6 BIODIVERSITY

6.1 INTRODUCTION

This chapter identifies, quantifies and evaluates the potential impacts of the proposed Shronowen Wind Farm development (herein after referred to as the 'proposed development') on certain habitats, species and ecosystems and provides an accurate prediction of the likely effects.[1] It prescribes mitigation as necessary; and describes any residual ecological effects.

This chapter is supported by seven appendices included in Volume 3 of the EIAR; these are as follows:

- Appendix 2-1: Construction Environmental Management Plan.
- Appendix 6-1: Evaluation Table (NRA 2009a).
- Appendix 6-2: Bat Report (2019).
- Appendix 6-3: Bat Report (2020).
- Appendix 6-4: Fisheries Assessment Report.
- Appendix 6-5: List of Species.
- Appendix 6-6: Figures.

The chapter, and the ecological assessment contained herein, was carried out with regard to the following legislative framework:

- Wildlife Acts 1976 to 2018.[2]
- Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora.[3]
- Council Directive 2009/147/EC on the conservation of wild birds.[4]
- European Communities (Birds and Natural Habitats) Regulations 2011-2015.[5]
- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy;[6] (2000/60/EC).
- European Communities (Water Policy) Regulations 2003, as amended (S.I. No. 722 of 2003).
- The Planning and Development Act (2000) (as amended).
- Planning and Development Regulations 2001 to 2020.[7]

The chapter, and the ecological assessment contained herein, took cognisance of, *inter alia*, the following publications:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017).

[1] Definitions of impacts and effects are provided in **Table 6-1**.
[2] Collective citation for the following: Wildlife Act 1976 (no. 39 of 1976); Wildlife (Amendment) Act 2000 (no. 38 of 2000); Wildlife (Amendment) Act 2010 (no. 19 of 2010); Wildlife (Amendment) Act 2012 (no. 29 of 2012) and Heritage Act 2018 (no. 15 of 2018), Part 3.
[3] Hereinafter referred to as the Habitats Directive.
[4] Hereinafter referred to as the Birds Directive.
[5] Collective citation for the following: S.I. No. 477 of 2011, S.I. No. 499 of 2013, S.I. No. 355/2015.
[6] Hereinafter referred to as the Water Framework Directive.
[7] Collective citation for: Planning and Development Regulations 2001 (S.I. No. 600 of 2001) and amending Regulations.

- Guidelines for Ecological Impact Assessment in the UK and Ireland - Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019).
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009a).
- Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (SNH, 2019).

While areas designated for nature conservation are considered in this chapter, a Natura Impact Statement (NIS), which considers the potential impacts on the integrity of Natura 2000 site(s)[8] of the proposed development, either alone or in combination with other plans or projects, with respect to the structure and function and the Conservation Objectives of Natura 2000 sites in question, has also been prepared and is provided as a standalone document in the planning application. As per EPA (2017), while this chapter will not repeat the detailed assessment of potential effects on European sites contained in said NIS, it will refer to the findings of that assessment.

The core wind farm development components, which are described in detail in **Chapter 2** of this EIAR include:

- Wind turbines.
- Wind turbine foundations.
- Hardstands and lay down areas.
- Permanent meteorological mast.
- Substation and buildings.
- Underground cabling.
- Internal site service roads.
- Underground grid connection cable route.

As part of the proposed development, some tree felling is required; it is proposed to replace the areas of felled woodland on lands within the proposed development site, in an area of marginal lands with low ecological value, for which the proponent has obtained the necessary landowner consent. The replacement of the felled woodland is not proposed as mitigation; it is as a Forestry Service requirement.

6.1.1 Scope of Assessment

Ecological impact assessment (EcIA) is "the process of identifying, quantifying, and evaluating the potential impacts of defined actions[9] on ecosystems or their components"[10] (Treweek, 1999 cited in NRA, 2009a; CIEEM, 2019). In the case of this proposed development the process will determine whether the ecosystems and/or their components, identified in **Section 6.3** and described hereinafter as ecological features, will be subject to impacts from the proposed development, identified in **Section 6.7** and it will characterise these impacts and their effects. To that end this chapter will:

[8] A network of protected sites - Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) - comprising core breeding and resting sites for rare and threatened species and some rare natural habitat types listed under both the Birds Directive and the Habitats Directive.

[9] In this case the defined actions are the activities associated with the proposed development.

[10] The habitats - the environments in which an animal or plant lives (generally defined in terms of vegetation and physical structures) - features, assemblages, species or individuals that occur in the vicinity of a project and upon which impacts are possible (NRA, 2009a).

- Describe the ecological features within the Zone of Influence[11] of the proposed development (**Section 6.3**).
- Identify, from among those features, the receptors upon which impacts ensuing from the proposal are likely **(Section 6.5**).
- Select from those the Important Ecological Features (IEF),[12] comprising those ecological features which are evaluated as being greater than Locally Important (Lower Value),[13]which may be impacted by the proposed development (NRA, 2009a) (**Section 6.5**).
- Identify the potential direct, indirect and cumulative impacts of the project that are probable or likely to occur during its lifetime (**Section 6.7**).
- Assess whether said impacts are likely to result in significant direct, indirect and cumulative effects upon the Important Ecological Features (**Section 6.7**).
- Where necessary propose mitigation measures to remove or reduce those impacts (**Section 6.8**).
- Assess the residual ecological effects of the project (those remaining after mitigation) (**Section 6.9**).

The distinction between 'impact' and 'effect' is clarified by the definitions in **Table 6-1**.

Table 6-1: Definitions used for the terms 'impact' and 'effect' (CIEEM, 2019)

Term	Definition
Impact	Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow.
Effect	Outcome to an ecological feature from an impact. For example, the effects on a pygmy shrew population from loss of a hedgerow.

6.1.2 Study Area

The study area for the proposed development site comprises the area within the red line boundary (the site proper), the adjacent lands in the area extending away from the boundary and any other lands supporting habitats or species considered ecologically connected to the site proper, should these be identified. It includes any sites designated for nature conservation on a national or international basis. The following were considered when identifying the potential study area at the initial stages of the drafting of this chapter:

- The characteristics, size and location of the proposed development.
- The ecological connectivity, if any, between the proposed development and the wider landscape.
- The full extent of surface water catchments which are hydrologically connected to the project.
- The presence of sensitive habitats and species in the study area.
- The presence of suitable habitats for sensitive species within the study area.
- The sensitivities of the relevant sensitive habitats and species.
- Identification of potential effect pathways to relevant sensitive habitats and species.

[11] See **Section 6.1.3**

[12] CIEEM (2019) guidance uses the concept of Important Ecological Features (IEF) rather than Key Ecological Receptors (KER) which, previously, was the commonly used term. IEF has been used in this chapter and the term is synonymous with KER.

[13] Further detail on this Evaluation Scheme is provided in **Section 6.1.5.1**

- The nature and extent of habitat connectivity for mobile, ranging fauna such as certain mammals and fish species.
- Foraging ranges of said fauna.

6.1.3 Zone of Influence

The zone of influence of the proposed development is the area over which ecological features may be affected by biophysical changes that result from the proposed development and its associated activities. The zone differs from project to project in light of the nature, size and location of each project and varies for different ecological features depending on their sensitivity to an environmental change. The features affected could include habitats, species, and ecosystems and the processes on which they depend. These features may be geographically distant from a proposed project, but their ecological interests may be indirectly affected by the construction and operation of it. CIEEM (2019) provides a definition of term 'zone of influence' and sets out the criteria by which the extent of the said zone may be determined.

Criteria to determine the zone of influence include:

- What 'important' ecological features are known to occur within the proposed development site and the surrounding area?
- What other 'important' ecological features could occur within the proposed development site and surrounding area based on knowledge of the local distribution of relevant habitats and species?
- What activities may generate ecological impacts and which of these might have an influence on ecological features beyond the site boundaries?
- Is the proposed development likely to affect migratory species?
- Is the area used by mobile species that make regular movements to, from, or across the site?
- What are the key ecological processes or species activity periods? Are there seasonal variations in distribution, abundance and activity?
- What are the key hydrodynamic processes at the site (e.g., river morphology, direction of flow, flooding)?
- Are there seasonal or cyclic variations in these?
- Does the proposed development affect, directly or indirectly, any internationally important sites[14] or sites of national importance[15], that are designated or likely to be designated in the foreseeable future? What are the reasons for designation?
- What is required for the maintenance of particular ecosystems, networks, habitats or species populations? How would these be affected by proposed development activities?
- What are their distribution and status elsewhere for comparison?
- What were their historical distributions, status and management compared with present?
- Is anything known about the key factors influencing distribution and abundance of the feature(s)?
- What are their scales of variation, vulnerability and likely exposure to the proposed development?

[14]Natura 2000 sites, Ramsar sites and Important Bird and Biodiversity Areas

[15] Natural Heritage Areas and proposed Natural Heritage Areas

- Are there any features whose disappearance would have significant consequences for other features?
- Are there any other projects planned within the same area or timeframe that may contribute to cumulative effects?

Using these criteria, a preliminary study of the geographical area extending away from the proposed development was completed and an assessment was made that the area within a 15 km radius of the proposed development was within a potential zone of influence of the proposal. This assessment relied on the combined professional experience, judgement and discretion of contributors to the field surveys and report authors.

6.1.4 Survey Area

The survey area comprises lands within the study area, particularly those within the red line boundary and areas adjacent, where detailed, targeted baseline ecological field surveys were carried out. These included surveys of habitats - terrestrial and aquatic - and non-avian faunal surveys. These are described in detail in **Sections 6.2.4** and **6.2.5**.

6.1.5 Assessment Criteria

This section outlines the criteria, set out in the relevant legislation, guidelines and policies, from which the evaluations of ecological features are derived and upon which the assessments of the ecological impact of the project on those features are based.

An assessment of the likely significant impacts or effects of the proposal is completed in **Section 6.7**, below. This is carried out with regard to the criteria outlined in various impact assessment guidelines (CIEEM, 2019; NRA, 2009a; EPA, 2017) that set down a number of parameters such as approximate magnitude, character, duration and reversibility that should be considered when determining which elements of the proposed development could constitute impact or sources of impacts. Once impacts are defined, their significance was categorised using EPA guidelines.

6.1.5.1 Criteria for Evaluation of Ecological Features

NRA (2009a) and CIEEM (2019) set out scientifically robust and objective methodologies, by which a geographic level of importance can be assigned to the conservation value of any particular habitat, feature, assemblage, species or individual. These criteria are based on the systematic hierarchical scales listed in **Table 6-2**. NRA (2009a), further, provides criteria (included, in tabulated format, in **Appendix 6-1**) for determining the appropriate evaluation of each ecological feature. As the hierarchical scales are broadly similar, and because the NRA criteria are specific to circumstances in Ireland, the NRA criteria have been used in this report to assess the value of the individual ecological features, identified in **Section 6.3**, within the proposed development site and its zone of influence.

Table 6-2: NRA (2009a) and CIEEM (2019) Evaluation Categories

NRA Scale	CIEEM Scale
International.	International and European.
National.	National.
County.	Regional.
Local Importance (Higher value).	Metropolitan, County, vice-county or other local authority-wide area
Local Importance (Lower Value).	River Basin District.
	Estuarine system/Coastal cell.
	Local.

Internationally Important Ecological Features (IEF) are either sites which are designated for conservation or which provide the best examples of habitats or internationally important populations of protected flora and fauna. Therefore, sites that are independently evaluated as being of international or national importance either by means of legislation or international convention are selected as IEF. The value of habitats outside these sites is assessed based on condition, size, rarity, conservation and legal status. The value of fauna is assessed on biodiversity value, legal status and conservation status. Biodiversity value is based on its national distribution, abundance or rarity, and associated trends.

On the basis of the criteria summarised in the preceding paragraphs all the ecological features within the zone of influence will be assigned an evaluation in **Section 6.5**, below. The features that are evaluated as being as being greater than Locally Important (Lower Value) will be selected as Important Ecological Features and the significance of any potential impacts and their effects on each of these receptors will be assessed in **Section 6.7**, below.

6.1.5.2 Description of Effects

EPA (2017) stipulates that an EIAR should focus on effects that are probable or likely to occur and sets out comprehensive criteria by means of which the effects that are reasonably foreseeable can be identified and their likelihood can be accurately predicted. These criteria are:

- Quality of Effects (**Table 6-3**).
- Significance of Effects (**Table 6-4**).
- Probability of Effects (**Table 6-5**).
- Duration and Frequency of Effects (**Table 6-6**).

Table 6-3: Quality of Effects [adapted from EPA (2017)]

Quality of Effect	Characteristic
Positive	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
Neutral	No effects or effects that is imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative/adverse	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

The definitions listed in **Table 6-4**, below, will be used, in **Section 6.7**, below, when quantifying significance of effects.

Table 6-4: Significance of Effects [adapted from EPA (2017)]

Significance of Effects	Definition
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.

Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.

Table 6-5: Probability of Effects [adapted from EPA (2017)]

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

The likely effects and their significance are discussed in detail in **Section 6.7**, below.

In order to accurately characterise the frequency of effects a description of how often the effect will occur will be used; these are: once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually. The definitions listed in **Table 6-6**, below, will be used, in **Section 6.7**, below, when quantifying the duration of effects.

Table 6-6: Duration and Frequency of Effects [adapted from EPA (2017)]

Duration	Corresponding Time Frame
Momentary.	Effects lasting from seconds to minutes.
Brief.	Effects lasting less than a day.
Temporary.	Effects lasting less than a year.
Short-term.	Effects lasting one to seven years.
Medium-term.	Effects lasting seven to fifteen years.
Long-term.	Effects lasting fifteen to sixty years.
Permanent.	Effects lasting over sixty years.
Reversible.	Effects that can be undone, for example through remediation or restoration.

The likely effects and their significance are assessed in detail in **Section 6.7**, below.

6.1.5.3 Prediction Confidence Level Criteria

The definitions listed in **Table 6-7**, below, will be used, in **Section 6.7**, below, when quantifying the confidence levels of the effects predicted.

Table 6-7: Confidence Levels of Predictions of Effects [adapted from NRA (2009a)]

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

6.1.6 Cumulative Effects

The cumulative impacts of the proposal are also assessed, in **Section 6.7.4**, below, by discussing the impact of the proposal, in terms of other developments that have planning permission, that are under construction, or are in existence in the area.

6.1.7 Mitigation: Rationale and Design

Where potential effects are assessed to be significant, mitigation measures have been incorporated into the project design to remove or reduce these effects. These are outlined in **Section 6.8**, below. The residual effects after mitigation are then assessed in **Section 6.9**, below.

6.1.8 Residual Impacts

After assessing the impacts of the proposed development and taking account of measures to avoid and mitigate ecological impacts, the residual effects after mitigation are assessed in **Section 6.9**, below.

6.2 METHODOLOGY

6.2.1 Consultation

Statutory and non-statutory bodies including, *inter alia*, the following, were consulted in relation to the proposed project:

- An Taisce.
- Dept of Communications, Climate Action and Environment.
- Dept of Culture, Heritage and the Gaeltacht.[16]
- The Heritage Council.
- Inland Fisheries Ireland (IFI).
- NPWS - District Conservation Officer.
- Irish Wildlife Trust.

Responses can be viewed in Chapter 1 of the EIAR.

6.2.2 Data Requests

A data request was submitted to NPWS for records of any rare or protected flora and fauna within the hectads encompassing the proposed project.

A data request was submitted to Bat Conservation Ireland (BCI) for records of any bat species within 10 km of the proposed project site.

6.2.3 Desk Study

A desktop review of the information available for the study area was undertaken. The study area includes lands on which the components of proposed development occur, as well as locations that may be geographically distant from the proposed development but whose ecological interests may be indirectly exposed to the impacts generated by the construction and operation of the proposed development.

The desk study undertaken for this assessment included a thorough review of the available ecological data including, *inter alia*, the following:

- Online resources:
    - National Parks and Wildlife Service (NPWS) mapping, data sets and literature.
    - National Biodiversity Data Centre (NBDC) mapping and data sets.
    - Environmental Protection Agency (EPA) water quality data and on-line mapping.

[16] Renamed as the Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media in September 2020.

- Inland Fisheries Ireland (IFI) reports.
- Geological Survey of Ireland (GSI) area maps.
- Ordnance Survey Ireland (OSI) 6", 25" and 1:50000 mapping and ortho-photography.
- Office of Public Works (OPW) national flood hazard mapping.
- Water Framework Directive Ireland mapping.
- Ramsar Sites Information Service mapping and data sets.
- Birdlife International Data Zone mapping and data sets.

6.2.4 Terrestrial Surveys

Multidisciplinary ecological surveys were conducted at the proposed development site during winter 2018/2019 and during spring, summer and autumn of 2019 and of 2020. The surveys were designed to provide comprehensive information on all ecological features present. These surveys are described in the sections below.

Detailed targeted surveys were carried out for habitats, mammals, invasive species and invertebrates owing to the features and locations of potential ecological significance which were recorded. These surveys were carried out in compliance with NRA (2009b).

6.2.4.1 Habitats

Dedicated terrestrial habitat surveys were undertaken between the summer and autumn of 2019. Following finalisation of the site layout, the wind farm was re-surveyed in April 2020. These surveys were supplemented by monthly visits to the site that occurred as part of the bird surveys that were conducted from September 2018 to August 2020 and the site visits required as part of the 2019 and 2020 bat surveys.

The habitat surveying, categorisation and mapping of habitats recorded, had regard to the national standards as outlined in Smith *et al*. (2011) and Fossitt (2000) and incorporated a targeted survey for rare or protected species and habitats present within the study area. Habitat boundaries and associated attribute data were mapped using desk-based GIS software, namely ArcView (10.2.2) which was also used to calculate habitat areas and lengths.

Once the baseline ecological survey and mapping was complete, any Important Ecological Features and resources were identified. The results of the survey are discussed in **Section 6.3.3**, below.

6.2.4.2 Protected Flora

During the surveys described in the preceding section surveyors completed an exhaustive search of the habitat features likely to support protected species including:

- The plant species listed in Annex II of the EU Habitats Directive.
- Flora Protection Order species.[17]
- Flora species listed in The Irish Red Data Book (Wyse Jackson *et al.*, 2016).

Plant nomenclature for vascular plants followed Parnell *et al*. (2012) and Blamey *et al*. (2003), respectively. Mosses and liverworts followed Atherton *et al.* (2010).

[17] S.I. No. 355/2015

6.2.4.3 Invasive Plant Species

During the surveys described in **Section 6.2.4.1** a search for Invasive Alien Plant Species (IAS) was completed. Any IAS recorded was documented with details on the GPS location and the size and area of infestation. During surveys particular focus was given to species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) (Amendment) Regulations 2015.[18] The surveys encompassed two growing seasons (2018 and 2019). The surveys were based on the Transport Infrastructure Ireland (TII) guidelines detailed in NRA (2010).

6.2.4.4 Mammals (bat species)

Bat surveys were completed in the study area in summer of 2019, and in the spring, summer and autumn of 2020. While SNH (2019) was the primary guidance on which the surveys were based, cognisance was also taken of Kelleher *et al.* (2006), BCI (2012) and Collins (2016).

Subsequent analysis of the bat survey results was undertaken, and a bat survey report was compiled. The bat survey reports, which include full details of methodologies followed, results and impact assessments are provided in **Appendix 6-2** and **Appendix 6-3**.

6.2.4.5 Other Mammals

Desk studies, initial ecology walkover surveys, habitat surveys and information obtained during public consultations informed the scope of the mammal surveys.

Mammal surveys included habitat suitability assessments and targeted walkovers, following the methodologies outlined in SNH, (2003), Chanin (2003), Bang *et al.* (2004), NRA (2009b) and Muir *et al*. (2013).

Targeted mammal surveys included checking for evidence of activity such as prints, droppings, burrow-holes, dens and food caches, activity trails, disturbed vegetation, and direct visual observations in suitable breeding and foraging habitats.

6.2.4.6 Amphibians and Reptiles

Common frog (*Rana temporaria*), smooth newt (*Lissotriton vulgaris*) and common lizard (*Lacerta vivipara*) are all protected species under the Wildlife Acts and have a widespread distribution in Ireland. During initial walkover surveys at the study area in 2018, habitat suitability for these protected species was recorded. During subsequent ecology surveys presence or incidental sightings of these species was recorded.

The smooth newt, formerly *Triturus vulgaris*, is the only native newt species found in Ireland. Common frog is the only species of frog found in Ireland and is listed as an internationally important species.[19] Frogs are protected under the European Union Habitats Directive and by the Irish Wildlife Acts.

6.2.4.7 Macro-invertebrates

All macro-invertebrates encountered during field investigations were recorded.

[18] SI 477 of 2011, as amended

[19] http://www.ipcc.ie/a-to-z-peatlands/frogs/

6.2.5 Aquatic Surveys

The detailed aquatic surveys report, including details of surveys completed, methodologies followed, survey locations and results is provided in **Appendix 6-4.** Information collated from desk studies and field surveys has also been included in the aquatic ecology report.

The physical characteristics of the surface water features within and adjacent to the proposed development site were recorded. The substrates were noted with reference to Fossitt (2000) and flow characteristics with reference to EA (2003). The riverine habitats' suitability for salmonids were evaluated with due cognisance of Hendry *et al.* (2003). An evaluation of lamprey nursery habitat was also carried out based on the habitat requirements of juvenile lampreys as outlined in Maitland (2003). To evaluate habitat for macroinvertebrates, criteria in Barbour *et al.* (1991) was used. Any fish captured were identified with reference to Maitland (2004).

The following sub-sections summarise the aquatic surveys completed for the project.

6.2.5.1 Physicochemical sampling

Field sampling of the physicochemical properties of streams adjacent to the site was carried out in 2020. The locations of the sampling points are illustrated in **Figure 6-1**; the results are listed in **Table 6-36**, **Section 6.3.4.1**.

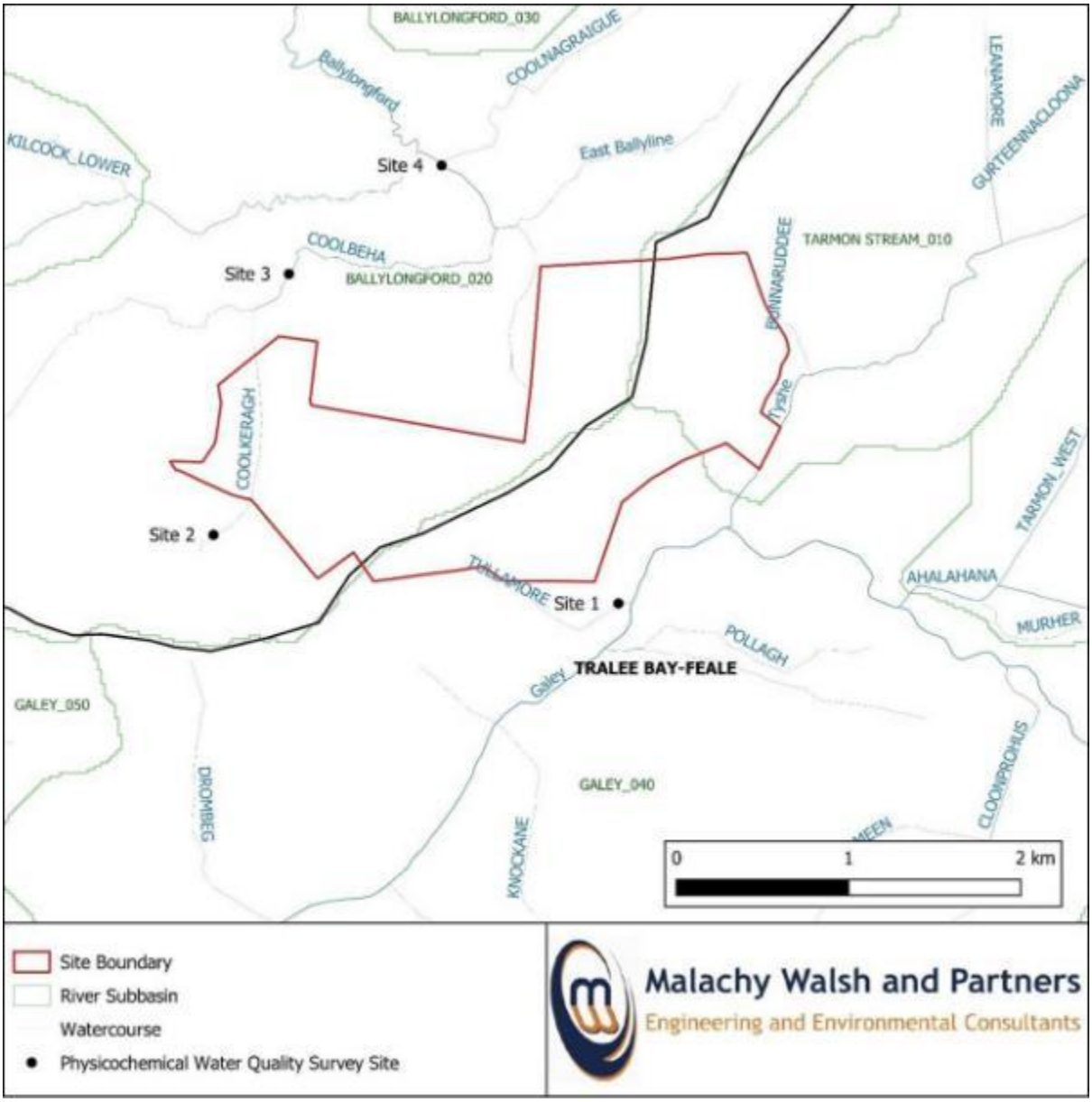


Figure 6-1: Physicochemical water quality sampling points.

Qualitative sampling of benthic macro invertebrates was undertaken at 5 locations on watercourses draining the proposed development during August and September 2020. These locations are identified in **Table 6-8** and illustrated in **Figure 6-2.**

Table 6-8: Locations surveyed on watercourses draining the proposed development during August and September 2020.

Site		Site 1	Site 2	Site 3	Site 4	Site 5
Coordinate	X	97825	104398	101847	99305	98356
	Y	137199	138384	140148	143412	141870
Hydrometric Area		23	23	23	24	24
Basin sub code		23_1	23_3	23_1	24_9	24_9
Watercourse		Galey	Galey	Tarmon Stream	Ballylongford[20]	Ballylongford
RWB name		Galey_040	Galey_030	Tarmon Stream_010	Ballylongford_020	Ballylongford_010

[20] The Coolkeragh and Ballyline rivers drain to the Ballylongford River.

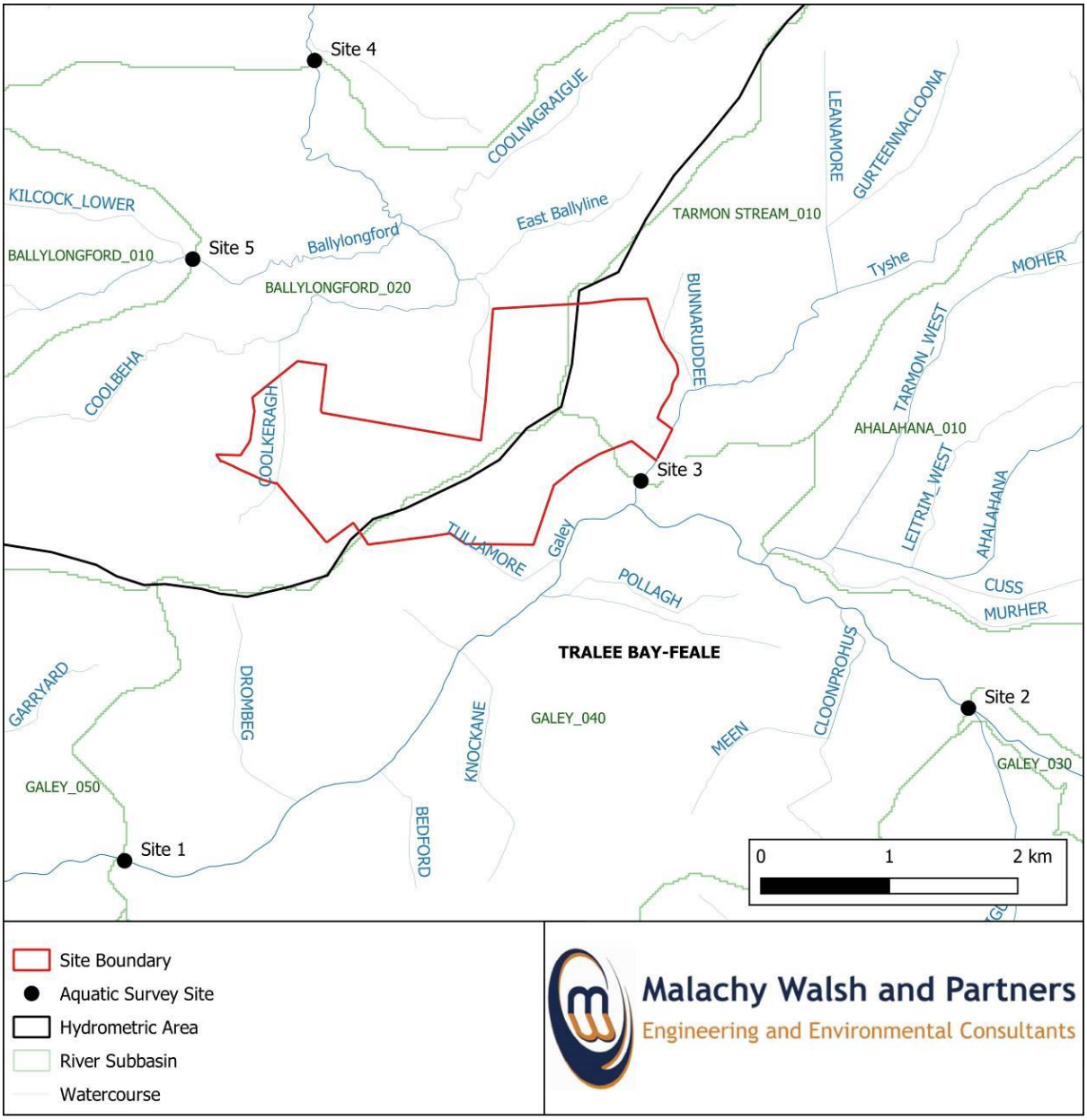


Figure 6-2: Locations surveyed on watercourses draining the proposed development during August and September 2020.

6.2.6 Statement on Limitations and Difficulties Encountered

Limitations to methodologies, procedures, equipment and knowledge can arise during the course of an ecological assessment. Some limitations may be foreseen and can be accounted for while others may not be apparent until the actual assessment has taken place.

No significant limitations or difficulties were encountered.

6.2.7 Competency of Assessor

All assessments have been carried out by appropriately qualified, trained and competent professionals with years of experience. This Biodiversity Chapter was prepared by Patrick Ryan (BSc Hons Wildlife Biology), staff ecologist at Malachy Walsh and Partners (with input on aquatic ecology from Gerard Hayes senior aquatic ecologist with the same firm). He has 10 years' experience in ecological impact assessment and the appropriate assessment process and. He has completed numerous ecological assessments for a variety of projects, including wind farm proposals. He is an experienced field

ecologist and has a diverse ecological profile, including flora identification, habitats, mammals (including bats), birds, amphibians, and terrestrial invertebrates.

This report was reviewed by Gerard Hayes (Ba. Sc.). He is a senior aquatic ecologist with over 13 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 has had numerous responsibilities including waste assimilation capacity assessment, report writing (EIS, EIA, EA, AA, NIS) and ecological monitoring. His project involvement has been primarily in the areas of wind energy development, wastewater treatment plants, roads/bridges, water supply, flood defense and hydro schemes. He is co-author and/or carried out surveys for the National Parks and Wildlife Service Irish Wildlife Manual Nos. 15, 24, 26, 37, and 45.

More detail on these personnel can be found in **Chapter 1.**

6.2.8 Scientific Nomenclature: Conventions

Species nomenclature follows the standard form of common name, followed by the binomial, on first instance of usage in the text and first instance of usage in a table. Thereafter, for any subsequent usage, common names only are used. The full list of species in standard form is included in **Appendix 6-5**.

6.3 EXISTING RECEIVING ENVIRONMENT

6.3.1 Data Requests

6.3.1.1 National Parks and Wildlife Service

Sensitive data records from the NPWS (received 21/09/2020).

Records of protected faunal species, which are dated from the year 2000 onwards, that are retained by the NPWS for the 10 km grid squares overlapping the proposed development site, are listed in **Table 6-9**. No records of Flora Protection Order[21] species were included in the results received.

Table 6-9: NPWS Records: Non-avian Faunal species

Species	Level of protection	Grid
Mammals		
Badger (*Meles meles*)	Wildlife Acts 1976 to 2018.	Q94
Irish hare (*Lepus timidus* subsp. *hibernicus*)	Wildlife Acts 1976 to 2018.[22] EU Habitats Directive Annex V.[23]	Q94
Otter (*Lutra lutra*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV.	Q93 Q94
Fish		
Sea lamprey (*Petromyzon marinus*)	EU Habitats Directive Annex II.	Q93, R03
Molluscs		
Freshwater pearl mussel (*Margaritifera margaritifera*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV.	Q93

[21] S.I. No. 356 of 2015.

[22] Under S.I. No. 331/1998 - Wildlife (Wild Mammals) (Open Seasons) Order, 1998, hares may be shot, coursed or hunted in the period September to February.

[23] Annex V species are those species of community interest whose taking in the wild and exploitation may be subject to management measures.

Narrow-mouthed whorl snail (*Vertigo angustior*)	EU Habitats Directive Annex II.	Q94
Arthropods		
Marsh fritillary (*Euphydryas aurinia*)	EU Habitats Directive Annex II	Q93
White-clawed crayfish (*Austropotamobius pallipes*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex V.	R03

6.3.1.2 Bat Conservation Ireland

Available records were provided by Bat Conservation Ireland on 16th of July 2020. The records received include roost locations (**Table 6-10**), results from transect surveys (**Table 6-11**) and Ad-hoc observations (**Table 6-12**). Grid references for all these data were provided by BCI, however, in light of the sensitivity of the data, in order to blur the resolution of the locations the specific locations are not identified in the tables below and the locations shown are indicative. As the key issue is the distribution of these records relative to the location of the proposed development site, it is considered that this level of detail is sufficient for the purposes of the assessments carried out in this chapter.

In Ireland there are 9 resident bat species of two families (Rhinolophidae and Vespertilionidae). These species are:

- **Rhinolophidae:**
  - Lesser horseshoe bat (*Rhinolophus hipposideros*).
- **Vespertilionidae:**
  - Daubenton's bat (*Myotis daubentoni*).
  - Whiskered bat (*Myotis mystacinus*).
  - Natterer's bat (*Myotis nattereri*).
  - Common pipistrelle (*Pipistrellus pipistrellus*).
  - Soprano pipistrelle (*Pipistrellus pygmaeus*).
  - Nathusius' pipistrelle (*Pipistrellus nathusii*).
  - Leisler's bat (*Nyctalus leisleri*).
  - Brown long-eared bat (*Plecotus auritus*).

Of these, only lesser horseshoe bat and Nathusius' pipistrelle were not included in the data received from BCI.

Table 6-10: Roost location

Location	Species
Tarbert area	Soprano pipistrelle & whiskered bat

Table 6-11: Transect surveys

Location	Species
Listowel area	Brown long-eared bat, common pipistrelle, soprano pipistrelle, Daubenton's bat, unidentified bat.
Finuge area	Daubenton's bat, unidentified bat.

Table 6-12: Ad-hoc records

Location	Species
< 2 km south east	Common pipistrelle, soprano pipistrelle, Daubenton's bat, unidentified bat.
< 2 km south west	Soprano pipistrelle.
< 2 km north	Leisler's bat, common pipistrelle, soprano pipistrelle.
< 3 km north east	Leisler's bat, common pipistrelle, soprano pipistrelle.
< 5 km north east	Leisler's bat, common pipistrelle, soprano pipistrelle.
Newtownsandes/Knocanure	Leisler's bat, common pipistrelle, soprano pipistrelle, *Myotis* spp.
Newtownsandes area	Daubenton's bat, Leisler's bat, common pipistrelle.

Location	Species
Tarbert area	Common pipistrelle, soprano pipistrelle, Daubenton's bat.
Listowel area (a)	Daubenton's bat, Natterer's bat, Leisler's bat, common pipistrelle, soprano pipistrelle.
Listowel area (b)	Common pipistrelle, soprano pipistrelle.
Listowel area (c)	Brown long-eared bat, Daubenton's bat, Leisler's bat, common pipistrelle.

6.3.2 Desk Study

6.3.2.1 Proximity to Designated Conservation Sites and Other Ecologically Significant Areas

6.3.2.1.1 Sites of International Importance

6.3.2.1.1.1 Natura 2000 Sites

Natura 2000 sites are sites of international importance, protected under European legislation. Two types of sites are incorporated within the Natura 2000 network. Special Areas of Conservation are protected under the European Union (EU) Habitats Directive (92/43/EEC); Special Protection Areas were initially designated under Directive 79/409/EEC, The Directive on the Conservation of Wild Birds, commonly known as the Birds Directive, and are now protected as Natura 2000 Sites under the EU Habitats Directive. The Natura 2000 sites within 15 km of the development site are:

- Lower River Shannon SAC (002165).
- River Shannon and River Fergus Estuaries SPA (004077).
- Moanveanlagh Bog SAC (002351).
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161).

As per the criteria described in **Section 6.1.5.1** these sites are selected as Important Ecological Features (IEF).

Articles 6(3) and 6(4) of the Habitats Directive lay down the permit procedure to be followed in cases where a plan or project, not directly connected with or necessary to the management of a Natura 2000 site, is likely to have a significant effect thereon, either individually or in combination with other plans or projects. Article 6(3) of the Directive states that:

> *Any plan or project not directly connected with or necessary to the management of the site*[24] *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 Ireland, the provisions of Article 6(3) pertain, *inter alia*, to proposed developments that are subject to the provisions of Section 177U of the Planning and Development Act (PDA), 2000[25] (as amended). An assessment carried out under Article 6(3) must, therefore, be completed before a consent decision can be made for the proposed wind farm development that is the subject matter of the current application. Consent approval under the PDA, 2000, can only be given after the competent authority, in this case An Bord Pleanála, has made certain that the proposed development will not adversely affect the integrity of the Natura 2000 site(s), relevant to the particular project or plan, in view of said sites' Conservation Objectives. This can only be the case where "no reasonable scientific doubt

[24] The meaning here is Natura 2000 site(s)

[25] Number 30 of 2000.

remains as to the absence of such effects"[26]. To that end a report for screening for Appropriate Assessment has been prepared (**Appendix 6-6**). This report concluded:

> [o]*n the basis of objective information, that the project, either individually or in combination with other plans or projects, will not have a significant effect on the following Natura 2000 sites:*
>
> - *Moanveanlagh Bog SAC (002351)*
> - *Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (004161)*
>
> *However, in the absence of mitigation, it is concluded that significant effects, which, potentially, could ensue from water quality impacts identified …. cannot be precluded for the following Natura 2000 sites:*
>
> - *Lower River Shannon SAC (002165)*
> - *River Shannon and River Fergus Estuaries SPA (004077)*
>
> *Therefore, further assessment is required to determine whether the proposed development is likely to adversely affect the integrity of these Natura 2000 sites. This assessment will be presented in a Natura Impact Statement (NIS).*

The screening report for AA and the NIS (**Appendix 6-7**) have been prepared 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 farm development.

Notwithstanding that these Natura 2000 sites have been selected as IEF; in light of the conclusions of the screening report and bearing in mind that a Natura Impact Statement is available, and because the completion of the AA process is a reserved competence of ABP, the Natura 2000 sites listed above will not be considered further in this chapter.

6.3.2.1.1.2 Important Bird & Biodiversity Areas (IBAs)

The IBA programme is a BirdLife International initiative aimed at identifying and protecting a network of critical sites for the conservation of the world's birds. There are 156 IBA's in Ireland including 140 in the Republic of Ireland and 16 in Northern Ireland, 122 of which support wintering water birds. These sites are important for breeding seabirds and for wintering wildfowl.

There is one IBA[27] site namely, the Shannon and Fergus Estuaries IBA (IE68) site, within 15 km. The site, which is encompassed within the River Shannon and River Fergus Estuaries SPA (004077), comprises a large area situated in the inner reaches of the Shannon Estuary which extends from Foynes to Limerick City and includes a number of sub sites distributed along the Clare and Kerry coasts of the Shannon Estuary. The nearest of the two sub sections on the Kerry coast is situated to the north of the proposed wind farm development. This sub section stretches from Ballylongford Bay to Kilconly Point and incorporates Bunaclugga Bay and is, therefore, at its nearest point, approximately 2.7 linear kilometres north, and approximately 5.8 river kilometres downstream, of the proposed development site boundary. This is one of the most important sites in Ireland for wintering and migrating waterfowl,

[26] ECJ Case C-127/02 Landelijke Vereniging tot Behoud van de Waddenzee.

[27] http://www.birdlife.org

supporting 10 species in numbers of international importance and a further 13 species occur in numbers of national importance. Species[27] listed for this site comprise:

- Curlew (*Numenius arquata*).
- Greenshank (*Tringa nebularia*).
- Greylag goose (*Anser anser*).
- Lapwing (*Vanellus vanellus*).
- Pintail (*Anas acuta*).
- Shelduck (T*adorna tadorna*).
- Shoveler (*Anas clypeata*).
- Teal (*Anas crecca*).
- Wigeon (*Anas penelope*).
- Whooper swan (*Cygnus cygnus*).

As per the criteria described in **Section 6.1.5.1** this site is selected as an Important Ecological Feature (IEF).

6.3.2.1.1.3 Ramsar Sites

The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat, is an international treaty that was established for the conservation and sustainable use of wetlands. The Ramsar Convention was ratified by Ireland in 1984 and came into force for Ireland on 15 March 1985. Ireland presently has 45 sites designated as Wetlands of International Importance, with a surface area of 66,994 hectares.

There are no Ramsar sites within 15 km of the proposed development[28].

6.3.2.1.2 Sites of National Importance

The basic designation for wildlife in Ireland is the Natural Heritage Area (NHA). This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. In addition to 148 NHAs there are 630 proposed Natural Heritage Areas (pNHA) which have not yet been statutorily proposed or designated. Prior to statutory designation, pNHAs are subject to limited protection including in the areas of agri-environmental farm planning schemes, certain Forest Service requirements pertaining to payment of afforestation grants and recognition of the ecological value of pNHAs by Planning and Licensing Authorities. The NHA and pNHA sites within 15 km of the development site are listed in **Table 6-13**, below[29]. There are no site synopses available for these sites.

Table 6-13: Sites of national importance located within 15 km of the proposed development

Site Name & Code	Reason for site selection	Distance from designated site
Bunnaruddee Bog NHA (001352)	Peatlands.	Proposed development site is 0.9 km north west of the NHA.

[28] https://rsis.ramsar.org/

[29] http://dahg.maps.arcgis.com/apps/webappviewer/

Site Name & Code	Reason for site selection	Distance from designated site
Ballylongford Bay pNHA (001332)	Brackish lagoon and areas of reed beds have been designated as part of the Ballylongford Bay. This pNHA overlaps with the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	Proposed development site is 3.6 km to the south west of the pNHA.
Moanveanlagh Bog pNHA (000374)	This pNHA is collocated with the Moanveanlagh Bog SAC (002351).	Proposed development site is 5.6 km north west of the pNHA.
Tarbert Bay pNHA (001386)	The Tarbert Bay pNHA site consists of a sandy intertidal bay fringed by saline vegetation and also includes some deciduous woodland. The site is important for wintering waterfowl as it overlaps with River Shannon and River Fergus Estuaries SPA (004077). and the Lower River Shannon SAC (002165).	Proposed development site is 8.1 km south west of the pNHA.
Cashen River Estuary pNHA (0013400)	Historic rare plant records, whooper swan wintering site and the presence of otter. Overlaps with Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	Proposed development site is 10.1 km north east of the pNHA.
Scattery Island pNHA (001911)	Scattery Island lies c. 2 km offshore from Kilrush. It is composed of glacial till, with soft cliffs on the western side. There is a tidal lagoon, and some areas of salt marsh. Most of the island is grassland in light agricultural use. This pNHA overlaps with the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	Proposed development site is 10.6 km south of the pNHA.
Beal Point pNHA (001335)	Beal Point is a small coastal site (c. 32 ha) on the southern shore of the mouth of the Shannon estuary. Primarily the site is a sand dune system, formerly managed by a rabbit warren but now frequently used for cattle grazing. To the east of the point there is a small area of salt marsh. This pNHA overlaps with the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	Proposed development site is 11.2 km south east of the pNHA.
St. Senan's Lough pNHA (001025)	It is an acidic lake with adjoining marsh habitats. Acidic wetlands of this type support only small numbers of waterfowl in comparison with calcareous systems.	Proposed development site is 12.9 km south west of the pNHA.
Clonderalaw Bay pNHA (000027)	This pNHA overlaps with the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	Proposed development site is 13.2 km south west of the pNHA.
Poulnasherry Bay pNHA (000065)	Poulnasherry Bay is situated near the mouth of the Shannon estuary. It is a wide stony estuary with abundant growths of brown seaweed (*Fucus* spp.) and green algae. Poulnasherry Bay is an important ornithological site, forming part of the Shannon and Fergus estuarine complex. This pNHA overlaps with the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).	Proposed development site is 14.2 km south of the pNHA.

6.3.2.2 National Biodiversity Data Centre

6.3.2.2.1 Protected Species

Records of protected faunal species, which are dated from year 2000 onwards, and that are retained by the NBDC for the 10 km grid squares overlapping the proposed development site, are listed in **Table 6-14**. The Flora Protection Order species for which a record is retained is listed in **Table 6-15**.

Table 6-14: NBDC Records: Non-avian faunal species

Species	Level of Protection	Grid
Terrestrial Mammals		
Badger	Wildlife Acts 1976 to 2018.	Q93, Q94, R03, R04
Hedgehog (*Erinaceus europaeus*)	Wildlife Acts 1976 to 2018.	Q93 R04
Irish hare	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex V.	Q93, Q94, R03
Irish stoat (*Mustela erminea* subsp. *hibernica*)	Wildlife Acts 1976 to 2018.	Q93. R03
Otter	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV.	Q93, Q94, R03, R04
Pygmy shrew (*Sorex minutus*)	Wildlife Acts 1976 to 2018.	Q93
Red squirrel (*Sciurus vulgaris*)	Wildlife Acts 1976 to 2018.	Q93, R03, R04
Marine Mammals		
Bottle-nosed dolphin (*Tursiops truncatus*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV. Whale Fisheries Act 1937.	R04
Short-beaked common dolphin (*Delphinus delphis*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV. Whale Fisheries Act 1937.	Q94
Harbour porpoise (*Phocoena phocoena*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV. Whale Fisheries Act 1937.	Q94
Common seal (*Phoca vitulina*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV.	R04
Grey seal (*Halichoerus grypus*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV.	Q94, R04
Long-finned pilot whale (*Globicephala melas*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV. Whale Fisheries Act 1937.	Q94
Amphibians		
Common frog (*Rana temporia*)	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex V.	Q93, Q94, R03, R04
Smooth newt (*Lissotriton vulgaris*)	Wildlife Acts 1976 to 2018.	Q93, R03, R04
Reptiles		
Common lizard (*Zootoca vivipara*)	Wildlife Acts 1976 to 2018.	R03
Fish		
European eel (*Anguilla Anguilla*)	Wildlife Acts 1976 to 2018.	Q93, Q94
Molluscs		
Freshwater pearl mussel	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex IV.	Q93

Narrow-mouthed whorl snail	EU Habitats Directive Annex II.	Q94
Arthropods		
Marsh fritillary	EU Habitats Directive Annex II.	Q93
White-clawed crayfish	Wildlife Acts 1976 to 2018. EU Habitats Directive Annex II, Annex V.	R03

Table 6-15: Flora Protection Order species

Species	Grid
Liverworts	
Ribbonwort (*Pallavicinia lyellii*)	Q94

6.3.2.2.2 Invasive Alien Species

Records of invasive alien faunal species, which are dated from year 2000 onwards and that are retained by the NBDC for the 10 km grid squares overlapping the proposed development site, are listed in **Table 6-16**. Invasive alien faunal species for which records are retained are listed in **Table 6-17**. The compilation of these data was for the purposes of informing the design of the ecological surveys, described in **Section 6.2.4**, to ensure that all surveyors were cognisant of the potential presence of these species at, and in the area around, the proposed development site. None of these species will be included in the evaluation identifying the IEF completed in **Section 6.5**.

Table 6-16: Invasive Alien Species (faunal)

Species	Risk Rating	Grid
American mink (*Mustela vison*)	Risk of High Impact.	Q94, R04
Brown rat (*Rattus norvegicus*)	Risk of High Impact.	Q93, R03, R04
Rabbit (*Oryctolagus* cuniculus)	Risk of Medium Impact.	Q93, Q94, R03
Fallow deer (*Dama dama*)	Risk of Medium Impact.	R03, R04
House mouse (*Mus musculus*)	Risk of High Impact.	R04
Sika deer (*Cervus nippon*)	Risk of High Impact.	Q94, R04

Table 6-17: Invasive Alien Species (floral)

Species	Risk Rating	Grid
Common cord-grass (*Spartina anglica*)	High Impact.	Q94, R04
Blackcurrant (*Ribes nigrum*)	Medium Impact.	Q93
Canadian waterweed (*Elodea canadensis*)	High Impact.	Q93, R03
Cherry laurel (*Prunus laurocerasus*)	High Impact.	Q93, R03
Giant hogweed (*Heracleum mantegazzianum*)	High Impact.	R03
Giant-rhubarb (*Gunnera tinctoria*)	High Impact.	Q94, R03, R04
Indian balsam (*Impatiens glandulifera*)	High Impact.	Q93, Q94, R03, R04
Japanese knotweed (*Fallopia japonica*)	High Impact.	Q93, Q94, R03, R04
Japanese rose (*Rosa rugosa*)	Medium Impact.	R03
Pitcher plant (*Sarracenia purpurea*)	Medium Impact.	R03
Rhododendron (*Rhododendron ponticum*)	High Impact.	R03, R04
Spanish bluebell (*Hyacinthoides hispanica*)	Not specified.	R04
Sycamore (*Acer pseudoplatanus*)	Medium Impact.	Q93, Q94, R03, R04
Three-cornered garlic (*Allium triquetrum*)	Medium Impact.	Q93, R03, R04
Traveller's-joy (*Clematis vitalba*)	Medium Impact.	Q93

6.3.2.2.3 Bat Habitat Suitability Index

The National Biodiversity Data Centre's online mapper[30] includes a Bat Habitat Suitability Index (BHSI) layer derived from an analysis of the habitat and landscape associations of Irish bats compiled in Lundy *et al.* (2011). The index evaluation ratings range from 0 to 100 with 0 being the least favourable and 100 the most favourable for bats. Index evaluations are available for each individual species and an overall rating is also available for all species in combination. As the ratings are mapped to a 2 km grid square resolution, multiple ratings are available for areas that extend beyond this 2 km scope. The reference area, to which the indices listed in **Table 6-18** relate, comprises the proposed wind farm development site and the geographical area most adjacent. In order to ensure that the BHSI ratings for the proposed wind farm development site and its surrounds are fully described, the reference area, to which the indices listed in **Table 6-19** relate, comprises a 40 km^2 area that encompasses the proposed wind farm development site, lands adjacent and the wider geographical area[31].

Table 6-18: BHSI Ratings

Species	Rating
All bats	20.44
Nathusius' pipistrelle	9
Whiskered bat	9
Daubenton's bat	22
Natterer's bat	18
Common pipistrelle	29
Leisler's bat	26
Soprano pipistrelle	34
Brown long-eared bat	31
Lesser horseshoe bat	6

The BHSI ratings listed in **Table 6-19** that fall within different data classes are listed in **Table 6-20** and the percentages of the total that fall within different data classes are included. As can be seen from **Table 6-20** while there is a degree of variation in the ratings listed, the area encompassed within the 4 hectads is, quite consistently, of relatively low value to bats of all species. Only 5.6% of the ratings across this considerable expanse of the landscape, that surrounds the proposed wind farm development site, are above 40 and 62.3% have a rating below 30. These ratings, while not predictive, provide meaningful metrics that characterise the probable value of the area within and surrounding the proposed wind farm development site to bat species and are an indicator as to the likelihood that different bat species are, or are not, likely to, typically, be a significant presence in the area within and around the site. This likelihood then, in turn, indicates the probability that bats may use the proposed development site.

Table 6-19: BHSI Ratings for 4 hectads encompassing proposal site and surrounds

Species	Suitability Index Rating								
	Q94		RO4		Q93			R03	
All bats	17.67	31	21.11	30.33	20.56	28.56	25.44	21.11	23.33
Nathusius' pipistrelle	11	26	12	31	3	3	2	3	2
Whiskered bat	4	14	8	19	9	20	11	7	12
Daubenton's bat	17	28	23	24	30	30	34	23	25
Natterer's bat	16	31	18	29	20	28	26	19	22
Common pipistrelle	27	36	31	34	30	40	35	32	35
Leisler's bat	23	36	27	34	28	39	34	29	32

[30] https://maps.biodiversityireland.ie/Map

[31] The 40 km^2 area encompassed within hectads Q93, Q94, R03 and R04.

Soprano pipistrelle	31	41	35	40	35	44	40	37	38
Brown long-eared bat	25	42	31	43	33	45	39	33	36
Lesser horseshoe bat	5	25	5	19	7	8	8	7	8

Table 6-20: BHSI Ratings from Table 6-18 within data classes

Data Class (1)	Number	%	Data Class (2)	Number	%
0 - 1	0	0	**0 - 10**	16	17.8
2 - 5	8	8.9			
6 - 10	8	8.9			
11 - 15	5	5.6	**10 - 20**	14	15.6
16 - 20	9	10.0			
21 - 25	12	13.3	**20 - 30**	26	28.9
26 - 30	14	15.6			
31 - 35	19	21.1	**30 - 40**	29	32.2
36 - 40	10	11.1			
41 - 45	5	5.6	**> 40**	5	5.6

6.3.2.3 EPA Biological Water Quality Records

EPA biological water quality ratings available for the nearest stations on watercourses draining the proposed development site are listed in **Table 6-21**. As can be seen, while there is a degree of variation, the general trend over time for the watercourses has been one of improvement in biological water quality.

Table 6-21: EPA biological water quality ratings at stations on watercourses draining the proposed development site.

Watercourse		Galey	Galey	Tarmon	Ballylongford[32]	Ballylongford
EPA station		23G010500	23G010400	23T030500	24B030700	24B030400
Station		Shrone Bridge	Galey Bridge	Gabbets Bridge	Gortanacooka Bridge	Bridge SW of Shrone
Year	2001	Good	Moderate	Poor	Moderate	
	2005	Good	Moderate	Poor	Moderate	Poor
	2007	Moderate	Good	Poor	Good	Moderate
	2011	Good	Moderate	Poor	Good	Moderate
	2014	Moderate	Moderate	Moderate	Moderate	Poor
	2017	Good	Moderate	Moderate	Good	Good

6.3.3 Terrestrial Surveys

6.3.3.1 Habitats Recorded

The Fossitt (2000) habitats recorded at the proposed development site (PDS) are listed in **Table 6-22** with a description of their distribution within the site and the area they occupy. The Level 3 habitats are illustrated in **Figure 6-3**.

[32] The Coolkeragh and Ballyline rivers drain to the Ballylongford River.

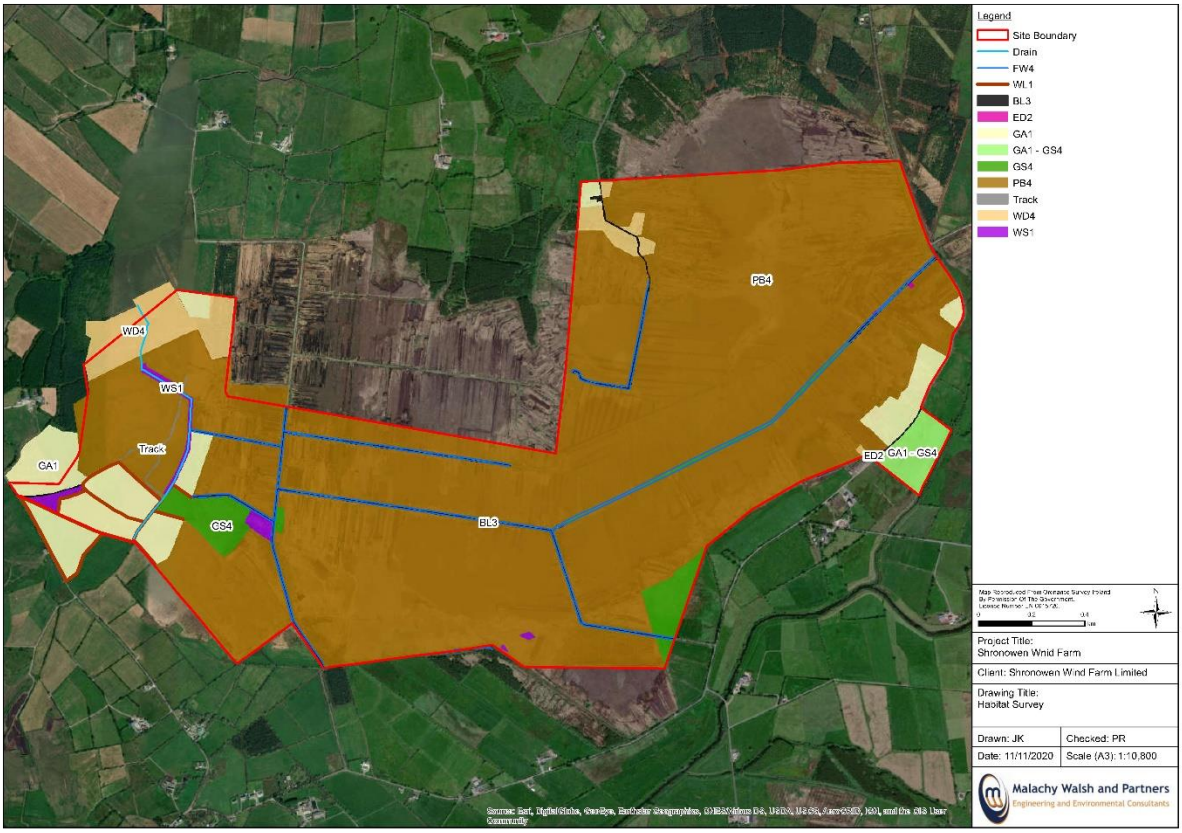


Figure 6-3: Fossitt (2000) habitats with proposed layout..

Table 6-22: Fossitt (2000) habitats recorded within the proposed development site

Level 1[33]	Level 2[34]	Level 3[35]	Location/distribution	Area within proposed development site
B Cultivated and built land	**BL Built land**	Buildings and artificial surfaces BL3	A substantial linear network of unpaved tracks/roads is present mostly in the western part of the PDS.	2.5527 ha
E Exposed rock and other disturbed ground	**ED Disturbed ground**	Spoil and bare ground ED2	A small section is present adjacent to the existing eastern entrance to the bog.	0.1471 ha
F Freshwater	**FW Watercourses**	Lowland depositing rivers FW2	One natural water course, the Coolkeragh stream a tributary of the Ballyline, traverses adjacent to the site boundary at the western part of the PDS for a short distance.	0.0 ha
		Drainage ditches FW4	The PDS includes an extensive network of drains both within the peat mass area and along the network of tracks present.	14,760 ha

[33] Level 1: Broad habitat groups.

[34] Level 2: Habitat subgroups.

[35] Level 3: Habitats

G Grassland & Marsh	**GA Improved grassland**	Improved agricultural grassland GA1	The dominant habitat in the area surrounding the PDS. Also present in the western section of the PDS.	18.3189 ha
	GS Semi-natural grassland	Wet grassland GS4	Some small areas of wet grassland are present.	10.0804 ha
	GA/GS Mosaic	GA1/GS4	Small mosaic areas are present.	4.5517 ha
P Peatlands	**PB Bogs**	Cutover bog PB4	The habitat that comprises the majority of the area within the PDS.	314.2277 ha
W Woodland and scrub	**WD Highly modified/non-native woodland**	Conifer plantation WD4	Rectilinear plantations of Sitka spruce of varying age classes are situated on the northern 'fringe' of the PDS and lands surrounding.	10.142 ha
	WS Scrub/transitional woodland	Scrub WS1	Present at a number of locations primarily in the western section of the PDS and lands surrounding.	2.8805 ha
	WL Linear woodland/scrub	Hedgerows WL1	Present in the field boundary system of the agricultural lands in the western section of the PDS and lands surrounding.	1,444 m

6.3.3.2 Terrestrial Fauna

The preceding sections described the existing habitats and flora at and within the environs of the proposed development site, based on desk and field studies. The disturbed areas of cutover bog, together with the modified character of other habitats (commercial forestry) results in generally impoverished habitats for faunal species. The species that comprise the fauna of the receiving environment are presented in the following sections. An ecological evaluation of the importance of each species or group of species (ecological receptor) is presented in **Section 6.5**.

6.3.3.2.1 Mammals (Bat species)

6.3.3.2.1.1 2019 Surveys

A total of 2,255 vocalisations generated by bats, including vocalisations to which a species or genus could not be attributed, were recorded during the 10 nights of deployment of the detectors during the 2019 surveys (see **Table 6-23**). The hourly average rates for each species, at each Sampling Point (SP), are listed in **Table 6-24**. The locations of the 4 SPs are illustrated in **Figure 6-4**.

Lesser horseshoe bat and Nathusius' pipistrelle bat were not recorded.

Table 6-23: Bat passes recorded at each SP during 2019 surveys

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	4	108	118	127	1	179	537
2	5	46	152	69	0	121	393
3	4	79	290	151	2	160	686
4	1	38	221	99	6	274	639
Total	14	271	781	446	9	734	2255
%	0.6	12.0	34.6	19.8	0.4	32.5	

Table 6-24: Hourly Averages 2019 Surveys

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID
1	0.36	9.82	10.73	11.55	0.09	16.27
2	0.45	4.18	13.82	6.27	0.00	11.00
3	0.36	7.18	26.36	13.73	0.18	14.55
4	0.09	3.45	20.09	9.00	0.55	24.91

6.3.3.2.1.2 2020 Surveys

A total of 25,961 vocalisations generated by bats, including vocalisations to which a species or genus could not be attributed, were recorded during the 30 nights of deployment of the detectors during the 2020 surveys (see **Table 6-25**). The hourly average rates for each species at each SP and for each season are listed in **Tables 6-26** to **6-35**, inclusive.

, inclusive. The locations of the 10 Sampling Points (SP) are illustrated in **Figure 6-5**.

As had been the case in 2019, lesser horseshoe bat and Nathusius' pipistrelle were not recorded.

Table 6-25: Bat passes recorded at each SP during 2020 surveys

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	**6**	**139**	**2752**	**1033**	**14**	**776**	**4720**
2	**5**	**156**	**1482**	**334**	**7**	**321**	**2305**
3	**1**	**93**	**1032**	**664**	**3**	**53**	**1846**
4	**4**	**222**	**268**	**73**	**1**	**177**	**745**
5	**69**	**136**	**311**	**146**	**15**	**175**	**852**
6	**46**	**253**	**3212**	**4005**	**3**	**931**	**8450**
7	**2**	**305**	**1157**	**472**	**2**	**395**	**2333**
8	**3**	**180**	**225**	**76**	**3**	**68**	**555**
9	**2**	**300**	**1615**	**619**	**11**	**1009**	**3556**
10	**2**	**157**	**236**	**94**	**3**	**107**	**599**
Total	**140**	**1941**	**12290**	**7516**	**62**	**4012**	**25961**
%	**0.5**	**7.5**	**47.3**	**28.9**	**0.24**	**15.5**	

Table 6-26: SP1 Average hourly species' rates by season 2020[36]

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.02	0.58	29.24	8.46	0.06	7.88
Summer	0.05	0.73	1.13	2.68	0.02	0.47
Autumn	0.01	0.43	0.52	1.11	0.08	0.39

Table 6-27: SP2 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.01	0.83	14.98	3.20	0.01	3.24
Summer	0.03	1.02	1.35	0.28	0.00	0.30
Autumn	0.02	0.20	0.53	0.29	0.06	0.11

[36] In calculating the averages, nightly durations of 9, 6 and 10 hours were used, respectively, for spring summer and autumn. [Using sunset to sunrise as per https://www.timeanddate.com/sun/@2961574?month=9&year=2019]

Table 6-28: SP3 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	0.00	0.00	0.00	0.00	0.00
Summer	0.02	0.60	4.42	7.63	0.00	0.48
Autumn	0.00	0.57	7.67	2.06	0.03	0.24

Table 6-29: SP4 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	1.06	2.48	0.51	0.00	0.77
Summer	0.03	0.67	0.17	0.15	0.00	0.08
Autumn	0.02	0.87	0.35	0.18	0.01	1.03

Table 6-30: SP5 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.66	0.44	2.08	0.99	0.09	1.24
Summer	0.13	0.37	1.32	0.53	0.05	0.47
Autumn	0.02	0.74	0.45	0.25	0.04	0.35

Table 6-31: SP6 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.02	1.56	27.41	8.87	0.03	6.04
Summer	0.42	0.62	1.28	4.18	0.00	1.67
Autumn	0.19	0.76	6.68	29.56	0.00	2.87

Table 6-32: SP7 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	1.84	11.41	3.69	0.01	3.51
Summer	0.00	0.68	0.70	0.80	0.00	0.22
Autumn	0.02	0.98	0.88	0.92	0.01	0.66

Table 6-33: SP8 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.00	0.88	1.96	0.51	0.00	0.60
Summer	0.02	0.90	0.68	0.20	0.02	0.15
Autumn	0.02	0.47	0.08	0.18	0.02	0.05

Table 6-34: SP9 Average hourly species' rates by season 2020

	Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring	0.01	2.07	9.51	3.53	0.01	4.27
Summer	0.02	0.78	4.00	0.75	0.00	2.15
Autumn	0.00	0.67	5.19	2.56	0.10	4.96

Table 6-35: SP10 Average hourly species' rates by season 2020

		Myotis spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	No-ID
Spring		0.00	0.62	1.38	0.49	0.02	0.79
Summer		0.00	0.38	1.08	0.20	0.00	0.13
Autumn		0.02	0.78	0.47	0.38	0.01	0.28

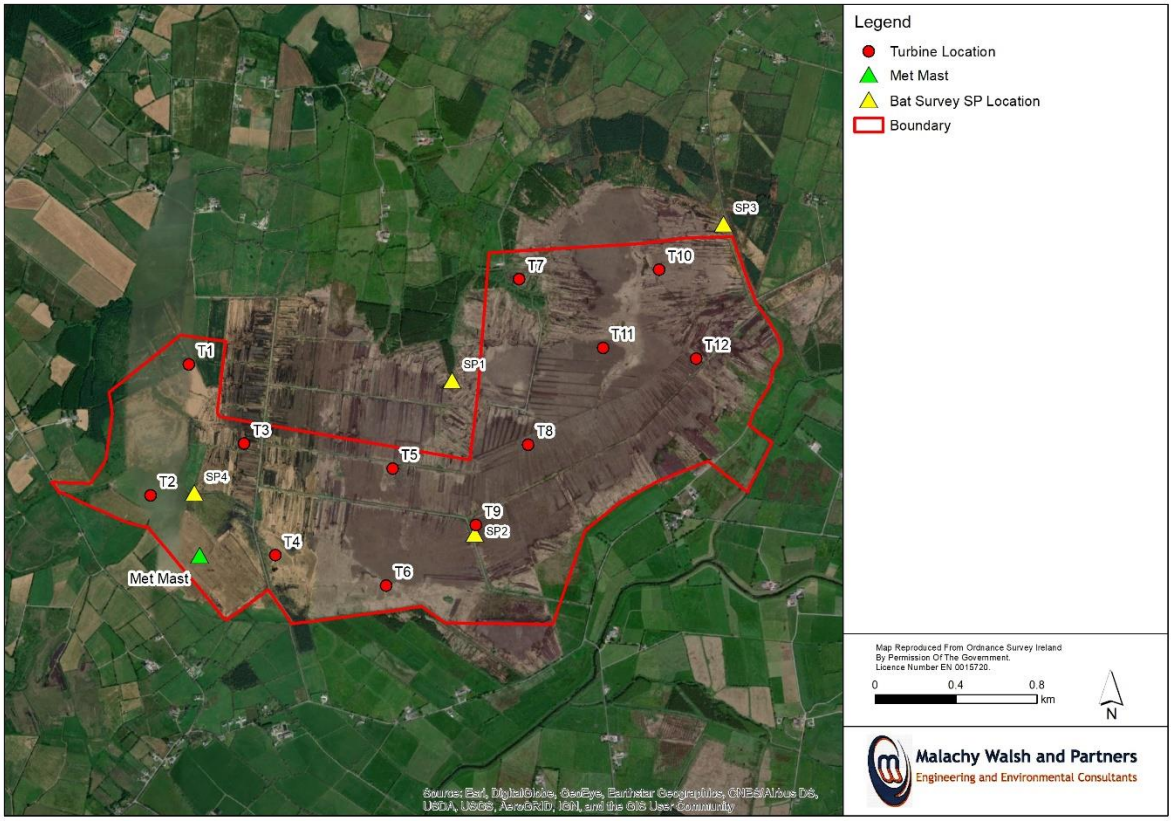


Figure 6-4: 2019 Bat Survey SP Locations

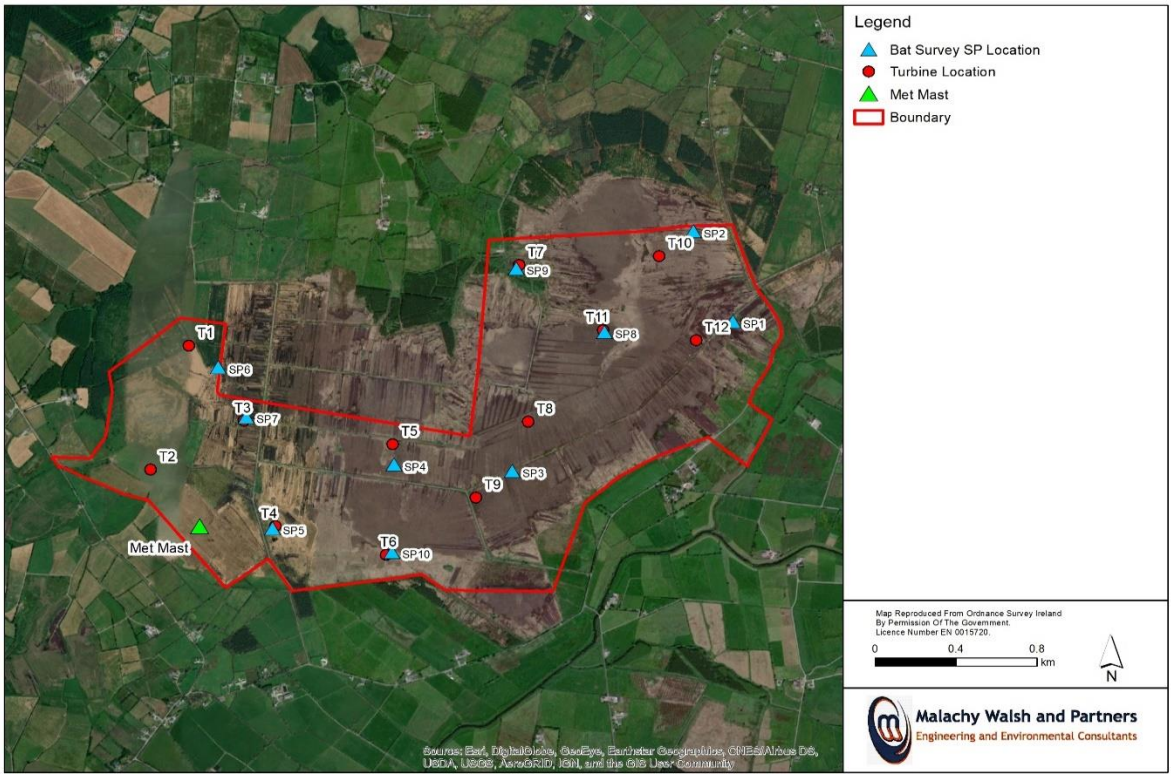


Figure 6-5: 2020 Bat Survey SP Locations

6.3.3.2.2 Other Mammals

No direct evidence of any of the species that usually would be found in similar locations was recorded within the proposed development site during the surveys. Typically, these species would comprise, *inter alia*, badger, rabbit, hare and, because of the proximity of the Galey River and the Ballyline River, otter.

While Irish hare was seen in the geographical area extending away from the proposed development site and dead badgers were, occasionally, observed on the network of roads around the site neither were observed within the site.

6.3.3.2.3 Amphibians and Reptiles

Common frog was observed on number of occasions and frog spawn was observed, at several locations, in the network of drains present within the PDS.

6.3.3.2.4 Invertebrates

Invertebrates were encountered only rarely, and the site was notable for the relative dearth of insect life observed.

6.3.3.3 Flora

6.3.3.3.1 Protected Flora

During extensive flora and habitat surveys completed in the study area, protected flora species were not recorded (see **Section 6.2.4.2)**.

6.3.3.3.2 Invasive Alien Plant Species

Two species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2015 were recorded within the study area. Japanese knotweed was recorded at two locations and giant rhubarb at one; only one of these three locations is within the application boundary. The locations are shown in **Figure 6-5**.

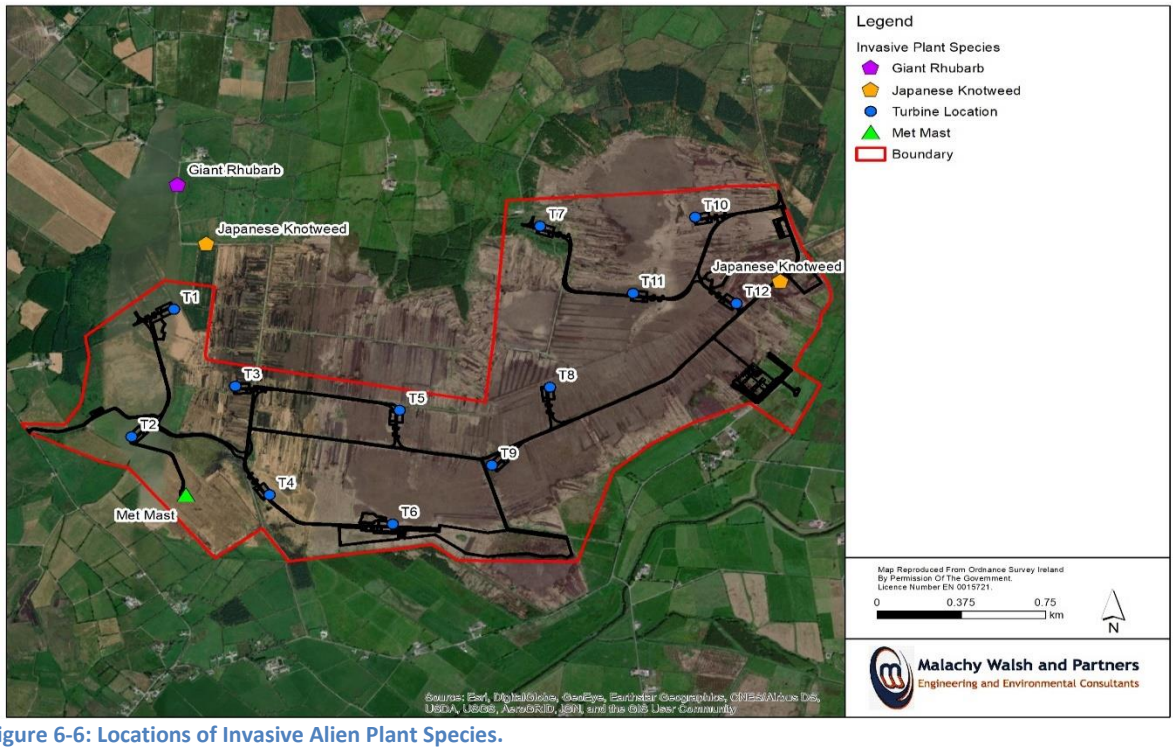


Figure 6-6: Locations of Invasive Alien Plant Species.

6.3.4 Results of Aquatic Surveys

6.3.4.1 Physicochemical Sampling

Field sampling of the physicochemical properties of streams adjacent to the site was carried out in 2020. The locations of the sampling points are illustrated in **Figure 6-1**, **Section 6.2.5**; the results are listed in **Table 6-36**. Parameters were measured on-site using a calibrated Aquaread AP-5000 Portable multi-parameter water quality probe.

Conductivity values ranged from 215 µS/cm to 437 µS/cm. These values reflect the peaty nature of the study area, with the lower values at Site 1 and Site 2 likely brought about by greater proportions of peat in the respective catchments. All Dissolved Oxygen concentrations were within the 80% - 120% range expected of water of good quality with respect to oxygenation. The range of pH suitable for fisheries is considered to be 5.0 - 9.0, though 6.5 - 8.5 is preferable (EPA, 2001). As the pH of the watercourses draining the proposed development site pH ranged from 7.24 to 8.03, they are deemed suitable for aquatic life with respect to pH.

Table 6-36: Physicochemical water quality results.

	Site 1 R01159 39554	**Site 2 R98796 39925**	**Site 3 R99231 41445**	**Site 4 R00119 42065**
Conductivity (µS/cm)	215	271	437	387
Temperature (°C)	8.28	8.7	8.8	8.2
Total dissolved solids (mg/L)	150	176	284	252
Dissolved oxygen (%)	96.7	95.3	94.6	96.2
Dissolved oxygen (ppm)	11.4	11.35	11.25	11.62
pH	8.03	7.41	7.24	7.36
Time	15:50	16:05	16:23	16:38

6.3.4.2 Fisheries Assessment

Qualitative sampling of benthic macro invertebrates was undertaken at 5 locations on watercourses draining the proposed development during August and September 2020. These locations are identified in **Table 6-8** and illustrated in **Figure 6-2** in **Section 6.2.5**.

6.3.4.2.1 Description of the receiving waters

The proposed development site overlies two Hydrometric regions. Within Hydrometric Area (HA) 24 at the north western extent of the site, the proposed development is drained by the 1st order Coolkeragh stream and an unnamed 1st order stream (EPA segment code 24_1164). The Coolkeragh stream flows into the Coolbeha stream before feeding the Ballylongford River, also known as the Ballyline River (EPA code 24B03). The Coolkeragh stream and other watercourses within the proposed development site are low gradient artificial channels with beds mostly of peat. These channels within the PDS are artificial and were created for the purpose of peat drainage. The Ballylongford River supports the submerged aquatic moss *Fontinalis squamosa*, the filamentous alga *Cladophora* spp. and emergent *Apium nodiflorum*. Some sheltered banks are lined with the crescent-cup liverwort (*Lunularia cruciata*).

The south eastern extent of the proposed development is within HA 23. Primary drainage of the proposed development site within HA 23 is via the River Galey (EPA code 23G01) and the Tarmon stream (EPA code 23T03). The reach of the River Galey south of the proposed development site has been subjected to arterial drainage dating from the 20th Century; it is a stretch with the character of a

typical drained river. The morphology of the channel has been affected by deepening with consequent alteration of flows and substrate composition. The river is characterised primarily by a series of shallow riffle-glide-pool sequences. The River Galey supports the aquatic moss *F. squamosa* as well as *Leptodictyum riparium, Chilosyphus polyanthus, Cladophora* spp. in stream, and *Phalaris arundinacea* along its banks.

The Tarmon stream is also drained where it flows to the east of the proposed development. It is a highly modified channel with a bank height of ca. 4.5m, formed presumably from spoil excavated from the channel. Emergent *Alisma plantago-aquatica* and *Sparganium erectum* were recorded in the Tarmon stream as well as marginal *A. nodiflorum* and *P. arundinacea*. *C. polyanthus, Lyngbya* spp. *Concephalum* spp. and *Cladophora* spp. were also recorded.

All sites investigated were rated suboptimal for macro invertebrates with reference to criteria in Barbour *et al.* (1991). This was due to poor pool quality and substratum condition (siltation).

6.3.4.2.2 Fish habitats and fish

In McGinnity *et al.* (2003), which gives the distribution of migratory salmonids in Irish watercourses, all watercourses larger than 2nd order are indicated as supporting salmon and sea trout. Biological water quality of the main watercourses draining the proposed development site is unsatisfactory and therefore deemed marginal/suboptimal for salmonids. The Galey and Ballyline rivers are likely to support populations of salmonids but the 1st order streams draining the proposed development site are considered unsuitable for spawning and the early life stage of salmon with as per Hendry *et al.* (2003). These watercourses are deemed too small to be of importance to adult salmonids. The Tarmon stream to the east of the proposed development is also evaluated as unsuitable as a spawning and nursery area for salmonids. Likewise, lamprey nursery habitat in these stream reaches is regarded as unsuitable based on the habitat requirements of juvenile lampreys as outlined in Maitland (2003). The Tullamore stream is a 1st order watercourse that flows along the southern boundary of the PDS and discharges to the River Galey less than 0.5km east of the PDS. A sluice gate has been installed on this watercourse ca. 100 m upstream of the River Galey confluence, which would prevent any upstream fish migration.

The River Galey is a suitable spawning, nursery and holding area for salmonids, though the hydro morphological character and, thus, the river habitat quality of this channel has been drastically reduced by lowering of the riverbed, decreased physical heterogeneity and severance of floodplain connectivity. It is considered that most salmon in the river spawn in reaches of the main stem upstream of the proposed development and its tributaries. The Ballylongford River is best suited to the early life stages of salmonids, with few pools of adequate depth to hold adult salmon during low water. This river has been degraded by channelisation along some reaches, agricultural intensification, bank side works and installation of bank protection and at least one weir but supports a good stock of brown trout (*Salmo trutta*).

The conditions in the Ballylongford and Galey rivers are of a quality sufficient to support a population of brook lamprey and possibly migratory lampreys (river and sea). The occurrence of lampreys in watercourses nearer and within the proposed development site is doubtful as spawning areas are a limiting factor here. European eel and stone loach (*Barbatula barbatula*) were recorded at Site 1 on the River Galey downstream of the PDS.

6.3.4.2.3 Aquatic macro invertebrates

All macro invertebrates recorded during the biological sampling carried out on watercourses draining the proposed development site are listed the report included at **Appendix 6-4**. The macro invertebrate assemblage recorded comprised mostly of pollution tolerant indicators including larvae of the mayfly *Baetis rhodani,* Dipteran larvae (*Similium* spp., *Dicronata* spp*.,* green chironomids), Coleopterans (the riffle beetles *Elmis aenea* and *Limnius volckmari*, diving beetles) and snails (*Ancylus fluviatilis, Potamopyrgus antipodarium*). The only pollution sensitive macro invertebrates recorded were larvae of the stonefly *Protonemura* spp. and the Heptagenid mayfly *Ecdyonurus* spp.

Drains and ponds at the proposed development site are considered used by a range of macro invertebrates such as Coleoptera (beetles) and Hemiptera (bugs), as well as Diptera (flies) and Odonata (damselfly and dragonfly) during their aquatic stages.

6.3.4.2.4 Water quality

Substrates at all five survey locations were silted to a degree consistent with unsatisfactory water quality, with significant overlying silt and moderate to heavy plumes emitted during substrate sampling. Algal growth which is indicative of enrichment was recorded at all locations. The biological water quality results for 2020 are given in **Table 6-37**; taxa richness and biological water quality ratings are based on the relative abundance of macro invertebrate pollution sensitivity groups as well as other factors including siltation and algal growths. Biological water quality at Site 3 was rated 'Moderately polluted, Q3'. A rating of Q3 corresponds with Water Framework Directive (WFD) 'poor' status with reference to macro invertebrates. The remainder of the locations were rated 'Slightly polluted, Q3-4', equivalent to WFD 'moderate' status.

Table 6-37: Results of the 2020 biological sampling at stations on watercourses draining the proposed development site.

Site	1	2	3	4	5
Q-value	3-4	3-4	3	3-4	3-4
Corresponding WFD Status	Moderate	Moderate	Poor	Moderate	Moderate
No. of taxa	24	22	14	19	20

6.4 DESCRIPTION OF THE PROPOSED DEVELOPMENT SITE

The description of the proposed development site is based on the totality of the information provided in **Section 6.3** and on the knowledge of the site gathered during the repeated site visits over an almost 2-year period across all seasons. It draws together all the survey data and desktop information to provide a narrative account of the site. It is informed by a considerable body of experience and expertise gained from work on equivalent developments in similar receiving environments. The Fossitt (2000) habitat types recorded are listed **Table 6-22**, Bat Habitat Suitability Index ratings for the site are listed in **Table 6-18**, EPA biological water quality ratings are listed in **Table 6-21**, Physicochemical water measurements are listed in **Table 6-36** and the results of the 2020 biological sampling of streams are provided in **Table 6-37**.

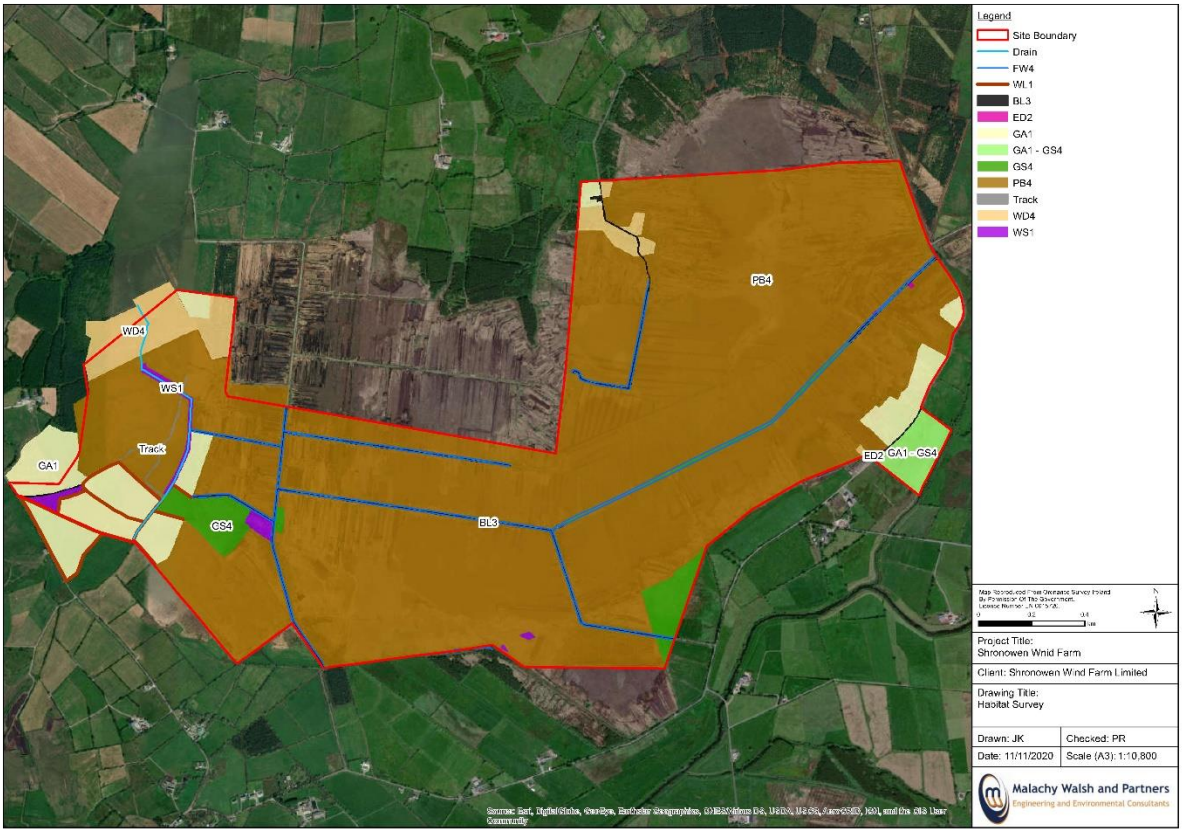


Figure 6-7: Habitat map

The site largely comprises cut over bog (*sensu* Fossitt, 2000), which in its original form was a blanket bog, but which is now substantially cut over and significantly altered by turf cutting. It is situated within a landscape dominated by agricultural grassland habitats and with some commercial conifer plantations against which the bog itself abuts (see **Figure 6-8** for Corine Landcover). The topography of the site is essentially flat - albeit with the slight peat dome that is a characteristic of the lowland bog type. The site is intersected by a network of access tracks of robust construction that, while too rough for cars, are, for the most part, in good condition. The southern boundary of the proposed development site is situated in close proximity to a 1st order tributary of the Galey River[37] which drains to the River Feale; the Ballyline River drains from the northern part of the site to the inner reaches of Ballylongford Bay[38] and the Coolkeragh, a tributary of the Ballyline River, drains northward through the western part of the site adjacent to the east of T2 (see **Figure 6-2**).

Turbary rights pertain to the entire site and much of the original peat mass has been removed and a significant proportion of the bog now comprises a mix of exhausted banks or banks that are currently being, or historically have been, worked. While a large central area remains relatively uncut, an extensive network of drains transects the site the effect of which is the lowering of the water table across the site. Because the water table is the key determinant of aerobic and anaerobic processes in a bog, the lowering of the water table within the peat boundary between the upper aerobic acrotelm (living) layer and the underlying, water-logged and compacted, catotelm (dead) layer, has fundamentally altered the peat forming capacity of Shroneowen Bog.

[37] Part of the Lower River Shannon SAC (002165)

[38] Within the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077)

While the dominant current practice is removal of peat by excavator to a hopper from which the peat is then extruded (see **Drone Flown Image 6-1**, below) there is clear evidence of historic sausage cutting in the eastern part of the site (see **Drone Flown Image 6-2**, below). **Aerial Image 6-1**, below, illustrates the extent to which, over time, the peat mass has been removed progressively and incrementally from the edge of the bog to the interior area of the peat mass.

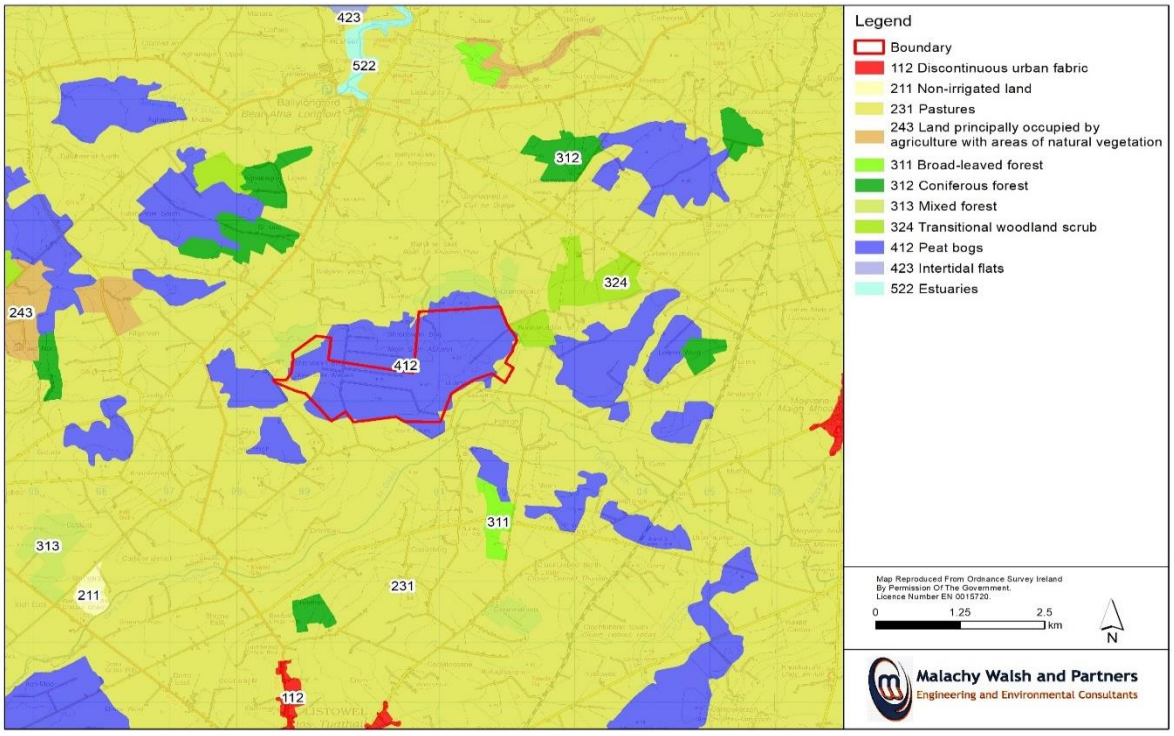
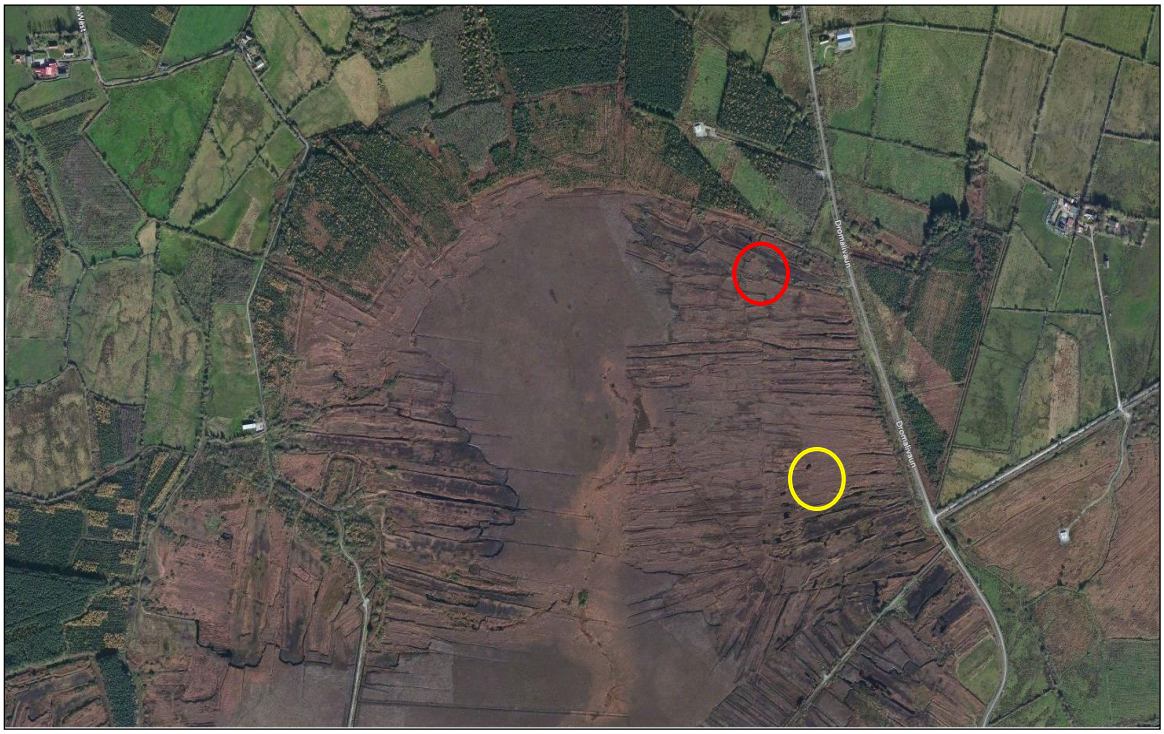


Figure 6-8: Corine Landcover



Aerial Image 6-1: Typical view showing distinct signature of turf banks progressing from edge to centre at northern section of Shronowen Bog. (Red circle: approximate location of Drone Image 1; Yellow circle approximate location of Drone Image 2).

Drone Flown Image 6-1: Extruded turf with excavated bank adjacent (2019)

Drone Flown Image 6-2: Evidence of historic sausage cutting (*parallel 'scars' aligned left to right*)

The vegetation communities that the bog supports are constrained by the nutrient poor conditions that pertain and the cover currently comprises a relatively uniform and homogenous cover of purple moor-grass (*Molinia caerulea*). While ling heather (*Erica cinerea*) and bell heather (*Calluna vulgaris*) are present, surveys indicate that it is not a significant component in the overall plant mix. A few isolated tree lines are present; these consist primarily of birch (*Betula* spp.) and all are of a relatively low stature with an average canopy height in the region of 5 m. Areas of willow scrub (*Salix* spp.) are also present; however, these are primarily distributed within the transitional marginal habitats that fringe the bog, in the interface areas between the agricultural and commercial forestry habitats and the bog itself. Willow shrub lines also fringe the sides of the tracks in many places. A variety of grasses

and ruderal species have colonised the margins along the sides of the tracks where disturbance has disrupted the dominance of the indigenous vegetation that dominates the reminder of the site. A significant proportion of the site comprises bare unvegetated ground which is present in areas where sustained peat extraction has been occurring.

Small diffuse stands of the food plant of marsh fritillary, devil's bit scabious (*Succisa pratensis*), were recorded at two locations but these were not considered suitable to support breeding by the species due to the lack of suitable conditions - size of the stands, lack of habitat structure, relative rankness of the sward and the absence of grazing or sward management. During the spring, summer and autumn site visits required to deploy and collect bat detectors, plants were checked systematically for eggs and for signs of leaf damage which is a diagnostic of the possible presence of the larval stage, but no such evidence was noted.

Apart from some localised ponding of water in some of the lower lying peat banks, no established ponds or other bodies of standing water were noted during the site surveys and none are visible in the range of aerial imagery reviewed[39]. However, any that are present are likely to support amphibians and frog spawn was noted at several locations along roadside drains and in small areas of standing water. While stands of bulrush (*Typha latifolia*) are present in some trackside drains in the western part of the site, the individual stands are generally small and localised and the distribution within the site is somewhat uneven and diffuse. Gorse (*Ulex* spp.) is present and quite abundant along track sides.

In summary the site is, both topographically and ecologically, relatively homogeneous in terms of the wider landscape, a characteristic that inhibits species diversity not only in terms of the floristic communities but also in the variety of animal species routinely present. The extant plant communities comprise low-growing, open vegetation with low plant species richness that lacks the variety and complexity required for high insect macro invertebrate productivity. The PDS lacks the characteristics synonymous with high value foraging, roosting or breeding habitats for any animal species.

6.4.1 Suitability of the Site as Bat Foraging Habitat

The site, as described in the preceding paragraphs, lacks the characteristics that would render it of high potential value as bat foraging habitat and there is little in the way of variation within the habitat structure of the site and, relative to its surroundings, it is less ecologically and structurally diverse than is the case in the geographical area extending away from it. As a result, the site will provide less insect prey biomass than in the agricultural grassland areas that dominate the area extending away from the proposed wind farm development site which, in any event, bats are more likely to preferentially select. In addition, because the proposed development site comprises an open and relatively featureless terrain, it is quite exposed and lacks the types of landscape features that would provide habitat connectivity for bats, within the site and between the site and the surrounding landscape, which bats could use for commuting between roosts and foraging grounds. While forest edges present do provide sheltered corridors along which insect prey may accumulate and bats forage, the open and unsheltered character of the majority of the proposal site is entirely lacking in equivalent shelter belts.

With regard to the area within the proposed wind farm development site, as can be seen from the BHSI ratings listed in **Table 6-18**, above, not only is the overall habitat suitability rating for all bat species very low, only soprano pipistrelle and brown long-eared bat have a rating above 30, and, while

[39] OSI aerial imagery (1995 to 2012); Google imagery (2017); Bing (undated)

Daubenton's bat, Leisler's bat and common pipistrelle have a rating above 20, the remainder of the species have ratings below this level - a clear indication that the site is evaluated, by the BHSI criteria, as, in effect, having little or no potential value for these species.

Of the ninety individual species BHSI ratings listed in **Table 6-19**, above, that pertain to the 40 km^2 area[40] that encompasses the proposed wind farm development site and the extended geographical area surrounding it, only sixty (37.8%) have a rating above 30; of which only five (5.6%) are above 40. This characteristic of the PDS and its extended surrounds is significant in light of the known strong correlation between bat activity and the habitat mix of an area. While this preferential selection behaviour and the tendency towards site loyalty, that are characteristic of bat foraging behaviours (Entwhistle *et al.* 2001) do not preclude the occasional use of sub-optimal habitats, they are key determinants in the level of activity at any location and of the frequency or regularity of its occurrence. It is self-evident, if the wider geographical area is of uniformly low value to bats, then the likelihood that the proposed wind farm is within the core or extended foraging ranges of any bat species is significantly reduced as, in all cases, individual species forage over relatively limited ranges that do not exceed kilometres in the single digit range. For detail on metabolic constraints on bat activity see reports in **Appendices 2** and **3**.

Therefore, in light of the low BHSI ratings for the site and the bog habitat that dominates it is considered that the site is of relatively low value for bat species particularly by comparison with the characteristics of the surrounding area and which is characterised by a more ecologically and structurally diverse habitat mix than is the case within the proposed wind farm development site. It is also evident from the 'All species' ratings for the wider geographical area, comprising the 4 hectads that are listed in, **Table 6-19**, above, that the proposed development site is not adjacent to any locations rated as being of high ecological value to bats.

In summary the site is, both topographically and ecologically, relatively homogeneous, a characteristic that influences species diversity not only in terms of the floristic communities but also in the variety and biomass of insect species. The proposed development site is exposed and unsheltered and the plant communities present comprise low-growing, open vegetation with low plant species richness that lacks the variety and complexity required for high macro invertebrate productivity. It is concluded that the site is unlikely to provide significant foraging, roosting or breeding habitats for any bat species.

Therefore, while bat activity by certain species is reasonably foreseeable, the levels of activity are unlikely to be significant at any point and it is concluded that the level of activity and the patterns in site usage described in **Section 6.3.3.2.1**, above, are consistent with this assessment of the proposed wind farm development site's suitability as bat foraging habitat. It is concluded, therefore, that the levels of activity recorded during 2019 and 2020 are reflective of the normal patterns that pertain at the site.

Therefore, while a regular pattern of bat activity by certain species is reasonably foreseeable, the levels of activity are unlikely to be significant.

[40] The proposed development site and surrounds are encompassed within the following hectads: Q93, Q94, R03 and R04.

6.4.2 Initial Site Risk Assessment for Bat species

In order to characterise potential risks that may exist at a site, SNH (2019) recommends that an Initial Site Risk Assessment (ISRA) of site-based risk factors be carried out. This ISRA, which comprises an evaluation of the site's risk level, is based on a consideration of the habitat and development related features of a proposed wind farm site. Using the risk criteria outlined in **Table 6-38**, below, the proposed wind farm site is evaluated as 'Low' risk.

Table 6-38: Initial Site Risk Assessment

Habitat Risk	**Project Size**		
	Small	Medium	Large
	Site Risk Level		
Low	1[41]	2	3
Moderate	2	3	4
High	3	4	5

Habitat Risk Level	
Habitat Risk	**Description**
Low	• **Small number of potential roost features, of low quality.** NO ROOST FEATURES • **Low quality foraging habitat that could be used by small numbers of foraging bats.** YES • **Isolated site not connected to the wider landscape by prominent linear features.** NO
Moderate	• **Buildings, trees or other structures with moderate-high potential as roost sites on or near the site.** NO • **Habitat could be used extensively by foraging bats.** NO • **Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.** YES
High	• **Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site.** NO • **Extensive and diverse habitat mosaic of high quality for foraging bats.** NO • **Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows.** NO • **At/near edge of range and/or on an important flyway.** NO • **Close to key roost and/or swarming site.** NO
Project Size Risk Level	
Project Size	Description
Small	• **Small scale development (≤10 turbines).** NO • **No other wind energy developments within 10 km.** NO • **Comprising turbines <50 m in height.** NO
Medium	• **Larger developments (between 10 and 40 turbines).** YES • **May have some other wind developments within 5 km.** YES • **Comprising turbines 50-100 m in height.** NO
Large	• **Largest developments (>40 turbines) with other wind energy developments within 5 km.** NO • **Comprising turbines >100 m in height.** YES

[41] Key: (1-2) - low/lowest site risk; (3) - medium site risk; (4-5) - high/highest site risk

6.5 IDENTIFICATION AND EVALUATION OF IMPORTANT ECOLOGICAL FEATURES

The habitats and associated flora, fauna and other ecological features or resources identified in **Section 6.3** are now evaluated on the basis of their local, national and international conservation importance using the evaluation criteria described in **Section 6.1.5.1.** On the basis of these evaluations an assessment will then be made as to which of these habitats or species are considered Important Ecological Features (IEF). An evaluation of designated sites to identify those that are IEF is also presented below.

6.5.1 Designated Conservation Sites

6.5.1.1 Sites of International Importance

With regard to Natura 2000 sites see **Section 6.3.2.1.1.1**.

Due to its status and proximity, the Shannon and Fergus Estuaries IBA (IE68) is selected as an IEF.

6.5.1.2 NHAs and pNHAs

As sites of national importance, all NHA and pNHA sites within 15km are selected as IEF. These sites are:

- Bunnaruddee Bog NHA (001352).
- Ballylongford Bay pNHA (001332).
- Moanveanlagh Bog pNHA (000374).
- Tarbert Bay pNHA (001386).
- Cashen River Estuary pNHA (0013400).
- Scattery Island pNHA (001911).
- Beal Point pNHA (001335).
- St. Senan's Lough pNHA (001025).
- Clonderalaw Bay pNHA (000027).
- Poulnasherry Bay pNHA (000065).

6.5.2 Fossitt (2000) Habitats

The criteria for the evaluation of habitats are provided in **Section 6.1.5.1** and the Fossitt (2000) habitats selected as IEF are listed below. The evaluations and selection processes are described in **Table 6-39**.

- Depositing lowland rivers FW2.
- Drainage ditches FW4.
- Cutover bog PB4.
- Hedgerows WL1.
- Scrub WS1.

6.5.3 Species

The criteria for the evaluation of species are provided in **Section 6.1.5.1** and the species selected as IEF are listed below under the various animal groups. The evaluations and selection processes for species for which records are retained by NPWS and NBDC are presented in **Table 6-40**. The evaluations and selection processes for bat species are presented in **Table 6-41.** The evaluations and selection processes for species which were recorded during the aquatic surveys are presented in **Table 6-42**.

6.5.3.1 Terrestrial Fauna

6.5.3.1.1 Bats

- Brown long-eared bat.
- Common pipistrelle.
- Daubenton's bat.
- Leisler's bat.
- Lesser horseshoe bat.
- Nathusius' pipistrelle.
- Natterer's bat.
- Soprano pipistrelle.
- Whiskered bat.

6.5.3.1.2 Other Mammals

- Badger.
- Irish hare.
- Irish stoat.
- Otter.

6.5.3.1.3 Amphibians and Reptiles

- Common frog.
- Common lizard.
- Smooth newt.

6.5.3.2 Invertebrates

- Marsh fritillary.

6.5.3.3 Aquatic Fauna

6.5.3.3.1 Fish

- Brook lamprey (*Lampetra planeri*).
- European eel.
- River lamprey *(Lampetra fluviatilis*).
- Salmon.
- Sea lamprey.

6.5.3.3.2 Invertebrates

- Duck mussel.

Table 6-39: Fossitt (2000) habitats and selection as IEF

Habitat type and area within PDS	Area within PDS	IEF	Rationale					
			Description	Condition	Scale (as component of PDS)	Rarity	Conservation/ Legal Status	NRA (2009) Evaluation
Buildings and artificial surfaces BL3	2.5527 ha	No	No intrinsic ecological value.	Built habitat with no natural characteristics.	Minor	Ubiquitous	Habitat not managed for conservation value.	Local (Lower Value)
Spoil and bare ground ED2	0.1471 ha	No	No intrinsic ecological value.	Modified habitat with no natural characteristics.	Minor	Ubiquitous	Habitat not managed for conservation value.	Local (Lower Value)
Depositing lowland river FW2	0.0	Yes	Moderate to good ecological value with capacity to support some aquatic species.	Significantly modified but with many characteristics of a freshwater habitat.	Not present but connected	Common	Habitat not managed for conservation value but connected to downstream riparian habitats of value to aquatic species.	Local (Higher Value)
Drainage ditches FW4	14,760 m	Yes	Moderate ecological value with capacity to support some aquatic species.	Very significantly modified but with minor characteristics of a freshwater habitat.	Medium	Common	Habitat not managed for conservation value but connected to downstream riparian habitats of value to aquatic species.	Local (Higher Value)
Improved agricultural grassland GA1	18.3189 ha	No	Low intrinsic ecological value.	Profoundly modified with no natural characteristics. Managed (intensively) for agriculture.	Medium	Ubiquitous	Habitat not managed for conservation value.	Local (Lower Value)

Habitat type and area within PDS	Area within PDS	IEF	Rationale					
			Description	Condition	Scale (as component of PDS)	Rarity	Conservation/ Legal Status	NRA (2009) Evaluation
Wet grassland GS4	10.0804 ha	No	Low intrinsic ecological value.	Profoundly modified with no intrinsic natural characteristics. Managed (intensively) for agriculture.	Medium	Common	Habitat not managed for conservation value.	Local (Lower Value)
Improved agricultural grassland GA1/ Wet grassland GS4	4.5517 ha	No	Low intrinsic ecological value.	Profoundly modified with no intrinsic natural characteristics. Managed (intensively) for agriculture.	Negligible /Slight	Common	Habitat not managed for conservation value.	Local (Lower Value)
Cutover bog PB4	314.2277 ha	Yes	Medium ecological value due to its capacity to support plant species and communities not adapted for other habitat types.	Profoundly modified and degraded from natural condition by peat extraction and drainage which has caused the permanent lowering of the water table.	Dominant	Uncommon	Habitat not managed for conservation value but subject to limited constraints pertaining to rights of turbary. The extent of the right is limited to the fuel requirements of the dwelling house of the holder – it is not a right to cut and sell turf.	Local (Higher Value)

Habitat type and area within PDS	Area within PDS	IEF	Rationale					
			Description	Condition	Scale (as component of PDS)	Rarity	Conservation/ Legal Status	NRA (2009) Evaluation
Conifer plantation WD4	10.142 ha	No	Low intrinsic ecological value.	Commercial monoculture crop. Profoundly modified habitat with no natural characteristics.	Medium	Common	Habitat not managed for conservation value but subject to provisions of the Forestry Act 2014, as amended.	Local (Lower Value)
Scrub WS1	2.8805 ha	Yes	Moderate ecological value with capacity to support a variety of species.	Semi-natural in an otherwise highly modified setting	Slight/Minor	Common	Habitat subject to limited management for conservation value: it is an offence[42] to destroy vegetation on uncultivated land between the 1st of March and the 31st of August each year.	Local (Higher Value)
Hedgerows WL1	1,444 m	Yes	Moderate ecological value with capacity to support a variety of species and to provide connectivity within site.	Moderately modified and managed for agriculture but with semi- natural characteristics.	Minor	Common	Habitat subject to limited management for conservation value: it is an offence[43] to destroy vegetation on uncultivated land between the 1st of	Local (Higher Value)

[42] Section 40 of the Wildlife Act 1976 as amended by the Wildlife (Amendment) Act 2000 and the Heritage Act 2018

[43] Section 40 of the Wildlife Act 1976 as amended by the Wildlife (Amendment) Act 2000 and the Heritage Act 2018

Habitat type and area within PDS	Area within PDS	IEF	Rationale					
			Description	Condition	Scale (as component of PDS)	Rarity	Conservation/ Legal Status	NRA (2009) Evaluation
							March and the 31st of August each year. Conservation of hedgerows under the Common Agricultural Policy is part of management on Teagasc farms.	

Table 6-40: Species identified during desk top study.

Species	IEF	Rationale			
		Evidence Collated from Desk Study and Site Surveys	Conservation Status - Trend[44]	Red List[45] Status[46]	Biodiversity Value
Badger	Yes	Precautionary principle. While not recorded at PDS habitats available in certain parts of PDS are suitable, albeit to a limited extent, for this species	Not listed in annexes	Least Concern	Local (Higher Value)
Bottle-nosed dolphin	No	No plausible pathway for ex-situ effects. Marine species with restricted distribution situated at a significant remove from PDS.	Favourable - stable	Unavailable	N/A[47]
Common frog[48]	Yes	Ubiquitous species recorded at PDS. Habitats available at PDS are suitable.	Favourable - stable	Least Concern	Local (Higher Value)
Common lizard	Yes	Precautionary principle.		Least Concern	Local (Higher Value

[44] As per NPWS (2019) for species listed in the annexes to the Habitats Directive.

[45] Red Lists are documents which list the threatened species within a geographical area. Species are assessed against standard criteria and assigned a threat status.

[46] As per Nelson *et al.* (2019).

[47] Site evaluation for this species not relevant in the context of this proposed development in light of the species' known distribution and ecological characteristics.

[48] European status limited to inclusion in Annex V of the Habitats Directive as a species of community interest whose taking in the wild can be regulated.

		While not recorded at PDS habitats available in certain parts of PDS are suitable, albeit to a limited extent, for this species			
Common seal	No	No plausible pathway for ex-situ effects. Marine species with restricted distribution situated at a significant remove from PDS.	Favourable - stable	Least Concern	N/A
Freshwater pearl mussel	No	No suitable habitats available in river systems downstream of PDS. River systems have been damaged and rendered unsuitable by sustained extensive channel widening and deepening which has been ongoing for numerous decades.	Bad - deteriorating	Critically Endangered	N/A
Grey seal	No	No plausible pathway for ex-situ effects. Marine species with restricted distribution situated at a significant remove from PDS.	Favourable - improving	Least Concern	N/A
Harbour porpoise	No	No plausible pathway for ex-situ effects. Marine species with restricted distribution situated at a significant remove from PDS.	Favourable - stable	Unavailable	N/A
Hedgehog	No	Not recorded at PDS. Habitats available at PDS are sub-optimal and not expected to be preferentially selected by this species.	Not listed in annexes	Least Concern	Local (Lower Value)
Irish hare	Yes	While not recorded at PDS this species was seen in the areas extending away from the site. Species with a nationwide distribution whose occasional presence at the site is reasonably foreseeable.	Listed only in Annex V[49]	Least Concern	Local (Higher Value)
Irish stoat	Yes	While not recorded at PDS a record of 3 individuals, from 2017, is retained at NBDC for Grid R009394 on the local road immediately adjacent to the south of the PDS.	Not listed in annexes	Least Concern	Local (Higher Value
Long-finned pilot whale	No	No plausible pathway for ex-situ effects. Marine species with restricted distribution situated at a significant remove from PDS.	Favourable - stable	Unavailable	N/A

[49] Annex V species are those species of community interest whose taking in the wild and exploitation may be subject to management measures.

Marsh fritillary	Yes	While not recorded at PDS, a record, from 2017, of 2 individuals is retained, by NBDC, for Grid R007403 - a location approximately 250 m to the south west of, and approximately 30 m north of the proposed access road to, Turbine 8.	Inadequate - improving	Vulnerable	County
Narrow-mouthed whorl snail	No	Highly restrictive niche habitat requirements (NPWS, 2019) not available within the PDS.	Inadequate - deteriorating	Vulnerable	N/A
Otter	Yes	Habitats available in river systems downstream PDS are suitable for this species. Precautionary principle.	Favourable - improving	Least Concern	Local (Higher Value)
Pygmy shrew	No	Not recorded at PDS. Habitats available in area extending away from the PDS are more suitable for this species.	Not listed in annexes	Least Concern	Local (Lower Value)
Red squirrel	No	Not recorded at PDS. Habitats available in area extending away from the PDS are more suitable for this species. Red squirrel R014364 2018 3km se R037474 6.5 ne 2017	Not listed in annexes	Least Concern	Local (Lower Value)
Brook lamprey	Yes	Aquatic ecology report. Habitats available in river systems downstream PDS are suitable, albeit to a limited extent, for these species. Precautionary Principle.	Favourable - stable	Near Threatened	Local (Higher Value)
River lamprey			Unknown (trend not indicated)	Least Concern	
Sea lamprey			Bad - stable	Least Concern	
Short-beaked common dolphin	No	No plausible pathway for ex-situ effects. Marine species with restricted distribution situated at a significant remove from PDS.	Favourable - stable	Unavailable	N/A
Smooth newt	Yes	Notwithstanding that this species was not recorded at the PDS suitable habitat is available.	Not listed in annexes	Least Concern	Local (Higher Value)
White-clawed crayfish	No	Aquatic ecology report. No suitable habitats available in river systems downstream of PDS due to physicochemical characteristics of water.	Bad - deteriorating	Unavailable	N/A
Ribbonwort	No	Not recorded at PDS.	Not listed in annexes	Least Concern	Local (Lower Value)

Table 6-41: Selection of IEF Bat species

Species	IEF	Rationale			
		Evidence Collated from Desk Study and Site Surveys	Conservation Status - Trend[50]	Red List Status[51]	Biodiversity Value
Brown long-eared bat	Yes	BCI data Recorded at PDS.	Favourable – improving	Least Concern	Local (Higher Value
Common pipistrelle	Yes	BCI data Recorded at PDS.	Favourable – improving	Least Concern	Local (Higher Value)
Daubenton's bat	Yes	BCI data Recorded at PDS.	Favourable - improving	Least Concern	Local (Higher Value)
Leisler's bat	Yes	BCI data. Recorded at PDS.	Favourable - improving	Least Concern	Local (Higher Value)
Lesser horseshoe bat	Yes	Notwithstanding that this species was not recorded at the PDS and there are no BCI records within 10 km of PDS, it is selected on the basis of the precautionary principle.	Unfavourable -inadequate	Least Concern	Local (Higher Value)
Nathusius' pipistrelle	Yes	Notwithstanding that this species was not recorded at the PDS and there are no BCI records within 10 km of PDS, it is selected on the basis of the precautionary principle.	Unknown – N/A	Least Concern	Local (Higher Value)
Natterer's bat	Yes	BCI data. *Myotis* spp. recorded at PDS.	Favourable - stable	Least Concern	Local (Higher Value)
Soprano pipistrelle	Yes	BCI data. Recorded at PDS.	Favourable - improving	Least Concern	Local (Higher Value)
Whiskered bat	Yes	BCI data. *Myotis* spp. recorded at PDS.	Favourable - stable	Least Concern	Local (Higher Value)

[50] As per NPWS (2019) for species listed in the annexes to the Habitats Directive.

[51] As per Nelson *et al.* (2019).

Table 6-42: Species recorded during aquatic surveys

Species	IEF	Rationale			
		Evidence Collated from Site Surveys	Conservation Status - Trend[52]	Red List Status (RLS)[53]	Biodiversity Value
Brown trout	No	Aquatic ecology report species records.	Not listed in annexes.	Least Concern.	Local (Lower Value).
Duck mussel	Yes	Aquatic ecology report species records.	Not listed in annexes.	Vulnerable.	National due to RLS.
European eel	Yes	Aquatic ecology report species records.	Not listed in annexes.	Critically endangered.	National due to RLS.
Salmon	Yes	Aquatic ecology report species records.	Inadequate – Stable.	Vulnerable.	National due to RLS and Habitats Directive.
Stone loach	No	Aquatic ecology report species records.	Not listed in annexes.	Least Concern.	Local (Lower Value).

[52] As per NPWS (2019) for species listed in the annexes to the Habitats Directive.

[53] As per King *et al.* (2011) except duck mussel (Byrne *et al.*, 2009)

6.6 DO-NOTHING SCENARIO

The proposed development site is situated in an area where a well-established pattern of mixed land use pertains both within the application boundary and surrounds. These comprise peat extraction, agriculture and commercial forestry with a dispersed pattern of settlement, in the immediate surrounds, and urban centres, such as Ballylongford, Newtownsandes and Tarbert, in the wider area. If the proposed wind farm development does not progress beyond the planning application stage, it is likely that the current land-use practices will continue at the PDS.

6.7 LIKELY SIGNIFICANT EFFECTS

Wind farm developments are projects that may potentially impact on the natural environment (habitats, flora, fauna, water quality, aquatic ecology and fisheries). For wind farm projects, the construction phase is likely to have the most significant effect on biodiversity. This section will identify in detail the ecological impacts of the construction, operational and decommissioning phases of the proposed wind farm development on the receiving natural environment. The potential impacts of the proposed project were considered and assessed to ensure that all effects on IEF are adequately addressed and no significant residual effects are likely to remain following the implementation of mitigation measures.

For ease of reference, the criteria used to characterise Quality of Effects (**Table 6-3**), Significance of Effects (**Table 6-4**), Duration and Frequency of Effects (**Table 6-6**) and Confidence Levels of Predictions of Effects (**Table 6-7**) are reproduced below. The terms outlined in said tables are integral to the assessments and characterisation of effects in the sections hereunder.

Table 6-43: Quality of Effects [adapted from EPA (2017)]

Quality of Effect	Characteristic
Positive	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
Neutral	No effect or effect that is imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative/adverse	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Table 6-44: Significance of Effects [adapted from EPA (2017)]

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

Table 6-45: Duration and Frequency of Effects [adapted from EPA (2017)]

Duration	Corresponding Time Frame
Momentary	Effects lasting from seconds to minutes.
Brief	Effects lasting less than a day.
Temporary	Effects lasting less than a year.
Short-term	Effects lasting one to seven years.
Medium-term	Effects lasting seven to fifteen years.
Long-term	Effects lasting fifteen to sixty years.
Permanent	Effects lasting over sixty years.
Reversible	Effects that can be undone, for example through remediation or restoration.

Table 6-46: Confidence Levels of Predictions of Effects [adapted from NRA (2009a)]

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

6.7.1 Construction Phase Effects

- Habitat loss and alteration effects associated with forestry felling, replacement forestry, vegetation clearance, site access roads, and excavations for turbine foundations and peat deposition areas, site substation and temporary construction compound within the site boundary of the proposed project.
- Habitat loss, and disturbance, as a result of side-casting, and, or stockpiling of material.
- Temporary disturbance, and or displacement of species as a result of increased activity, and physical presence.
- Pollution of drains and streams draining the site and of downstream watercourses.
- Spread of invasive species.
- Habitat loss and alteration during the installation of ducting.

6.7.1.1 Impacts to Designated Conservation Sites

6.7.1.1.1 Sites of International Importance

The proposed development does not overlap with the Shannon and Fergus Estuaries IBA (IE68) site the only site of international importance selected as an IEF. Therefore, in light of the impacts identified in **Section 6.7.1** it is concluded that there will be no direct effects on this site as a result of the construction of the proposed development. There is, however, some, albeit limited, potential that in-situ water quality impacts generated by the proposed development could exert indirect ex-situ effects on the IBA.

While the IBA site is situated approximately 6 km downstream from the proposed development there is a risk that, without a programme of mitigation measures to control the potential construction phase water quality impacts, that alteration of the physico-chemical parameters in the water column in streams draining the site and in the Ballyline River could ensue. Any potential impairment of the downstream coastal and halophytic habitats that support the ecological resources supported within this site, by means of adverse water quality impacts, could, potentially, result in indirect habitat loss or alteration impacts by means of contamination of the water or sediments that support these features.

These impacts should they occur could then, potentially, result in indirect disturbance or displacement effects on the bird species for which this site is selected by means of a reduction in infaunal prey biomass available in the intertidal mud and sand flats and subtidal areas on which the bulk of the species rely. While there is a risk of ingress of sediments any ex-situ effects would be imperceptible due to the fact that the foundational habitats within the site are sedimentary in nature and any increase in the sediment load reaching the site would be imperceptible in the context of the normal background rates that pertain to estuarine habitats. The primary in-situ impact sources comprise cementitious materials and any fuels oils or chemicals integral to the construction phase of the proposed development.

The ex-situ effect that could ensue is characterised in **Table 6-47** using the criteria set out in **Section 6.1.5.2.**

Mitigation measures designed to prevent ex-situ effects on this IBA site are described in **Section 6.8**.

Table 6-47: Shannon and Fergus Estuaries IBA (IE68) - Description of impact and characterisation of effect

In-situ impact	Ex-situ Effect	Characterisation of Effect			Confidence Level
		Quality	Significance	Duration	
Impairment of water quality	Disturbance or displacement of species	Negative	Significant	Short-term	Near certain

6.7.1.1.2 Sites of National Importance

As can be seen from **Table 6-13**, **Section 6.5.1.2**, the proposed development does not overlap with any site of national importance selected as an IEF and, in most cases, significant separation distances intervene. In light of the impacts identified in **Section 6.7.1** and bearing in mind the distances that intervene, it is concluded that there will be no direct effects on these sites as a result of the construction of the proposed development. There is, however, some, albeit limited, potential that in-situ water quality impacts generated by the proposed development could exert indirect ex-situ effects on the Ballylongford Bay pNHA (001332). The pNHA, while afforded limited protection only, encompasses a brackish lagoon and areas of reed beds and overlaps with the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077).

While the site is situated approximately 6 km downstream from the proposed development there is a risk that, without a programme of mitigation measures to control the potential construction phase water quality impacts, that alteration of the physico-chemical parameters in the water column in streams draining the site and in the Ballyline River could ensue. Any potential impairment of the downstream coastal and halophytic habitats that support the ecological resources supported within this site, by means of adverse water quality impacts, could, potentially, result in indirect habitat loss or alteration effects by means of contamination of the water or sediments that support these features. The ex-situ effect that could ensue, which is, essentially, indistinguishable from that characterised for the IBA site, is characterised in **Table 6-48**, using the criteria set out in **Section 6.1.5.2.**

Mitigation measures designed to prevent ex-situ effects on this pNHA site are described in **Section 6.8**.

Table 6-48: Ballylongford Bay pNHA (001332) - Description of impact and characterisation of effect

In-situ impact	Ex-situ Effect	Characterisation of Effect			Confidence Level
		Quality	Significance	Duration	
Impairment of water quality	Habitat alteration	Negative	Significant	Short-term	Near certain

Effects on the other sites listed in **Table 6-13** are not anticipated for the following reasons:

- Distance from the proposed development and absence/lack of hydrological connectivity; and
- Lack of any identifiable source-pathway-receptor chain for effects.

6.7.1.2 Impacts to IEF Habitats

Habitat loss would result from the construction of turbine bases and hardstands for wind turbines, the construction of the electrical substation, construction of new roads and widening of existing track, site compound, peat deposition areas and underground electrical and communications cabling connecting the turbines to the proposed on-site substation. The network of existing access tracks which would be upgraded and widened, together with new excavated and new floating roads would be used to access each of the turbines, substation compound and meteorological mast. **Figure 6-7** illustrates the habitats at the proposed development site overlain by proposed development infrastructure.

The area required for each turbine and associated hardstand is approximately 0.3ha. Internal roads would have a design width of 5m, with additional area (dependent of gradient) where cut and fill are required. The habitats recorded and their areas, or, in the case of linear habitats, their lengths are provided in **Table 6-22**. Most infrastructure is situated in Cutover bog PB4 and there will be some minor loss of Hedgerows WL1 and Scrub WS1. The areas of loss of each IEF habitat are provided in **Table 6-49**.

There is the additional risk of peat failure and landslide and the resulting potential impacts on habitats and species, particularly downstream aquatic IEF. Guidelines for the risk management of peat slips have been incorporated into the current design, lessening the magnitude of impacts (See Engineering **Chapter 3** and Land and Soils **Chapter 9**). The ease with which erosion can be triggered and the amount of material that can be eroded increases with the depth of the peat deposit. The proposed road layout and other infrastructure has been selected on the basis of field investigations, using criteria such as peat depth and gradients to minimise both the impact of peat slippage and impacts on higher value peat habitats. Areas of deep and soft peat have been avoided insofar as possible. The proposed roads comprise a combination of those that 'float' on the peat surface (in flatter/wetter and deeper areas) as well as the 'cut and fill' type (on sloping ground).

Electrical cabling would be required between turbines and the site substation, and from the 110kv wind farm substation to the existing 110kv line to the east of the site. This would require digging of trenches which could alter the drainage pattern during, and after, construction.

Construction of turbine bases on peat is subject to many of the same issues as road construction. In addition, excavations are deeper, down to bedrock for installation of a concrete foundation pad. The digging of voids to cast turbine bases generates waste peat, introduces alkaline concrete and requires some drainage, as do the tracks. The design of tracks has been informed by desk study, site reconnaissance, peat probing and peat stability assessment and the indirect impact pertaining to hydrological changes have been minimised.

The stream within the site, and the one adjacent to the south of the planning boundary are classified, per Fossitt (2000), as Depositing lowland rivers FW2, however, neither will require crossing. Operations taking place on-site, such as the movement of materials, can disturb local ecosystems. There is potential to generate dust from extraction of raw material, loading and haulage and vehicle movement. This can travel into waterways and can impact upon sensitive habitats thus disrupting wildlife.

The effects that could ensue are characterised in **Table 6-50** using the criteria set out in **Section 6.1.5.2.**

Mitigation measures designed to prevent irreversible effects are described in **Section 6.8**.

Table 6-49 : Areas of habitat loss within PDS

Habitat Type	Habitat Loss (ha)	Habitat Loss (m)
Depositing lowland Rivers FW2	0.0	0
Drainage ditches FW4	N/A	6,166
Cutover bog PB4	26.11	N/A
Hedgerows WL1	N/A	238
Scrub WS1	0.54	N/A

Table 6-50: IEF Fossitt (2000)-Habitats - Description of impact and characterisation of effect

Habitat	In-situ Impact	In-situ/Ex-situ Effect	Characterisation of Effect			Confidence Level
			Quality	Significance	Duration	
FW2	Impairment of water quality.	In-situ/Ex-situ Impairment of water quality. In-situ/Ex-situ Stream bed habitat loss or alteration.	Negative	Significant	Short-term/ Reversible	Near certain
FW4	Impairment of water quality.	In-situ/Ex-situ Impairment of water quality.	Negative	Moderate	Short-term/ Reversible	
PB4	Habitat loss.	In-situ habitat loss. In-situ disturbance of species impacts.	Negative	Significant	Permanent	
WL1	Habitat loss.	In-situ habitat loss. In-situ reduction in habitat connectivity.	Negative	Significant	Permanent	
WS1	Habitat loss.	In-situ habitat loss.	Negative	Significant	Permanent	

6.7.1.3 Impacts to IEF Species

6.7.1.3.1 Terrestrial Fauna

6.7.1.3.1.1 Bats

Because the activities generated by the proposed wind farm development will be restricted to daylight hours, direct disturbance or displacement effects on bat species are not expected. However, it is possible that the loss of habitat, which would mainly be confined to the area of cutover bog that would result from the proposed wind farm would have an effect on bat species selected as IEF. However, it is considered, in light of the homogeneity of the site, the relatively slow pace and low area of habitat

loss and the intrinsically low ecological value of the habitat to bats, that any impact, while permanent, would be neutral and imperceptible, as similar habitat of equivalent ecological value is abundantly available within the proposed development site and its immediate surrounds.

Table 6-51: IEF Bat species - Description of impact and characterisation of effect

Species	Description of in-situ impact	Characterisation of in-situ effect	Confidence level
Brown long-eared bat	Habitat loss.	Neutral, Imperceptible, Permanent.	Near certain
Common pipistrelle	Habitat loss.	Neutral, Imperceptible, Permanent.	
Daubenton's bat	Habitat loss.	Neutral, Imperceptible, Permanent.	
Leisler's bat	Habitat loss.	Neutral, Imperceptible, Permanent.	
Whiskered bat	Habitat loss.	Neutral, Imperceptible, Permanent.	
Nathusius' pipistrelle	Habitat loss.	Neutral, Imperceptible, Permanent.	
Natterer's bat	Habitat loss.	Neutral, Imperceptible, Permanent.	
Soprano pipistrelle	Habitat loss.	Neutral, Imperceptible, Permanent.	
Lesser horseshoe bat	Habitat loss.	Neutral, Imperceptible, Permanent.	

6.7.1.3.1.2 Other mammals

6.7.1.3.1.2.1 Badger

No badger setts were recorded, no evidence of any badger activity was observed within the proposed development site, and suitable breeding habitat and/or resting habitat was not recorded. As a result, habitat loss or alteration impacts are not likely. However, instances of roadkill were observed and given the relatively wide distribution of the species and the availability of suitable habitat in the area around the site, it is possible that this species frequents the site occasionally. In the event that badgers do use the site, disturbance/displacement effects could arise as a result of increased activity at the site during the construction phase. However, because these activities will be restricted to daylight hours and having regard for the fact that the number of individuals habitually present will be low it is considered potential disturbance or displacement effects are likely to be inconsequential.

6.7.1.3.1.2.2 Irish hare

No hares were recorded within the proposed development site. As a result, habitat loss or alteration impacts are not likely. However, given the relatively wide distribution of the species and the fact that individuals were seen in the areas around the site, it is possible that this species frequents the site occasionally. In the event that hares do use the site, disturbance/displacement effects could arise as a result of increased activity at the site during the construction phase. However, because these activities will be restricted to daylight hours and having regard for the fact that the number of individuals habitually present will be low it is considered potential disturbance or displacement effects are likely to be inconsequential.

6.7.1.3.1.2.3 Irish stoat

No stoats were recorded within the proposed development site. However, a record of 3 individuals, from 2017, is retained at NBDC for Grid R009394 on the local road immediately adjacent to the south of the PDS. The species is adapted for a wide range of habitats and can be found in woodlands, hedgerows, marsh, heather, lowland farms, moorland, coastal areas and on small mountains. However, areas of open land devoid of any cover are unsuitable for a stoat's habitat requirements. The species tends to hunt along ditches, hedgerows and walls or through meadows and marshes. Male and female stoats live separately, marking their territories with scent and individuals will defend their territory against intruders of the same sex. In light of the habitat requirements of the species the proposed development site is not suitable and habitat loss or alteration impacts are not likely.

However, given that individuals were recorded near the site it is possible that individuals frequent the site occasionally. In the event that individuals do use the site, disturbance/displacement effects could arise as a result of increased activity at the site during the construction phase. However, because these activities will be restricted to daylight hours and having regard for the fact that the number of individuals habitually present will be low it is considered potential disturbance or displacement effects are likely to be inconsequential. The competitive territoriality of the species militates against the species being exposed in anything more than low numbers.

6.7.1.3.1.2.4 Otter

No otter holts were recorded, and no evidence of any activity was observed within the proposed development site or in the waterways draining the site and suitable breeding habitat and/or resting habitat was not recorded. As a result, neither habitat loss or alteration impacts or disturbance/displacement effects as a result of increased activity at the site during the construction phase are likely.

However, as the fluvial habitats downstream of the proposed development site are considered suitable for foraging otter, potential impacts could ensue in the event that water quality impacts were to reduce the prey biomass in these rivers. These impacts are considered to be limited given the localised and temporary nature of the works and the wide availability of suitable habitat downstream of the works. The extent of foraging habitat in watercourses downstream of the proposed development site means that the resilience of this species is safeguarded at a local level.

Table 6-52: Other Mammals: Description of impact and characterisation of effect

Habitat	In-situ Impact	In-situ/Ex-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Badger	Disturbance/ Displacement	In-situ disturbance/ displacement.	Neutral	Not significant	Brief/Reversible	Near certain
Irish hare	Disturbance/ Displacement	In-situ disturbance/ displacement.	Neutral	Not significant	Brief/Reversible	
Irish stoat	Disturbance/ Displacement	In-situ disturbance/ displacement.	Neutral	Not significant	Brief/Reversible	
Otter	Disturbance/ Displacement	In-situ/Ex-situ disturbance/ displacement.	Neutral	Not significant	Brief/Reversible	

Habitat	In-situ Impact	In-situ/Ex-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
	Impairment of water quality	Ex-situ disturbance/ displacement.	Negative	Slight	Short-term/Reversible	Near certain

Mitigation measures designed to prevent ex-situ effects on these species are described in **Section 6.8**.

6.7.1.3.1.3 Amphibians and reptiles

Common Frog occurs in the study area, with common lizard also likely. The loss and alteration of peatland habitats would result in a reduction of foraging habitat for this group. The proposed development is unlikely to result in a significant effect on amphibians and reptiles at a local level.

Table 6-53: Amphibians and Reptiles: Description of impact and characterisation of effect

Species	In-situ Impact	In-situ/Ex-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Common frog	Habitat loss. Disturbance/ Displacement.	In-situ habitat loss. In-situ disturbance/ displacement.	Negative	Slight	Short-term/ Reversible	Near certain
Common lizard	Habitat loss. Disturbance/ Displacement.	In-situ habitat loss. In-situ disturbance/ displacement.	Negative	Slight	Short-term/ Reversible	
Smooth newt	Habitat loss. Disturbance/ Displacement.	In-situ habitat loss. In-situ disturbance/ displacement.	Negative	Slight	Short-term/ Reversible	

6.7.1.3.1.4 Invertebrates

6.7.1.3.1.4.1 Marsh fritillary

While not recorded at the proposed development site, a record, from 2017, of 2 individuals is retained, by NBDC, for Grid R007403 - a location approximately 250 m to the south west of, and approximately 30 m north of the proposed access road to, Turbine 8.

As was noted in **Section 6.4**, small stands of the food plant of this species, devil's bit scabious, were recorded in a number of locations but these were not considered suitable to support breeding by the species due to the lack of suitable conditions - size of the stands, habitat structure and the absence of grazing or sward management and no damage to the leaves of any plant, a diagnostic of the presence of the species, was observed The proposed development is unlikely to result in a significant effect on this species at a local level.

Table 6-54; Invertebrates: Description of impact and characterisation of effect

Habitat	In-situ Impact	In-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Marsh fritillary	None occurring	None ensuing	N/A	N/A	N/A	Near certain

6.7.1.3.2 Aquatic fauna

6.7.1.3.2.1 Fish & Invertebrates

The fish species in the watercourses in the study area that are selected as IEF comprise salmon, European eel, lampreys and the invertebrate bivalve species duck mussel. Salmon are dependent on good water quality requiring a constant oxygen and stable food supply. An array of physico-chemical water quality parameters dictates the water chemistry and biological water quality of a water body required by the dependent aquatic ecosystem. The range of pH suitable for fisheries, for example, is considered to be 5.0-9.0, though 6.5-8.5 is preferable. Salmonid fish would begin to be affected as Dissolved Oxygen levels drop to around 50% saturation. Water quality changes in fluvial habitats downstream of the proposed development can affect the fish sustained by these habitats. Pathways from proposed construction areas to receiving watercourses (the Galey and Ballyline rivers) are primarily via overland flows and drainage ditches. While these pathways are of relatively low conveyance capacity due to small size and low gradients, potential source-pathway-receptor linkages do exist.

There is some potential for drains to act as pollution pathways between the proposed development site and the rivers downstream. A reduction in water quality due to pollutants entering the Galey or the Ballyline rivers as a result of the construction phase of the proposed development could potentially have an impact on the habitats required by aquatic species for the various stages of their life cycles. Pollutants including silt, chemicals or hydrocarbons are associated with construction activities.

One of the main risks is the siltation of gravel beds suitable for spawning lamprey and salmon which would reduce the availability of the habitat and, if present, reduce oxygen levels to fish eggs occupying substrate interstices. Spawning salmon need a clean well aerated riverbed substrate to survive. Siltation of the substrate and eutrophication leading to increased biomass of filamentous algae reduces the available suitable habitat. A reduction in the quality of the river-bed substrates arising from siltation can reduce habitat quality and therefore fragment the available suitable habitat for spawning IEF fish species. Such events could lead to negative impacts on fish further downstream or to habitats that support fish and their food. Excessive fine sediment, in suspension or deposited, can have damaging impacts on all life stages of fish, particularly salmonids.

The effects of excessive deposition of fine sediment on salmonid spawning success and egg survival have been well documented over the years. The effects of excessive sediment on fish are mortality; reduction in suitable spawning habitat and declines in egg/early life stage success; gill irritation/trauma; altered blood physiology; altered movement/swimming performance; changed foraging behaviour and reduced territoriality. [54] It has been proven that infiltration of fine sediment limits success of eggs hatching through the reduction of gravel permeability and oxygen availability.

[54] https://www.salmon-trout.org/wp-content/uploads/2017/09/STC-The-impact-of-excess-fine-sediment-on-invertebrates-and-fish-in-riverine-systems.pdf

Salmonid and lamprey eggs require a well-oxygenated environment during the embryonic development stage, so eggs are laid in permeable gravel beds with interstitial pore spaces, which allow the passage of oxygenated water. Excess fine sediment in the water, when deposited, can clog these interstitial pores, obstructing the circulation of oxygenated water, which reduces egg survival.[54] The release of silt from works areas to surface waters could exacerbate the existing unsatisfactory substrate conditions of a watercourse already degraded by anthropogenic activities e.g., land drainage.

Nutrients such as phosphorous are often bound to sediments and could result in eutrophication and in an increase in filamentous algae, which in turn can grow on gravels reducing the availability of the habitat and also reduce oxygen levels. An increase in polluting substances such as oils, fuels and cementitious materials in the water could reduce the suitability of the habitat for populations of salmon, lamprey and eels.

However, given the unsuitable lamprey nursery habitats and apparent absence of this fish group in the watercourses most adjacent to the proposed development site, the proposed development is unlikely to result in a significant effect on lampreys at a local level (i.e., within the Coolkeragh and Ballyline rivers).

Notwithstanding that excessive loading can have adverse effects on river ecosystem function, healthy freshwater ecosystems require sediment inputs to maintain habitat and nutrient fluxes. Specifically, with regard to duck mussel, this species is not as vulnerable to adverse effects resulting from the ingress of silts as are the IEF fish species and, in fact, is adapted to silty conditions and hence able to cope with natural 'baseline' sediment inputs. It is, however, as vulnerable to direct physical effects such as reduction in habitat availability and modification of habitat biogeochemical conditions through reduction of oxygen and increased concentrations of toxic compounds as are the other species.

Table 6-55: Fish & Invertebrates; Description of impact and characterisation of effect

Habitat	In-situ Impact	In-situ/Ex-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
European eel	Impairment of water quality.	Ex-situ habitat loss. Ex-situ disturbance/ displacement	Negative	Slight	Short-term/ Reversible	Near certain
Salmon	Impairment of water quality.	Ex-situ habitat loss. Ex-situ disturbance/ displacement	Negative	Slight	Short-term/ Reversible	
Lamprey species	Impairment of water quality.	Ex-situ habitat loss. Ex-situ disturbance/ displacement	Negative	Slight	Short-term/ Reversible	
Duck mussel	Impairment of water quality.	Ex-situ habitat loss. Ex-situ disturbance/	Negative	Slight	Short-term/ Reversible	

Habitat	In-situ Impact	In-situ/Ex-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
		displacement				

Mitigation measures designed to prevent ex-situ effects on these species are described in **Section 6.8**.

6.7.2 Operational Phase

6.7.2.1.1 Site of International Importance Shannon and Fergus Estuaries IBA (IE68)

It is considered that there will be no direct, indirect or secondary effects on this site of international importance as a result of the operation of the proposed development. The construction phase effects, identified in **Section 6.7.1**, were those ensuing from adverse water quality impacts, however, once the construction phase is completed the source element of the source – pathway – receptor pathway will be significantly reduced. There is some potential for minor excavations associated with drainage, road and cable maintenance however these will be small in scale and infrequent in comparison to the construction phase. Maintenance works on turbines will be carried out from the roads and hardstands. Some erosion of soil will continue into the operation phase, however, as vegetation becomes established and equilibrium is achieved, erosion rates will reduce to pre-construction levels The impact and effect that could ensue is characterised in **Table 6-56** using the criteria set out in **Section 6.1.5.2**.

Table 6-56: Shannon and Fergus Estuaries IBA (IE68) - Description of impact and characterisation of effect

In-situ Impact	Ex-situ Effect	Characterisation of Effect			Confidence Level
		Quality	Significance	Duration	
None occurring	None ensuing	N/A	N/A	N/A	Near certain

6.7.2.1.2 Sites of National Importance

Section 6.7.1 determined that there is some, albeit limited, potential that in-situ water quality impacts generated by the proposed development could exert indirect ex-situ effects on one site of national importance, namely the Ballylongford Bay pNHA (001332). Notwithstanding that, prior to statutory designation, pNHAs are subject to limited protection,[55] the Ballylongford Bay pNHA (001332)encompasses a brackish lagoon and areas of reed beds and overlaps with the Lower River Shannon SAC (002165) and the River Shannon and River Fergus Estuaries SPA (004077). However, once the construction phase is completed the source constituent of the source – pathway – receptor pathway will no longer exist. The impact and effect that could ensue is characterised in **Table 6-57** using the criteria set out in **Section 6.1.5.2**.

Table 6-57: Ballylongford Bay pNHA (001332) - Description of impact and characterisation of effect

In-situ Impact	Ex-situ Effect	Characterisation of Effect			Confidence level
		Quality	Significance	Duration	
None occurring	None ensuing	N/A	N/A	N/A	Near certain

6.7.2.2 Impacts to IEF Habitats

Once the construction phase is completed sources of adverse water quality impacts will no longer exist and the source-pathway-receptor chain for effects cannot be activated and, as a result, the

[55] https://www.npws.ie/protected-sites/nha

freshwater habitats that were exposed to impairment of water quality impacts during the construction phase will no longer be exposed.

However, during operation of a wind farm, any medium and long-term impacts are typically associated with the permanent site infrastructure such as roads, turbine bases and hard standings (Natural England, 2010) which, in the case of this proposed development, are sited primarily in peat habitats and it is this habitat type, therefore, that is most exposed to operational phase impacts.

While impacts during the operational phase may be lower in magnitude the proposed development is likely to operate for at least 30 years. Impacts associated with the permanent site infrastructure can include alteration of surface and groundwater flow patterns, peat subsidence, sediment release and chemical pollution. Changes to the blanket peat can lead to changes in the vegetation, habitats and biodiversity. Surface flows may be locally altered by new drainage systems. Groundwater flow patterns may also be locally modified by turbine bases, the foundations of the substation and cable trenches, which may act as groundwater conduits, or barriers. There may be localised disruption of flow paths near the turbines and a slight lowering of the groundwater table near drainage ditches. In summary, during operation the proposed development may:

- Lower water levels in bog areas, due to the on-going drainage of tracks which provide access to the turbines for maintenance. The effect is less than during the construction phase; and
- The tracks may change flow pathways across the site, increasing potential for erosion in areas where water flow is now focussed.

However, as was noted in **Section 6.4**, the peat mass at the Shroneowen has been significantly altered by peat harvesting and by the existing extensive network of drains which have lowered the water table significantly throughout the peat mass. As a result, the operation of the proposed development is unlikely to result in significant effects on peat habitats beyond localised effects.

The impacts and effects that could ensue are characterised in **Table 6-58** using the criteria set out in **Section 6.1.5.2**.

Table 6-58: IEF Habitats: Description of impact and characterisation of effect

Habitat	Impact	Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Depositing lowland Rivers FW2	None occurring	None ensuing	N/A	N/A	N/A	Near certain
Drainage ditches FW4	None occurring	None ensuing	N/A	N/A	N/A	
Cutover bog PB4	None occurring	None ensuing	N/A	N/A	N/A	

6.7.2.3 Impacts to IEF Species

6.7.2.3.1 Bats

For ease of reference the results of the 2019 and 2020 surveys provided, previously, in **Table 6-23** and **Table 6-24** are provided again in **Tables 6-59** and **6-60**, below.

Table 6-59: Bat passes recorded at each SP during 2019 surveys

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	4	108	118	127	1	179	537
2	5	46	152	69	0	121	393
3	4	79	290	151	2	160	686
4	1	38	221	99	6	274	639
Total	14	271	781	446	9	734	2255
%	0.6	12.0	34.6	19.8	0.4	32.5	

Table 6-60: Bat passes recorded at each SP during 2020 surveys

SP	*Myotis* spp.	Leisler's bat	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	NoID	Total
1	**6**	**139**	**2,752**	**1,033**	**14**	**776**	**4,720**
2	**5**	**156**	**1,482**	**334**	**7**	**321**	**2,305**
3	**1**	**93**	**1,032**	**664**	**3**	**53**	**1,846**
4	**4**	**222**	**268**	**73**	**1**	**177**	**745**
5	**69**	**136**	**311**	**146**	**15**	**175**	**852**
6	**46**	**253**	**3,212**	**4,005**	**3**	**931**	**8,450**
7	**2**	**305**	**1,157**	**472**	**2**	**395**	**2,333**
8	**3**	**180**	**225**	**76**	**3**	**68**	**555**
9	**2**	**300**	**1,615**	**619**	**11**	**1,009**	**3,556**
10	**2**	**157**	**236**	**94**	**3**	**107**	**599**
Total	**140**	**1,941**	**12,290**	**7,516**	**62**	**4,012**	**25,961**
%	**0.5**	**7.5**	**47.3**	**28.9**	**0.24**	**15.5**	

With regard to the area within the proposed wind farm development site, as can be seen from the BHSI ratings listed in **Table 6-18**, above, not only is the overall habitat suitability rating for all bat species very low, only soprano pipistrelle and brown long-eared bat have a rating above 30, and, while Daubenton's bat, Leisler's bat and common pipistrelle have a rating above 20, the remainder of the species have ratings below this level - a clear indication that the site is evaluated, by the BHSI criteria, as, in effect, having little or no potential value for these species. The initial risk assessment of the proposed development site, provided in **Section 6.4.2**, determined that the site is Low risk.

The primary impact associated with operational wind farms, one that pertains to all bat species, is the risk of mortality due to collision with rotating turbine blades (Natural England, 2014). At the species level, the risk of collision with rotating turbines is correlated to the flight behaviours of each species. However, at the population level the risk of significant effects from the impact of collision with wind turbines is correlated to the level of bat activity – the level of exposure to the risk. The extent of this risk is, therefore, site specific and correlated to the numbers of bats utilising an area, the frequency of their usage and the duration of bat activity. Of the resident species all, apart from one species - Leisler's bat, are normally low fliers that forage and commute at heights of less than 10m above ground level and, as a consequence, are considered to be at a lower risk from turbine impacts (BCI, 2012) than this high-risk species.

SNH (2019) provides evaluations, at the population level, of the relative vulnerability to risk of collision of each bat species resident in the UK and places them into low, medium or high-risk categories based

on each species' behaviour and ecology in combination with evidence of casualty rates in the UK and Europe. These evaluations are summarised in **Table 6-61** and are outlined, in detail, in **Table 6-62**.

Table 6-61: Level of potential vulnerability of populations of bat species

Low collision risk	High collision risk
Brown long eared bat	Common pipistrelle
Myotis species	Soprano pipistrelle
Lesser horseshoe bat	Nathusius' pipistrelle
	Leisler's bat

Table 6-62: Potential vulnerability to collision based on physical and behavioural characteristics

Risk of turbine impact			
Factor	**Low Risk**	**Medium Risk**	**High Risk**
Habitat preference	Bats preferring cluttered habitat.	Bats able to exploit cluttered space.	Bats preferring to use open Habitat.
Echolocation characteristics	Short range. High frequency. Low intensity. Detection distance ~15m.	Intermediate – more plastic in their echolocation.	Long range. Low frequency. High intensity. Detection distance ~80m.[56]
Wing shape	Low wing loading. Low aspect ratio. Broadest wings.	Intermediate.	High wing loading. High aspect ratio. Narrow wings.
Flight speed	Slow.	Intermediate.	Fast.
Flight behaviour and use of landscape	Manoeuvres well. Will travel in cluttered habitat. Keeps close to vegetation. Gaps may be avoided.	Some flexibility.	Less able to manoeuvre. May avoid cluttered habitat. Can get away from unsuitable habitat quickly. Commute across open landscape.
Hunting techniques	Hunt close to vegetation. Exploit richer food sources in cluttered habitat. Gleaners.	Hunt in edge and gap habitat. Aerial hawkers.	Less able to exploit insect abundance in cluttered habitat. Aerial hawker. Feed in open.
Migration	Local or regional movements.	Regional migrant in some parts of range.	Long-range migrant in some parts of range.
Conclusion	***Myotis* species** **Brown long-eared bat** **Lesser horseshoe bat**	**No medium risk species resident in Ireland**	**Common pipistrelle** **Soprano pipistrelle** **Nathusius' pipistrelle** **Leisler's bat**

An area of 3.15 ha of keyhole felling is required adjacent to T1 and T7 to facilitate construction. Keyhole felling can introduce risk as the cleared areas create edges that many species favour and the rotating blades can potentially 'protrude' into the air space above the forest canopy used by high flying species (SNH, 2019). While it is not plausible to predict operational phase changes in bat foraging behaviours that may result from habitat changes, particularly clearfelling, the fact that the sampling points used in the surveys, that are the basis of this current assessment, sampled activity in open habitats within the proposed wind farm development site allows an evidence-based assessment of the species likely to use the new clear-fell areas and their associated edge habitats.

[56] Except *Pipistrellus* spp.

6.7.2.3.1.1 Risk Assessments

The bat species selected as IEF are categorised by likely risk vulnerability, as outlined in **Table 6-61** and **Table 6-62**, above, in the paragraphs hereunder. The survey data is then used to assess the extent of each species' exposure to collision risk based on the level of each species' presence on the site. The impact and effect that could ensue is characterised in **Table 6-63** using the criteria set out in **Section 6.1.5.2**. The rationales supporting the characterisations of the effects are provided in **Sections 6.7.2.3.1.1.1** to **6.7.2.3.1.1.5**, inclusive, below.

Mitigation measures designed to prevent effects on bat species site are described in **Section 6.8**.

Table 6-63: Bat species: Description of impact and characterisation of effect

Species	In-situ Impact	In-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Bat species	Collision	Mortality	Negative	Significant	Long term	Near certain

6.7.2.3.1.1.1 Brown long-eared bat

This species comprised 0.4% of the activity recorded in 2019 and 0.24% of that recorded in 2020 with hourly average rates of <1 in 2019 for all SPs and <1 in 2020 for all SPs and for all seasons.

In light of the low level of activity recorded and the correlation between risk exposure and that level of activity, and bearing in mind the low risk of collision attributed to this species in **Table 6-61** and **Table 6-62**, it is concluded that the level of collision risk at this site for this species is low. However, it is reasonably foreseeable that foraging brown long-eared bats currently using the site will continue to do so and are likely to use the 3.15 ha of clearfelling required for two turbines - T1 and T7. While the level of exposure to collision risk is minimal it is concluded, on the basis of the precautionary principle, that moderate negative impacts on individuals frequenting the site are reasonably foreseeable and it is considered probable that any potential unmitigated impact could be significant to the local population. Mitigation measures designed to prevent effects on these species are described in **Section 6.8**.

6.7.2.3.1.1.2 Myotis bats

This species comprised 0.6% of the activity recorded in 2019 and 0.5% of that recorded in 2020 with hourly average rates of < 1 in 2019 and <1 in 2020 for all SPs and for all seasons.

In light of the low level of activity recorded and the correlation between risk exposure and that level of activity and, bearing in mind the low risk of collision attributed to this species in **Table 6-61** and **Table 6-62**, it is concluded that the level of collision risk at this site for this species is low. However, it is reasonably foreseeable that foraging *Myotis* bats currently using the site will continue to do so and are likely to use the 3.15 ha of clearfelling required for two turbines - T1 and T7. While the level of exposure to collision risk is minimal it is concluded, on the basis of the precautionary principle, that moderate negative impacts on individuals frequenting the site are reasonably foreseeable and it is considered probable that any potential unmitigated impact could be significant to the local population. Mitigation measures designed to prevent effects on these species are described in **Section 6.8**.

6.7.2.3.1.1.3 Pipistrelle bats

Common pipistrelle bats comprised 34.6% of the activity recorded in 2019 and 19.8% of that recorded in 2020 with a highest hourly average rate of 26 in 2019 and of 29 in 2020 at SP1 during the spring surveys.

Soprano pipistrelle bats comprised 47.3% of the activity recorded in 2019 and 28.9 % of that recorded in 2020 with a highest hourly average rate of 14 in 2019 and of 29 in 2020 at SP6 during the autumn surveys.

Notwithstanding the high risk of collision attributed to these species in **Table 6-61** and **Table 6-62**, in light of the low levels of activity recorded and the correlation between risk exposure and that level of activity it is concluded that the level of collision risk at this site for these species is low. However, it is reasonably foreseeable that foraging pipistrelle bats currently using the site will continue to do so and are likely to use the 3.15 ha of clearfelling required for two turbines - T1 and T7. While the level of exposure to collision risk is minimal it is concluded, on the basis of the precautionary principle, that moderate negative impacts on individuals frequenting the site are reasonably foreseeable and it is considered probable that any potential unmitigated impact could be significant to the local population. Mitigation measures designed to prevent effects on these species are described in **Section 6.8**.

6.7.2.3.1.1.4 Leisler's bats

This species comprised 12.0% of the activity recorded in 2019 and 7.5% of that recorded in 2020 with a highest hourly average rate of 10 in 2019 and of 2 in 2020 at SP9 during the spring surveys.

Notwithstanding the high risk of collision attributed to this species in **Table 6-61** and **Table 6-62**, in light of the low levels of activity recorded and the correlation between risk exposure and that level of activity it is concluded that the level of collision risk at this site for this species is low. However, it is reasonably foreseeable that foraging Leisler's bats currently using the site will continue to do so and are likely to use the 3.15 ha of clearfelling required for two turbines - T1 and T7. While the level of exposure to collision risk is minimal it is concluded, on the basis of the precautionary principle, that moderate negative impacts on individuals frequenting the site are reasonably foreseeable and it is considered probable that any potential unmitigated impact could be significant to the local population. Mitigation measures designed to prevent effects on this species are described in **Section 6.8**.

6.7.2.3.1.1.5 Lesser horseshoe bat & Nathusius' pipistrelle

While these species were not recorded, they are included, on the basis of the precautionary principle, and the assessments of risk completed in the preceding sections are taken to pertain to these species as are the efficacy of the mitigation measures designed to prevent effects on the species recorded that are described in **Section 6.8**.

6.7.2.3.1.2 Conclusion

Notwithstanding the low level of activity recorded for all species, foraging bats using the site may be impacted by mortality due to collision with rotating turbine blades. As a result, it is concluded that long-term, significant, negative effects on bat species are likely at a local level.

Mitigation measures designed to prevent effects on these species are described in **Section 6.8**.

6.7.2.3.2 Other Mammals

Once the construction phase of the proposed development has been completed, any individuals of these species that may have been temporarily displaced owing to construction activity would utilise the habitats within and adjacent to the proposed development site within a short period of time. Any further impacts to otters during operation would be related to water quality and assessed as long term, imperceptible and neutral. Once the construction phase is completed the source element of the source – pathway – receptor pathway will be significantly reduced. There is some potential for minor excavations associated with drainage, road and cable maintenance however these will be small in scale and infrequent in comparison to the construction phase. Maintenance works on turbines will be carried out from the roads and hardstands. Some erosion of soil will continue into the operation phase, however, as vegetation becomes established and equilibrium is achieved, erosion rates will reduce to pre-construction levels, lowering the risk of ex-situ effects on prey biomass of otter, and therefore, on otter.

The impacts and effects that could ensue are characterised in **Table 6-64** using the criteria set out in **Section 6.1.5.2**.

Table 6-64: Other mammals; Description of impact and characterisation of effect

Species	Impact	Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Badger	None occurring	None ensuing	N/A	N/A	N/A	Near certain
Irish hare	None occurring	None ensuing	N/A	N/A	N/A	
Irish stoat	None occurring	None ensuing	N/A	N/A	N/A	
Otter	None occurring	None ensuing	N/A	N/A	N/A	

6.7.2.3.3 Amphibians and Reptiles

Once the construction phase of the proposed development has been completed, any individuals of these species that may have been temporarily displaced owing to construction activity would utilise the habitats within and adjacent to the proposed development site within a short period of time. The impacts and effects that could ensue are characterised in **Table 6-65** using the criteria set out in **Section 6.1.5.2**.

Table 6-65: Amphibians and Reptiles Description of impact and characterisation of effect

Species	Impact	Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Common frog	None occurring	None ensuing	N/A	N/A	N/A	Near certain
Common lizard	None occurring	None ensuing	N/A	N/A	N/A	
Smooth newt	None occurring	None ensuing	N/A	N/A	N/A	

6.7.2.3.4 Invertebrates

Once the construction phase of the proposed development has been completed, any marsh fritillary butterflies that may have been temporarily displaced owing to construction activity would utilise the habitats within and adjacent to the proposed development site within a short period of time. The impact and effect that could ensue is characterised in **Table 6-66**, using the criteria set out in **Section 6.1.5.2**.

Table 6-66: Invertebrates: Description of impact and characterisation of effect

Habitat	In-situ Impact	In-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
Marsh fritillary	None occurring	None ensuing	N/A	N/A	N/A	Near certain

6.7.2.3.5 Aquatic species

Once the construction phase is completed the source element of the source – pathway – receptor pathway will be significantly reduced. There is some potential for minor excavations associated with drainage, road and cable maintenance however these will be small in scale and infrequent in comparison to the construction phase. Maintenance works on turbines will be carried out from the roads and hardstands. Some erosion of soil will continue into the operation phase, however, as vegetation becomes established and equilibrium is achieved, erosion rates will reduce to pre-construction levels, the risk of water quality impacts and related effects returning with pre-construction conditions.

It is expected that any aquatic species that may have been temporarily affected due to construction activity would utilise the aquatic habitats within and downstream of the proposed development site within a short period of time. The impacts and effects that could ensue are characterised in **Table 6-67** using the criteria set out in **Section 6.1.5.2**.

Table 6-67: Aquatic Species: Description of impact and characterisation of effect

Species	In-situ Impact	In-situ Effect	Characterisation of Effect			Confidence level
			Quality	Significance	Duration	
European eel	None occurring	None ensuing	N/A	N/A	N/A	Near certain
Salmon	None occurring	None ensuing	N/A	N/A	N/A	
Lamprey species	None occurring	None ensuing	N/A	N/A	N/A	
Duck mussel	None occurring	None ensuing	N/A	N/A	N/A	

6.7.3 Decommissioning Phase

At the end of the estimated 30-year lifespan of the proposed development, the Developer will make the decision whether to 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 partially 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 Kerry County Council for approval:

- A plan outlining measures to ensure the safety of the public workforce and the use of best available techniques at the time.
- A comprehensive reinstatement proposal, including the implementation of a program 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. The towers, blades and all components will then be removed. The turbine transformers will also be removed from site. It is likely that any turbine component will be reused as they have a life well in excess of the wind farm proposal i.e., greater than 30 years. Wind farm components may also be recycled.

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

At present it is anticipated that underground cables connecting the turbines to the selected 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. The assessment will be carried out closer to the time to take into account environmental changes over the project life.

The new 110 kV substation will remain in place as it will be under the ownership of ESB/EirGrid and will operate as a grid asset in North Kerry going forward.

Hardstand areas will be remediated to match the existing landscape thus requiring agricultural pasture reinstatement, peatland restoration or reforestation. Access roads will be left for use by the landowners.

The current view is that the disturbance associated with the removal and disposal of the material would be more deleterious than leaving them in place. In the event of decommissioning being progressed, full engagement with the Local Authority and relevant departments including planning, environment and roads would take place to agree and ensure that any potential effects are minimised and controlled. A decommissioning plan would be agreed, and this would guide the process and control any potential effects.

Any structural materials suitable for recycling will be disposed of in an appropriate manner. The financial costs of decommissioning, at current material values, will be more than met by the recycling value of the turbine components.

Prior to wind turbine removal, due consideration would be given to any potential impacts arising from these operations. Some of the aspects to be considered and agreed with the Local Authority prior to decommissioning may include:

- Potential disturbance by the presence of crane, heavy goods vehicles and personnel on-site.
- On-site temporary compound would need to be located appropriately.
- Time of year and timescale (to be outside sensitive periods).
- Prior to the decommissioning work, a comprehensive plan will be drawn up to ensure the safety of the public and workforce and the use of best available techniques at the time.
- Prior to the decommissioning work, a comprehensive reinstatement proposal, including the implementation of a programme that details the removal of structures and landscaping, will be submitted to the Planning Authority.

6.7.4 Cumulative Effects

A cumulative impact arises from incremental changes caused by other past, present, or reasonably foreseeable activities interacting synergistically with the impacts generated by the proposed wind farm development in a manner that has the potential to cause effects on the receiving environment. The activities, pressures and projects identified as plausible sources of impacts to be assessed for their potential to generate cumulative effects are listed in **Table 6-68,** as are the characterisations of cumulative effects. The assessment and rationales supporting the individual characterisations are provided in **Sections 6.7.4.1** to **6.7.4.10**, inclusive, below. In each case the Confidence Level of the Prediction is Near certain.

With regard to the activities, pressures and projects that are germane, what is to be determined is if any such impacts are likely and, if so, if they are of a magnitude, character or duration sufficient to have an inherent/intrinsic capacity to cause cumulative effects through synergistic interaction with the proposed development.

Table 6-68: Characterisation of Cumulative Effects

Other Activities	Characterisation of Effect			Confidence level
	Quality	Significance	Duration	
Climate change	Neutral	Imperceptible	Long term	Near certain
Water quality	Negative	Significant	Short term	Near certain
Agriculture	Negative	Significant	Short term	Near certain
Forestry	Negative	Slight	Short term	Near certain
Peat Extraction	Neutral	Slight	Long-term	Near certain
Urban Treatment Plants and Domestic	Neutral	Imperceptible	Long-term	Near certain
Other Wind Farms (Excluding Tullahennel and Leanamore Wind Farms)	Neutral	Imperceptible	Long-term	Near certain
Tullahennel and Leanamore Wind Farms (Water quality)	Neutral	Slight	Temporary	Near certain
Tullahennel and Leanamore Wind Farms (Bats)	Neutral	Imperceptible	Long-term	Near certain
Solar farm	Neutral	Imperceptible	Long-term	Near certain
Plans	Neutral	Imperceptible	Long-term	Near certain
Minor Developments	Neutral	Imperceptible	Long-term	Near certain

6.7.4.1 Climate change

Climate is an important environmental influence on ecosystems. Changing climate affects ecosystems 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. Similarly, as sea level rises, saltwater intrusion into freshwater systems may force some key species to relocate or die, thus removing predators or prey that are critical in the existing food chain. Climate change not only affects ecosystems and species directly, but it also interacts with other human stressors such as development. Although some stressors cause only minor impacts when acting alone, their cumulative impact may lead to dramatic ecological changes (Settele *et al.*, 2014). Because species differ in their ability to adjust, asynchronies[57] can develop, increasing species and ecosystem vulnerability. These asynchronies can include mismatches in the timing of migration, breeding, pest avoidance, and food

[57] Absence or lack of concurrence in time.

availability. Growth and survival are reduced when migrants arrive at a location before or after food sources are present (Horton *et al.,* 2014).

Ecosystems can serve as natural buffers from extreme events such as wildfires, flooding, and drought. Climate change and human modification may restrict ecosystems' ability to temper the impacts of extreme conditions, and thus may increase vulnerability to damage. An example is the riparian zone that acts as buffer zone protecting riverine ecosystems from runoff of silt/nutrient laden waters via overland/pluvial flow, by absorbing/attenuating surface floodwaters. Land along the Galey and Ballyline rivers, as well as land 'improvement' along other watercourses within the catchment may become vulnerable to erosion if climate change leads to increases in heavy rainstorms. This could lead to uncontrolled erosion of riverbanks, and riparian areas and loss of soil from fields, resulting in unnatural sediment loads and associated siltation of rivers. Climate change and shifts in ecological conditions could also support the spread of pathogens, parasites, diseases, and non-native biota, with potentially serious effects on agriculture and aquatic ecosystems. Together with the proposed development, the effects of climate change could exacerbate potential impacts associated with the proposed development.

However, considering the dominance of intensively managed agricultural grassland habitats, which are of low intrinsic ecological value, in the wider study area, the potential for cumulative impacts as a result of any synergies between the impacts of the proposed development and the impacts of climate change are considered unlikely to be significant. It is concluded that it is Near certain that cumulative effects will be Neutral, Imperceptible, and Long-term.

Notwithstanding the conclusion of the preceding paragraph, the proposed wind farm development would reduce the need for fossil fuels to generate electricity so would have a positive impact by reducing CO_2 emissions. In this regard, it is likely that the long-term quality of the effect of the wind farm will be positive in the context of factors known to influence climate change.

6.7.4.2 Water quality

In terms of the potential impacts of the proposed development on downstream surface water bodies, the biggest risk would be during the construction phase, as this is the phase when earthworks and excavations will be undertaken.

The aquatic environment in Ireland is subjected to impacts from many different human activities and pressures including, *inter alia*, chemical, microbiological, organic, acidification and hydro-morphological pressures. The main problem impacting on Irish waters is nutrient pollution (nitrogen and phosphorus) which can cause excessive plant growth and increase the likelihood of harmful algal blooms. Excess nutrients, mainly phosphorus but also ammonium, are the dominant issue in many rivers. Forestry and peat extraction can cause ecological problems through increased erosion rates, siltation, and nutrient loss. Phosphorus losses come primarily from waste-water discharges, and from runoff losses from agriculture on poorly draining soils. In a study by Deakin *et al.* (2016), the transport of phosphorus (P) via overland flow and interflow, and from small point sources, proved the key issues in a catchment underlain by poorly draining soils.

Considering the dominance of intensively managed agricultural grassland habitats in the wider geographical area, agriculture is the primary potential source of point or diffuse pollution sources with which the proposed development could interact to cause cumulative effects. The proposed development is assessed as potentially having a short-term slight negative cumulative impact on water

quality which could result in significant cumulative effects on water quality at a local level, so could result in significant cumulative effects on aquatic IEFs. It is noted however that mitigation has been put in place to alleviate these effects, including engineering design based on detailed site survey and best practice drainage strategy.

However, considering that the risk of negative water quality impacts associated with the proposed development will occur, primarily, during the construction phase, as this is the phase when earthworks and excavations will be undertaken, the potential for cumulative effects as a result of any synergies between the impacts of the proposed development and the impacts from agriculture are considered unlikely to be significant. It is concluded that it is Near certain that cumulative effects will be Negative, Significant, and Short-term.

6.7.4.3 Agriculture

In the context of synergistic interaction, between the proposed development and agriculture, the most pertinent environmental components likely to be exposed to cumulative effects are the downstream river systems, of which water quality (outlined above) is a relevant factor. As was noted, previously, regarding the potential impacts of the proposed development on downstream surface water bodies, the biggest risk would be during the construction phase, as this is the phase when major earthworks and excavations will be undertaken. Earthworks will also be undertaken during the decommissioning phase, albeit to an extent that will be significantly less. Agriculture is a widely acknowledged source of point and diffuse source of water quality impacts on freshwater habitats and excess phosphorus is the key concern in freshwaters and in some of estuaries. While sediment from land drainage works, bank erosion from animal access or stream crossings can also be a problem, the issues pertaining to farming are mainly loss of phosphorus to surface waters from, *inter alia*, direct discharges, runoff from yards, roadways or other compacted surfaces, or runoff from poorly draining soils. Excess phosphorus can lead to eutrophication, when a body of water becomes overly enriched with minerals and nutrients, which then induce excessive growth of algae. This process may result in oxygen depletion of the water body after the bacterial degradation of the algae. Diffuse phosphorus losses from agriculture are particularly difficult to manage as the sources do not occur uniformly in the landscape, but from critical source areas where runoff pathways connect phosphorus sources to rivers and streams. It takes only very small amounts of phosphorus to be lost, relative to the amounts used in agriculture, to cause a water quality problem. Impacts by pesticides and/or herbicides are also an issue with sheep dip recorded as an issue in many water bodies.

The dominant activity in the area extending away from the proposed development site is intensive dairy farming. During the water quality assessments at sites on watercourses downstream of the PDS, the main driver of water quality degradation was determined to be agricultural related. There is, therefore, potential for the proposed wind farm development to contribute to a cumulative effect on the water quality of the downstream fresh and marine waters identified. This derives from the potential for sediments and other pollutants entering the watercourses because of construction activities to act in-combination with emissions from ongoing farming activities in the areas surrounding the proposed development site. It is unlikely that the proposed wind farm development will generate or emit any nutrient enriched waters even as point source unmitigated impacts nor is it likely that sediments, to which nutrients are chemically bound, will be liberated for transmission to the relevant downstream water bodies.

However, considering that the highest risk of negative water quality impacts, associated with the proposed development, will occur during the construction phase, as this is the phase when earthworks and excavations will be undertaken, the potential for cumulative effects as a result of any synergies between the impacts of the proposed development and the impacts from agriculture are considered unlikely to be significant once construction is completed However, it is concluded that it is Near certain that cumulative effects will be Negative, Significant, and Short-term during the construction phase.

6.7.4.4 Forestry

Poorly managed and inappropriately sited forest operations can negatively impact on water quality and aquatic habitats and species. The significant issues that could arise would result from a combination of general forestry pressures such as acidification, drainage, road construction, planting and clearfelling. These pressures, which are primarily associated with the beginning and end phases of a crop growth cycle, can result in the release of soil bound nutrients or sediments to water courses, to organic pollution and, in certain circumstances, to morphological changes to streams and rivers. The proposed wind farm development will involve the construction of some new roads and other earthworks that may mobilise peat silt and nutrients within a footprint adjacent to conifer plantation blocks and will require clearfelling in the areas around turbine T1 and T7 which could lead to nutrient release from the soil which previously had been somewhat shielded from rainfall due to interception by the forest canopy.

While forestry is one of the land uses in the area adjacent to the proposed development site, it is not a dominant constituent in the wider geographical area. These blocks mainly comprise single species stands with Sitka spruce (*Picea sitchensis*), Japanese larch (*Larix kaempferi*) and alder (*Alnus* spp.) dominant. One of the legacy impacts of forestry on the local environment has been habitat loss and habitat alteration which would have reduced the habitat available for certain fauna and flora and, in the event that the forestry has been subject to poor management, commercial forestry may have resulted in a reduction in water quality. However, to the extent that the currently extant unforested habitats reflect the circumstances prior to afforestation of the current woodland footprint, the previous circumstances were unlikely to have supported a markedly richer level of biodiversity. With regard to any potential for adverse water quality impacts ensuing from the change in land use that potential is correlated to, the extent of the areas now afforested which, while not insignificant, are not extensive in absolute area or as a proportion of the habitats either in the areas most adjacent to the proposed development site or in the wider geographical area extending away from it.

There is potential for the proposed development to contribute to a cumulative impact on water quality in local watercourses, within and downstream of the site, through the potential for sediments and other pollutants entering the watercourses via the site drainage that will be constructed. However, considering that the highest risk of negative water quality impacts, associated with the proposed development, will occur during the construction phase, as this is the phase when earthworks and excavations will be undertaken, the potential for cumulative effects as a result of any synergies between the impacts of the proposed development and the impacts from forestry are considered unlikely to be significant. It is concluded that it is Near certain that cumulative effects will be Negative, Slight, and Short-term.

6.7.4.5 Peat extraction

Peat extraction has been occurring at the proposed development site for many decades. The resultant activity has led to habitat alteration of what originally was lowland blanket bog to the current cutover

bog. The subsequent drying out of the peat, as a result of drainage, and the alteration and reduction of the peatland habitat, due to cutting, has resulted in the formation of different habitats. Notwithstanding that peat extraction is likely to continue during the construction and operational phases, the potential for cumulative effects as a result of any synergies between the impacts of the proposed development and the impacts from peat extraction are considered unlikely to be significant. It is concluded that it is Near certain that cumulative effects will be Neutral, Slight, and Temporary.

6.7.4.6 Wastewater (Urban Treatment Plants and Domestic)

The Ballylongford Kerry Urban Wastewater Treatment (UWWT) Plant has a tertiary Nitrogen removal point located in Ballylongford Bay (RegCD D0459). The Listowel UWWT Plant has a secondary treatment facility south-west of the site (RegCD D0179). The pressures associated with these plants, and with domestic on site WWT units, are the discharges that may impact upon on physico-chemical parameters such as the levels of dissolved nutrients, suspended solids, and some elemental components. It should be noted that the pressures resulting from the proposed development are primarily associated with an increased risk of sediment mobilisation and fuel or oils spills. However, these effects are unlikely as the volumes generated would need to be very large for any adverse impact to ensue and they are not likely to impact on physico-chemical parameters in the water column. It is, therefore, concluded that, given the pressure resulting from the discharges from the various plants would likely impact on physico-chemical parameters in the water column, any in-combination effects with discharges from these plants are considered to be minimal or negligible. It is concluded that it is Near certain that cumulative effects will be Neutral, Imperceptible, and Temporary.

6.7.4.7 Wind Farm Development

Fifteen operational or permitted wind farms, listed in **Table 6-69**, are situated within 15 km of the proposed development site.

Table 6-69: Wind Farms within 15 km of the Proposed Development Site

Wind Farm Name	Status	No. of Turbines	Distance and Direction from Shronowen Wind Farm
Tullahennel	Existing	10	c. 1.3 km to the north west
Ballylongford	Granted	6	c. 2.2 km to the north west
Leanamore	Existing	9	c. 2.5 km to the north east
Larha	Existing	2	c. 5.5 km to the north west
Carhooeargh	Granted	2	c. 7.0 km to the north west
Toberatooreen	Existing	7	c. 6.5 km to the south east
Curraghderrig	Existing	2	c. 8.0 km to the north west
Beennanaspuck	Existing	3	c. 9.0 km to the south east
Moneypoint	Existing	5	c. 10.2km to the north east
Beale Hill	Existing	5	c. 10.7 km to the north west
Ballyhorgan	Granted	10	c. 11.0 km to the south west
Athea (includes: Tooradoo Cratoloe West, Tooradoo and Upper Athea wind farms)	Existing	16	c. 11.0 km south east
Pallas	Existing	20/26	c. 14.0 km to the south
Muingnaminnane	Existing	6	c. 14.5 km to the south east
Dromada	Existing	12	c. 15.7 km to the south east

Tullahennel and Leanamore, which are operational, are at removes of 1.3 km, and 2.5 km, respectively. Ballylongford Wind Farm, which is not operational, is 2.2 km to the northeast. The remaining twelve are in excess of 6 km away, with six of these being in excess of 10 km. It is Near certain that the quality of any potential cumulative effects with these, latter, twelve wind farms projects will be Neutral, Imperceptible, and Long-term.

With regard to Tullahennel, Leanamore and Ballylongford wind farms: part of the Tullahennel Wind Farm, which is to the west of the proposed development site, and Leanamore Wind Farm, which is to the east, drain to tributaries of the Ballyline River. **Chapter 8** of this EIAR (Water) has concluded that each of these individual wind farms will have insignificant effects on the downstream flood risk and it is not envisaged that the addition of the proposed wind farm development at Shronowen would incur any significant cumulative flood risk downstream. With regard to potential cumulative water quality impacts, because Tullahennel and Leanamore wind farms are operational, they are inherently low risk in terms of point or diffuse water quality impact sources. In the event that the current application for Shronowen Wind Farm development is successful, and its construction phase coincides with that of the Ballylongford Wind Farm, then there is potential for cumulative water quality impacts in the Ballyline River and fresh and marine waters downstream. However, the programme of mitigation measures, identified in **Section 6.8**, that will be integral to the construction of the proposed Shronowen development will avoid, prevent and minimise any water quality impacts. As it had been decided, by the competent authority, that the Ballylongford Wind Farm will not give rise to any significant effects, significant cumulative effects, as a result of synergistic interaction between the proposed Shronowen wind farm development and the Ballylongford Wind Farm, are not likely.

Overall, the potential for significant cumulative impacts on geology and hydrogeology or water quality arising from the proposed development and other existing and permitted wind farms in the region is considered to be slight. It is concluded that it is Near certain that cumulative water quality effects will be Neutral, Slight, and Temporary.

With regard to cumulative effects to bat species occurring as a result of collision impacts, as impacts on bat species from these wind farms are not likely and significant impacts from Shronowen not likely, it is concluded that cumulative effects are not likely to be significant. Therefore, significant cumulative collision effects as a result of synergistic interaction with the proposed wind farm development are not likely. It is concluded that it is Near certain that cumulative effects will be Neutral, Slight, and Temporary.

6.7.4.8 Plans

A review of the relevant plans that could potentially interact with the proposed project was undertaken. Plans that could interact synergistically with the project include:

- Kerry County Development Plan 2015 – 2021.
- South Western River Basin Management Plan, 2009 – 2015.
- Draft River Basin Management Plan for Ireland (2018-2021).
- Fáilte Ireland South West Tourism Development Plan 2008-2010.

No significant cumulative impacts with the plans listed above are likely, as each plan has a range of environmental and natural heritage policy safeguards in place. it is concluded that it is Near certain that cumulative effects will be Neutral, Imperceptible, and Long-term.

6.7.4.9 Solar Farm

There is a granted solar farm project with an output of up to 50 MW due south of the proposed wind farm development site. The project envisages the installation of photovoltaic (PV) panels on approximately 35 ha of land at Tullamore, Drombeg, and Coolkeragh.

No significant cumulative impacts with this development are likely. The solar farm development will have environmental controls as stipulated by the competent authority. It is concluded that it is Near certain that cumulative effects will be Neutral, Imperceptible, and Long-term.

6.7.4.10 Minor Developments

A search of Kerry County Council's on-line planning enquiry system determined that there are several current grants of planning permission for the townlands of Ballyline West and Dromalivaun. These permissions are for minor development works typical; of a rural setting with dispersed dwellings and where agriculture is the dominant activity including afforestation, dwelling houses with ancillary works (WWTS, extensions, landscaping, etc.), farm structures (silage pits, sheds, compost pile, etc.).

No significant cumulative impacts with these minor developments are likely, as each has, or will have environmental controls, as required, in each case, by the competent authority. It is concluded that it is Near certain that cumulative effects will be Neutral, Imperceptible, and Long-term.

6.8 MITIGATION

6.8.1 Introduction

The design of the project will avoid, prevent and minimise any adverse ecological impacts. The footprint of the development area and construction area will be clearly marked prior to commencement of construction. There will be no removal of habitat, movement/storage of construction machinery or any other construction related activities permitted outside the development area.

Construction of the proposed wind farm is expected to cause temporary adverse impacts on the local ecology, as outlined in **Section 6.7**, above. Several planned mitigation measures detailed below will reduce these impacts significantly. Many of the mitigation measures below have been based on CIRIA technical guidance on water pollution control (Murnane *et al*., 2006). With regard to the other species and habitats listed above, a number of mitigation measures will be required in order to reduce the likely significance of the potential impacts identified on these. The worst-case scenario would be significant ingress of sediments to the Galey or the Ballyline rivers or a small to medium scale spillage of a pollutant such as diesel. Either of these could have a significant negative impact on the riparian, estuarine and marine environments downstream and downpipe of the proposal. The main concerns are, as follows:

- Release of contaminants in the form of fuels or oil spillage and siltation from construction works into the water bodies that drain from the proposed development site.
- The potential impairment of water quality from those pollutants and the resultant alteration of aquatic habitats.
- Consequent disturbance and/or displacement of aquatic and semi aquatic species.

In order to ensure that an integrated approach to the implementation of the migration measures, stipulated in this section, is adopted, the contractors' timeline will have to take the following general measures into account with regard to works sequencing:

- Avoidance of any aggregation of works in one area at any one time.
- Management of invasive species (Japanese Knotweed and other species) if encountered.
- Hedgerow and scrub removal will take place outside the bird nesting season (1 March to 31 August).
- Works which may impact on aquatic habitats to be undertaken only during the months May – September; and method statements to be prepared and approved in advance by IFI.

In order to avoid or reduce the risks associated with these potential impacts, the mitigation measures described in the following sections will be incorporated into the project design in the Construction Environmental Management Plan (CEMP). An outline CEMP, which sets out the key environmental management issues associated with the construction, operation and decommissioning of the proposed development includes measures to ensure that during these phases of the development, the environment is protected, and any potential impacts are minimised, is included in **Appendix 2-1** to the EIAR.

6.8.2 Appointment of Project Ecologist

A Project Ecologist (PE) with appropriate experience and expertise will be employed on site for the duration of the construction phase to ensure that all the mitigation measures outlined are implemented. The PE will be awarded a level of authority and will be allowed to stop construction activity if there is potential for adverse environmental/ecological effects. The PE will provide all personnel involved in the construction with an ecological Toolbox Talks and ensure that the proposed mitigation measures are adhered to. The PE will document the safe construction and implementation of the mitigation measures through the use of a SOWOR system (Schedule of Works Operation Record).

6.8.3 Construction Environmental Management Plan (CEMP)

- Construction method statements have been prepared and incorporated into the CEMP.
- An Invasive species management plan has been prepared and incorporated into the CEMP.
- Fuel management measures have been incorporated into the CEMP.
- A dedicated construction phase site compound will be established prior to commencement of works. All site offices and welfare facilities will be located within this compound and all necessary equipment for management and control of waste, and the storage of material such as fuels and oils will be put in place prior to delivery of any supplies required. The compound will function as the main secure designated storage area for all materials. Secure bunding for fuels and oils will be constructed at this location and sufficient car parking will be made available to ensure that secure overnight parking of site vehicles and mobile equipment is available. The temporary compound will be set back a minimum distance of 25m from any drain or watercourse.
- Construction Machinery and vehicles shall remain within the footprint of the development site only. There shall be no parking or storage on adjacent habitats outside the footprint of the development. The development area will be clearly demarcated prior to commencement of construction.

The CEMP includes the following minimum site management controls.

6.8.3.1 Temporary Construction Compounds

- Drainage within the temporary site compounds will be directed to an oil interceptor to prevent pollution if any spillages occur.
- No domestic wastewater discharges to the environment. Temporary toilet facilities will include an integrated wastewater holding tank which will be emptied routinely by a licenced waste contractor.
- A bunded containment area will be provided within the compounds for the storage of fuels, lubricants, oils etc.
- The compounds will be in place for the duration of the construction phase and will be removed once commissioning is complete.

6.8.3.2 Soil Stripping

- The timing of the construction phase soil stripping and excavation works will take account of predicted weather, particularly rainfall.
- Soil stripping activities will be suspended during periods of prolonged rainfall events.
- The area of exposed ground will be kept to a minimum by maintaining where possible existing vegetation that would otherwise be subject to erosion in the vicinity of the wind farm infrastructure. The clearing of peat will be delayed until just before construction begins rather than stripping the entire site months in advance, particularly during road construction.

6.8.3.3 Excavation Works

- Earth movement activities will be suspended during periods of prolonged rainfall events.
- The earthworks material will be placed and compacted in layers to prevent water ingress and degradation of the material.
- Drainage and associated pollution control measures will be implemented on site before the main body of construction activity commences.
- Best practice for excavation in peat is that the acrotelm (top 50cm of peat), which contains the seed bank, is stored and maintained separately from the catotelm (i.e., peat below the acrotelm layer). Wherever good quality acrotelm is identified, it will be stored for re-use in accordance with best practice. Once works are complete, the acrotelm can be used to cover exposed areas of peat. Exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation. This can be by natural regeneration or by reseeding. Natural regeneration relies on colonisation of bare ground by native species from adjacent habitats. For this method, a roughened surface will be provided that can trap seeds and soil to provide initial regeneration areas.

6.8.3.4 Dewatering

- Where dewatering is required for construction activities, any pumped waters will be directed to the surface water management system.

6.8.3.5 Storage and Stockpiles

- Temporary stockpiles of excavated spoil, stored in the footprint of the excavation areas, will then be directed for use in backfilling, landscaping and restoration or placed in the deposition areas.

- Stockpiles of stripped topsoil will be in locations with minimum trafficking to prevent damage and dusting.
- Reusable excavated sub-soils and aggregate will be stored in temporary stockpiles at suitably sheltered areas to prevent erosion or weathering and shall be shaped to ensure rainfall does not degrade the stored material.
- Where unsuitable material is encountered this will be removed for permanent disposal.
- Stockpiled materials will be located 50m away from drainage systems and silt retaining measures (silt fence, / silt curtain or other suitable materials) to reduce risk of silt run-off shall be installed along the down gradient edges of stockpiled earth materials.

6.8.3.6 Refuelling of Construction Plant On-Site

- 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 in using.
- Plant nappies or absorbent mats to be placed under refuelling point during all refuelling to absorb drips.
- Mobile bowsers, tanks and drums should be stored in secure, impermeable storage areas, 50m 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 or spill, the leak or spill will be contained immediately using oil spill kits, all oil and any contaminated material will be removed 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 also in 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 in site vehicles and machinery.

6.8.3.7 Materials Handling, Fuels and Oil Storage

- Storage of fuels/oil will be located 50m from watercourses.
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores.
- Collision with oil stores will be prevented by locating oils within a steel container in a designated area of the site compounds away from vehicle movements.
- Leakages of fuel/ oil from stores will be prevented by storing these materials in bunded tanks which have a capacity of 110% of the total volume of the stored oil. Ancillary equipment such as hoses and pipes will be contained within the bunded storage container. Taps, nozzles or valves will be fitted with a lock system.

- Long term storage of waste oils will not be allowed on site. These waste oils will be collected in leak-proof containers and removed from the site for disposal or re-cycling by an approved service provider.

6.8.3.8 Road maintenance

The road surface can become contaminated with clay or other silty material during construction. Road cleaning will, therefore, need to be undertaken regularly during wet weather to reduce the volume of sediment runoff to the treatment system. This is normally achieved by scraping the road surface with the front bucket of an excavator and disposing of the material at designated locations within the site which may include the proposed borrow pits.

6.8.3.9 Construction Wheel Wash

A Construction Wheel Wash will be used to wash truck tyres leaving the construction site. Water residue from the wheel wash will be fed through a settlement pond, interceptor and then discharged to a vegetated area of low ecological value. The wheel wash area will be cleaned regularly so as to avoid the buildup of residue.

6.8.3.10 Concrete Management

The ingress of concrete or cementitious material into surface water bodies or drains within and in close proximity to the site will be prevented by the following measures which will be implemented during construction of the proposed wind farm:

- Washout of concrete trucks will not occur at any location within the proposed development site.
- A designated trained operator experienced in working with concrete will be employed during any concrete pouring.
- Any volumes of concrete water will be pumped into a skip to settle out. Settled solids will be appropriately disposed of off-site. The total volume will be reduced by only permitting concrete chutes to be washed off-site at the supplier's yard.
- 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 into the ground. Settled solids will need to be appropriately disposed of off-site.

6.8.4 Water Quality Measures during the Construction Phase

A number of mitigation measures will be implemented in order to reduce the significance of the potential adverse impacts associated with the construction phase.

6.8.4.1 Protection of Watercourses (General Measures)

The main risk to the water quality results from the potential for ingress of sediment or accidental fuel or oil spillages discharging to either the Galey or Ballyline rivers. Any pollutants entering the Galey could then be transferred to the downstream fresh and marine waters. These risks arise particularly during the excavation and construction activities.

The following measures will be incorporated into the development so as to ensure no adverse impact on water courses or on the relevant Natura 2000 sites:

- Raw or uncured waste concrete / cementitious material will be disposed of by removal from the site.
- Fuelling and lubrication of equipment will be carried out in bunded areas.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of.
- Sufficient oil booms and oil soakage pads will be kept on site to deal with any accidental spillage.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling.
- Prior to any work it will be ensured that all construction equipment is mechanically sound to avoid leaks of oil, fuel, hydraulic fluids and grease.
- Overnight parking of plant machinery and site vehicles will only take place in the designated site compound area away from watercourses and aquatic zones.

6.8.5 Fuel and Oil

Fuel oils must not, under any circumstances, discharge into an aquatic zone. A comprehensive set of fuel and oil management measures been incorporated into the CEMP. Collectively these define the control measures required to prevent fuel and oil from entering any surface water body and describe the emergency procedures designed to control any accidental spillages. All site plant and machinery site e.g., excavators, dumpers etc, will be refuelled in a bunded, designated area at least 50 m from any watercourses, drains or riparian zones. All site vehicles will be fuelled off site. No servicing or repair of plant, machinery or vehicles will be undertaken outside the site compound area. Fuels and lubricants – any required fuel will be stored in bunded tanks within a dedicated lock up. Lubricants will be stored in the lock up. It is proposed that refuelling will be done directly from a delivery vehicle in a designated area in the compound. All vehicles will be parked at night in the compound and refuelling will be the first action undertaken on a works day. Drip trays and spill kits will be used and available during refuelling activities.

A fuel management plan will be implemented which will incorporate the following elements:

- Prior to any work commencing it will be ensured that all construction equipment is mechanically sound to avoid leaks of oil, fuel, hydraulic fluids and grease.
- All machinery will carry emergency spill kits and additional spill kits will be available in all active construction areas.
- Mobile bowsers, tanks and drums will be stored in a secure, impermeable storage area, away from drains and open water.
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores.
- Fuelling and lubrication of equipment will be carried out in bunded areas.
- Ancillary equipment such as hoses, pipes will be contained within the bund.
- Taps, nozzles or valves will be fitted with a lock system.
- Fuel and oil stores, including tanks and drums will be regularly inspected for leaks and signs of damage.
- Only designated trained operators will be authorised to refuel plant and emergency spill kits will be present beside equipment for all refuelling events.

- Procedures and contingency plans will be set up to deal with emergency accidents or spills; and
- An emergency spill kit with oil boom, absorbers etc. will be kept on site in the event of an accidental spill.

6.8.6 Site Drainage

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. The site drainage layout is presented in **Planning Drawings 19876-MWP-00-00-DR-C-5011** to **5016** with drainage details presented in **Planning Drawings 19876-MWP-00-00-DR-C-5404** to **5405** (see **Appendix 6-6** to the EIAR).

This process will cause the normally dispersed flow to be concentrated at specific discharge points downstream of the works. In order to disperse this flow, each clean water drain will be terminated in a discharge channel running parallel to the ground contours that will function as a weir to disperse the flow over a wider area of vegetation. An alternative method is to allow the water to discharge through perforated pipes running parallel to the ground contours. Both of these methods will prevent erosion of the ground surface and will attenuate the flow rate to the downstream receiving waters. The specific drainage measures to be used at each location are shown on the drainage drawings included with the planning application. The clean water interceptor drains, or earth mounds are all positioned upslope to prevent any mixing of the clean and dirty water. The outflow from these drains is then piped under the road at suitable intervals and at low points depending on the site topography.

Separating the clean and dirty water will minimise the volume of water requiring treatment. The dirty water from the works areas will be collected in a separate drainage system and treated by removing the suspended solids before discharging it to the downstream watercourse over vegetated ground. Dirty water drains will be provided on both sides of the access roads and along the periphery of the turbines, crane hardstands, substation compound and the temporary site construction compounds.

The drainage and treatment system will be managed and monitored and particularly after extreme rainfall events during the construction phase. Controls will be regularly inspected and maintained to ensure that any failures are quickly identified and repaired so as to prevent water pollution. A programme of inspection and maintenance will be designed, and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed, and records kept of inspections and maintenance works.

6.8.6.1 Settlement Ponds

The treatment system will consist of a series of settlement ponds at designated locations throughout the site (see **Figure 6-9**). The treated outflow from the treatment system will be dispersed over vegetation in the same manner as the clean water dispersion and will become diluted through contact with the clean water runoff in the buffer areas before entering the downstream watercourses. The

site at Shronowen is relatively flat and low lying. As such, the flow rates are low in existing drains and watercourses.

Figure 6-9: Multi-tiered settlement pond with stone filter

The effluent from each settlement pond will discharge to an open channel, 8 to 10 metres in length, running parallel to the ground contours. This will form a weir that will overflow on its downhill side and disperse the flow across the existing vegetation. Buffer widths are designed as per Forestry Commission (2017) provisions on the protection of watercourses during forestry operations and management. This method buffers the larger volumes of run-off discharging from the drainage system during periods of high precipitation, further reducing suspended sediment load to surface watercourses. Existing rills and drains within the dispersion zone will be blocked off where necessary to prevent concentration of the flow.

6.8.6.2 Flood Attenuation

The creation of impermeable areas within a development site has the effect of increasing rates of runoff into the downstream drainage systems and this may increase flood risk and flood severity downstream. The proposed development is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is minimal in the context of the catchment size and therefore represents a negligible increase in downstream flood risk. However, it is proposed to provide some attenuation in order to limit the flow rate into the settlement ponds during high intensity storm events so that they do not become overloaded. This will also attenuate the flow to the downstream watercourses.

The volume of water requiring attenuation relates to direct precipitation on the roads and other infrastructure footprint only. Due to their predominant unbound nature, the developed surfaces have some permeability, and this reduces the attenuation requirement. It is proposed to provide the temporary storage within the drainage channels by creating stone dams at regular intervals within the channels to provide flow attenuation, slow down runoff to promote settlement and to reduce scour and ditch erosion (See **Figure 6-10**). Check dams are relatively small and constructed with gravel, straw

bales or other suitable material. The spacing of the dams is typically 100 metres but will depend on the channel slope, with steeper channels requiring shorter intervals. As Shronowen is a flat site, it is not envisaged that closer spacing will be required. The dams, which are constructed with small sized aggregate held in place by large aggregate, also reduce the flow rate through the drainage system and are an effective means of providing flow control. Temporary silt fences will also provide storage and flow control.

Figure 6-10: Examples of check dams along roadside drainage channels

6.8.6.3 Silt Fences

The silt fences will be placed at approximately 50m spacing on both sides of the floated roads as shown on the drainage drawings (**Planning Drawing Numbers 19876-MWP-00-00-DR-C-5011** to **5016** provided in **Appendix 6-6** to the EIAR). They will also be placed at the end of any locally steep section of drains. They have the double benefit of effectively producing a localised swale to reduce scour effects and also attenuating and filtering the discharge. An example of a typical silt fence installation is shown in **Figure 6-11** and **Figure 6-12**.

Figure 6-13 shows a typical measure to be put in place at drainage and watercourse crossings in order to ensure dirty water does not enter clean watercourses. For the proposed development, the proposal is to use vegetated soil bunds to divert dirty water generated on the section of road over the crossings to the dirty water system. Alternatively, temporary silt curtains, as shown in **Figure 6-14**, can be placed along the existing roads within the hydrology buffer zone. These silt curtains can run longitudinal to watercourses with a layer of stone placed along the bottom to prevent any seepage if there is a risk of silted runoff.

Figure 6-11: Example of a silt fence used in conjunction with check dams along roadside drainage channels

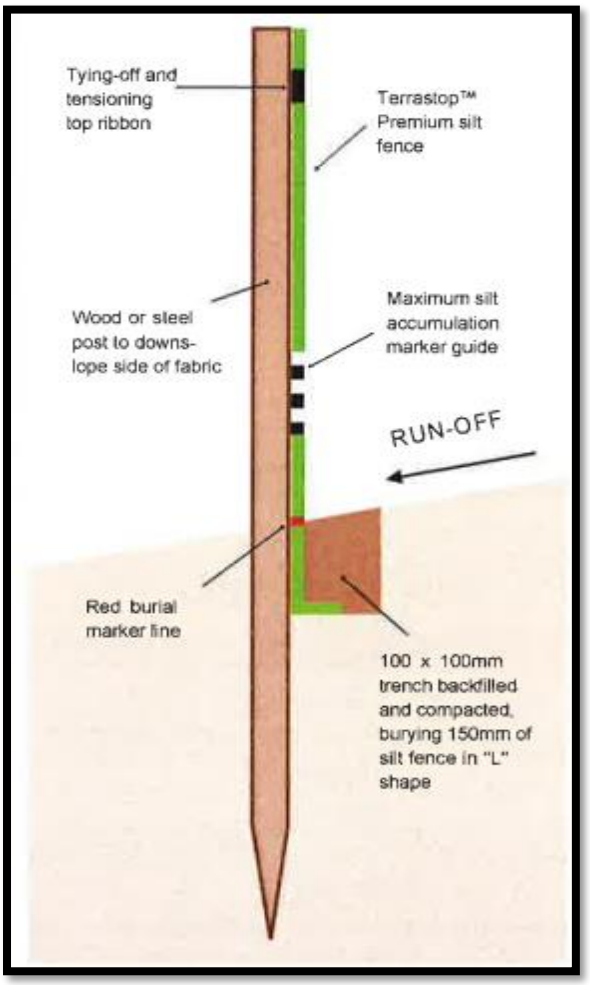


Figure 6-12: Schematic Detail of a Silt Fence

Figure 6-13: Dirty water containment at watercourse crossings

Figure 6-14: Silt curtain containment along existing roads near watercourses

6.8.6.4 Buffering of Peat Deposition Areas

In addition to the measures described in **Sections** 6.8.6.2 and 6.8.6.3, peat deposition areas will also have a 50 m buffer from any OSI mapped watercourses to further militate against any risk of siltation. This buffer provides a natural filter to reduce the sediment that may be generated by the deposition

area from reaching the watercourse. Any drains or other surface water features between these watercourses and peat deposition zones will be subject to protection by methods outlined above.

6.8.7 Restoration of Peat Deposition Areas

Peat is characterised by two distinct layers, the lower *catotelm* layer of highly humified peat and the upper *acrotelm* layer of fibrous peat which contains the live seed bank. The *acrotelm* layer should be regarded as an ecological resource that can be used for habitat restoration rather than simply as surplus excavated material.

As peat is excavated the *acrotelm* layer will be stripped first and set aside temporarily for re-use. As the peat deposition areas are filled, they will be covered over with the *acrotelm* layer. This includes the outer faces of the containing berm(s). The peat deposition areas need to be completed and restored in a continuous cycle so as to minimise the length of time the *acrotelm* is stored and to allow the vegetation to be re-established as quickly as possible. It is important that the *acrotelm* is handled carefully and that it is not allowed to dry out while it is being stored. Regular watering may be necessary during dry weather periods. This will be carried out by the appointed Contractor.

6.8.8 Bats

For low-risk sites, such as the proposed development, SNH (2019) recommends a buffer distance of 50 m between a turbine blade tip and the nearest woodland. This buffer creates a clearance setback of 50 m between the arc of the blade's sweep and the forest edge which could be used by bats without risk of collision with the turbine blades. To calculate the clear-fell distance, the formula below is used to calculate **(D),** the distance between the edge of the woodland and the centre of the tower:

$$D = [(50 + bl)^2 - (hh - fh)^2]^{1/2}$$

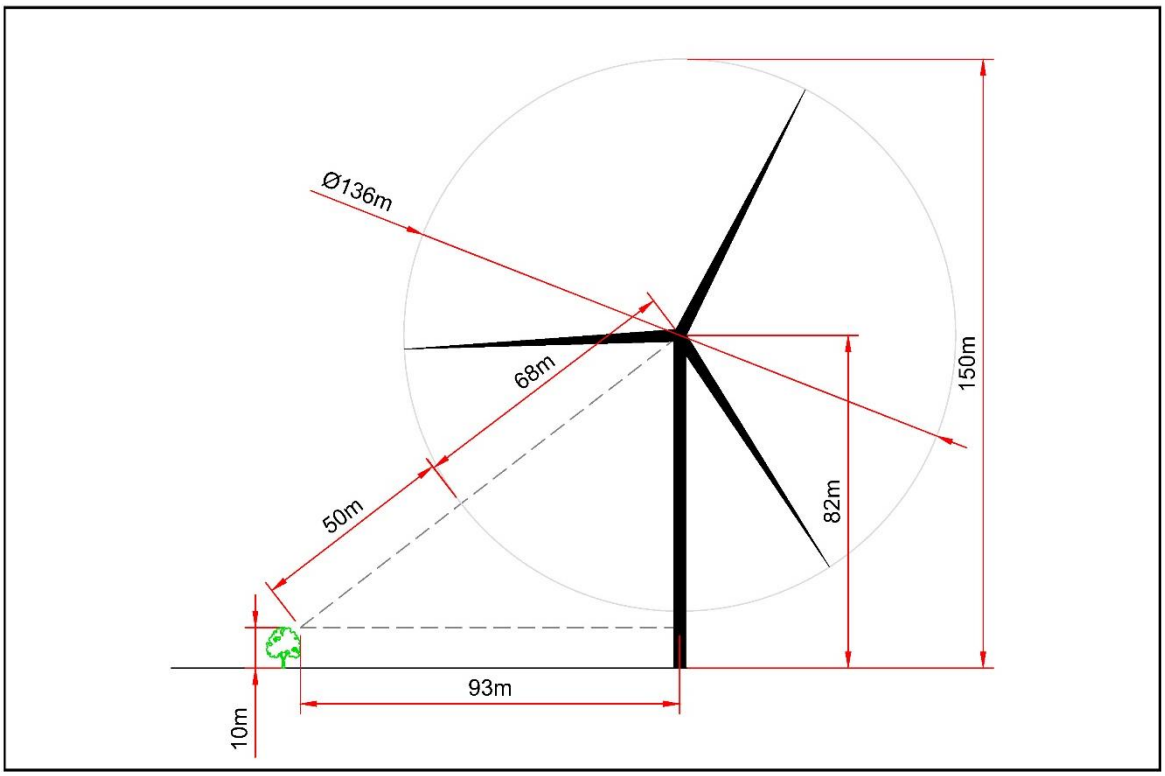


Figure 6-15: Clear-fell Dimensions for Bats

Where **bl** = blade length, **hh** = hub height, **fh** = feature height *(all in metres*). Based on this formula and provisional proposed turbine dimensions, a felling distance of 93 m around proposed turbine T1 would be required to comply with Natural England (2014) guidelines for minimising impacts to foraging bats. The 93 m figure is based on a provisional turbine blade length of 68 m, hub height of 82 m and tree heights (Sitka spruce) of 10 m.

To ensure that the keyhole clear-fell area will not develop into the types of habitat that support high value insect macro-invertebrate production, that would be a prey resource for bats, control of tree and scrub regrowth would be required to keep vegetation height low in order to maintain the buffer distance around the proposed turbines T1 and T7. As with the peat habitat reinstatement measures proposed above, the keyhole area will be managed to ensure it revegetates with low-growing, open vegetation with low plant species richness that lack the variety and complexity required for high insect macro invertebrate productivity.

Any lighting introduced to the proposed development site would follow guidance in the documents:

- Bat Mitigation Guidelines for Ireland. *Irish Wildlife Manuals, No. 25* (Kelleher and Marnell, 2006); and
- *Bats & Lighting*. Guidance Notes for: Planners, engineers, architects and developers (BCI, 2010).

6.8.9 Operational Phase

The measures for control of runoff and sediment relate to the construction phase of the project when there is continuous movement of site vehicles, delivery vehicles and earthworks vehicles moving around the wind farm development site. All major excavation work associated with the project will be carried out during the construction phase. Following construction, the amount of on-site traffic and excavation works will be negligible and there will be no particular risk of sediment runoff. Silt ponds and silt fences constructed for water quality protection, will remain in place. Six months post construction, where necessary, ponds will be partly filled with stone so that they will not present a long-term safety risk. Runoff from the hard-standings, and other works areas will continue to be directed to these ponds and from there to the outfall weirs. Check dams and silt fences within the drainage channels will also remain in place. The retention of this drainage infrastructure will ensure that runoff continues to be attenuated and dispersed across existing vegetation before reaching the downstream receiving waters.

6.8.10 Decommissioning Phase

6.8.10.1 Runoff and Sediment Control: Water Quality Management

Mitigation measures will be implemented to ensure that pollutants and sediment are not transferred to either the Galey or the Ballyline by surface water flow during wet periods. Erosion control, where runoff is prevented from flowing across exposed ground, and sediment control, where runoff is slowed to allow suspended sediment to settle, are important elements in runoff and sediment control. Significant suspended solids pollution caused by runoff during the decommissioning process will be avoided. This will be achieved by best practice methodology during construction as per Murnane *et al*. (2006) and further mitigation measures discussed below. The measures will:

- Implement erosion control to prevent runoff flowing across exposed ground and become polluted by sediments.
- Implement sediment control to slow down runoff, allowing suspended sediments to settle in situ.
- Implement the erosion and sediment controls before starting site decommissioning works.
- Regularly inspect and maintain surface water and sediment controls. Inspection and maintenance are especially important after prolonged or intense rainfall.
- Additional protection by silt trapping apparatus such as a geotextile silt fence to prevent contaminated runoff.
- Install a series of silt fences or other appropriate silt retention measures, where there is a risk of erosion runoff to watercourses from decommissioning related activity, particularly if working during a prolonged wet weather period or, if working during an intense rainfall event;
- Install appropriate silt control measures such as silt-traps, check dams and sedimentation ponds.
- Provide recommendations for public road cleaning where needed, particularly in the vicinity of drains.

Controls will be regularly inspected and maintained in order to avoid a build-up of silt or a tear in a silt fence, which could lead to pollution of watercourses. This will ensure optimum effectiveness of the controls throughout the duration of the decommissioning works. Inspection, monitoring and maintenance during and after prolonged or intense rainfall will be mandatory.

6.9 RESIDUAL EFFECTS

Residual impacts are impacts that remain, once mitigation has been implemented or, impacts that cannot be mitigated. Provided that the mitigation measures outlined in **Section 6.8**, above, are implemented in full, it is not expected that adverse effects, to the IEF habitats and species identified for appraisal in this chapter, will arise. It is considered that the receiving environment within the proposed development site has the capacity to accommodate the proposed development without significant effects on habitats and faunal features discussed in this chapter. The watercourses downstream are considered to have assimilation capacity adequate to absorb water quality effects to a level that would not have significant effects on aquatic biota.

It is considered that the effects on IEFs from potential construction, operation and decommissioning impacts would be avoided, reduced and mitigated sufficiently to ensure that no likely significant effects remain, provided the ecological mitigation measures are implemented in full.

Table 6-70 Predicted residual impacts for IEF considered exposed to impacts

IEF	Unmitigated Impacts		Mitigation	Residual Effects
	Construction	Operational		
Shannon and Fergus Estuaries IBA (IE68)	Negative, Significant, Short-term, Reversible Impairment of water quality.	Unlikely	Implementation of CEMP. Water Quality Controls. Best Practice. Site Management.	Negative, Imperceptible, Short-term.
Ballylongford Bay pNHA (001332)		Unlikely		
Depositing lowland rivers FW2		Unlikely		
Drainage ditches FW4		Unlikely		
Cutover bog PB4	Negative, Significant, Permanent Habitat loss.	Unlikely	None: Irreversible loss.	Negative, Significant, Permanent.
Hedgerows WL1		Unlikely		
Scrub WS1		Unlikely		
Bat species	Neutral, Imperceptible, Permanent Habitat loss.	Mortality	50 m buffer at T1 and T7. Turbine lighting. Management to ensure buffer remains unproductive (of prey).	Neutral, Imperceptible, Long-term.
Badger	Neutral, Not significant, Brief, Reversible Disturbance/ Displacement.	Unlikely	None required.	Negative, Imperceptible, Long-term.
Irish hare		Unlikely		
Irish stoat		Unlikely		
Otter	Negative, Slight, Short- term, Reversible Disturbance/ Displacement.	Unlikely	Implementation of CEMP. Water Quality Controls. Best Practice. Site Management.	Neutral, Imperceptible, Long-term.
Common frog	Negative, Slight, Short-term Habitat loss & Disturbance/ Displacement.	Unlikely	None required.	Neutral, Imperceptible, Long-term.
Common lizard		Unlikely		
Smooth newt		Unlikely		
European eel	Negative, Slight, Short-term, Reversible Habitat loss & Disturbance/Displacement.	Unlikely	Implementation of CEMP. Water Quality Controls. Best Practice. Site Management.	Neutral, Imperceptible, Long-term.
Salmon		Unlikely		
Lamprey species		Unlikely		
Duck mussel		Unlikely		

6.10 CONCLUSION

Provided that the proposed wind farm development is constructed and operated in accordance with the design, best practice and mitigation stipulated, significant effects on ecology are not anticipated at the international, national or county scales or on any Important Ecological Feature (IEF).

The application of construction phase mitigation and protection measures will ensure that no significant residual ecological impacts either alone or in combination with other plans or projects will arise from the project.