recorded were generally indicative of artificially induced siltation and conditions considered unfavourable in terms of the species' habitat.

For more details, refer to the Aquatic Ecology and Fish Survey Report in **Appendix 6C** of **Volume III** of the **EIAR**, and to **Chapter 6 Biodiversity**, of **Volume II** of the **EIAR**.

4.4.3.6 Ornithology

A comprehensive suite of ornithological field surveys was undertaken at the proposed development site from October 2019 to September 2023, inclusive. These surveys included vantage point surveys, walkover transect surveys, breeding and winter roost surveys for hen harrier, breeding raptor, woodcock and nightjar surveys, hinterland surveys, breeding wader surveys, and wintering waterfowl counts at the Shannon Estuary. Surveys relevant to the SCI species of European sites within the ZOI of the proposed development are discussed in the following sections.

For full details of survey methodologies and results, refer to **Appendices 7B**, **7I** and **7J** in **Volume III** of the **EIAR**, and to **Chapter 7 Ornithology**, in **Volume II** of the **EIAR**.

4.4.3.6.1 Vantage Point Surveys and Transect Surveys Results

Table 2, lists the primary and secondary target species recorded during the vantage point and transect surveys at the proposed wind farm site (species listed on Annex I of the Birds Directive[28] are highlighted in **bold**). Two Special

[26] Salmonids – family (*Salvelinus*) of fishes that include salmon, trout, and chars.
[27] EPA Maps Accessed: 9th November 2022
[28] Annex I lists 194 species and sub-species of birds that are particularly threatened. EU Member States must designate Special Protection Areas (SPAs) for them and all migratory bird species.

Conservation Interest (SCI) species for which the River Shannon and River Fergus Estuaries SPA is designated were recorded during VP surveys at the site, namely black-headed gull and cormorant, and their flightpaths are shown in Figure 9.

Table 2: Primary and secondary target species recorded during VP and transect surveys carried out at the proposed Ballycar Wind Farm site between October 2019 and September 2023, inclusive.

Species	Winter 2019/20	Summer 2020	Winter 2020/21	Summer 2021	Winter 2021/22	Summer 2022	Winter 2022/23	Summer 2023
Black-headed gull (*Chroicocephalus ridibundus*)*			✓		✓		✓	
Buzzard (*Buteo buteo*)	✓	✓	✓	✓	✓	✓	✓	✓
Common gull (*Larus canus*)							✓	
Cormorant (*Phalacrocorax carbo*)*	✓							✓
Great black-backed gull (*Larus marinus*)						✓		
Grey heron (*Ardea cinerea*)					✓	✓		✓
Grey wagtail (*Motacilla cinerea*)			✓			✓		✓
Hen harrier (*Circus cyaneus*)	✓	✓			✓		✓	
Herring gull (*Larus argentatus*)		✓					✓	
Kestrel (*Falco tinnunculus*)	✓	✓	✓	✓	✓	✓	✓	✓
Lesser black-backed gull (*Larus fuscus*)		✓		✓		✓	✓	✓
Little egret (*Egretta garzetta*)		✓						
Mallard (*Anas platyrhynchos*)						✓		✓
Peregrine (*Falco peregrinus*)				✓		✓	✓	✓
Snipe (*Gallinago gallinago*)			✓		✓	✓	✓	✓
Sparrowhawk (*Accipiter nisus*)	✓	✓	✓	✓	✓	✓	✓	✓
Whimbrel (*Numenius phaeopus*)				✓				
Woodcock (*Scolopax rusticola*)	✓		✓					

*Special Conservation Interest (SCI) species for which the River Shannon and River Fergus Estuaries SPA (004077) is designated. The SPA is located 4.4 km southwest of proposal site. Refer to **Section 4.6**, below.

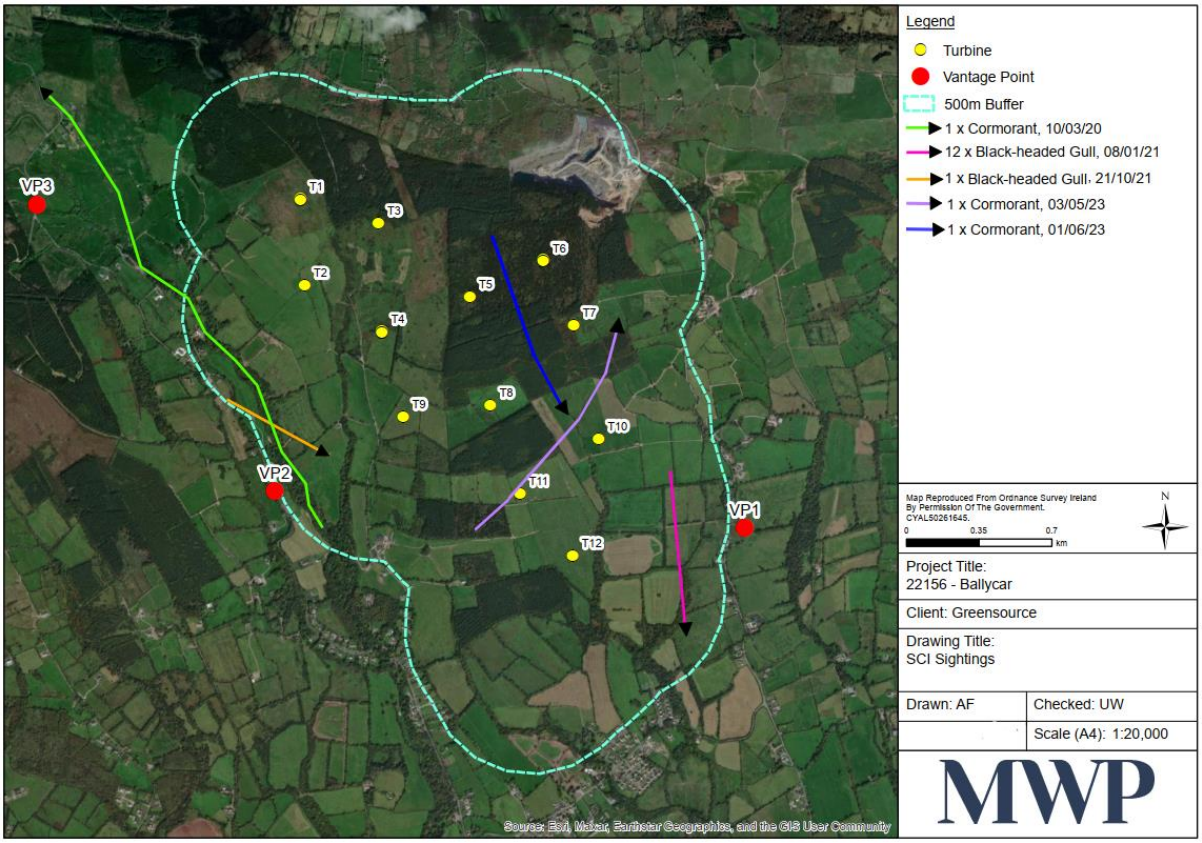

Figure 9: Flightpaths of the SCI species for which the River Shannon and River Fergus Estuaries SPA is designated recorded during VP surveys of the proposed development site.

4.4.3.6.2 Wintering Waterbird Distribution Surveys

The species recorded were typical estuarine species associated with the River Shannon and River Fergus Estuaries SPA and the entire Shannon and Fergus estuarine complex. The winter 2019/20 counts were carried out all along the stretch of Shannon Estuary shown in **Figure 10**, while for the 2022/23 winter counts, the stretch of estuary was divided into four survey areas – A, B, C, and D.

As the winter 2019/20 counts were carried out without the specificity of fixed locations, a peak count for the entire surveyed area per season was obtained. **Table 3**, below, details the collective peak counts for the Special Conservation Interest (SCI) wintering waterfowl species for which the River Shannon and River Fergus Estuaries is designated that were counted in the winter 2019/20 season. Black-headed gull (*Larus ridibundus*) was recorded in moderately large numbers while cormorant (*Phalacrocorax carbo*), teal (*Anas crecca*) and lapwing (*Vanellus vanellus*) were the only other SCI species counted during the 2019/20 winter counts.

Cooperhill Lake is located within Survey Section D shown in **Figure 10**, approximately 6.5 kilometres southwest of the proposed development site on the southern side of the River Shannon where each year, a population of whooper swan return to use as a regular roost. During the 2022/23 counts, a peak flock count of 154 whooper swan (*Cygnus cygnus*) occurred in Section D on 17th January 2023. On the same date, a flock of 14 whooper swan were recorded in Section A at King's Island, approximately 4 kilometres southeast of the proposed development site. Black-headed gull was recorded in large numbers at all four of Sections A, B, C, and D with a peak count of 870 at Section D on the 7th March 2023. All wintering waterfowl Special Conservation Interest (SCI) species for

which the River Shannon and River Fergus Estuaries is designated that were counted during wintering waterbird counts are summarised in **Table 3**.

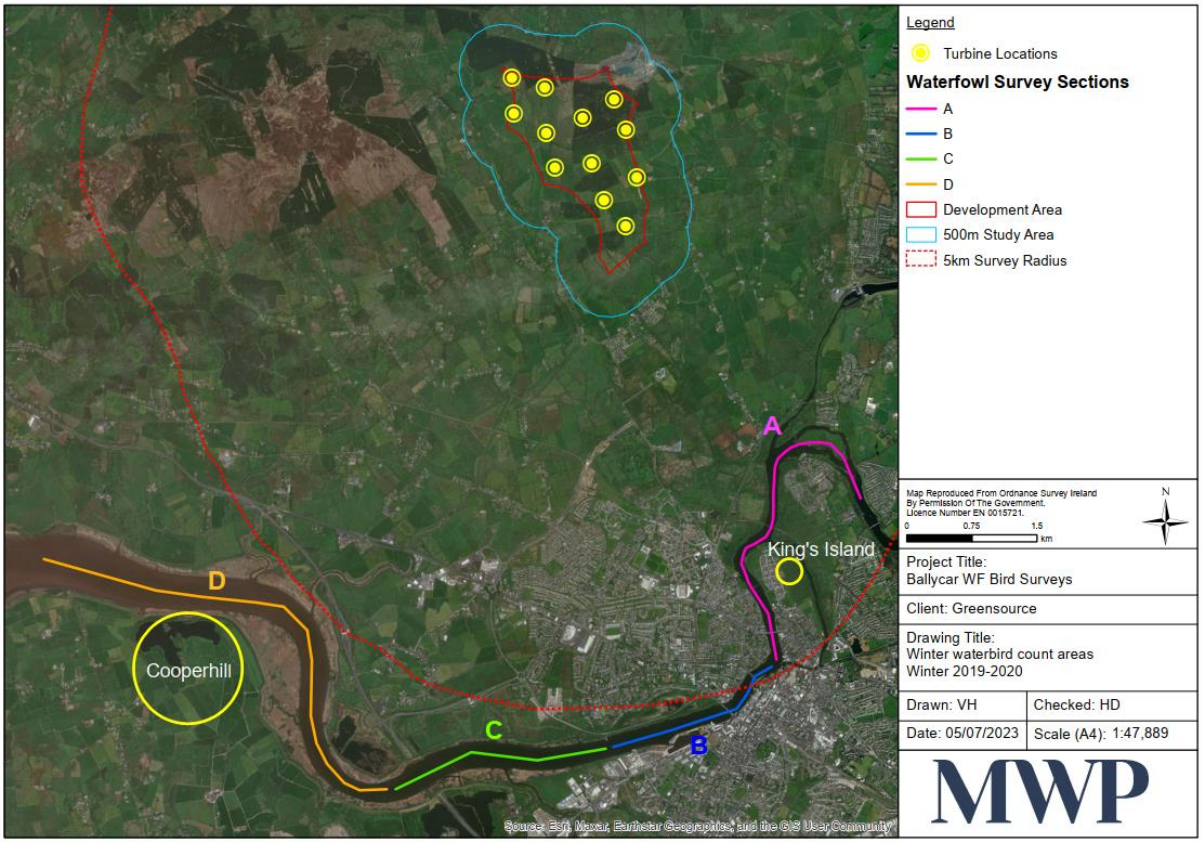

Figure 10: Locations of wintering waterbird counts undertaken at four sections along Shannon Estuary.

Table 3: Peak counts recorded during winter waterbird distribution surveys of Special Conservation Interest (SCI) species for which the River Shannon and River Fergus Estuaries SPA is designated.

SCI Species	Peak Count for Winter 2019/20	Peak Count for Winter 2022/23			
		Section A	Section B	Section C	Section D
Cormorant *Phalocrocorax aristotelis*	4	34	11	406	32
Whooper Swan *Cygnus cygnus*		14			154
Wigeon *Anas penelope*					48
Teal *Anas crecca*	4	10	28	235	52
Pintail *Anas acuta*			1		
Shoveler *Anas clypeata*		6	2		14
Grey Plover *Pluvialis squatarola*			3	3	
Lapwing *Vanellus vanellus*	51	6			27
Dunlin *Calidris alpina*				1	
Curlew *Numenius minimus*				11	1
Redshank *Tringa totanus*		1	1	21	
Black-headed Gull *Larus ridibundus*	242	421	495	357	870

4.4.3.6.3 Breeding Wader Survey Results

Breeding wader surveys were carried out in April, May and June 2023 at suitable areas within the 500-metre buffer study area shown in **Figure 9**. The only target species recorded during these surveys was one snipe seen in April between T10 and T11 to the southeast of the site as it was flushed from an area of wet grassland.

4.5 Identification of Other Projects or Plans or Activities

4.5.1 Introduction

A review of relevant existing and proposed projects, plans and activities occurring within the wider geographical area around the proposed development site was conducted and the results are presented in the following sections. In-combination impacts will be considered in **Section 4.8.7**.

4.5.2 Plans

Plans that are relevant to the region encompassing the proposed Ballycar Wind Farm site include the Clare County Development Plan (2023 – 2029). The Clare County Development Plan 2023-2029 was adopted by the Elected Members of Clare County Council at a Special Meeting on 9th March 2023 and came into effect on 20th April 2023.

Within Volume 6 of the County Development Plan (2023 – 2029) is the Clare Wind Energy Strategy which seeks to facilitate 'the development of onshore wind farms in Clare by maximising the wind resources of the county having regard to recent technological advances in turbine design, updated information on wind speeds, proximity and availability to grid connections and to changing energy and grid connection regulations, while minimising any environmental and visual impacts'[29].

4.5.3 Other Wind Energy Developments

Within a 25-kilometre radius of the proposed development site, there are two single wind turbines currently in operation, one permitted 19-turbine wind farm, and a 16-turbine wind farm whose permission has expired. The proposed 8-turbine Fahy Beg Wind Farm was refused permission by Clare County Council and an appeal has been lodged to An Bord Pleanála (ABP) with a decision pending – refer to **Table 4**.

Table 4: Statuses of wind energy developments within 25 kilometres of proposed Ballycar Wind Farm

Wind Farm Name	Status	No. of turbines	Approximate distance and direction from proposed Ballycar development site
Limerick Blow Moulding, Parteen	Operational	1	3.2 km southeast of proposal site
Vistakon	Operational	1	8.2 km southeast of proposal site
Fahy Beg[30]	Refused: 03/05/23 Appealed lodged: 31/05/23 ABP decision due: 02/10/23	8	8.5 km northeast of proposal site
Carrownagowan	Permitted (not constructed)	19	13 km northeast of proposal site

[29] Volume 5 Clare Renewable Energy Strategy-Clare County Development Plan 2023-2029 (Interim) (clarecoco.ie) Accessed 26th June 2023
[30] Clare County Council (CCC) Planning Application Number: 23148; An Bord Pleanála (ABP) Planning Application Number: 317227

Wind Farm Name	Status	No. of turbines	Approximate distance and direction from proposed Ballycar development site
Castlewaller	Granted: 18/04/12[31] Extension granted: 05/07/16[32] Permission expired: 22/05/22	16	20 km east of proposal site

[31] Tipperary County Council (TCC) Planning Application Number: 11510251
[32] Tipperary County Council (TCC) Planning Application Number: 16600472

4.5.4 Solar Energy Developments

Within a 25-kilometre radius of the proposed development site there are several granted and on-going planning applications for solar farm developments as detailed in Table 5. A search of Clare County Council's online planning enquiry system for granted or on-going planning solar energy developments within a 25-kilometre radius of the proposed development site was undertaken on 8th December 2023.

Table 5: List of granted and/or on-going planning applications for solar energy developments within 25 kilometres of the proposed development site.

Planning application number	Solar Farm location	Status	Decision date	Approximate distance and direction from proposed development site
2360249	Castlebank, Drummin, Glenlon North, Glenlon South and Ballykeelaun, Co Clare	Permitted	06/09/23	2 km east of proposal site
CCC: 2357 ABP: 316237	Castlebank, Glenlon North, Glenlon South, Drummin and Ballykeelaun, Clare.	Permitted: 03/04/23 Appealed: 14/04/23 Application withdrawn: 10/07/23	-	1.5 km east of proposal site
CCC: 22591 ABP: 316043	Ballyglass, Coolderry, Dromintobin North, Reanabrone and Oakfield, Ardnacrusha, Co Clare.	Permitted: 17/02/23 Appealed: 14/03/23 Permitted with revised conditions	21/11/23	4.4 km northeast of proposal site
18215	Islandduane, Mungret, Co. Limerick.	Permitted	03/10/18	10.8 km southwest of proposal site
18585	Clonloghan, Caherteige, Co. Clare.	Permitted	23/08/19	14.5 km west of proposal site
22586	Ballyvonnavaum, Coolshamroge, Cloonmore, Deerpark, Manusmore, Ennis, Co Clare.	Permitted	14/04/23	18 km northwest of proposal site
20562	Manusmore, Clarecastle, Co Clare.	Permitted	12/11/20	18 km northwest of proposal site
21915	Manusmore & Carrownanelly, Clarecastle, Ennis.	Permitted	30/11/21	20 km northwest of proposal site
19180	Cahershaughnessy near Spancil Hill, Co Clare.	Permitted	17/08/19	22 km northwest of proposal site
19194	Knockanoura and Cranagher, Spancil Hill, Co. Clare.	Permitted	19/08/19	22 km northwest of the proposal site
171001	Lissan West, Ballaghafaddy West, Clarecastle, Clare.	Permitted	06/02/19	22 km northwest of proposal site
17750	Tuogh, Cappamore, Co. Limerick.	Permitted	07/12/17	24 km southeast of proposal site

4.5.5 Other Permitted and Proposed Developments in the Locality

A search of Clare County Council's online planning enquiry system for granted or ongoing planning applications for the townlands Glennagross, Cappateemore East, Ballycannan West, Ballycannan East, Ballycar South, and Ballycar North was undertaken on 8th December 2023, the results of which are presented in Table 6.

Table 6: Granted and/or ongoing planning applications within the vicinity of the proposed development.

Application No.	Applicant	Location	Proposed Development	Decision	Decision Date
23461	Edward Ryan	Ballycar, Ardnacrusha	To retain an agricultural structure and all associated site works.	Further information request: 19/10/23	Pending
23229	Ciaran O'Connell	Ballycar South, Ardnacrusha	Construct a cubicle house extension with slatted tank, cattle shed with slatted tank, dungstead, and ancillary works.	Further information request: 08/06/23	Due: 12/01/24
2313	Mark Manning	Glennagross, Meelick, Clare	Construct dwelling house, bored well, waste water treatment system, percolation area, entrance and all associated site works.	Conditional	25/05/23
22886	Bobby O'Connell	Ballycar South, Ardnacrusha	Renovation, alterations and extension of existing disused dwelling, upgrading of existing entrance, change of use from residential to office use, all ancillary works.	Conditional	15/03/23
21935	O'Connell Quarry	Ballycar South, Ardnacrusha	Proposed concrete batching plant, storage shed, precast concrete yard, product storage area, office/canteen, dispatch office, new site entrance, all ancillary works.	Further information request: 28/10/21	Withdrawn: 06/05/22
21454	Kieran O'Connell	Ballycar North, Sixmilebridge	Two story extension with habitable space, open shed and balcony to west, boot room to south, addition of two windows to east elevation, replacement of two windows at front with one picture window on west elevation with double doors, and replacement of two windows on south elevation with one window.	Conditional	10/08/21
CCC: 18818 ABP: 304690	Bobby O'Connell and Sons Ltd	Ballycar, Ardnacrusha	Quarrying area of 10 hectares located adjacent to existing working quarry including extraction of rock by blasting to 150m OD; Extracted rock will be processed at existing working quarry; Landscaping of quarry during operational phase and restoration of quarry on completion of extraction; All associated ancillary facilities/works.	Conditional	13/12/19
19728	Jack & Siobhán Keane	Cappateemore East, Meelick	Retain existing sunroom, all existing elevations; conversion of garage to storage room and ancillary site works.	Conditional	25/11/19
1929	Lisa Hurley	Cappateemore West, Meelick	Rebuild and extend existing burned down dwelling house and replace existing septic tank with new wastewater treatment system and percolation area along with ancillary site works.	Conditional	25/08/19

4.5.6 EPA Licenced/Registered Facilities

A review of the EPA mapping tool determined that there are no IPPC, IPC or IEL[33] facilities within the immediate vicinity of the subject site. Stabright Limited[34] (IEL Registered Licence No. P0356-01) is located at Clondrina, Ennis Road, Limerick, approximately 4.5 kilometres southwest of the proposed wind farm.

Other EPA licenced facilities comprise Ballycannon[35] sewerage treatment works (<500 p.e.[36]) is located at Meelick, approximately 0.9 kilometres south of the proposed wind farm site. This treatment works has a plant design capacity of 279 with an agglomeration p.e. of 188. This facility discharges treated effluent to the North Ballycannon_010 WFD River Waterbody which drains to the River Shannon.

Extending southwards towards the Shannon, a licenced landfill site (identified as Longpavement Landfill[37] is situated at Monabraher, Longpavement approximately 2.9 kilometres southeast of the proposed wind farm.

4.5.7 Existing Land-use and On-going Activities

Lands within the proposed development site and within the surrounding areas are managed for agricultural purposes under varying levels of farming practice intensity with areas of conifer plantation interspersed throughout.

Commercial quarrying takes place in the immediate environs of the subject site. O'Connell Quarries (Register No. QS0797) is located approximately 0.32 kilometres north of the proposed development site's northeast corner. This operational quarry extracts and processes rock and produces ready-mix concrete and has an existing working area of 16.9 hectares with planning approval for an extension of 10 hectares (Planning Ref No. 18818) (refer to Table 6), and an existing concrete batching plant.

The Ardnacrusha hydroelectric power plant is operational and is located approximately 2.3 kilometres southeast of the proposed permanent wind farm entrance. A regulating weir at Parteen controls the flow of water to the power plant using a sluice barrage and diverts the normal flow of the River Shannon into the 12-kilometre long headrace canal and on to the 30 metre high dam at Ardnacrusha Power Station[38].

Residential properties and farms are scattered throughout the surrounding area.

4.5.8 Potential for Significant In-combination Effects

It is considered that agriculture, forestry, on-going (and future) quarrying operations, and to a lesser extent, one-off rural residential developments comprise the land-use and activities which could potentially interact synergistically with the proposed development and result in significant cumulative/in-combination effects.

The potential in-combination effects are discussed further in Section 4.8.7.

[33] Integrated Pollution Control (IPC) Licence (formerly IPPC Licence), and Industrial Emissions Licence (IEL)
[34] According to EPA mapping database, this facility is currently 'in voluntary liquidation'
[35] Ballycannon Reg Number: A0081-01
[36] Defined using population equivalent value (p.e.)
[37] EPA Waste License Number: W0076-01
[38] Preliminary Synopsis of the WFD Surveillance Monitoring Fish Stock Survey on Lough Lene in the Western River Basin District, August 2010 (wfdfish.ie) Accessed: 11th January 2023

4.6 Identification of European Sites

4.6.1 Zone of Impact Influence and Selection of European Sites

As discussed in **Section 3.4**, above, the ZOI for the proposed development is the geographical area over which there is potential for the Qualifying interests (QI) of a European site may be affected by biophysical changes arising from the construction and/or operation and/or decommissioning of the proposed wind farm. To establish which European sites are located within the ZOI, the Source-Pathway-Receptor (SPR) model is applied during the screening stage of AA, since according to the Office of the Planning Regulator guidelines (OPR, 2021), 'a European site will only be at risk from likely significant effects where the Source-Pathway-Receptor link exists between the proposed development and the European site'.

The SPR model firstly considers the nature, size and location of the proposed development and then identifies characteristics that may provide a source of direct (e.g. water, noise, habitat loss) or indirect (e.g. collision risk, impact to the prey species of a QI) ecological impacts. Secondly, any pathways (e.g. watercourses) that exist linking the proposed development site to the European site(s) are identified, before, finally, establishing 'the location, nature and sensitivities of the qualifying species and habitats, the ecological conditions underpinning their survival and the conservation objectives specified to maintain or restore favourable conservation status' (OPR, 2021).

Following this, and in view of best scientific knowledge, an assessment is made to ascertain whether the proposed development, individually or in combination with other plans/projects, is likely to have a significant effect on a European site(s) in view of its conservation objectives. If there are any significant, potentially significant, or uncertain effects, it will be necessary to proceed to Appropriate Assessment and submit an NIS.

With regards the proposed Ballycar development and identification of potentially affected European sites, adoption of the SPR risk assessment principle and use of the precautionary approach, has led to the inclusion of all European sites within a 15-kilometre radius of the proposal site, details of which are included in **Table 7** and **Figure 11**.

Table 7: European sites within a 15-kilometre radius of the proposed development site at Ballycar.

Designated site	Site code	Approximate distance of designated site from nearest point of subject site	Hydrological/ Ecological connection?
Lower River Shannon SAC	002165	1km southeast of proposed development (46m approx. from temporary works at junction of R464 and L3056)	Yes (1.6 rkm downstream from WC6 and WC7[39])
River Shannon and River Fergus Estuaries SPA	004077	4.4km southwest of proposed development (3.1km from temporary works at junction of R464 and L3056)	Yes (6.6 rkm downstream from WC1)
Glenomra Wood SAC	001013	5.8km northeast of proposed development	No
Danes Hole, Poulnalecka SAC	000030	6.1km north of proposed development	No
Ratty River Cave SAC	002316	6.4km northwest of proposed development	No
Kilkishen House SAC	002319	8.7km northwest of proposed development	No
Slieve Bernagh Bog SAC	002312	10.7km north of proposed development	No
Lough Gash Turlough SAC	000051	14.4km northwest of proposed development	No

[39] WCX – Watercourse Crossing No. X - Refer to **Figure 6**.

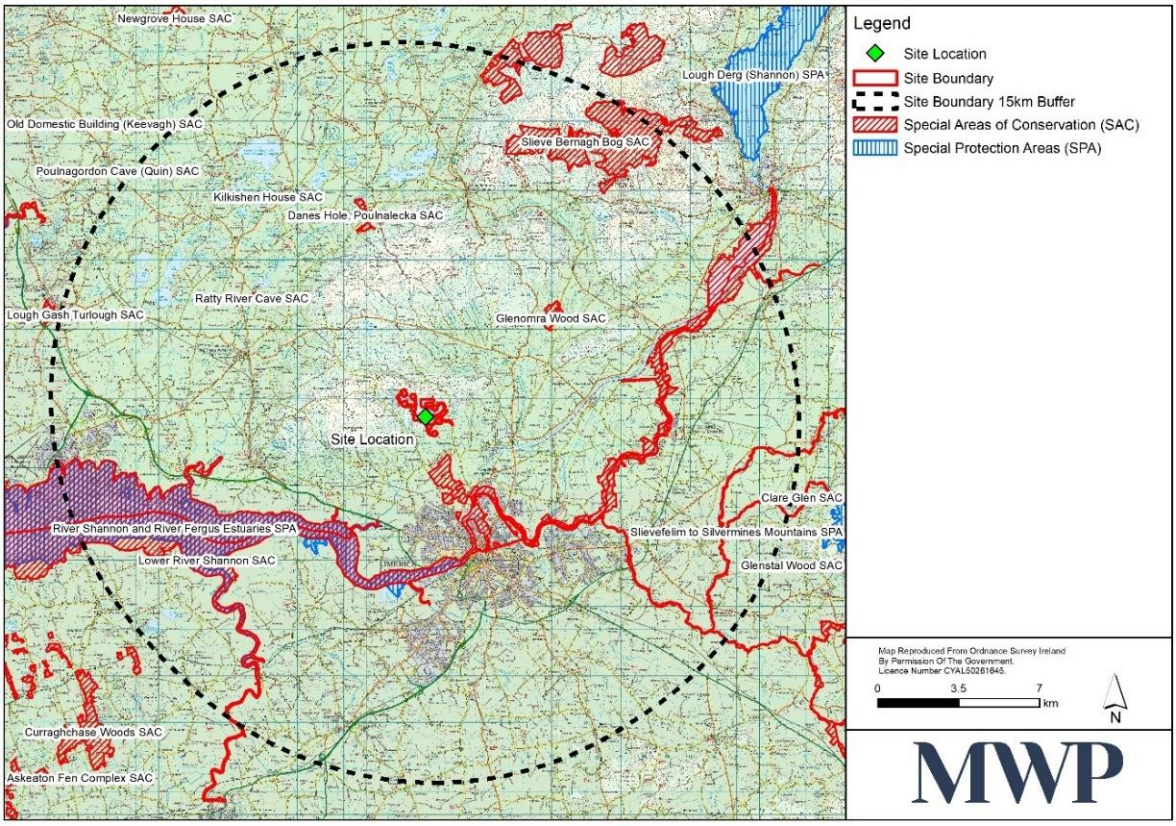

Figure 11: European sites located within 15 kilometres of the proposed development site at Ballycar.

4.6.2 Characteristics of European Sites

The following table lists the qualifying features of conservation interest for the European sites identified in the previous table. Information pertaining to the European sites is from the site synopses, conservation objectives and other information available on Protected Sites in Ireland | National Parks & Wildlife Service (npws.ie).

Table 8: European sites located within 15 km of the proposed development and their associated qualifying interests (QI) or special conservation interest (SCI) species.

Designated Site and code	Qualifying features of conservation interest[40]
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 fluitantis* and *Callitricho-Batrachion* vegetation [3260]

[40] Asterisk (*) denotes a priority habitat considered to be in danger of disappearance.

Designated Site and code	Qualifying features of conservation interest[40]
	▪ *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] ▪ Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029] ▪ Sea Lamprey (*Petromyzon marinus*) [1095] ▪ Brook Lamprey (*Lampetra planeri*) [1096] ▪ River Lamprey (*Lampetra fluviatilis*) [1099] ▪ Atlantic Salmon (*Salmo salar*) [1106] QI status applies only to freshwater phases of lifecycle. ▪ Common Bottlenose Dolphin (*Tursiops truncatus*) [1349] ▪ Otter (*Lutra lutra*) [1355]
River Shannon and River Fergus Estuaries SPA (004077)	▪ Cormorant (*Phalacrocorax carbo*) [A017] Wintering and breeding ▪ Whooper Swan (*Cygnus cygnus*) [A038] Wintering ▪ Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Wintering ▪ Shelduck (*Tadorna tadorna*) [A048] Wintering ▪ Wigeon (*Anas penelope*) [A050] Wintering ▪ Teal (*Anas crecca*) [A052] Wintering ▪ Pintail (*Anas acuta*) [A054] Wintering ▪ Shoveler (*Anas clypeata*) [A056] Wintering ▪ Scaup (*Aythya marila*) [A062] Wintering ▪ Ringed Plover (*Charadrius hiaticula*) [A137] Wintering ▪ Golden Plover (*Pluvialis apricaria*) [A140] Wintering ▪ Grey Plover (*Pluvialis squatarola*) [A141] Wintering ▪ Lapwing (*Vanellus vanellus*) [A142] Wintering ▪ Knot (*Calidris canutus*) [A143] Wintering ▪ Dunlin (*Calidris alpina*) [A149] Wintering ▪ Black-tailed Godwit (*Limosa limosa*) [A156] Wintering ▪ Bar-tailed Godwit (*Limosa lapponica*) [A157] Wintering ▪ Curlew (*Numenius arquata*) [A160] Wintering ▪ Redshank (*Tringa totanus*) [A162] Wintering ▪ Greenshank (*Tringa nebularia*) [A164] Wintering ▪ Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Wintering ▪ Wetland and Waterbirds [A999]
Glenomra Wood SAC (001013)	▪ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]
Danes Hole, Poulnalecka SAC (000030)	▪ Caves not open to the public [8310] ▪ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] ▪ Lesser Horseshoe Bat (*Rhinolophus hipposideros*) [1303]
Ratty River Cave SAC (002316)	▪ Caves not open to the public [8310] ▪ Lesser Horseshoe Bat (*Rhinolophus hipposideros*) [1303]
Kilkishen House SAC (002319)	▪ Lesser Horseshoe Bat (*Rhinolophus hipposideros*) [1303]
Slieve Bernagh Bog SAC (002312)	▪ Northern Atlantic wet heaths with *Erica tetralix* [4010] ▪ European dry heaths [4030] ▪ Blanket bogs (* if active bog) [7130]
Lough Gash Turlough SAC (000051)	▪ Turloughs* [3180] ▪ Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation [3270]

4.6.3 Conservation Objectives

According to the Habitats Directive, the *conservation status of a natural habitat* will be taken as 'favourable' within its biogeographic range when:

- its natural range and the areas covered within that range are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable as defined below.

According to the Habitats Directive, the *conservation status of a species* means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' within its biogeographical range when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The conservation objectives for each European site listed in **Table 8**, above, were accessed online on the 19th July 2023. Management plans are not currently available for any of the designated sites.

Site-specific conservation objectives were available for the following sites:

- Lower River Shannon SAC (002165). Version 1.0. Produced August 2012.
- River Shannon and River Fergus Estuaries SPA (004077). Version 1.0. Produced September 2012.
- Glenomra Wood SAC (001013). Version 1.0. Produced June 2018.
- Danes Hole, Poulnalecka SAC (000030). Version 1.0. Produced July 2018.
- Ratty River SAC (002316). Version 1.0. Produced July 2018.
- Kilkishen House SAC (002319). Version 1.0. Produced July 2018.
- Slieve Bernagh Bog SAC (002312). Version 1.0. Produced August 2016.
- Lough Gash Turlough SAC (000051). Version 1.0. Produced November 2017.

4.7 Identification of Potential Impacts of the Project

Potential likely direct, indirect or secondary ecological impacts arising from the proposed development (either alone or in combination with other plans or projects) are identified in this section.

Table 9: Identification of the impacts of the proposed wind energy development at Ballycar.

Description of elements of the project likely to give rise to potential ecological impacts sites.	Wind Farm Construction Phase ▪ Excavations, clear felling, ground moving, and heavy engineering required to construct windfarm tracks & hardstands, sub-station, underground cabling, grid connection, temporary works areas, surface water drainage system, permanent met mast, buildings & fencing.

	▪ Machinery: The presence and sustained use of heavy and light plant machinery on site, albeit at variable rates and numbers, during daylight hours for the duration of the works. ▪ Use of fuels/oils/lubricants, concrete and other such substances considered harmful to the aquatic environment. ▪ Human presence: Sustained increase in human activity, albeit at variable rates and numbers, during daylight hours for the duration of the works. ▪ Increased noise and air emissions associated with construction activity. ▪ Erection of turbines. Introduction of large physical structures into a previously unoccupied and uninterrupted air space. ▪ Temporary storage of excavated spoil. ▪ Temporary site compound. ▪ Temporary surface water flow management systems for specific engineering elements as required at various locations. ▪ Localised works along turbine delivery route. Wind Farm Operational Phase ▪ Operation of wind turbines at 12 locations (rotation of turbine blades). ▪ Operation of substation. ▪ Operational maintenance works. ▪ Human presence (wind farm staff and increased vehicular activity). Wind Farm Decommissioning Phase ▪ Decommissioning of wind farm infrastructure including excavation and heavy engineering works, ground moving, use of machinery, temporary storage of spoil, temporary site drainage. ▪ Increased human activity, increased noise and air emissions. ▪ Permanent disassembly and removal of wind farm components including turbines. ▪ Permanent disposal and storage of excavated materials. ▪ Temporary site compound.
Describe any likely direct, indirect or secondary ecological impacts of the project (either alone or in combination with other plans or projects) by virtue of: ▪ *Size and scale* ▪ *Land-take* ▪ *Distance from European Site or key features of the site* ▪ *Resource requirements* ▪ *Emissions* ▪ *Excavation requirements* ▪ *Transportation requirements* ▪ *Duration of construction, operation etc.* ▪ *Other.*	Wind Farm Construction Phase ▪ There is no spatial overlap between the subject site and any European site; therefore, there will be no direct habitat loss/alteration/land-take within any European site. ▪ There will be loss and direct alteration of habitats (comprising mainly mature conifer forestry and agricultural grassland) within the construction footprint. ▪ Potential for direct species disturbance/displacement impacts due to construction activity including fugitive noise emissions from machinery, human activity. ▪ Subject site is hydrologically connected to two European sites - the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA - via watercourses draining the site. ▪ Potential for water quality impacts through the erosion and run-off of silt, and/or ingress of fuels/oils, cementitious material, or other such substances via overland flow and/or the existing/proposed drainage network to local watercourses and the estuarine waters of the River Shannon into which they drain. ▪ Potential for groundwater contamination via spillage of oils/fuels, chemicals.

- Potential for indirect alteration of habitats located outside the development site but hydrologically linked to it.
- Potential for indirect species disturbance/displacement due to *in-situ* or *ex-situ* habitat loss/alteration impacts, impairment of water quality and/or impacts on prey availability.
- Potential for spread of invasive species.

Wind Farm Operational Phase

- Risk of bird mortality through collision or interaction with turbine blades or other infrastructure.
- Potential for species disturbance/displacement (indirect habitat loss) due to operation and maintenance of wind turbines and substation.
- Potential for species displacement because of 'barrier effects' whereby species are deterred from using normal routes to access breeding, foraging or roosting habitats. For example, behavioural responses to the presence of turbines could cause some species to stop using or reduce their use of foraging grounds in proximity to the turbine envelope.
- Potential for water quality impacts through the erosion and run-off of silt, and/or ingress of fuels/oils via overland flow and/or the drainage network to local watercourses and the estuarine waters of the River Shannon into which they drain.
- Potential for groundwater contamination through spillage of oils, fuels and chemicals.
- Potential for indirect alteration of habitats outside of but hydrologically linked to the development site.
- Potential for indirect species disturbance/displacement due to impairment of water quality and/or impacts on prey availability.

Wind Farm Decommissioning Phase

- Potential for water quality impacts, as above.
- Potential for groundwater contamination, as above.
- Potential for direct species disturbance/displacement due to fugitive noise emissions associated with disassembly and/or removal of wind farm components and human activity.
- Potential for indirect alteration of habitats outside of but hydrologically linked to the development site.
- Potential for indirect species disturbance/displacement due to impairment of water quality and/or impacts on prey availability.
- Potential for spread of invasive species.

4.8 Assessment of Significance of Potential Impacts

This section considers the list of sites identified in **Table 8**, together with the potential ecological impacts identified in **Table 9**, and determines whether the project is likely to have significant effects on a European site. As discussed in **Section 4.6.1**, when assessing impact, European sites are only considered relevant where a credible or tangible source-pathway-receptor link exists between the proposed development and a protected species or habitat type. For an impact to occur there must be a risk initiated by having a 'source' (e.g. excavation) and an impact pathway between the source and the receptor (e.g. a waterbody which connects the proposal site to the protected species or habitats). An evaluation based on these factors to determine which European sites are the plausible ecological receptors for potential impacts of the proposed development will be conducted in **Sections 4.8.1** and **4.8.2**. The evaluation takes cognisance of the scope, scale, nature and size of the project, its location relative to the European

sites listed in Table 7, and the degree of connectedness that exists between the project and each European site's potential ecological receptors.

4.8.1 European Sites Outside the Zone of Potential Impact after Application of SPR Model

With regards to the proposal, it is considered that the works do not include any element that has the potential to significantly affect the conservation objectives for which certain European sites are designated. Although located within 15 kilometres of the proposed development site, these European sites are deemed to be outside the zone of potential impact influence of the proposed development due to the absence of plausible impact pathways when the SPR model was applied (see Section 4.6.1 for details of the model). Therefore, it is objectively concluded that significant effects on the conservation objectives of these sites are not reasonably foreseeable because of the proposed development described at Section 4.3. These sites are listed in Table 10, along with their approximate distances from the subject site and the rationale for their exclusion, and therefore will not be considered further in this report.

Table 10: European sites excluded from further assessment including rationale for exclusion.

Designated site and code	Approximate distance from proposal site	Rationale for exclusion from further assessment
Glenomra Wood SAC (001013)	5.8 km to the northeast	- Designated for woodland habitat. - No spatial overlap with the proposal site. - No plausible impact pathway linking the proposed development site to SAC
Danes Hole, Poulnalecka SAC (000030)	6.1 km to the north	- Designated for cave, woodland habitat, and lesser horseshoe bat. - No spatial overlap with the proposal site. - Proposal site located outside the maximum foraging range of lesser horseshoe bat (c.6 km) (BCI, 2012). - No plausible impact pathway linking the proposed development site to SAC.
Ratty River Cave SAC (002316)	6.4 km to the northwest	- Designated for caves and lesser horseshoe bat. - No spatial overlap with the proposal site. - Proposal site located outside the maximum foraging range of lesser horseshoe bat (c.6 km) (BCI, 2012). - No plausible impact pathway linking the proposed development site to SAC.
Kilkishen House SAC (002319)	8.7 km to the northwest	- Designated for lesser horseshoe bat. - No spatial overlap with the proposal site. - Proposal site located outside the maximum foraging range of lesser horseshoe bat (c.6 km) (BCI, 2012). - No plausible impact pathway linking the proposed development site to SAC.
Slieve Bernagh Bog SAC (002312)	10.7 km to the north	- Designated for three peatland habitats. - No spatial overlap with the proposal site. - Proposal site is in separate WFD sub-catchment to the SAC[41] with no hydrological connection between the two. - No plausible impact pathway linking the proposed development site to SAC.

[41] Slieve Bernagh Bog SAC (002312) overlaps with the Owenogarney_SC_010, Shannon [Lower]_SC_080, Graney [Shannon]_SC_010 and the Shannon [Lower]_SC_070 WFD Sub-catchments. Available at https://gis.epa.ie/EPAMaps/ Accessed: 28th November 2022

Designated site and code	Approximate distance from proposal site	Rationale for exclusion from further assessment
Lough Gash Turlough SAC (000051)	14.4 km to the west	- Designated for turlough habitat and associated flora. - No spatial overlap with the proposal site. - Proposal site is in separate WFD sub-catchment to the SAC with no hydrological connection between the two. - No plausible impact pathway linking the proposed development site to SAC.

4.8.2 European Sites Within the Zone of Potential Impact after Application of SPR Model

The assessment of significance of potential impacts that follows focuses on the two remaining European sites identified in Table 11. When the SPR framework discussed in Section 4.6.1, is applied, these sites are deemed to have the potential to be impacted by the proposal described in Section 4.3, due to the existence of plausible impact pathways linking the proposed development site (source) to the Qualifying Interest species and habitats (receptors) of the European sites. Therefore, it is objectively concluded that significant effects on the conservation objectives of these two European sites because of the proposed development described at Section 4.3, have the potential to occur and cannot be ruled out at this stage. These sites are listed in Table 11, along with their approximate distances from the subject site and will be subjected to further assessment in this report.

Table 11: European sites within the likely zone of impact and rationale for inclusion

Designated site and code	Approximate distance from subject site	Rationale for inclusion for assessment
Lower River Shannon SAC (002165)	1 km southeast of T12 1.6 rkm downstream from WC6 and WC7 46m approx. from temporary works at junction of R464 and L3056	- Designated for wide variety of aquatic and terrestrial habitats and species. - No spatial overlap: however, several watercourses draining the proposal site drain to the SAC. - Direct hydrological connection between the proposal site and the SAC, located approximately 1.6 rkm downstream. - Habitats within the proposal site suitable for some QI's. - Potential for significant effects to the SAC. - Further assessment is required.
River Shannon and River Fergus Estuaries SPA (004077)	4.4 km southwest of subject site 6.6 rkm downstream from WC1 3.1km from temporary works at junction of R464 and L3056	- Designated for wide variety of predominantly wintering waterfowl species, and wetlands. - No spatial overlap: however, several watercourses draining the proposal site drain to the SPA. - Direct hydrological connection between the proposal site and the SPA, located approximately 6.6 km downstream. - Foraging and roosting habitats such as agricultural grassland, wet grassland and bog within proposal site suitable for some SCI's. - Potential for significant effects to the SPA. - Further assessment is required.

The likelihood of significant effects from the project to the European sites outlined above was determined based on several indicators including:

- Water quality;

- Habitat loss/alteration;
- Habitat or species fragmentation; and
- Disturbance and/or displacement of species.

The likelihood of significant in-combination effects is assessed in Section 4.8.7.

4.8.3 Water Quality

The topography of the proposed wind farm site undulates, and elevations range from 60 to 262 metres AOD with the terrain gently sloping south-eastwards to Ardnacrusha. As described in Section 4.4.2, watercourses leaving the proposed development site all eventually drain into the River Shannon and the Lower River Shannon SAC and subsequently into the River Shannon and River Fergus SPA located slightly further downstream. Therefore, via overland and existing drain pathways, there is potential for a hydrological link between the proposed wind farm site and two European sites located downstream. Temporary local road widening works are proposed at the junction of R464 and L3056 approximately 46m from the SAC.

As detailed in Table 8, the Lower River Shannon SAC is designated for a variety of marine and freshwater aquatic habitats and species, and the River Shannon and River Fergus Estuaries SPA is designated for a variety of water-dependant bird species and wetland habitat.

During a wind farm's construction phase, and in the absence of any pollution prevention controls, earthworks have the potential to adversely impact water quality due to soil erosion. The subsequent suspension of soil sediment particles in site run-off and overland flow can eventually reach the natural watercourses draining the site in the absence of implementation of appropriate controls and protective measures. Nutrients such as phosphorous can be bound to soil from past fertilisation of forestry crop and can become transported in overland flow. The presence of felled trees and brash at a site can increase the risk of this phosphorous release to local drains and watercourses. Potential also exists for accidental ingress of fuel and oils, concrete and cementitious material and other such substances considered harmful to the aquatic environment via overland flow, direct discharges to drainage features and/or leaching to groundwater in the event of a spillage/leakage.

Water quality is a key environmental factor underpinning the conservation condition of the complex of aquatic and wetland habitats and species that support the qualifying features for which the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA are classified. There is a hydrological connection between the proposed development site and both European sites via the various watercourses that drain the proposed development area (see Figure 6). Given the pollution risk associated with the construction phase of the works and this hydrological pathway and the proximity of the temporary works proposed, it is considered that potential significant effects on water quality to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA cannot be ruled out.

The decommissioning phase of the project and, to a lesser extent, the operational phase are also considered to have the potential to result in water quality impacts.

Consequently, in the absence of mitigation, it is objectively concluded that significant water quality effects within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA arising from the impacts identified in Section 4.7, above, have the potential to occur and further assessment is required.

4.8.4 Habitat Loss and Alteration

There is no spatial overlap between the subject site and any European site; therefore, there will be no direct loss/alteration of any of the qualifying habitats of conservation interest for which the European sites outlined in

Table 8, are designated. Any permanent direct habitat loss arising because of the proposal will be restricted to the proposed development site boundary. However, as detailed in Section 4.4.2, the proposed development site is hydrologically connected to both the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

The Lower River Shannon SAC site is designated for fourteen Annex I habitat types as listed in Table 8. The River Shannon and River Fergus Estuaries SPA is designated for the protection of the habitat and species complex 'Wetlands and waterbirds [A999]' which requires the conservation of wetland habitat within the SPA as a resource for regularly occurring migratory waterbirds. As discussed in Section 4.8.3, significant indirect impacts to the water quality of the SAC and SPA have the potential to occur which subsequently creates the potential for an indirect loss and/or alteration of habitats within the SAC and/or the SPA located downstream.

Consequently, in the absence of mitigation, it is objectively concluded that significant loss and/or alteration of habitats within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA arising from the impacts identified in Section 4.7, have the potential to occur and further assessment is required.

4.8.5 Disturbance and/or Displacement of Species

4.8.5.1 Lower River Shannon SAC

The Lower River Shannon SAC is designated for the following QI species:

- Freshwater pearl mussel (*Margaritifera margaritifera*) [1029];
- Sea lamprey (*Petromyzon marinus*) [1095];
- Brook lamprey (*Lampetra planeri*) [1096];
- River lamprey (*Lampetra fluviatilis*) [1099];
- Atlantic salmon (*Salmo salar*) [1106] (QI status pertains only to freshwater phases of life cycle);
- Bottlenose dolphin (*Tursiops truncates*) [1349]; and
- Otter (*Lutra lutra*) [1355].

All these QIs are exclusively aquatic in nature and/or dependant on aquatic habitats (i.e. otter) and require an adequate level of water quality to be maintained within their environments.

The Conservation Objective for the freshwater pearl mussel within the SAC applies only to the population occurring within the Cloon River (NPWS, 2012) which is situated in a different sub-catchment to those of the proposed development site at Ballycar. There is no hydrological connection between the proposal site and the Cloon River and therefore no plausible pathway for impacts to the Cloon River's designated freshwater pearl mussel population can occur.

It has already been concluded in Section 4.8.3, above, that because of the proposal and in the absence of water quality protection mitigation measures, there is potential for significant impacts to the water quality of the watercourses draining the proposed development site and the SAC located approximately 1.6 river kilometres downstream (46m approx. from temporary local road widening works).

The Ballycar Aquatic Ecology and Fish Survey Report (see Appendix 6C in Volume III of the EIAR) concluded that the watercourses draining the proposed development site 'are suboptimal trout habitats, poor in terms of lampreys and highly unlikely to support migratory fish populations. The lower reaches of some watercourses draining the proposal site contain some deeper pools that are more suitable for adult fish, however, these are also considered suboptimal for spawning (e.g. salmon) due to siltation, drainage (hydromorphological changes), and their low gradients.

Nevertheless, as a precautionary measure, it is assumed for this assessment that the watercourses draining the proposed development site have the potential, albeit slight, to support areas of habitat considered suitable for lamprey, salmon and otter and which may be constituents of the SAC's QI populations. Therefore, there is potential for indirect disturbance and/or displacement of these species to occur via impairment of water quality and the resulting impacts on prey availability, and/or the indirect alteration of habitats located downstream. Such impacts could affect QIs within watercourses which are outside the SAC, but which have been identified as potential pathways for impacts in **Section 4.8.3**, above, as well as within the SAC boundary located downstream.

Additionally, there is potential for indirect disturbance and/or displacement of otter because of the proposed works due to an increase in noise levels, lighting and human activity, primarily during the construction phase and to a lesser extent during the operational and decommissioning phases.

Consequently, in the absence of mitigation, it is objectively concluded that significant disturbance and/or displacement of QI species within the Lower River Shannon SAC arising from the impacts identified in **Section 4.7**, above, have the potential to occur and further assessment is required.

4.8.5.2 River Shannon and River Fergus Estuaries SPA (004077)

The River Shannon and River Fergus Estuaries SPA is designated for the following SCI species:

- 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];
- Black-tailed Godwit (*Limosa limosa*) [A156];
- Bar-tailed Godwit (*Limosa lapponica*) [A157];
- Curlew (*Numenius arquata*) [A160];
- Redshank (*Tringa totanus*) [A162];
- Greenshank (*Tringa nebularia*) [A164]; and
- Black-headed Gull (*Chroicocephalus ridibundus*) [A179].

This SPA site is selected for the resident population of one species, namely cormorant, and the migratory overwintering populations of twenty other SCI species, as listed above (and listed in **Table 8**, above). The SCI species for which the SPA is selected comprise seabirds and wildfowl, both groups that are deemed to be at risk from wind farms (Percival, 2003). As detailed in **Figure 9** and **Table 2**, above, there were two SCI species recorded

during the vantage point surveys carried out at the site, namely black-headed gull and cormorant, and each record occurred outside the proposed development boundary.

There are no waterbodies encompassed within the proposed development site in which any of the SCI species for which the SPA is designated could reasonably be expected to occur. Species may fly over the site when moving between suitable habitats within the greater area, however none were recorded within the proposed development's site boundary during bird surveys of the area. A review of the BirdLife report on the potential impacts of wind farms on birds determined that most, if not all, of the SPA's SCI species have the potential to be disturbed and/or displaced from wind farms through collision, habitat loss/damage, or the barrier effect of turbines once operational (BirdLife, 2003).

Indirect ecological impacts potentially arising because of the proposed works include an increase in noise levels/human activity during the construction phase and/or the operational phase and/or decommissioning phase of the proposed development whereby species are disturbed and avoid the area, although it is noted that these aspects of the proposal will be temporary in nature and will be carried out on a phased basis. Further assessment is required to determine whether any potential disturbance/displacement impacts to the SCI species for which the SPA is designated will be significant. Additionally, it has already been concluded in Section 4.8.3, that in the absence of water quality protection mitigation measures, there is potential for significant impacts to the water quality of the watercourses draining the proposed development site and, therefore, to the SPA located approximately 6.6 river kilometres downstream (3.1m approx. from temporary local road widening works). This creates the potential for indirect disturbance and/or displacement of SCI species via impacts to aquatic habitats and/or prey resource.

Consequently, in the absence of mitigation, it is objectively concluded that significant disturbance and/or displacement of SCI species within the River Shannon and River Fergus Estuaries SPA arising from the impacts identified in Section 4.7, have the potential to occur and therefore further assessment will be required.

4.8.6 Habitat or Species Fragmentation

Habitat fragmentation has been defined as 'reduction and isolation of patches of natural environment' (Franklin *et al*., 2002; Morrison *et al.*, 2012) which results in spatial separation of habitat areas which had previously been in a state of greater continuity. Adverse effects of habitat fragmentation on species include the increased isolation of populations which can detrimentally impact upon the resilience or robustness of the populations.

The preceding Sections 4.8.3, 4.8.4 and 4.8.5 have concluded that habitat loss and alteration impacts, water quality impacts and disturbance/displacement impacts cannot be ruled out for the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA because of the proposed development. Therefore, significant habitat or species fragmentation on these European sites also cannot be ruled out and further assessment is required.

4.8.7 Cumulative/In-combination Impacts

As set out in the preceding sections, there is potential for the proposed development to cause indirect habitat loss/alteration, water quality impacts, disturbance/displacement of species, and/or habitat/species fragmentation impacts to the QI species and habitats for which two European sites are designated, namely the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. However, as established in Section 4.6, above, no plausible pathway exists to connect either the Lower River Shannon SAC or the River Shannon and River Fergus Estuaries SPA with the European sites located outside the zone of impact (listed in Table 10, above) and, therefore, the potential for cumulative impacts with other European sites is negligible.

There is, however, the potential that any or all the possible effects to the Lower River Shannon SAC or the River Shannon and River Fergus Estuaries SPA could cause significant cumulative/in-combination impacts with other developments, plans and activities within the area identified in Section 4.5, above. Further assessment is required to determine whether significant cumulative/in-combination impacts will ensue from the proposed development.

4.9 Conclusion of Screening Stage

In conclusion, to determine any potential impacts of the proposed project on nearby European sites, a screening process for Appropriate Assessment was undertaken. The permitted development site is located within 15 kilometres of eight European sites.

It has been objectively concluded during this screening process that the proposed construction, operation and eventual decommissioning of a 12-turbine wind farm at Ballycar in County Clare, either individually or in combination with other plans or projects, is not likely to have significant effects on the following six European sites located within 15 kilometres of the proposed development in view of those sites' Conservation Objectives, and further assessment is deemed unnecessary:

- Glenomra Wood SAC (001013);
- Danes Hole, Poulnalecka SAC (000030);
- Ratty River Cave SAC (002316);
- Kilkishen House SAC (002319);
- Slieve Bernagh Bog SAC (002312); and
- Lough Gash Turlough SAC (000051).

It cannot be objectively concluded at this stage that the proposed development at Ballycar in County Clare will not result in significant effects on the following designated European sites due to the impacts identified in Sections 4.8.3 to 4.8.7, above:

- Lower River Shannon SAC (002165); and
- River Shannon and River Fergus Estuaries SPA (004077).

Therefore, it has been concluded that, in respect of these European sites, the project should proceed to Stage 2 of the Appropriate Assessment process and as such, a Natura Impact Statement is required. It is concluded that all other European sites have been correctly screened out or excluded from further consideration based on objective information that the project, individually or in-combination with other plans or projects, will have no, or no appreciable, effects on those sites.

5. References

Bat Conservation Ireland (BCI) (2012). *Bats and Appropriate Assessment Guidelines*, Version 1, December 2012.

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Appendix A

Stages of Appropriate Assessment

Stage 1 - Screening

This is the first stage of the Appropriate Assessment process and is undertaken to determine the likelihood of significant direct and indirect effects on European Sites, in light of their conservation objectives, because of a proposed project or plan, individually or in-combination with other plans or projects. It determines the need for a full Appropriate Assessment.

If it can be concluded that no significant direct and indirect effects to European Sites are likely, in light of their conservation objectives, either individually or in-combination with other plans or projects, then the assessment can stop here. If not, it must proceed to Stage 2 for a more detailed assessment.

Stage 2 - Natura Impact Statement (NIS)

The second stage of the Appropriate Assessment process assesses the impact of the proposal (either alone or in combination with other projects or plans) on the integrity of the European site(s) with respect to the conservation objectives of the site(s) and its ecological structure and function. This is a much more detailed assessment that Stage 1. A Natura Impact Statement is required to contain a professional scientific examination of the proposal and include any mitigation measures deemed necessary to avoid, reduce or offset negative impacts.

If the outcome of Stage 2 is negative i.e. adverse impacts to the site(s) cannot be scientifically ruled out despite mitigation, the plan or project should proceed to Stage 3 or be abandoned.

Stage 3 - Assessment of alternative solutions

A detailed assessment must be undertaken to determine whether alternative ways of achieving the objective of the project/plan exists.

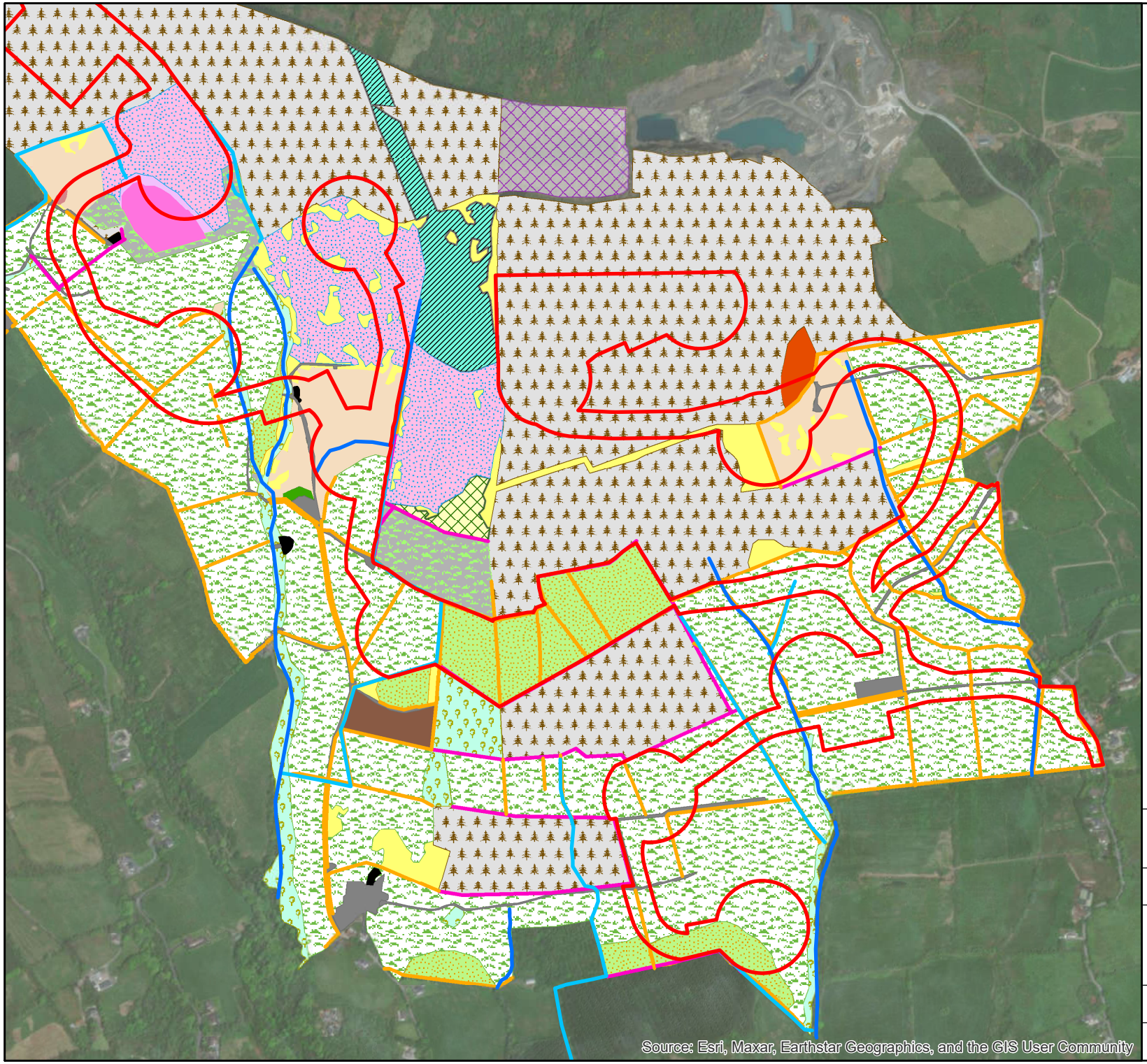
Where no alternatives exist, the project/plan must proceed to Stage 4.

Stage 4 - Assessment where no alternative solutions exist and where adverse impacts remain

The final stage is the main derogation process examining whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project to adversely affect a European Site where no less damaging solution exists.

Appendix 2

Habitat Map



Legend

- Planning Application Boundary
- Watercourse FW1
- Drainage Ditch FW4
- Hedgerows WL1
- Treelines WL2
- Buildings and artificial surfaces BL3
- Spoil and bare ground ED2
- Active quarries and mines ED4
- Improved agricultural grassland GA1
- Improved agricultural grassland GA1 / Wet grassland GS4
- Improved agricultural grassland GA1 / Dry-humid acid grassland GS3
- Dry-humid acid grassland GS3
- Dry-humid acid grassland GS3 / Wet grassland GS4
- Wet grassland GS4
- Wet grassland GS4 / Wet Heath HH3
- Scrub WS1 / Wet Grassland GS4
- Bracken HD1
- Bracken HD1 / Conifer Plantation WD4
- Wet Heath HH3
- Wet Heath HH3 / Upland Blanket Bog PB2
- Mixed Broadleaved Woodland WD1
- Conifer Plantation WD4
- Scrub WS1
- Recently Felled Woodland WS5

N

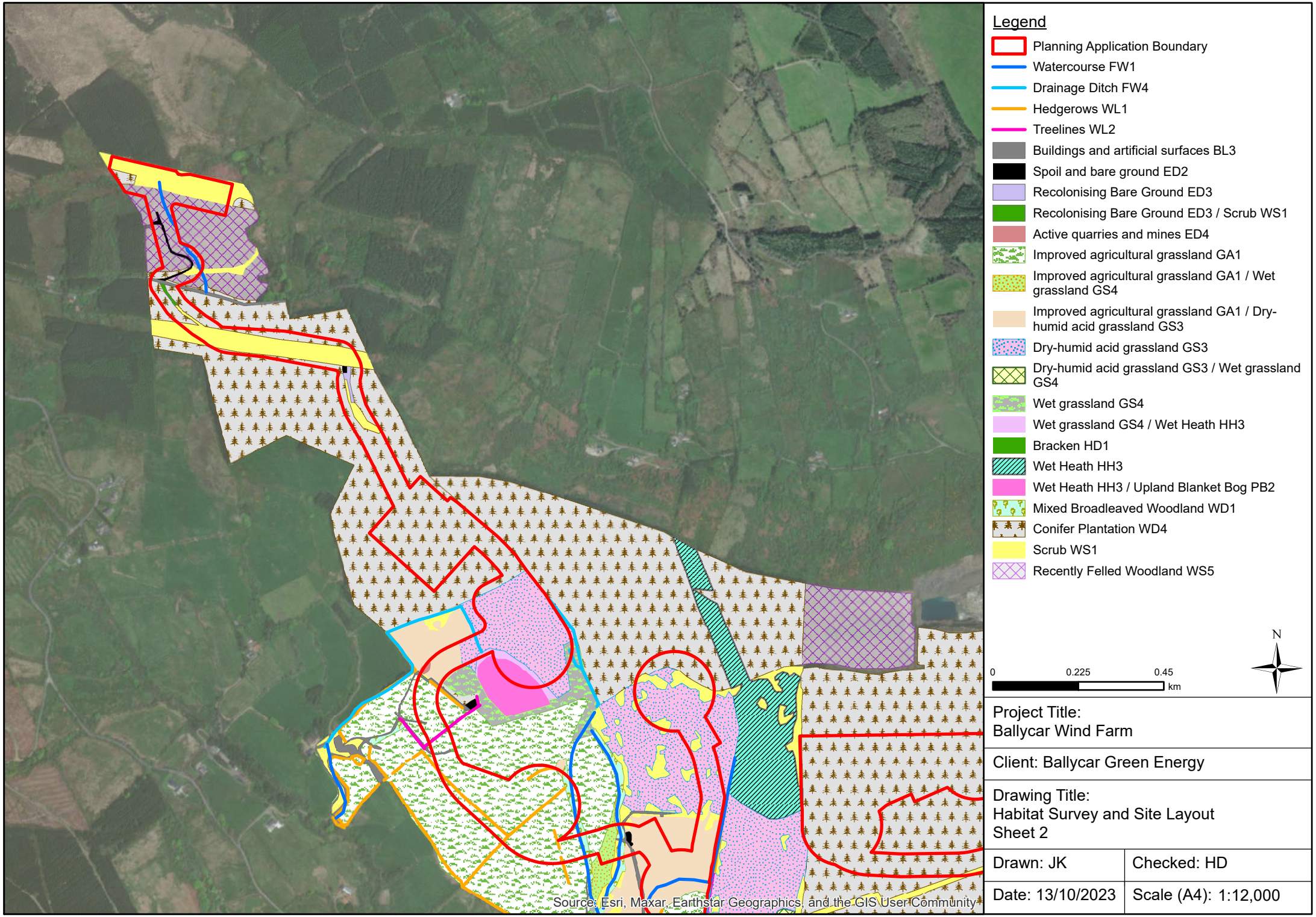
0 0.225 0.45 km

Project Title:
Ballycar Wind Farm

Client: Ballycar Green Energy

Drawing Title:
Habitat Survey and Site Layout
Sheet 1

Drawn: JK	Checked: HD
Date: 13/10/2023	Scale (A4): 1:12,000


Legend
Planning Application Boundary
Watercourse FW1
Drainage Ditch FW4
Hedgerows WL1
Treelines WL2
Buildings and artificial surfaces BL3
Spoil and bare ground ED2
Recolonising Bare Ground ED3
Recolonising Bare Ground ED3 / Scrub WS1
Active quarries and mines ED4
Improved agricultural grassland GA1
Improved agricultural grassland GA1 / Wet grassland GS4
Improved agricultural grassland GA1 / Dry-humid acid grassland GS3
Dry-humid acid grassland GS3
Dry-humid acid grassland GS3 / Wet grassland GS4
Wet grassland GS4
Wet grassland GS4 / Wet Heath HH3
Bracken HD1
Wet Heath HH3
Wet Heath HH3 / Upland Blanket Bog PB2
Mixed Broadleaved Woodland WD1
Conifer Plantation WD4
Scrub WS1
Recently Felled Woodland WS5
N
0
0.225
0.45
km
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Project Title:
Ballycar Wind Farm
Client: Ballycar Green Energy
Drawing Title:
Habitat Survey and Site Layout
Sheet 2
Drawn: JK
Checked: HD
Date: 13/10/2023
Scale (A4): 1:12,000