Planning and Environmental Consultants

Natura Impact Statement

Proposed Ballivor Wind Farm Development

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1. INTRODUCTION

1.1 Background

MKO has been appointed to prepare a Natura Impact Statement to allow the competent authority to conduct an Appropriate Assessment under Part XAB of the Planning and Development Acts 2000 (as amended) and under Article 6 (3) of the European Habitats Directive of a proposed wind energy development and all associated infrastructure located within the Ballivor Bog Group (Ballivor, Carranstown, Bracklin and Lisclogher bogs) located in Counties Meath and Westmeath.

An Appropriate Assessment Screening Report (AASR) has been prepared and is provided in Appendix 1. Under Article 6(3) of the Habitats Directive '*Any plan or project not directly connected with, or necessary to, the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans and projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives*'. The AASR in Appendix 1 identified the European Sites upon which the Proposed Development has the potential to result in significant effects and the pathways by which those effects may occur. The AASR identifies the European Sites upon which significant effects could not be excluded. Those sites will be assessed in this Natura Impact Statement (NIS).

This NIS has been prepared in compliance with Part XAB of the Planning and Development Acts 2000 (as amended), the Planning and Development Regulation 2001 - 2019 and relevant jurisprudence of the European and Irish Courts. It was also prepared in accordance with all relevant guidance including the European Commission's Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2021), *Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC* (EC, 2018), the Department of the Environment's *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities* (December 2009, amended 11 February 2010).

1.2 Statement of Authority

This report has been prepared by Sarah Mullen (B.Sc., M.Sc., Ph.D., ACIEEM) and Pat Roberts (B.Sc. MCIEEM). Pat Roberts is Principal Ecologist at MKO with over 16 years' experience. He currently manages the ecological team within MKO. Pat holds B.Sc. (Hons) in Environmental Science. He has extensive experience of providing ecological consultancy on large scale industrial and civil engineering projects. He is highly experienced in the completion of ecological baseline surveys and impact assessment at the planning stage.

Sarah holds a B.Sc. (Hons) in Botany, an M.Sc. in Biodiversity and Conservation and a Ph.D. in Botany. Sarah has over 6 years' experience working in ecological consultancy and has extensive experience in undertaking habitat and species surveys and working on Ecological Impact Assessment and Appropriate Assessment for a range of developments including renewable energy, residential and commercial developments.

The baseline ecological surveys undertaken to inform the assessment were undertaken between April 2020 and February 2023 by Pat Roberts (B.Sc., MCIEEM), John Hynes (B.Sc., M.Sc., MCIEEM), Sarah Mullen, Inga Reich (BSc., Ph.D.), Patrick Ellison (B.Sc., M.Sc., ACIEEM), Rachel Walsh (B.Sc.), Julie O'Sullivan (B.Sc., M.Sc.), Aoife Joyce (B.Sc., M.Sc.), Luke Dodebier (B.Sc.), Cathal Bergin (B.Sc.) Neansai O'Donovan (B.Sc.), Neill Campbell (M.Sc.), Laoise Kelly (B.Sc.), Patrick O'Boyle (B.Sc., M.Sc.), Rudraksh Gupta (B.Sc., M.Sc.) and Kailan Mitchell (B.Sc.) of MKO.

The bird surveys undertaken to inform the Environmental Impact Assessment Report (EIAR) for the proposed development, and the results of which were also used to inform this assessment, were undertaken between October 2019 and September 2022. The scope of surveys was devised by Senior Ornithologist Padraig Cregg (B.Sc., MSc.) of MKO and the surveys were undertaken by Andre Robinson, Conor Rowlands, Declan Manley, Donnacha Woods, Eric Dempsey, Eilis Hogan, Enda Flynn, Eric Dempsey, Ian Hynes, Jack Kennedy (B.Sc.), John Curtin (B.Sc.), John McMahon, Kate Bismilla (B.Sc.), Kathryn Sheridan, Niall McHugh, Padraig Webb, Patrick Manley (B.Sc.), Paul Troake, Peter Capsey, Sarah Jorgensen (née Ingham), Tom Rae and Tom Siekaniec of MKO.

MKO ecologists are trained in field ecology and are competent experts in undertaking botanical, faunal and ornithological surveys.

The hydrological assessment which is included as Chapter 9 of the EIAR which accompanies the planning application for the proposed development, and the results of which have informed the conclusions of this assessment, has been prepared by Michael Gill (BA, BAI, Dip Geol., MSc, MIEI), Adam Keegan (B.Sc., M.Sc.) and Conor McGettigan (B.Sc., M.Sc.) of Hydro Environmental Service (HES).

2. SUMMARY OF AASR AND ASSESSMENT OF QUALIFYING FEATURES LIKELY TO BE SIGNIFICANTLY AFFECTED

The Article 6(3) Appropriate Assessment Screening report, that is provided as Appendix 1 to this NIS, concluded that there was potential for the Proposed Development to result in significant effects on the following European Sites:

- River Boyne and River Blackwater Special Area of Conservation (SAC)
- River Boyne and River Blackwater Special Protection Area (SPA)

The Qualifying Interests/Special Conservation Interests (QI/SCI) with the potential to be affected and the pathways by which any such effects may occur are set out below for each site. The location of the Proposed Development and EU Designated Sites is provided as Figure 2-1.

No potential for significant effects on any other European Site as a result of the Proposed Development were identified.

2.1 River Boyne and River Blackwater SAC

This European Site is located 412m from the Wind Farm Site Boundary at its closest point. Taking a precautionary approach, a potential pathway for direct effects on the QI otter where they occur outside the SAC as a result of ex-situ habitat loss within the Proposed Development Site was identified. Ex-situ habitat loss could potentially occur if any otter resting or breeding sites are present within small watercourses within the construction footprint at the time of construction works.

Taking a precautionary approach, a potential pathway for indirect effects on otter as a result of disturbance during construction works was also identified.

There is hydrological connectivity between the Proposed Development and this SAC via watercourses within and adjacent to the Site Boundary which discharge to the Stonyford River to the east and the Deel (Raharney) River to the south-west both of which are designated as part of the SAC at this location.

Following the precautionary principle, given that there is hydrological connectivity between the Proposed Development and the SAC, a potential pathway for indirect effects on the aquatic QIs of this SAC was identified. The Proposed Development has the potential to cause deterioration in water quality due to run off of and infiltration of pollutants, including silt, hydrocarbons and cement-based products, during construction activities associated with the proposed development. These include construction of turbine hardstands, windfarm access roads, substations, borrow pits and amenity paths and associated carparks and other associated activities. There is also potential for run-off of pollutants from turbine hardstand areas, access tracks and any other hard surfaces during the operational phase of the development and during activities associated with the decommissioning of the proposed development.

Deterioration of water quality could potentially affect the following aquatic QIs where they occur downstream of the Proposed Development:

- Alkaline fens [7230]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]
- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Salmo salar* (Salmon) [1106]
- *Lutra lutra* (Otter) [1355]

The works along the proposed haul route will include temporary road widening works at two locations (refer to Figure 3-1) to facilitate turbine component delivery. Although there is no direct hydrological connectivity between these works and the SAC, and the SAC or nearest watercourse with connectivity to the SAC is located >200m from any land take/road widening works, taking a precautionary approach, there is potential for indirect effects on the aquatic QIs of the SAC due to deterioration in water quality as a result of overland release of silt laden waters during road widening works along the proposed haul route.

2.2 River Boyne and River Blackwater SPA

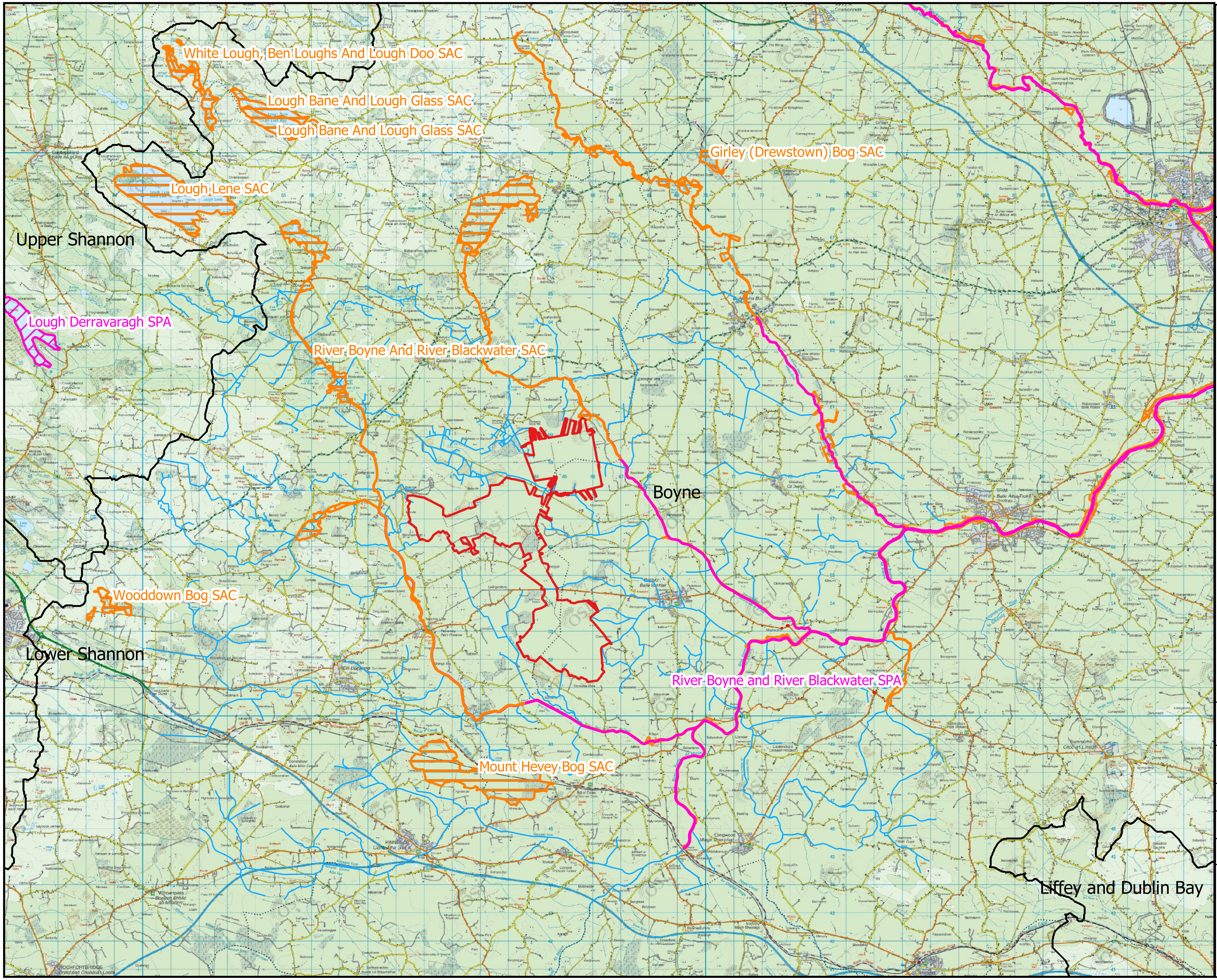
This European Site is located approximately 486m from the Wind Farm Site Boundary at its nearest point. Taking a precautionary approach, a potential pathway for direct effects on the SCI species kingfisher, where it occurs outside the SAC, as a result of ex-situ habitat loss within the Proposed Development site was identified. If Kingfisher nesting habitat is present within the Proposed Development Site at the time of construction, there is potential for loss of this habitat during windfarm construction works. Taking a precautionary approach, a potential pathway for indirect effects on kingfisher as a result of disturbance during the construction phase and collision risk during the operational phase of the development was also identified and considered.

There is hydrological connectivity between the Proposed Development and this SPA via watercourses within and adjacent to the site boundary which discharge to the Stonyford River to the east and the Deel (Raharney) River to the south-west both of which are designated as part of the SAC at this location.

The Proposed Development has the potential to cause deterioration in water quality due to run off of and infiltration of pollutants, including silt, hydrocarbons and cement-based products, during construction activities associated with the Proposed Development. These include construction of turbine hardstands, windfarm access roads, substations, borrow pits and amenity paths and associated carparks and other associated activities. There is also potential for run-off of pollutants from turbine hardstand areas, access tracks and any other hard surfaces during the operational phase of the development as well as during activities associated with the decommissioning of the proposed development. Deterioration of water quality could potentially affect availability of food resources for kingfisher.

The works along the proposed haul route will include temporary road widening works at two locations to facilitate turbine component delivery. Although there is no direct hydrological connectivity between these works and the SPA, taking a precautionary approach, there is also potential for indirect effects on the SPA due to deterioration in water quality as a result of road widening works along the proposed haul route. Taking a precautionary approach a potential pathway for indirect effects on kingfisher as a result of disturbance during the construction phase of the development was also identified.

The works along the proposed haul route will include temporary road widening works at three locations to facilitate turbine component delivery. Although there is no direct hydrological connectivity between these works and the SPA, and the SPA or nearest watercourse with connectivity to the SPA is located >200m from any land take/road widening works, taking the precautionary approach, there is also potential for indirect effects on the SPA due to deterioration in water quality as a result of overland release of silt laden waters.



Map Legend

- Propsoed Development site
- WFD Watercourses
- WFD Catchments
- Special Areas of Conservation (SACs)
- Special Protected Areas (SPAs)

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Drawing Title	EU Designated Sites surrounding the Proposed Development site
Project Title	Propsoed Ballivor Windfarm
Drawn By: PD	Checked By: SM
Project No.: 191137	Drawing No.: Figure 2-1
Scale: 1:175000	Date: 2023.03.24

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3. DESCRIPTION OF PROPOSED DEVELOPMENT

3.1 Site Location

The proposed development, known as Ballivor Wind Farm, will be located on Ballivor bog, Carranstown bog, Bracklin bog, Lisclogher bog and adjacent third-party land for the provision of a borrow pit.

The 'Application Site' which comprises the proposed wind farm site and two areas of temporary accommodating works along the haul route is illustrated in Figure 3-1.

The Wind Farm Site Boundary for the purposes of this EIAR corresponds with the red-line boundary of the wind farm site proper and encompasses an area of approximately 1,770 hectares. This is illustrated on Figure 3-2

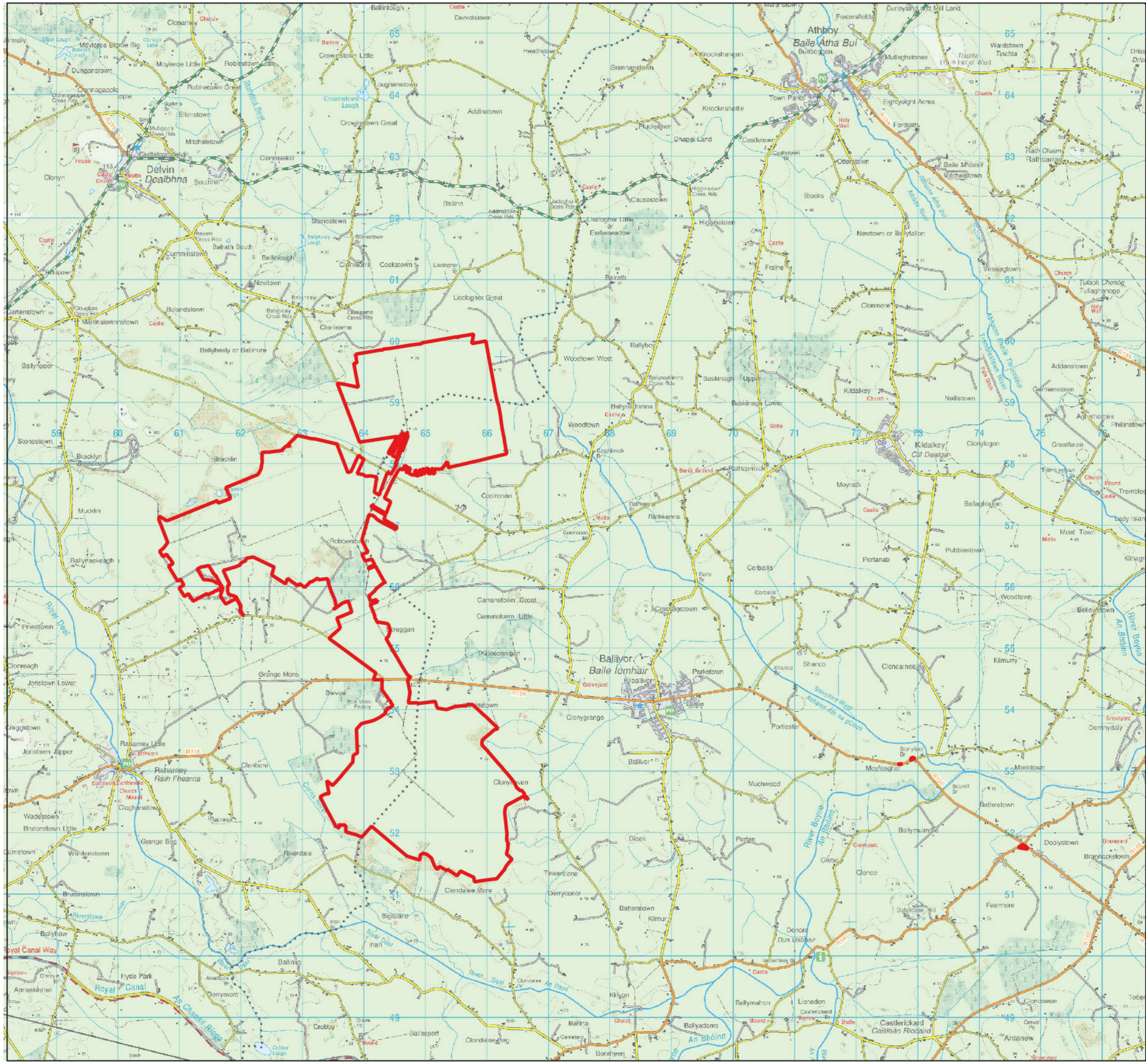
For the purposes of this NIS, the Proposed Development Site/ Site Boundary refers to the 'Application Site' as shown on Figure 3-1. The Proposed Development refers to the construction footprint of the entire renewable energy development. The construction footprint in shown in Figure 3-3 which shows the layout of the Proposed Development.

The Wind Farm Site Boundary measures approximately 9 kilometres (km) in length from north to south and approximately 6 km from east to west, at its widest point with a topography range between 69 metres above ordnance datum (m AOD) at its lowest point to approximately 84 m AOD at its highest point. The closest settlements to the site are Delvin located 5km north, Raharney, 4km west and Ballivor, 3.5km east of the site. The townlands within which the Proposed Development falls are listed in Table 3-1.

Table 3-1 Townlands within which the Proposed Development is located

Wind Farm Site	
Bracklin	Craddanstown
Clondalee More	Derryconor
Clonleame	Grange More
Clonmorrill	Killagh
Clonycavan	Lisclogher Great
Cockstown	Riverdale
Coolronan	Robinstown
Haul Route Temporary Accommodating Works Areas	
Moyfeagher	Doolystown

An application for leave to apply for Substitute Consent for peat extraction and all peat extraction related activities that have been and are currently being carried out within the Ballivor Bog Group (Ballivor, Carranstown, Bracklin, Lisclogher and Lisclogher West bogs) has been made to An Bord Pleanála (Planning ref: 311646, date 13/10/2021). The application for Substitute Consent will be accompanied by an EIAR, AASR and NIS which will assess the impacts that historical peat extraction activities are likely to have had on biodiversity and Designated Sites.



Map Legend

Application Site Boundary

N

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Drawing Title	
Application Site Boundary	
Project Title	
Proposed Ballivor Wind Farm	
Drawn By: DOS	Checked By: KM
Project No.: 191137	Drawing No.: Figure 3-1
Scale: 1:60,000	Date: 2023-03-01

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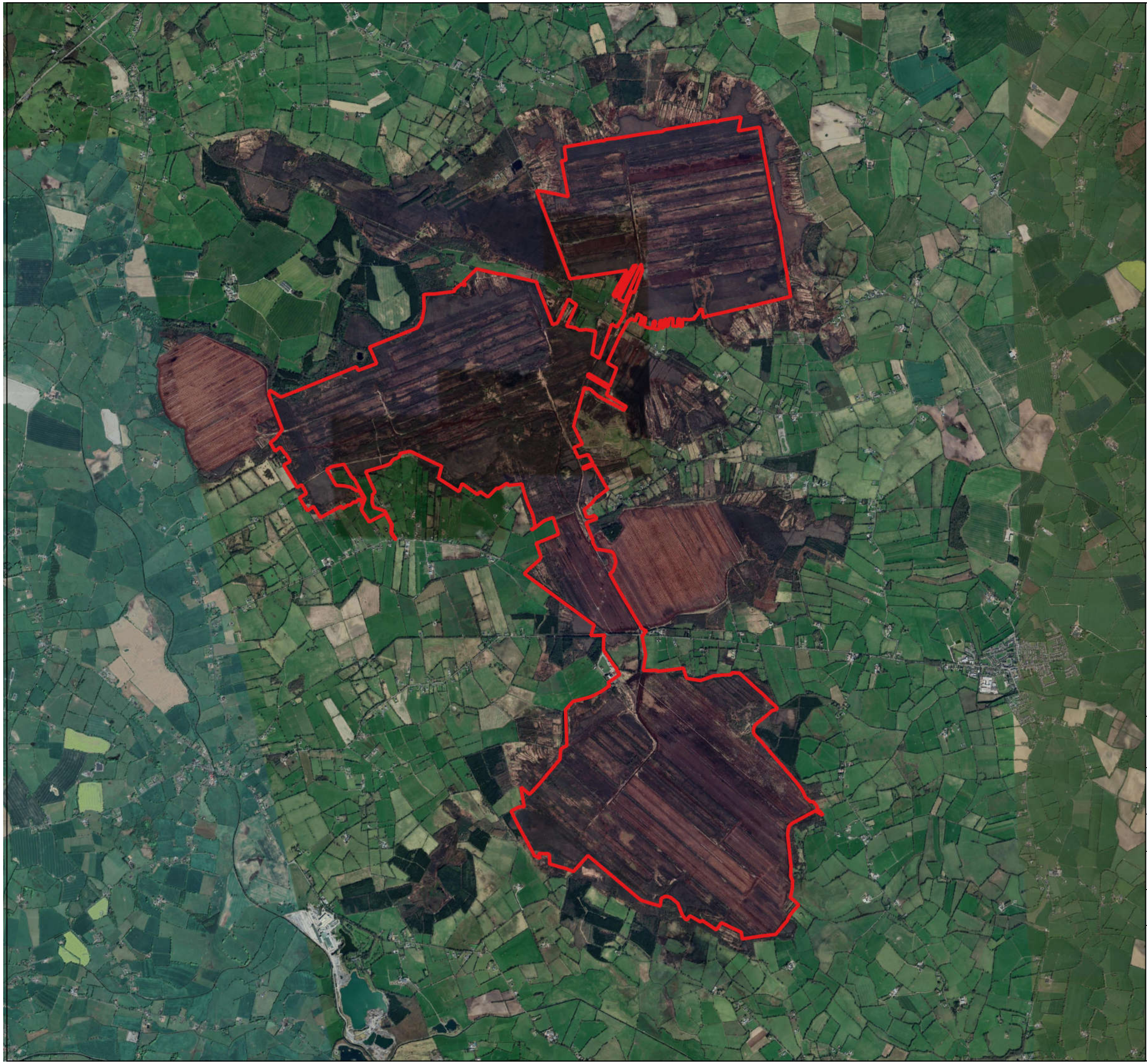

Map Legend

Site Boundary

N

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Drawing Title Wind Farm Site Boundary	
Project Title Proposed Ballivor Wind Farm	
Drawn By DOS	Checked By KM
Project No. 191137	Drawing No. Figure 3-2
Scale 1:40,000	Date 2023-03-01

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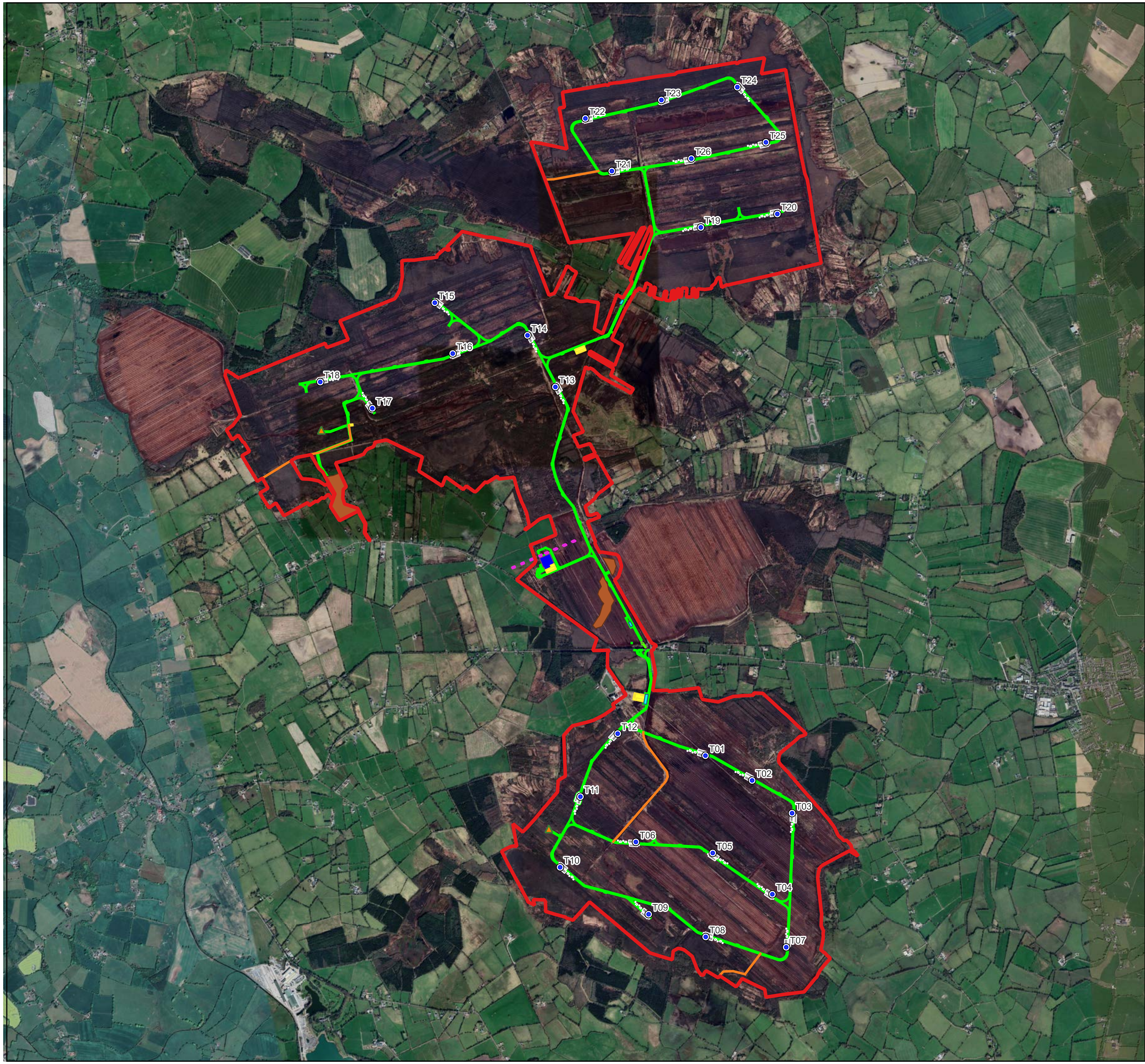

Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Locations
- Proposed Substation Location
- Proposed Met Mast
- Proposed Internal Roads
- Proposed Grid Connection
- Proposed Construction Compounds
- Proposed Borrowpit Locations
- Proposed Amenity Paths
- Amenity Carparks
- Proposed Security Cabins

N

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Drawing Title: Wind Farm Site Layout	
Project Title: Proposed Ballivor Wind Farm	
Drawn By: SM	Checked By: PR
Project No.: 191137	Drawing No.: Figure 3-3
Scale: 1:35000	Date: 2023-03-24

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3.2 Characteristics of the Proposed Development

3.2.1 Description of the Project

The Proposed Development will comprise 26 No. wind turbines and all associated site development works. The proposed turbines will have a blade tip height of 200 metres above the top of the turbine foundation. The Proposed Development will also provide public amenity walks and car parking. The applicant is seeking a ten-year planning permission for the following:

i. *26 No. wind turbines with a blade tip height of 200m and all associated hard-standing areas.*
ii. *2 No. permanent Meteorological Anemometry Masts with a height of 115 metres and removal of existing meteorological mast.*
iii. *4 No. temporary construction compounds, in the townlands of Bracklin and Grange More.*
iv. *5 No. temporary security cabins at the main construction site entrances as well as at a number of access points around the site, in the townland of Killagh, Grange More and Coolronan.*
v. *2 No. borrow pits located in Carranstown Bog, and in third party land in the townland of Craddanstown; All works associated with the opening, gravel and spoil extraction, and decommissioning of the borrow pits.*
vi. *1 No. 110 kV electrical substation, which will be constructed in the townland of Grange More. The electrical substation will have 2 No. control buildings, a 36 metre high telecom tower, associated electrical plant and equipment, a groundwater well and a wastewater holding tank. All associated underground electrical and communications cabling connecting the turbines and masts to the proposed electrical substation and all works associated with the connection of the proposed wind farm to the national electricity grid, which will be to the existing Mullingar – Corduff 110 kV overhead line via overhead line.*
vii. *Provision of new internal site access roads with passing bays measuring a total length of 28km and provision/upgrade of existing/new pathways for amenity uses measuring a total length of approximately 3.3km and associated drainage.*
viii. *Temporary accommodating works to existing public road infrastructure to facilitate delivery of abnormal loads at locations on the R156 and R161 in the townlands of Doolystown and Moyfeagher;*
ix. *Accommodating works to widen existing site entrances off the R156 into Ballivor and Carranstown Bogs to be used as main construction site entrances and to facilitate delivery of turbine components and construction materials; Previous site entrances to be reinstated and used for maintenance and amenity access for the operational period;*
x. *Permanent vertical realignment of the R156 in the vicinity of the site entrance to achieve required sight lines.*
xi. *Construction of permanent site entrances off a local road into Lisclogher and Bracklin Bogs to facilitate a crossing point for turbine components and construction materials and operation/amenity access;*
xii. *Provision of amenity access using existing entrances off the R156 and local roads in the townlands of Bracklin, Coolronan, Clondalee More and Craddanstown;*
xiii. *3 No. permanent amenity carparks in Ballivor Bog (50 car parking spaces), Carranstown (15 car parking spaces) and Bracklin Bog (15 car parking spaces).*
xiv. *All associated site works and ancillary development including access roads, amenity pathways, drainage, and signage.*
xv. *A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*

Current and future wind turbine generator technology will ensure that the wind turbine model, chosen for the Proposed Development, will have an operational lifespan greater than or equal to 30-years.

The overall layout of the Proposed Development is shown on Figure 3-3. This drawing shows the proposed locations of the wind turbines, electricity substation, construction compounds, internal roads layout and the site entrances. The sections below provide details of the Proposed Development. A full description of the Proposed Development is provided in Chapter 4 of the Environmental Impact Assessment Report (EIAR) which accompanies the Proposed Development planning application. Detailed layout drawings are included as Appendix 4-1 of the EIAR.

3.2.2 Construction details

3.2.2.1 Wind Turbines

3.2.2.1.1 *Turbine Locations*

The proposed wind turbine layout has been optimised using wind farm design software (a combination of WAsP and WindPro) to maximise the energy yield from the site, while maintaining sufficient distances between the proposed turbines to ensure turbulence and wake effects do not compromise turbine performance. The ITM Grid Reference coordinates of the proposed turbine locations are listed in Table 3-2 below. The final ground level of the turbine foundations will be determined by the actual ground conditions at each proposed turbine location and may differ slightly from those levels listed in Table 3-2.

Table 3-2 Proposed Wind Turbine Locations and Elevations

Turbine	ITM X	ITM Y	Top of Foundation Levels metre OD
1	665162	753511	75.3
2	665604	753275	73.9
3	665983	752965	73.9
4	665796	752196	72.6
5	665231	752587	73.1
6	664502	752692	72.2
7	665928	751694	72.4
8	665164	751792	72.9
9	664623	752007	74.4
10	663783	752452	74.1
11	663976	753121	75.0
12	664329	753719	78.1
13	663739	757007	73.8
14	663474	757496	74.9

15	662595	757805	78.1
16	662765	757323	74.9
17	662002	756804	79.0
18	661508	757054	77.0
19	665118	758520	73.3
20	665844	758647	73.2
21	664274	759054	73.3
22	664023	759553	75.2
23	664744	759727	75.0
24	665464	759850	75.1
25	665735	759326	73.9
26	665028	759172	73.5

3.2.2.1.2 Turbine Type

Wind turbines use the energy from the wind to generate electricity. A wind turbine, as shown in Plate 3-1 below, consists of four main components:

- Foundation unit;
- Tower;
- Nacelle (turbine housing);
- Rotor
- 3 no. blades

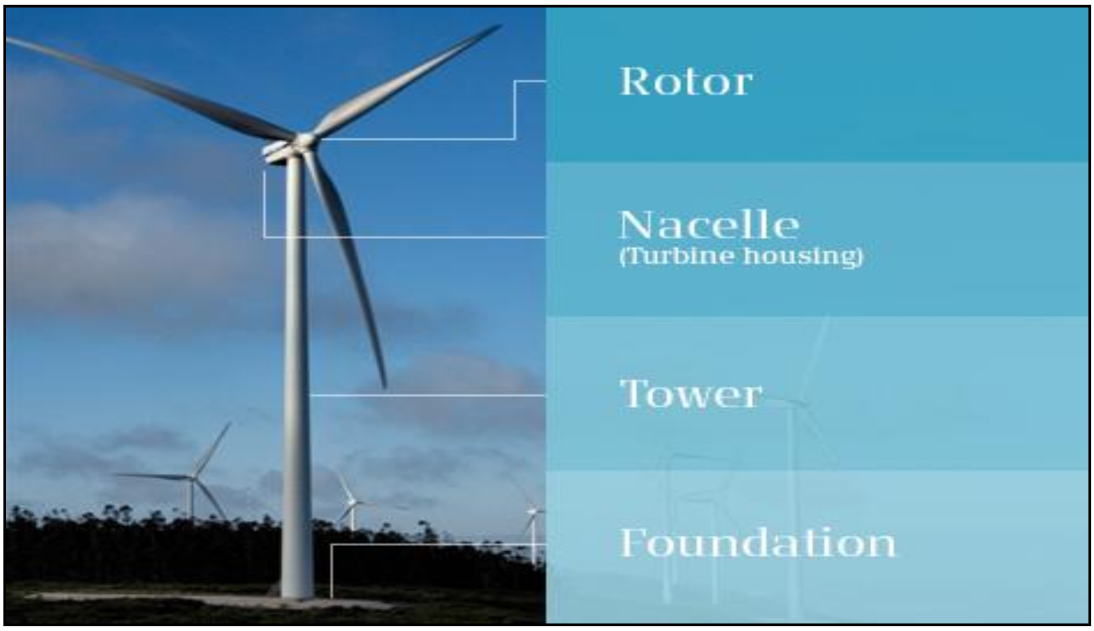


Plate 3-1 Wind Turbine Components

The proposed wind turbines to be installed on the site will have a ground-to-blade tip height, hub height and blade length within the following, limited, ranges:

- Turbine Tip Height –200 metres
- Hub Height –115 metres
- Blade Rotor Diameter: - 170 metres

The wind turbines that will be installed on the site will be conventional three-blade turbines, which will be geared to ensure the rotors of all turbines rotate in the same direction at all times.

The turbines will be multi-ply coated to protect against corrosion. It is proposed that the turbines would be of an off-white or light grey colour to blend into the sky background. This minimises visual impact as recommended by the following guidelines on wind energy development:

- *Wind Farm Development – Guidelines for Planning Authorities, Department of the Environment, Heritage and Local Government (DoEHLG, 2006);*
- *The Influence of Colour on the Aesthetics of Wind Turbine Generators (ETSU, 1999).*

The individual components of a geared wind turbine nacelle and hub are shown in Plate 3-2 below. Wind turbines without a gearbox (i.e. direct drive) may also be considered for use in the Proposed Development. This will have no impact on the external design.

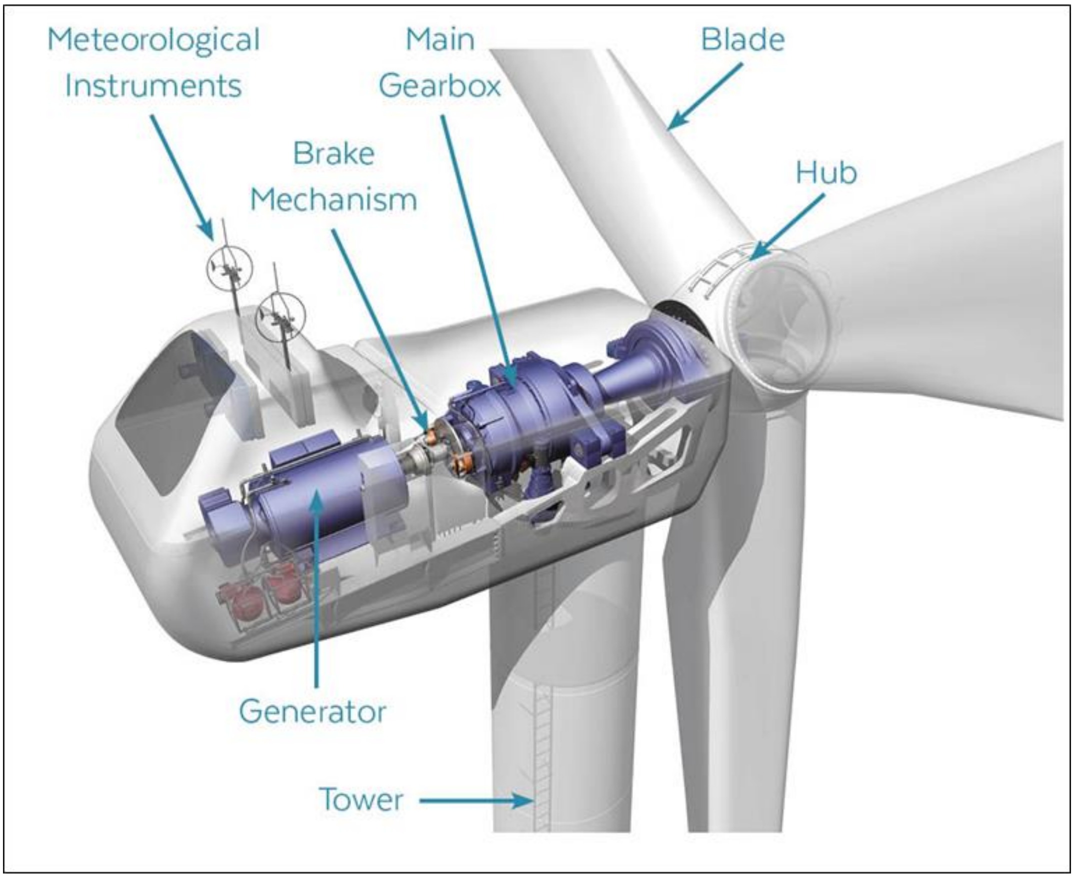


Plate 3-2 Turbine nacelle and hub components

3.2.2.1.3 Turbine Foundations

Turbine foundations are constructed by excavating peat and soil to sub-formation level. Imported structural fill and blinding is placed and compacted to formation level. A reinforced concrete base is cast in-situ. The turbine foundation transmits any load on the wind turbine into the ground. The approximate horizontal and vertical extent of the turbine foundation will be 26m and 4m respectively.

The top of the base is referred to as 'Top of Foundation Level'. Where ground conditions are unfavourable to excavate and replace, piles will be installed to formation level. The size of the concrete foundation will be approximately 25 m in diameter for gravity type foundations and 20m in diameter for pled type foundations, based off current models of this scale, but will depend on the loads specified by the turbine manufacturer selected from the competitive tender process. After the formation level has been reached, the bottom section of the turbine tower "Anchor Cage" is levelled and reinforcing steel is built up around and through the anchor cage (Plate 3-3 below). The outside of the foundation is shuttered with formwork to allow the pouring of concrete and is backfilled with granular fill to finished surface level (Plate 3-4 below).

Plate 3-3 Turbine Base Anchor Cage

Plate 3-4 Finished Turbine Base

3.2.2.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted granular fill are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are typically used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The hard-standing area is intended to accommodate a crane during turbine assembly and erection.

3.2.2.1.5 *Assembly Area*

Levelled assembly areas will be located on either side of the hard-standing area. These assembly areas are required for offloading turbine blades or turbine blade segments, tower sections and hub from trucks until they are ready to be lifted into position by cranes and to assist the main crane during turbine assembly.

3.2.2.1.6 *Segmented Blades*

The wind farm has been designed to accommodate turbines with a blade length of 85m. The designated turbine delivery haul route allows for turbine blade segments of up to 76m and therefore segmented blade technology is proposed for turbines with a blade length of 85m. Whilst the specific turbine will be selected at procurement stage, the haul route assessment has considered a range of segment blade lengths that would be applicable for a turbine with a blade length of up to 85m. Based on a maximum possible segment length of 76m, the delivery scenario is the transfer of a 85m blade delivered to site in 2 segments over 2 no. deliveries, with the longer segment being up to 76m (expected range being 60-70m) and the shorter segment being up to 20m (expected range being 10-20m). These segment lengths are based on the segmented blade technologies currently available on the market, such as the LM 77.4m P blade from General Electric, which is supplied in two segments, a 65.4m root and a 12m tip[1]; however, the exact segment lengths with be determined at procurement based on available options on the market at the time.

3.2.2.2 Site Roads

3.2.2.2.1 *Road Construction Types*

To provide internal access to the development site to connect the wind turbines and associated infrastructure, approximately 28 kilometres of internal access roads will need to be constructed. Fehily Timoney & Company Ltd. (FTC) were appointed to assess the existing ground conditions and specify the type of road required to access all locations on site.

The road construction techniques to be considered are as follows:

- Construction of New Floating Roads over peat (majority)
- Construction of New Excavated Roads through peat

The construction methodology for each road type is detailed below.

Construction of New Floating Roads

Floating access roads are the predominant road construction type proposed for the site. The use of new floated access tracks will be limited on site to areas of flatter terrain with slopes typically less than 5°.

The construction methodology for floating roads is outlined below.

i. *Prior to commencing floating road construction movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
ii. *Floating road construction shall be to the line and level requirements as per design/planning conditions.*
iii. *Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.*

[1] Details can be seen at https://www.windenergy.org.nz/store/doc/GE-Cyprus-5MW-and-product-overview_Chris-Holsonback-GE.pdf.

iv. *Construction of road to be in accordance with appropriate design from the designer.*
v. *The typical make-up of the new floated access road is up to 1,200mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator. This may vary depending on designer requirements.*
vi. *Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 5m wide pressure berm (typically 1m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.*
vii. *The finished road surface width will be approximately 6m.*
viii. *Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.*
ix. *To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.*
x. *Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.*
xi. *Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.*
xii. *A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

Construction of New Excavated Roads

The construction methodology for the construction of excavated roads is outlined below.

i. *Prior to commencing the construction of the excavated roads movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
ii. *Interceptor drains should be installed upslope of the access road alignment to divert any surface water away from the construction area.*
iii. *Excavation of roads shall be to the line and level given in the design requirements. Excavation should take place to a competent stratum beneath the peat (as agreed with the site designer).*
iv. *Road construction should be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill unless otherwise agreed with the site designer or resident engineer on site.*
v. *All excavated peat shall be placed/spread alongside the excavations.*
vi. *Side slopes in peat shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations should be carried out as the excavation progresses.*
vii. *The surface of the finished excavated access road will be 1.2m above existing ground level.*
viii. *A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer).*
ix. *At transitions between floating and excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.*
x. *Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the*

adjacent peat and greatly reduces any risk of peat instability. It should be noted that slopes greater than 5 degrees are not envisaged on site.

xi. *A final surface layer shall be placed over the excavated road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

3.2.2.3 Electricity Substation

It is proposed to construct a 110 kV electricity substation within the site of the Proposed Development as shown in Figure 3-3. The proposed substation site is located in the northwest of Carranstown Bog, in the townland of Grange More within proximity to the existing Mullingar- Corduff 110 kV overhead line which traverses the site. The construction and exact layout of electrical equipment in the onsite electricity substation will be to Eirgrid networks specifications and will be under the ownership of ESB Networks. Access to the substation will be from the R156 to facilitate Eirgrid and ESB Networks during the operational period of the Ballivor Wind Farm and beyond. Upon decommissioning of the wind farm, the 110kV substation within Carranstown Bog will remain in-situ and form part of the national grid infrastructure.

The footprint of the proposed onsite electricity substation compound measures approximately 11,600 $m.^2$ It will include two control buildings and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid.

3.2.2.3.1 *Wind Farm Control Buildings*

Two substation control buildings will be located within the substation compound. The Transmission Asset Owner (TSO) Control Building will measure approximately 25 metres by 18 metres and approximately 9.7 metres in height. The Independent Power Provider (IPP) Control Building will measure approximately 19 metres by 12 metres and approximately 7 metres in height.

The wind farm control buildings will include staff welfare facilities that will work on the Proposed Development during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the Proposed Development, there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the Proposed Development does not necessitate a potable source. It is proposed to install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. A pump house is not currently envisaged as an in-well pump will direct water to a water tank within the roof space of the control building (subject to final design). Bottled water will be supplied for drinking, if required.

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewaters being tankered off site by an appropriately consented waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site.

The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the sites' turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site.

3.2.2.4 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 33kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in cable ducts approximately 1.2 metres below the ground surface, along the sides of or underneath the internal roadways. The route of the cable ducts will follow the access track to each turbine location.

Clay plugs will be installed at regular intervals of not greater than 50 metres along the length of the trenches to prevent the trenches becoming conduits for water. While the majority of the cable trenches will be backfilled with native material, clay subsoils of low permeability will be used to prevent conduit flow in the backfilled trenches. This material will be imported onto the site should sufficient volumes not be encountered during the excavation phase of roadway and turbine foundation construction.

3.2.2.5 Grid Connection

A connection between the Proposed Development and the national electricity grid will be necessary to export electricity on to the national grid. This connection from the proposed onsite substation to the national grid will occur within the vicinity of the proposed substation, via a new overhead line which will connect into the existing Mullingar-Corduff 110 kV transmission line located approximately 35m north of the proposed substation within the development Site Boundary. Approximately 35m of overhead line and two lattice loop in/loop out masts will be required to connect from the proposed substation to the existing overhead line. The proposed lattice masts will be located within the Application Site. Each mast will have a footprint of approximately 140m2 and an overall height of 12–15m. They will be lattice steel structures with cross-arms which can extend over the base footprint and internal bracing.

3.2.2.6 Rural (Local) Electricity Supply

A rural/local electricity supply will be required as a back-up power supply to the proposed substation for light, heat and power purposes. A rural/local supply pole is located within Carranstown Bog, approximately 10m from the proposed substation location. The rural/local supply will be designed and constructed by ESB Networks. The exact source of supply is to be confirmed by ESB Networks, however, the supply will enter the site by either MV overhead line or MV cable. The rural/local supply will have an associated step-down transformer (i.e., MV to LV) and will enter the substation building by underground cable and terminate onto the control building AC distribution board.

3.2.2.7 Anemometry Mast

Two permanent anemometry masts (met masts) are included in the design of the Proposed Development. The anemometry masts will be equipped with wind monitoring equipment at various heights. The masts will be located at ITM X661518, Y756596 and ITM X 663677, Y752816 as shown on the site layout in Figure 2-4 and will be slender structures 115 metres in height. The masts will be free-standing structures normally constructed with a reinforced concrete gravity foundation designed to cater for the mast loadings. A hard-standing area sufficiently large to accommodate the installation crane will be constructed adjacent to an existing track.

3.2.2.8 Temporary Construction Compounds

Four temporary construction compounds are proposed as part of the Proposed Development; one main compound at Ballivor bog, one sub-station compound, and two (2) smaller compounds. They will be located in the townlands of Grange More and Bracklyn.

Table 3-3 Temporary Construction Compound Scales

Compound No.	Bog	Scale	Total Area
1	Ballivor Bog (north)	130m by 70m	9,100m^2
2	Bracklin Bog (west)	40m x 25m	1,000m2
3	Bracklin Bog (east)	100m by 50m	5,000m^2
4	Carranstown Bog (substation)	100m by 50 – 60 m	4,800m^2

The location of the proposed construction compounds is shown on the site layout drawing in Figure 3-3.

The construction compounds will consist of temporary site offices, staff welfare facilities, storage areas, and car-parking areas for staff and visitors.

Temporary toilets will be used during the construction phase as part of the welfare facilities for site staff and visitors. Wastewater from toilets will be directed to a sealed storage tank, with all wastewater tankered off site by an appropriately consented waste collector to wastewater treatment plants.

3.2.2.9 Temporary Security Cabins

Five temporary security cabins will be installed within the site for the duration of the construction phase of the Proposed Development. The security cabins will be located close to the proposed temporary and permanent site entrances and at crossing points on local roads from one bog to another.

The security cabins will be prefabricated structures measuring approximately 7.2 metres by 2.5 metres and 2.85 metres in height. The cabins will serve as the check in and check out point for staff and visitors during the construction phase. The temporary cabins will be removed as part of the post-construction reinstatement works of the wind farm development.

3.2.2.10 Borrow Pits

It is intended to obtain significant volumes of crushed stone that will be required for the construction of the Proposed Development from two proposed onsite borrow pits.

Borrow Pit No. 1a is located in Carranstown Bog west of a proposed access track and the Bord na Móna railway line, approximately 440m southeast of the proposed 110kV substation. It measures approximately 52,700 m2 in total.

Borrow pit 1b is a smaller pit located approximately 80m east of borrow pit 1a, approximately 440m from the proposed 110kV substation.

Access to borrow pit 1a and 1b will be via internal roads constructed in the same manner as excavated turbine roads (see section 3.2.2.2.1 above), and measure 15m and 45m, respectively. Post-construction, both borrow pits in Carranstown will be reinstated with excavated peat or spoil, however, the access roads to both pits will be retained.

Borrow Pit No. 2 is located on third party land immediately south of the Bracklin Bog boundary. It is located approximately 700 m southwest of Turbine No. 17 and 440m south of the proposed Bracklin Bog Met Mast and measures approximately 57,800 m^2.

Initial access to the borrow pit field will be via the landowners farm access track off the local road 800m south of Bracklin Bog. This existing farm access track will be upgraded. From the borrow pit area, an access road connecting it to Bracklin Bog will be constructed; approximately 50m will be constructed through pastureland via the excavated road method and approximately 120m will be floated (over an existing drain) as per the methodologies in Section 3.2.2.2.1 above Once complete, machinery access to and from the borrow pit area during its construction, use and reinstatement will be via internal roads only, i.e. no local road use will be required by heavy goods vehicles for the purpose of transporting stone. Occasional employee access to the borrow pit and occasional movement of empty machinery to and from borrow pit may require use of the local road. Post-construction phase, the offsite borrow pit area and any construction access works will be permanently graded over and allowed to reseed.

The locations of the proposed borrow pits are shown on the site layout drawing in Figure 3-3.

The extraction of material from the borrow pits is a construction stage of the Proposed Development which will be a temporary operation run over a short period of time. No rock breakers or blasters are proposed for extracting material from these borrow pits. However, it is likely that processing and crushing of cobbles and boulders will be required at all borrow pits to achieve the grading requirements for use in construction.

The estimated volume to be extracted from the borrow pits for the construction of the Proposed Development is up to 674,000 m^3.

The construction of the borrow pits will follow a standard sequence as follows;

1. Prior to work commencing, scan for hidden services will be carried out and services will be relocated where required.
2. The working area will be cordoned using temporary fencing.
3. Extraction plant and vehicles on low loaders will be mobilised to site.
4. Topsoil will be removed to a designated location within the borrow pit extents to be stored.
5. A designated impermeable re-fuelling area will be constructed (within the pit for dry working, outside the pit for wet working).
6. Material will be extracted using excavators. No rock ripping or blasting will be carried out at any borrow pits.
7. Excess peat will be sidecast and landscaped.
8. Other extracted materials deemed unsuitable for re-use will be reinstated within the borrow pits.
9. Material will be processed to crush cobbles and boulders.
10. The processed material will be stockpiled in designated areas.
11. A temporary access track will be constructed to tie in with the internal road infrastructure.
12. Processed material will be loaded into lorries and transported to deposition location.
13. Temporary excavation side slopes will be designed by a geotechnical engineer.
14. Upon completion, all faces of excavation will be constructed to safe permanent side slopes to be designed by a geotechnical engineer.
15. Topsoil will be replaced and reseeded.
16. Extraction plant and vehicles on low loaders will be demobilised via. internal site roads and main site entrance.

3.2.2.11 Sand and Stone Requirements

Construction grade granular fill and higher quality, final surfacing fill (including sand) will both be required for the construction of the Proposed Development.

- The peat beneath the substation, all proposed hardstanding areas including temporary construction compounds will be excavated and replaced with construction grade granular fill up to the existing ground level.
- Roads will generally be constructed as floating roads except in areas with shallow peat and highly trafficked areas (e.g. site entrances and access roads in and out of borrow pits).
- The hardstanding areas and roads will be constructed to the 100 year flood level. Roads will generally comprise approximately 650mm of granular fill and approximately 150 mm of final surfacing layer (or capping). Geotextiles separators will be placed on the subgrade and geogrids will be installed within the road build-up.
- The proposed substation compound will be constructed to approximately 76 metres OD. The peat and unsuitable soil excavated beneath the substation footprint will be replaced with select granular fill in accordance with Eirgrid requirements. The final 250 mm shall comprise capping material.
- The internal site underground cable trenches will be approximately 1200mm in depth. The cable trench will be backfilled up to approximately 600mm with sand, within which the ducting will be placed. Suitable materials from the excavations of the trenches will be reinstated to form the final layer of the trench.

3.2.2.12 Peat and Spoil Management

A peat and Spoil Management Plan has been prepared for the Proposed Development and is included as Appendix 4-2 of the EIAR which accompanies the planning application for the Proposed Development. The total estimated volume of peat and spoil requiring management within the site is 732,000m^3. The site which is generally flat consists predominantly of bare, locally re-vegetated cutaway peat and shallow peat with an established drainage network. The site has been harvested by Bord na Móna using mechanical harvesting equipment. Bord na Móna has experience managing peat in similar terrain, both during peat production operations and during wind farm construction projects, particularly Mountlucas, Bruckana, Cloncreen (under construction) and Oweninny wind farms. These projects have demonstrated safe and effective methods for peat management and storage. The proposed methodology is detailed in the Peat and Spoil Management Plan which is included as Appendix 4-2 of the EIAR accompanying the planning application.

3.2.2.13 Site Entrances

Turbine Component Entrances

There are 2 no. main site entrances proposed for the delivery of turbine components to the site. These two main entrances are located on the R156 and provide access and delivery of components into Ballivor Bog to the south, and into Carranstown Bog and on to the remaining bogs to the north. These existing entrances will be widened to facilitate the delivery to site of turbine components. The entrance locations are depicted on Figure 3-3 and can be described as follows:

- Widening of existing site entrance off the R156 into Ballivor Bog in the townland of Grange More;
- Widening of existing site entrance off the R156 into Carranstown Bog in the townland of Grange More.

In addition to the above, in order to deliver turbine components into Lisclogher Bog, an entrance will be inserted at Bracklin Bog onto a local road and an opposing entrance will be inserted into Lisclogher Bog. This will facilitate the direct travel of components from Bracklin Bog to Lisclogher Bog across the local road, thus minimising road and traffic impacts as the components will travel through Carranstown and Bracklin bogs rather than the local road network and cross the narrow road into Lisclogher Bog. This local road network will not be used to facilitate access for components to these bogs.

General Construction Entrances

The northern component entrance into Carranstown Bog will also facilitate the delivery of construction materials (e.g. stone, steel, concrete) and construction staff to Carranstown, Bracklin and Lisclogher Bogs. Adjacent to the southern entrance, a new construction entrance will be constructed for all non-component vehicles. Following construction, the northern entrance will be narrowed to provide permanent access to accommodate light goods vehicles (LGVs) for maintenance work and private vehicles belonging to recreational visitors using the amenity carpark at Carranstown Bog. The general construction entrance into Ballivor Bog at the south will be retained for the operational phase for amenity and maintenance use. The larger component entrance will be reinstated and revegetated for the operational phase. Should replacement components be required during the lifetime of the development, the component entrances will be reopened to facilitate HGV and oversize component access to the site.

As discussed above, entrances will be inserted into Bracklin and Lisclogher Bogs to facilitate the movement of turbine components from Bracklin to Lisclogher Bog. These entrances will also be used to facilitate the direct travel of construction vehicles from Bracklin Bog to Lisclogher Bog across the local road. This local road network will not be used for general construction traffic to these bogs. For the operational period, these entrances will be upgraded to permanent site entrances for public amenity use and a permanent carpark will be provided off the Bracklin entrance.

Access to borrow pit no. 2 in Craddanstown is proposed via an initial use of an existing third party entrance and track, which will be upgraded, off a local road through a farmyard, 800m south of Bracklin Bog. At the commencement of the construction phase, machinery will enter the farmyard to the borrow pit area to commence construction of a temporary road from the pit area into Bracklin Bog. Once this temporary road is complete, access from the local road will not be required except for occasional employee access to the borrow pit and occasional movement of machinery from and to the borrow pit. The track and pit will be reinstated and reseeded during the construction phase.

3.2.2.14 Turbine Component Transport Route

There are a range of ports within the island of Ireland that have proven capability to accept and store large wind turbine components. These ports include Cork, Foynes, Galway and Dublin ports. Furthermore, subsequent access to the national motorway network during transportation from these ports has been demonstrated. The facilities within the ports and access to and from the ports is continually being upgraded as part of general improvements. It is on this basis that it is not foreseen that this project will require any material change to port select should the project be consented and enter into the construction phase.

It is proposed that the large wind turbine components will be delivered to site via the M3, exiting at Junction 6 onto the R125 before turning northwest onto the R154 Trim Road. The delivery route enters Trim town before turning south onto the R161 for approximately 7.5km where it meets the R156. The delivery route continues west for approximately 11.1km along the R156 through Ballivor Village before reaching the proposed site entrances off the R156.

3.2.2.15 Turbine Delivery Accommodation Works

Temporary road widening works will be undertaken along the haul route at two locations to facilitate turbine component delivery and parking/storage:

- Junction between the R156 and the R161 approximately 6.5km southwest of Trim: The junction accommodation works will comprise the road-widening within third-party land in order to facilitate turning of delivery vehicles carrying turbine components and other abnormal loads, from the R161 onto the R156 as well as the provision of off-road parking and storage facilities. The proposed widening will measure 3,751m^2 and the area of land take for the proposed parking and storage facilities measure 5,375 m^2.

- East of Ballivor Village on the R156: Accommodating works will be required on the R156 approximately 3.6km east of Ballivor Village. Here, road-widening within third-party land will be required in order to facilitate turning west of delivery vehicles carrying turbine components and other abnormal loads, toward Ballivor Village on the R156. The land take will also provide off-road parking and storage facilities during its development. The proposed accommodation works area on the road will measure 1,809m^2 and the area of land take for the proposed parking and storage facilities will measure 6,770m^2.

The proposed road widening works will be constructed as per the general construction methodology for new excavated roads as outlined in Section 2.3.2.1.2 above. The locations of these proposed accommodation works are shown in Figure 3-5 and the accommodation works areas are shown on the layout drawings in Appendix 4-1 of the EIAR which accompanies the planning application. Temporary fencing will be installed at temporary road widening and parking/storage locations. This fencing will be removed to facilitate turbine component delivery and replaced following each delivery.

Following the completion of the construction phase of the Proposed Development, the temporary road widening locations and parking/storage areas will be covered with a layer of topsoil and reseeded. These locations would only be used again in the event that an oversized delivery was required for wind turbine maintenance purposes.

Additional temporary works in the form of signage and bollard removal, lowering of traffic islands, roundabout lowering at locations along the R125, R154, R156 and R160 are required and to allow for oversailing of turbine components. These works will be reinstated once turbine components have been delivered to site and have been agreed in principle with Meath County Council.

3.2.2.16 Other Road Accommodating Works

3.2.2.16.1 *Proposed Permanent Road Improvement Works at R156*

On the R156 in between the proposed component entrances to Ballivor and Carranstown Bogs, existing visibility is currently impacted by a trough and rise in the road. An assessment of the vertical alignment shown indicates that a 44m section of the R156 impedes on required sightlines and as a result, a maximum reduction of approximately 0.47m for 44m along the R156 is required in this area. This proposed work will be undertaken prior to any construction phase works and will be retained for the operational phase and beyond. This proposed lowering of the road section will enhance the road safety for both construction and operational phase users as well as local road users of the R156.

3.2.2.17 Amenity Pathways and Carparks

The Proposed Development will provide approximately 28km of internal road network, which is intended for amenity use (walkways and cycleways) when the wind farm becomes operational. The roads will be re-purposed following construction to form the amenity pathways, in addition to being used for maintenance access during operation. The amenity pathways will be surfaced with a granular material.

An additional 3.3 km (approximately) of a dedicated amenity link is also proposed in the form of new and upgraded tracks along in Ballivor Bog and at existing entrances into Lisclogher and Bracklin Bogs to provide a greater variety of walking loops. These amenity pathways are illustrated in Figure 3-3. The additional connections will be 3 metres in width and will be constructed using a similar methodology as outlined in Section 2.3.2.1 above.

Three new public car parks will also be provided for recreational use during the operational stage. The car parks will be located along the proposed existing southern access off the R156 into Ballivor Bog, the northern access off the R156 into Carranstown Bog and off the local road which runs northwest–southeast between Lisclogher and Bracklin Bogs. The location and configuration of the proposed car parks are shown in Figure 2-4. The main car park will be located in Ballivor and will accommodate approximately 50 vehicles; the Carranstown car park will accommodate approximately 15 vehicles. The Bracklin car park will provide parking for approximately 15 vehicles. Each car park will also provide bicycle rack facilities for those who want to cycle to the area and then utilise the amenity loops for walking.

3.2.3 Site Drainage

The drainage design for the proposed wind farm development has been prepared by Hydro Environmental Services Ltd. (HES), and by the firm's principal, Mr. Michael Gill. It is described in Chapter 9 'Hydrology' of the EIAR which accompanies the planning application and is included here as Appendix 2. The drainage design has been prepared based on experience of the project team of other wind farm sites in peat-dominated environments, and the number of best practice guidance documents referred to in the References section of the EIAR accompanying the planning application.

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is important to establish the most appropriate drainage proposals for the site of the Proposed Development. There is an existing drainage system and surface water discharges from the site which are regulated by the Environmental Protection Agency (Licence Ref. P0501-01). The drainage design for the Proposed Development has been planned with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. The assessment of potential impacts on hydrology and hydrogeology due to the construction, operation and decommissioning of the Proposed Development is included in Chapter 9: Hydrology and Hydrogeology of the EIAR accompanying the proposed planning application.

3.2.3.1 Drainage Design Principles

No routes of any natural drainage features will be altered as part of the Proposed Development. Turbine locations and associated new roadways were designed to avoid natural watercourses with existing roads to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development.

Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader.

Collector Drains

Collector drains (or swales) are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the Proposed Development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above.

Collector drains will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.

Collector drains will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

Check Dams

The velocity of flow in the interceptor drains and collector drains, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the drain is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.
Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the site, downstream of where drainage swales connect in.

Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor/collector drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance during construction. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Stilling Ponds/Settlement Ponds

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase and will remain in place to attenuate runoff from roads and hardstanding areas of the Proposed Development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Silt Bags

Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.

Dewatering silt bags are an additional drainage measure for the construction phase that can be used downgradient of the stilling ponds at the end of the drainage swale channels and will be located, wherever it is deemed appropriate, throughout the site. The water will flow, via a pipe, from the stilling ponds into the silt bag. The silt bag will allow the water to flow through the geotextile fabric and will trap any of the finer silt and sediment remaining in the water after it has gone through the previous drainage measures. The dewatering silt bags will ensure that there will be no loss of peaty silt into any watercourse.

The dewatering silt bag, when full, will be removed from site by a waste contractor with the necessary waste collection permit/license, who will then transport the silt bag to an appropriate, fully licensed waste facility.

Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses where works are proposed within the 50-metre buffer zone of a stream.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document *'Control of Water Pollution from Linear Construction Projects'* published by CIRIA (No. C648, 1996).

Culverts

Culverts will be required where site roads, crane pads and turbine pads cross main bog drainage networks. Indicative locations of the culverts are shown on the drawings in Appendix 4-1 of the CEMP in Appendix 3 of this report.

Culverts will be installed with a minimum gradient of 1% (1 in 100). Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling doesn't occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

All new crossings and upgrades to existing crossings will be completed as follows:

- The access road on the approach watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- The installation of the culvert will take place in low flow conditions.
- Where a flow exists, the water running through the watercourse channel will be pumped around the water crossing location and back into the watercourse channel downstream of the works area.
- Where over pumping is required, measures will be taken to ensure that the pumped water discharge does not disturb the channel bed with the force of water from the discharge. A steel plate to reduce the force of the flow will be used where appropriate.
- The project engineer will determine the required gradient of the culvert. The culvert must be laid at a gradient that will ensure water is contained within the culvert at all times. Where necessary a rock armour dam will be installed within the channel to reduce flow and ensure an acceptable depth of water remains within the culvert. Where a gradient of 1 –1.5% is identified, the use of a baffle has been recommended.
- The embedded section will be allowed to fill naturally with existing material within the base of the drain or with suitable drainage material such as gravel or round shingle where deemed applicable.
- The culvert will be lowered into place using an excavator with a lifting mechanism.

- Large stone boulders (approx. 400mm), sourced from the on-site borrow pits, will be placed over the culvert to create a headwall for the culvert and a suitable sub-base for road construction.
- Smaller 50mm stone sourced on site will be placed upon the sub-base to construct the road over the water crossing.

The works will be undertaken in line with NRA Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.

For crossings at Bord na Móna bog drains the bed of the watercourse channel will be excavated, if necessary, to achieve the correct line and to allow the culvert to be embedded 300mm into the base of the existing drain.

Proposed mitigation measures for watercourse crossings are outlined below and are summarised as follows:

- All proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed. There will be no in-stream excavation works and therefore there will be no direct impact on the stream at the proposed crossing location
- Where the proposed underground cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road
- As a further precaution, works in proximity to watercourses will adhere to IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters.
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas; and,

All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent. All of the above works will be supervised by an Environmental Clerk of Works and the project hydrologist. Works in proximity to watercourses will adhere to IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters.

3.2.4 Waste disposal

The Construction and Environmental Management Plan (CEMP) (Appendix 3) includes a Waste Management Plan (WMP) which details the best practice procedures to be used during the construction, operation, and decommissioning phases of the proposed development. The WMP details the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage.

3.2.5 Operation

The Proposed Development is expected to have a lifespan of approximately 30 years. Planning permission is being sought for a 30-year operation period commencing from the date of full operational commissioning of the wind farm. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding to inputs from meteorological equipment and control systems to changes in factors such as wind speed and wind direction.

The wind turbines will be interconnected, and data relayed from the wind turbines to an off-site control centre. The meteorological mast will be similarly interconnected. Each turbine will also be monitored off-site by the wind turbine supplier. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at an off-site control centre 24-hours per day.

Each turbine will be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. Each meteorological mast will be subject to a routine maintenance programme involving a number of checks and changing of instrumentation when required. In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically, maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substation and site tracks will also require periodic maintenance. Maintenance of the site roads will involve filling potholes and maintaining road edge markers. Drainage maintenance will typically involve cleaning of drainage ditches when required to prevent water backing up.

The Substation would be operational 24 hours per day, 7 days a week throughout the year. Supervisory operational and monitoring activities will be carried out remotely using a SCADA system, with the aid of computers connected via a telephone modem link. The following maintenance procedures will also be adhered.

- Periodic service and maintenance works which include some vehicle movement.
- For operational and inspection purposes, substation access is required.
- Servicing of the substation equipment will be carried out in accordance with the manufacturer's specifications, which would be expected to entail the following:
    - Six-month service – three-week visit
    - Annual service – six-week visit
    - Weekly visits as required

Occasional technical problems may require maintenance visits by technical staff. During the six-month and annual service visits, some waste (lubricating and cooling oils, packaging from spare parts or equipment, unused paint, etc.) will arise. This will be recorded and removed from the site and reused, recycled or disposed of in accordance with the relevant legislation in an authorised facility.

This means that day-to-day access to the infrastructure by persons and vehicles will be infrequent, only required to undertake minor routine maintenance and inspection.

3.2.6 Decommissioning

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their service life, the wind turbines may be replaced with a new set of turbines or components, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully. The onsite substation will remain in place as it will be under the ownership of the ESB/EirGrid.

During decommissioning of the Proposed Development, the wind turbines and meteorological masts would be disassembled. All above ground turbine and mast components would be separated and removed off-site for recycling. Turbine and mast foundations would remain underground and would be covered with earth and allowed to revegetate. Site roadways will be in use as amenity and recreational pathways, and therefore will not be removed during decommissioning. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required. Underground cables, including grid connection, will be removed and the ducting left in place. A decommissioning plan will be agreed with Meath and Westmeath County Council prior to decommissioning the Proposed Development. A Decommissioning Plan is included as Appendix 4-5 of the EIAR which accompanies the planning application for the Proposed Development.

4. CHARACTERISTICS OF THE RECEIVING ENVIRONMENT

The ecological surveys that were undertaken to inform this NIS are fully described in this section. The specific surveys that were undertaken to assess the potential effects on the identified European Sites are described below.

4.1 Ecological Survey Methodologies

4.1.1 Desk Study methodology

The desk study undertaken for this assessment included a thorough review of the available ecological data associated with the Proposed Development Site and surrounding area. Sources of data included the following:

- Bord na Móna Draft Rehabilitation Plans for Ballivor Bog
    - Ballivor Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
    - Bracklin Bog Cutaway Bog Decommissioning and Rehabilitation Plan
    - Lisclogher-West Cutaway Bog Decommissioning and Rehabilitation Plan
    - Lisclogher Cutaway Bog Decommissioning and Rehabilitation Plan
    - Carranstown Cutaway Bog Decommissioning and Rehabilitation Plan
- Review of NPWS Conservation Objectives supporting documents, site synopsis, standard data forms and supporting documents for EU Designated Sites,
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), EPA (Envision), Water Framework Directive (WFD), Geological Survey of Ireland (GSI) and Inland Fisheries Ireland (IFI)
- Review of the publicly available National Biodiversity Data Centre (NBDC) web-mapper,
- Inland Fisheries Ireland (IFI) reports, where relevant/available,
- Review of NPWS Article 17 metadata and GIS database.
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads in which the Proposed Development is located.
- MKO field assessments and bird surveys carried out between 2019 and 2022 and as provided in full in Chapter 7 'Ornithology' of the EIAR which accompanies this planning application.
- Cummins et al. (2010). Assessment of the distribution and abundance of Kingfisher [*Alcedo atthis*] and other riparian birds on six SAC river systems in Ireland. A report commissioned by the National Parks and Wildlife Service and prepared by BirdWatch Ireland

4.1.2 Scoping and Consultation

MKO undertook a scoping exercise during preparation of the NIS in 2020 and again in 2021. Copies of all scoping responses in relation to the Proposed Development are included in Appendix 2-1 of the EIAR which accompanies the planning application for the Proposed Development. Scoping responses relevant to European Site and Appropriate Assessment are listed in Table 4-1 below and the responses are included as Appendix 6 of the NIS.

The recommendations of the consultees have been taken into consideration in the preparation of this NIS.

Table 4-1 Organisations consulted with regard to biodiversity

Consultee	Contact	Response
Department of Agriculture, Food and the Marine	Email 28th May 2020	It is important to note that when applying to a Local Authority, or An Bord Pleanála, for planning permission where developments are: a) subject to an EIA procedure (including screening in the case of a sub-threshold development) and an resulting requirement to produce an EIAR; and/or b) subject to an Appropriate Assessment procedure (including screening) and any resulting requirement to a Natura Impact Statement (NIS); and c) the Proposed Development in its construction or operational phases, or any works ancillary thereto, would directly or indirectly involve the felling and replanting of trees, deforestation for the purposes of conversion to another type of land use, or replacement of broadleaf high forest by conifer species, 1. that there is a requirement inter alia under the EIA Directive for an overall assessment of the effects of the project or the alteration thereof on the environment to be undertaken, including the direct and indirect environmental impact of the project; and 2. pursuant to Article 2(3) of the EIA Directive, the Department of Agriculture, Food and the Marine strongly recommends that, notwithstanding the fact that a parallel consent in the form of felling licence may also have to be applied for, any EIAR and/or NIS produced in connection with the application for planning permission to the Local Planning Authority or An Bord Pleanála, should include an assessment of the impact of and measures, as appropriate, to prevent, mitigate or compensate for any significant adverse effects direct or indirect identified on the environment arising from such felling and replanting of trees, deforestation for the purposes of conversion to another type of land use, or replacement of broadleaf high forest by conifer species.
Development Applications Unit- NPWS	Emailed 07.05.2020	**Nature Conservation** 1. Cumulative impacts- this appears to suggest that the only cumulative impacts which will be considered are those with other wind farms within 20km of the proposed site. This would not adequately assess the potential impacts on wide ranging species especially those in migration such as geese and swans. Also cumulative effects should include more than just multiple wind farm effects. The cumulative effects of the Proposed Development with other types of projects should be considered. The indirect effects of the demands for resources to supply and build the development and the impacts these may have elsewhere should be assessed. 2. Interactions with the Proposed Development and the on-going peat extraction activities at the sites and any impacts arising should be considered. Also detailed rehabilitation plans should be prepared for the peatlands concerned within and adjacent to the proposed site and the potential impacts of the Proposed Development on rehabilitation of the peatlands should be considered and assessed in an EIAR. Hydrological changes which may prevent future rehabilitation of

		suitable areas of the site to peat forming habitat are of particular concern. 3. In deciding on the layout of the proposed development, , adequate buffers should also be placed around important habitats and species in the locations identified in flora and fauna studies. 4. The EIAR should adequately address the potential impacts to determine local and international bird migration over the proposed site, particularly nocturnal migrants outlined in https://www.nature.scot/sites/default/files/2017-09/Guidance%20note%20-%20Guidance%20on%20methods%20for%20monitoring%20bird%20populations%20at%20onshore%20windfarms.pdf should be carried out. 5. Passive bat surveying at height should be undertaken to document highflying species such as Leisler bat. Risk to bats in terms of collision and barotrauma should be addressed. 6. The EIAR should include a robust post development mitigation monitoring plan.
Inland Fisheries Ireland (IFI)	Emailed 08.05.2020 2020 & 12.02.2021	Response received on the 19th May 2021 is included in Appendix 2-1 of the EIAR submitted with the planning application. Observations related to watercourse crossings, instream works, pollution control measures and biosecurity.

4.2 Ecological Survey Methodologies

A comprehensive survey of the biodiversity of the entire site was undertaken on various dates, set out below, between October 2019 and February 2023. Detailed ecological surveys of the Ballivor Bog Group were undertaken previously by Bord na Móna ecologists between 2011, 2012 and 2018 and a detailed habitat map of the site was produced. The habitat map of the Ballivor Bog Group provided by Bord na Móna was used to set the baseline and inform the surveys undertaken by MKO. The following sections fully describe the ecological surveys that have been undertaken and provide details of the methodologies, dates of survey and guidance followed.

4.2.1 Ecological Multidisciplinary Walkover Surveys

Multidisciplinary walkover surveys of the Proposed Development Site were undertaken on the 23rd April, 26th May, 4th June, 16th June, 20th July and 3rd September 2020, on the 26th and 27th May, the 8th and 15th July and 27th September 2021, on the 26th April and 26th September 2022 and on the 16th February 2023 in order to ground in truth the habitat-mapping provided by Bord na Móna, based on their ecological surveys of the site in 2011 and 2012. The vast majority of the survey timings fall within the recognised optimum period for vegetation surveys/habitat mapping, i.e. April to September (Smith *et al.*, 2011).

In addition to ground-truthing the results of the Bord na Móna habitat mapping, the walkover surveys were designed to detect the presence, or likely presence, of a range of protected habitats and species associated with European Sites.

The multi-disciplinary walkover surveys comprehensively covered the lands within the application Site Boundary and based on the survey findings, further detailed targeted surveys were carried out for features and locations of ecological significance. These surveys were carried out in accordance with NRA

Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna on National Road Schemes (NRA, 2009). All habitats recorded within the Proposed Development Site have been classified in accordance with Fossitt (2000). Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follows '*Mosses and Liverworts of Britain and Ireland - a field guide'* (British Bryological Society, 2010).

During the multidisciplinary surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

Other targeted survey methodologies undertaken at the site are described in the following subsections.

4.2.2 Otter Survey

Dedicated otter surveys were conducted on the 26th and 27th May, 8th July and 27th September 2021 of the watercourses within the Proposed Development Site which were identified as providing suitable habitat for otter. Additional otter surveys were undertaken by Ross Macklin of Triturus Environmental Ltd. during aquatic surveying of the watercourses within the vicinity of the application site in July 2021.

The otter survey was conducted as per TII (2009) guidelines (Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes). This involved a search for all otter signs e.g. spraints, scat, prints, slides, trails, couches and holts. In addition to the width of the rivers/watercourses, a 10m riparian buffer (both banks) was considered to comprise part of the otter habitat (NPWS 2009). The dedicated otter survey also followed the guidance as set out in NRA (2008) *'Guidelines for the Treatment of Otters Prior to the Construction of National Roads Schemes'* and following CIEEM best practice competencies for species surveys (CIEEM, 2013[2]).

4.2.3 Aquatic surveys

Aquatic surveys of the watercourses draining the application site were conducted by Ross Macklin of Triturus Environmental Ltd. in July 2021. A total of 20 sites were surveyed. The site locations are shown in Figure 2.1 of the Aquatic Report in Appendix 4 of this NIS.

The surveys included Biological Water Quality (Q sampling) which was assessed through kick sampling, electrofishing, a white-clawed crayfish survey, otter survey and an aquatic habitat assessment at each location which assessed watercourses in terms of:

- Physical watercourse/waterbody characteristics (i.e., width, depth etc.)
- Substrate type, listing substrate fractions in order of dominance (i.e., bedrock, boulder, cobble, gravel, sand, silt etc.)
- River profile in the sampling area
- Macrophyte and aquatic bryophyte communities at each site
- Riparian vegetation composition

The methodologies for the aquatic surveys are described in full within the aquatic report.

4.2.4 Kingfisher

Kingfisher is a Special Conservation Interest (SCI) for the River Boyne and River Blackwater SPA. During the multi-disciplinary walkover surveys described above a search for suitable kingfisher habitat was undertaken. In addition, extensive bird surveys were undertaken by MKO ornithologists at Ballivor Bog Group between October 2019 and September 2022. The methodologies are outlined in full in Chapter 7 'Ornithology' of the EIAR which accompanies the planning application for the proposed development. Those survey methodologies relevant to kingfisher are summarised below. During these surveys all observations and signs of kingfisher were recorded.

4.2.4.1 Survey Methodologies

In the absence of specific national bird survey guidelines, the ornithological surveys were designed and undertaken in full accordance with '*Recommended bird survey methods to inform impact assessment of onshore wind farms*' (SNH, 2017). The various survey types undertaken are described below.

[2] *CIEEM, 2013, Technical Guidance Series – Competencies for Species Survey, Online, Available at: https://cieem.net/resource/competencies-for-species-survey-css/ Accessed: 20.03.2021*

4.2.4.1.1 *Vantage Point Surveys*

Vantage point (VP) surveys were undertaken in accordance with SNH guidance from April 2020 to September 2022. Surveys were conducted monthly throughout this survey period from sixteen fixed point vantage points to allow as comprehensive as possible coverage of the 500m survey radius surrounding the proposed turbines (as per SNH, 2017). The vantage point locations were selected by undertaking a viewshed analysis, as described below, and confirmed by a recce visit in March 2020.

Viewshed Analysis

Viewshed analysis was carried out to inform coverage of the Wind Farm Site from fixed vantage point locations. Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with QGIS (Version 3.22) using a notional layer suspended at 30m, which is representative of the minimum height considered for the Potential Collision Risk Area based on the selected turbine model. While the relevance of being able to view as much of the site to ground level is acknowledged, the SNH guidance (2017) emphasizes the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collision with turbines by birds.

The viewshed analysis involved testing each VP location for its visibility coverage by creating a viewshed point 1.75m in height (to represent the height of the observer) on a map using 10m contours terrain data. The relative height of forestry and its effects on visibility is also accounted for in the analysis. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 30m from ground level up, to a 2km radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed from each VP location in line with SNH (2017). A 500m buffer was applied to the outer most turbines of the proposed wind farm development in line with SNH (2017). The viewshed analysis aims to establish whether the selected vantage points offer adequate coverage of the turbine layout proposed at that time of surveying.

4.2.4.1.2 *Breeding Walkover Surveys (O'Brien & Smith Survey)*

Breeding walkover surveys were undertaken to determine the presence of bird species of high conservation concern and identify areas of possible, probable, or confirmed breeding for bird species observed within the Proposed Development Site. The survey methodology followed the O'Brien & Smith (1992) method for lowland sites as outlined in Gilbert *et al.* (1998). The survey area for these surveys was the wind farm Site Boundary and a 500m survey radius of the wind farm site.

Transect routes were devised to ensure the required coverage of different habitat was achieved within the survey area. Transects were selected to ensure all areas of suitable breeding/ foraging habitat were approached to within 100m. Target species included waders, raptors, waterbirds, gulls and other birds of conservation concern. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Walkover surveys were carried out between daylight hours during the core breeding season months of April, May, June and July (2020, 2021 and 2022), with the Wind Farm Site being visited four to six days per month on each occasion. The timing of visits followed the recommendations of Calladine *et al.* (2009). Following all survey visits, the field maps were analysed to determine the number and location of breeding territories. All non-breeding individuals and species encountered were also recorded.

4.2.4.1.3 *Winter Walkover Surveys*

Winter walkover surveys were undertaken during the 2020/21 and 2021/22 winter seasons to record the presence of bird species of high conservation concern within areas of potentially suitable habitat for these species. The survey area extended 500m outside the Wind Farm Site.

Transect routes were devised to ensure coverage of different habitat complexes between vantage point locations within the study area, during the winter months. The methodology was broadly based on methods described in Bibby *et al.* (2000) and adapted Brown and Shepherd surveys' (SNH, 2017). Target species were raptors, waterbirds, gulls and ground birds of conservation interest. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

4.2.4.1.4 *Waterbird Distribution and Abundance Surveys*

Significant wetland sites within 5km of the Proposed Development Site were surveyed bimonthly for waterbird populations during the 2020/21 and 2021/22 winter seasons. The survey area extended approximately 5km from the Proposed Development Site which exceeds the recommended 500m radius distance for foraging waterbird and 1km radius recommendation for roosting waterbird surveys stipulated by SNH (2017). These surveys aimed to provide contextual information on the distribution and abundance of waterbird species within the wider surroundings of the site. The methodology was in line with survey methodology guidelines issued by SNH (2017) and BirdWatch Ireland (2015). Counts were undertaken during daylight hours (between dawn and dusk) from suitable vantage points at the wetland sites.

4.2.4.1.5 *Connectivity Vantage Point Surveys*

These surveys aimed to investigate whether there were any regular flight paths between the Lough Derravarragh SPA and the Proposed Development Site. Connectivity vantage points were surveyed between November 2020 and May 2021, and between October 2021 and April 2022.

Data on bird observations and flight activity was collected from a scanning arc of 180° and a two-kilometre radius by an observer from a fixed location for three hours, twice per month, from each of the five vantage point locations.

4.3 Desk Study Results

The results of a review of the NPWS Site-Specific Conservation Objectives documents, site synopsis documents and Natura 2000 standard data forms for the Screened-in European Sites identified in Section 2 above are presented below.

4.3.1 River Boyne and River Blackwater SAC

The site-specific conservation objectives for this SAC (NPWS, Version 1 2021) were reviewed. The relevant Qualifying Interests (QIs) for which the site is designated, and their associated conservation objectives (Site Specific Conservation Objectives, NPWS, Version 1 2021) are presented in Table 4-2.

Table 4-2 Qualifying Interest and Conservation Objectives

Qualifying Interest	Conservation Objective
Alkaline fens [7230]	To maintain the favourable conservation condition of Alkaline fens in River Boyne and River Blackwater SAC.
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* in River Boyne and River Blackwater SAC

Qualifying Interest	Conservation Objective
Lampetra fluviatilis (River Lamprey) [1099]	To restore the favourable conservation condition of River Lamprey (*Lampetra fluviatilis*) in River Boyne and River Blackwater SAC
Salmo salar (Salmon) [1106]	To restore the favourable conservation condition of Atlantic Salmon (*Salmo salar*) in River Boyne and River Blackwater SAC,
Lutra lutra (Otter) [1355]	To maintain the favourable conservation condition of Otter (*Lutra lutra*) in River Boyne and River Blackwater SAC

4.3.1.1 Main pressures, threats and activities with impacts on the SAC

The NPWS Natura 2000 – Standard Data Form for the SAC (available on www.natura2000.eea.europa.eu) was viewed on the 24th February 2023. The data form contains a description of and ecological information on the SAC. It also identifies the main threats, pressures and activities impacting on the SAC and identifies whether these occur inside or outside of the SAC or both.

The threats, pressures and activities identified in the Natura 2000 standard data form for the River Boyne and River Blackwater SAC are listed in Table 4-3. Threats, pressures and activities are ranked as either High (H), Medium (M) or Low (L) impact.

Table 4-3 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside/Both
M	G02.10	Other sport / leisure complexes	Inside
H	H01	Pollution to surface waters (limnic, terrestrial, marine & brackish)	Inside
L	D01.05	Bridge, viaduct	Inside
M	A07	Use of biocides, hormones and chemicals	Inside
M	A08	Fertilisation	Inside
M	A05.02	Stock feeding	Outside
L	G01	Outdoor sports and leisure activities, recreational activities	Inside
H	J02.15	Other human induced changes in hydraulic conditions	Inside
M	A01	Cultivation	Inside
M	A10.01	Removal of hedges and copses or scrub	Inside
M	C01.01	Sand and gravel extraction	Inside

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside/Both
L	G05.06	Tree surgery, felling for public safety, removal of roadside trees	Inside
L	G05	Other human intrusions and disturbances	Inside
M	E05	Storage of materials	Inside
M	E01.04	Other patterns of habitation	Inside
M	J02.11	Siltation rate changes, dumping, depositing of dredged deposits	Inside
M	J02.10	Management of aquatic and bank vegetation for drainage purposes	Inside
M	D01.02	Roads, motorways	Inside
M	E03.02	Disposal of industrial waste	Inside
H	E03.04	Other discharges	Inside
M	J02	Human induced changes in hydraulic conditions	Inside
H	E02	Industrial or commercial area	Inside
H	I01	Invasive non-native species	Inside
M	B01.02	Artificial planting on open ground (non-native trees)	Inside

4.3.1.2 Qualifying Interests

4.3.1.2.1 *Alkaline fens*

According to the site-specific conservation objectives (SSCO) document for the SAC alkaline fen has not been mapped in detail for the River Boyne and River Blackwater SAC. The main areas of alkaline fen in the SAC are documented to occur in the vicinity of Lough Shesk, Freekan Lough, Newtown Lough in the upper reaches of the Stonyford River. At Lough Shesk, the habitat is particularly well-represented and there is a good example of succession from open water to fen-type habitat. (NPWS, 2021). The nearest mapped area of alkaline fen is located adjacent to the northern boundary of the site; however this is not within the SAC boundary. The location is shown on Figure 4-1.

4.3.1.2.2 **Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnionincanae, Salicionalbae)*

According to the site-specific conservation objectives (SSCO) document for the SAC this is present within River Boyne and River Blackwater SAC. As part of the National Survey of Native Woodlands (NSNW), the sub-sites Grove Island (NSNW site code 688) and Yellow Island (752) were surveyed by Perrin et al. (2008). Yellow Island (code 752) was also included in national monitoring surveys (O'Neill and Barron, 2013; Daly et al., in prep.). Map 3 of the SSCOs shows the minimum area of alluvial forests within the

SAC, which is estimated to be 16.7ha (Perrin et al., 2008; Daly et al., in prep.). Further unsurveyed areas of this habitat may also be present within the SAC (NPWS 2021). According to Map 3 of the SSCOs there is an area of alluvial forest mapped approximately 67km downstream of the site, however, further un-surveyed areas of this habitat are likely to occur elsewhere.

4.3.1.2.3 *Lampetra fluviatilis (River Lamprey)*

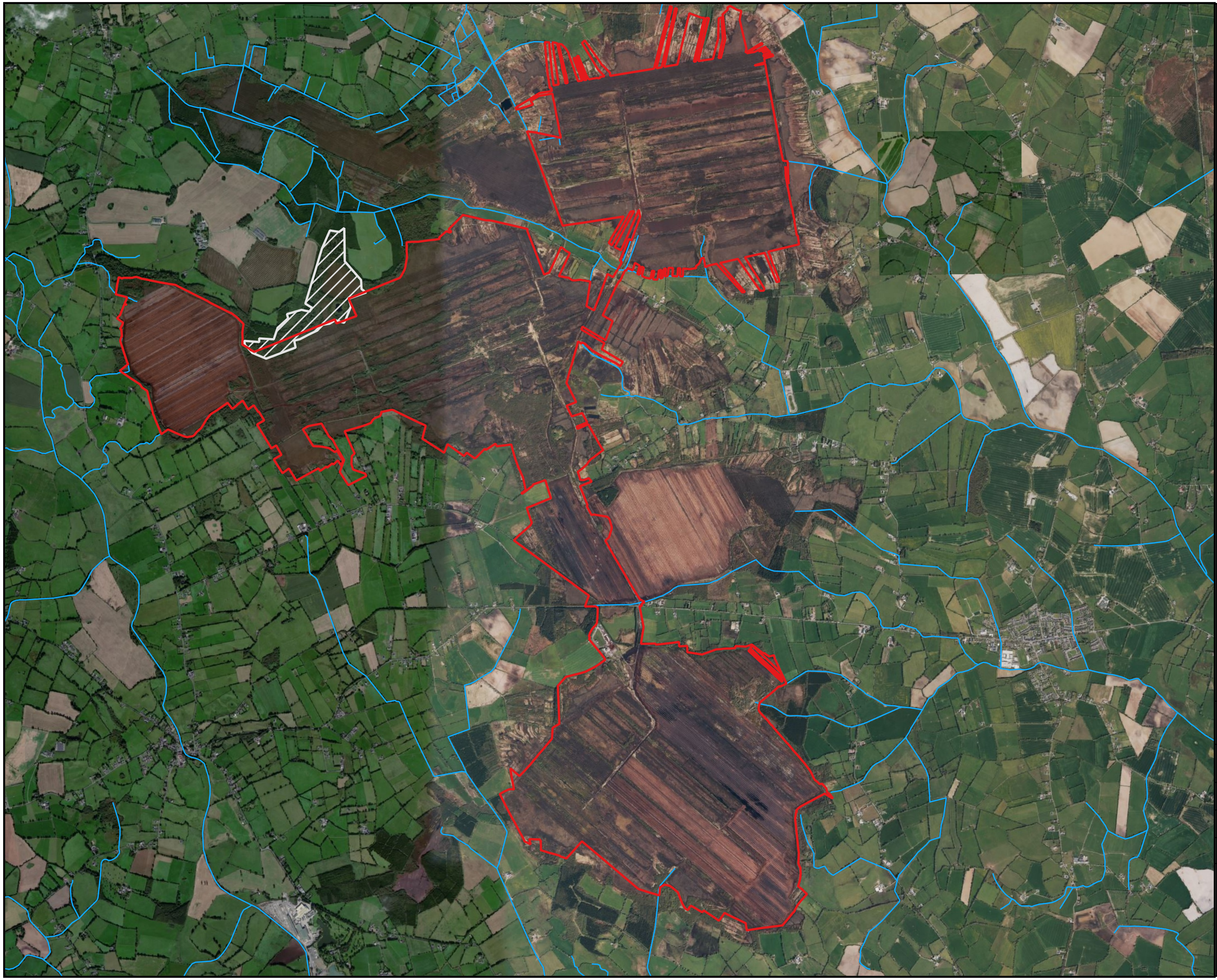
According to the site-specific conservation objectives (SSCO) document for the SAC artificial barriers can block or impede the passage of upstream migrating lamprey, thereby restricting access to spawning areas. There are a number of weirs along the lower sections of the Boyne main channel. Efforts to trap adult river lamprey were undertaken at four locations throughout the catchment during November 2014 to April 2015. This was augmented in April 2015 by an extensive fyke-netting survey (n=26 sites). No adult river lamprey was encountered, with the only record to date being a dead individual from the River Boyne at Slane in late March 2015. On the Boyne main channel, there is ideal spawning habitat both upstream and downstream of the weir at Blackcastle but spawning has not been observed at these locations to date (NPWS 2021).

4.3.1.2.4 *Salmo salar (Salmon)*

According to the site-specific conservation objectives (SSCO) document for the SAC artificial barriers can block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. There are multiple barriers to fish migration in the Boyne system (NPWS 2021). According to the site synopsis for the SAC, the Boyne is most important as it represents an eastern river which holds large three-sea-winter fish from 20-30 lb.

4.3.1.2.5 *Lutra lutra (Otter)*

According to the site-specific conservation objectives (SSCO) document for the SAC the current range for this species within the SAC is estimated at 93.6%. The extent of terrestrial habitat is calculated as 447.6 ha along river banks/lake shoreline/around ponds. The extent of freshwater habitat within the site is calculated as 363.3km. According to the site synopsis for the SAC, otter is found throughout the site and is therefore likely to occur in the proximity to the Proposed Development site.



Map Legend

- Propsoed Development site
- WFD Watercourses
- Alkaline Fens [7230]

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Drawing Title	
Article 17 Mapping: Alkaline Fen [7230]	
Project Title	
Propsoed Ballivor Windfarm	
Drawn By: PD	Checked By: SM
Project No.: 191137	Drawing No.: Figure 4-1
Scale: 1:50000	Date: 2023.03.24

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4.3.2 River Boyne and River Blackwater SPA

There are no detailed site-specific conservation objectives for this SPA. The first order site-specific conservation objectives (NPWS First Order Site-specific Conservation Objectives Version 1.0, 2022) were reviewed. The relevant Special Conservation Interest (SCI) and the associated generic conservation objective are presented in Table 4-4.

Table 4-4 Special Conservation Interest (SCI) and Conservation Objectives

Qualifying Interest	Conservation Objective
Kingfisher	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA

4.3.2.1 Review of site-specific pressures and threats

The NPWS Natura 2000 – Standard Data Form for the SPA (available on www.natura2000.eea.europa.eu) was viewed on 24th February 2023. The data form contains a description of and ecological information on the SPA. It also identifies the main threats, pressures and activities impacting on the SPA and identifies whether these occur inside or outside of the SPA or both.

The threats, pressures and activities identified in the Natura 2000 standard data form for the River Boyne and River Blackwater SPA are listed in Table 4-5 Threats, pressures and activities are ranked as either High (H), Medium (M) or Low (L) impact.

Table 4-5 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside/Both
M	J02	Human induced changes in hydraulic conditions	Inside
H	E01	Urbanised areas, human habitation	Outside
H	D01.02	Roads, motorways	Inside
H	D01.02	Roads, motorways	Outside
H	E01.03	Dispersed habitation	Outside

Rank: H = high, M = medium, L = low. i = inside, o = outside, b = both

4.3.2.2 Special Conservation Interests

4.3.2.2.1 *Kingfisher [A229]*

A detailed site-specific conservation objectives document is not available for this SAC. According to site synopsis document for the SPA (available at https://www.npws.ie/protected-sites/spa/004232,Version date

25/11/2010) the SPA supports a nationally important population of kingfisher with a 2010 survey recording 19 pairs of kingfisher in the SPA and a survey conducted in 2008 recording 20-22 Kingfisher territories within the SPA. A study by Cummins *et al.* (2010) '*Assessment of the distribution and abundance of Kingfisher Alcedo atthis and other riparian birds on six SAC river systems in Ireland. A report commissioned by the National Parks and Wildlife Service and prepared by BirdWatch Ireland'* recorded kingfisher sightings along both the Stonyford and Deel (Raharney) rivers. In addition, the study identified a section of the Stonyford River to the east of Lisclogher Bog as a possible kingfisher territory.

4.3.3 Water Quality Data

4.3.3.1 Surface Water Quality

The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High).

EPA Q-rating monitoring is undertaken at multiple locations on the Deel (Raharney), Stonyford and Boyne rivers in the vicinity and downstream of the site. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High).

The Deel (Raharney) River is located to the west of the Proposed Development Site and receives drainage from Bracklin and Ballivor bogs. The Stonyford River is located to the east of the proposed devleopment site and recieves discharge from Lisclogher, Lisclogher West, Bracklin and Carranstown bogs. The Boyne River recieves discharge from Carranstown and Ballivor Bogs and from the remainder of the site via the Deel (Raharney) and Stonyford Rivers. These watercourses are all designated as part of both the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPAThe most recent available Q-rating data for the Deel (Raharney), Stonyford and Boyne rivers is presented in Table 4-6 below. This data shows that the Q-status of the Deel (Raharney), Stonyford and Boyne rivers downstream of the site ranges from 'Poor' to 'Good' status. No available EPA Biological Q-rating monitoring data post-dates 2020.

Table 4-6 Most recent (2020) EPA Q-ratings

River	Station ID	Location	EPA Q-Rating (Year)	Q-Value Status
Deel (Raharney)	RS07D010200	Cummer Bridge	4 (2020)	Good
Deel (Raharney)	RS07D010300	Raharney Bridge	4 (2020)	Good
Deel (Raharney)	RS07D010400	Inan Bridge	3-4 (2020)	Moderate
Deel (Raharney)	RS07D010600	Bridge upstream of Boyne River confluence	4 (2020)	Good
Boyne	RS07B040800	Inchamore Bridge	4 (2020)	Good
Boyne	RS07B040900	Scariff Bridge	4 (2020)	Good
Stonyford*	RS07S020075	Stonestown Bridge	3 (2020)	Poor
Stonyford	RS07S020100	Bridge upstream of Rathkenna Bridge	3 (2020)	Poor

River	Station ID	Location	EPA Q-Rating (Year)	Q-Value Status
Stonyford	RS07S020400	Stonyford Bridge	3-4 (2020)	Moderate
Boyne	RS07B041000	Derrinydaly Bridge	3-4 (2020)	Moderate

4.3.3.2 Water Framework Directive Surface Water Body Status

A summary of the WFD status and risk result of Surface Water Bodies (SWBs) in the vicinity and downstream of the Ballivor Bog Group are shown in Table 4-7 below.

The western section of Bracklin Bog is drained by the Deel(Raharney)_030 SWB. The status of this SWB has decreased from "Good" in the 2010-2015 round to "Moderate" in the latest round (2013-2018). Further downstream the Deel(Raharney)_040 SWB achieved "Good" status in both monitoring rounds while the Deel(Raharney)_050 SWB was assigned "Moderate" status. The Deel(Raharney)_060 SWB drains the western section of Ballivor Bog and its status has increased from "Moderate" to "Good".

The Boyne_060 SWB drains the eastern section of Ballivor Bog and Carranstown Bog. This SWB has also experienced an improved status from "Moderate" in 2010-2015 to "Good" in 2013-2018. The Stonyford River drains Lisclogher Bog, Lisclogher West Bog and Bracklin Bog with both SWBs (Stonyford_030 and _040) recording a deteriorating in status from "Good" in 2010-2015 to "Moderate" in 2013-2018. Further downstream the Boyne_070 and Boyne_080 both achieved "Moderate" status in the latest WFD round.

The majority of these SWBs have been deemed to be "At risk" of not meeting their WFD objectives. Hydromorphological changes have been deemed to be significant stressors on several of these SWBs. Hydromorphological pressures mean that the waterbody has experienced change to its physical habitat or natural functioning caused by, for example, channelisation and straightening of rivers or land drainage.

Table 4-7: Summary WFD Information for Surface Water Bodies

River Waterbody	Status 2010-2015	Risk Status 2010-2015	Status 2013-2018	Risk Status 2013-2018	WFD Pressures
Deel (Raharney)_030	Good	Not at Risk	Moderate	At Risk	-
Deel (Raharney)_040	Good	Not at Risk	Good	Not at Risk	-
Deel (Raharney)_050	Moderate	At Risk	Moderate	At Risk	Hydromorphology
Deel (Raharney)_060	Moderate	At Risk	Good	Under Review	Hydromorphology
Boyne_050	Good	Not at Risk	Good	Not at Risk	-
Boyne_060	Moderate	At Risk	Good	At Risk	Hydromorphology
Stonyford_030	Good	Not at Risk	Moderate	At Risk	-
Stonyford_040	Good	Not at Risk	Moderate	At Risk	-
Boyne_070	Good	Not at Risk	Moderate	At Risk	-
Boyne_080	Moderate	At Risk	Moderate	At Risk	Hydromorphology

4.3.3.3 Groundwater Body Status

The Athboy Groundwater Body (GWB) (IE_EA_G_001) underlies the Ballivor Bog Group. This GWB has been assigned 'Good Status' in both the 2010-2015 and 2013-2018 Water Framework Directive monitoring rounds. This status is defined based on the quantitative status and chemical status of the GWB. The Athboy GWB is deemed to be "At risk" of not meeting its WFD objectives, however, no significant pressures have been identified to be impacting this GWB.

4.4 Ecological Survey results

4.4.1 Habitat survey

The habitats within the application site were the subject of a detailed survey and assessment by Bord na Móna ecologists between 2011, 2012 and 2018 and a detailed habitat map was produced of the entire Ballivor Bog Group. This habitat mapping and assessment was undertaken following the Bord na Móna habitat classification scheme and was cross referenced with '*A Guide to Habitats in Ireland*' (Fossitt, 2000). The habitat map is shown below in Figure 4-2.

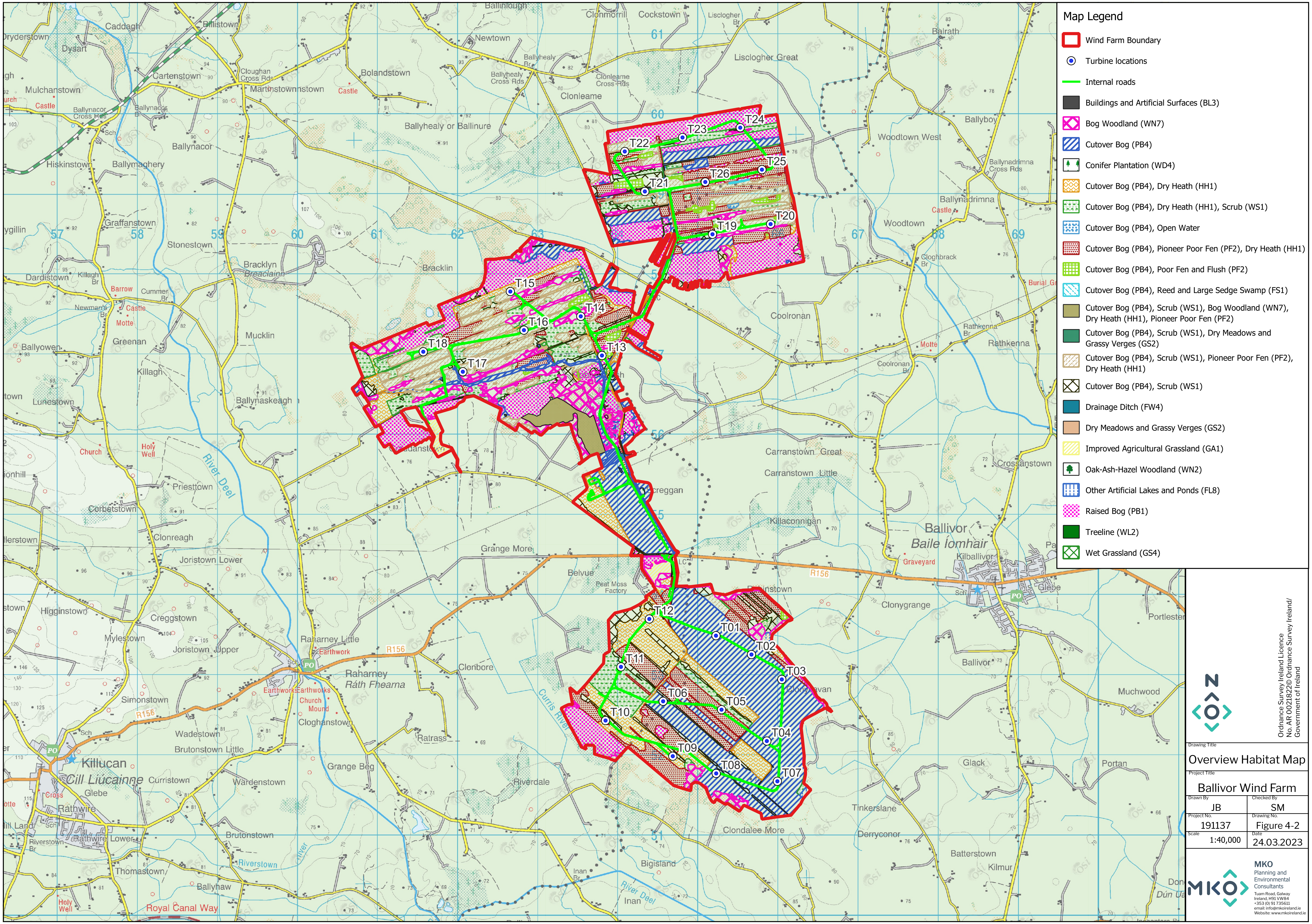
Between 2020 and 2023, MKO ecologists visited the site to ground-truth the results of the Bord na Móna habitat surveys and mapping and to undertake detailed habitat and botanical surveys. The habitat descriptions in this section are based on the walkover surveys and detailed vegetation surveys undertaken by MKO in 2021, 2022 and 2023. Detailed botanical quadrat data is provided in Appendix 6-1 of the EIAR which accompanies the planning application. All habitats described below have been classified in accordance with Fossitt (2000).

The Proposed Development Site comprises four large cutover raised bogs classified as **Cutover Bog (PB4).** Large areas of the cutover bog have been in commercial peat production by Bord na Móna until 2020 and are characterised by bare peat. Where areas of the cutover bog have been out of commercial peat production for a significant period of time these areas have since largely revegetated, primarily by dry heath type vegetation dominated by ling heather (*Calluna vulgaris*), birch (*Betula pubescens*) dominated scrub and woodland, pioneer poor fen communities characterised by common cottongrass (*Eriophorum angustifolium*) and small areas of grassland which occur mostly along the existing railway tracks traversing the site. In some areas, particularly lower lying areas where drainage is impeded, embryonic bog communities dominated by common cottograss and with a rich Sphagnum component have begun to form. The habitats described above occur in variable habitat mosaics within the site as shown in the Habitat Map in Figure 4-2 which shows the location and relative cover of the habitats recorded within the site at a high level. The habitats are described in greater details in the sections below.

In addition to the habitats of the cutover bog, there are also a number of small areas of remnant uncut raised bog at various locations throughout the site, predominantly but not exclusively at the edges of the site.

Waterbodies within the site include a network of drainage ditches, small streams/watercourses classified as lowland depositing rivers, small areas of standing open water and artificial silt ponds. The watercourses including streams and drainage ditches provide hydrological connectivity with downstream EU and Nationally designated sites and are described in more detail below.

No Annex I Habitats associated with any European Designated Sites were identified within or adjacent to the Proposed Development Site Boundary. While an area of Article 17 mapped alkaline fen is located adjacent to the northern boundary of Bracklin Bog (refer to Section 4.3.1 above), this mapped area of habitat is not within the boundaries of any SAC.


Map Legend
Wind Farm Boundary
Turbine locations
Internal roads
Buildings and Artificial Surfaces (BL3)
Bog Woodland (WN7)
Cutover Bog (PB4)
Conifer Plantation (WD4)
Cutover Bog (PB4), Dry Heath (HH1)
Cutover Bog (PB4), Dry Heath (HH1), Scrub (WS1)
Cutover Bog (PB4), Open Water
Cutover Bog (PB4), Pioneer Poor Fen (PF2), Dry Heath (HH1)
Cutover Bog (PB4), Poor Fen and Flush (PF2)
Cutover Bog (PB4), Reed and Large Sedge Swamp (FS1)
Cutover Bog (PB4), Scrub (WS1), Bog Woodland (WN7), Dry Heath (HH1), Pioneer Poor Fen (PF2)
Cutover Bog (PB4), Scrub (WS1), Dry Meadows and Grassy Verges (GS2)
Cutover Bog (PB4), Scrub (WS1), Pioneer Poor Fen (PF2), Dry Heath (HH1)
Cutover Bog (PB4), Scrub (WS1)
Drainage Ditch (FW4)
Dry Meadows and Grassy Verges (GS2)
Improved Agricultural Grassland (GA1)
Oak-Ash-Hazel Woodland (WN2)
Other Artificial Lakes and Ponds (FL8)
Raised Bog (PB1)
Treeline (WL2)
Wet Grassland (GS4)
T01
T02
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N
Drawing Title
Overview Habitat Map
Project Title
Ballivor Wind Farm
Drawn By
JB
Checked By
SM
Project No.
191137
Drawing No.
Figure 4-2
Scale
1:40,000
Date
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4.4.1.1 Cutover Bog (PB4)

The vast majority of the Proposed Development Site, with the exception of small remnant sections of raised bog mainly around the peripheries of the site, comprise of cutover raised bog or cutaway peat classified as **cutover Bog (PB4)**. Where peat cutting has ceased relatively recently on large areas of the Proposed Development Site, e.g., parts of Ballivor Bog and Lisclogher East, these areas are dominated by bare peat with little growth of vegetation (Plate 4-1). Where vegetation has begun to colonise relatively recently, areas consist of mosaics of bare peat and pioneer open cutaway communities, including pioneer ling heather (*Calluna vulgaris*) dominated **dry heath (HH1)** vegetation and pioneer common cottongrass (*Eriophorum angustifolium*) dominated **poor fen (PF2)** or a mosaic of both.

Where peat production/extraction has ceased for some time, e.g. much of Bracklin Bog as well as southern extent of Ballivor Bog and Lisclogher Bog, mosaics of well-established secondary dry heath and poor fen type communities as well as birch (*Betula pubescens*) dominated s**crub (WS1)** and dry birch-dominated **bog woodland (WN7)** are present.

A small number of areas of cutover bog within the study area, particularly those in low lying areas with impeded drainage, are relatively wet with some standing water and an abundant Sphagnum component in comparison to drier cutover habitats. These often occur in association with areas of standing water and poor fen and flush communities with abundant common cottongrass.

The following sub-sections provide a description of the secondary habitats that have begun to form on the cutover bog following cessation of peat extraction/milling.

Plate 4-1 Cutover bog characterised predominantly by bare peat

4.4.1.1.1 Bog Woodland (WN7)

Birch dominated **bog woodland (WN7)** is common throughout the Proposed Development Site (Plate 4-2), most notably in Bracklin Bog where it occurs alongside birch dominated Scrub, predominantly as long linear strips on the cutover bog alongside existing drainage channels. Smaller areas of this habitat are also present at various locations throughout Lisclogher and Ballivor Bogs.

Bog woodland within the site is generally dominated by downy birch (*Betula pubescens*) with some willows (*Salix* sp.), and occasional lodgepole pine (*Pinus contorta*), rowan (*Sorbus aucuparia*) and sitka spruce (*Picea sitchensis*). The shrub layer is mostly dominated by brambles (*Rubus fruiticosus agg.*) with ivy (*Hedera helix*) and bracken (*Pteridium aquilinum*) also occurring frequently and bilberry (*Vaccinium myrtillus*) occasionally. Ground flora frequently included wild strawberry (*Fragaria vesca*) and occasionally field woodrush (*Luzula sylvatica*), purple moor grass (*Molinia caerulea*), soft rush (*Juncus effusus*) and hart's tongue fern (*Asplenium scolopendrium*). The areas of bog woodland were mostly dry underfoot with little to no Sphagnum cover and did not conform to Annex I Bog Woodland (91DO). Bryophytes recorded typically included *Thuidium tamariscinum, Kindbergia praelonga* and *Hypnum jutlandicum*. Areas of bog woodland within the sire are generally small in size, often comprising wide linear strips running parallel to drainage ditches, however larger more extensive areas of bog woodland are present in some areas, including at the southern and northern ends of Bracklin Bog and at the southern end of Ballivor Bog. The Annex I Bog Woodland habitat (91DO) was not recorded on the site during the Bord na Móna habitat surveys in 2011 and 2012 or during the detailed habitat surveys undertaken by MKO between 2020 and 2023.

Small sections of the proposed turbine infrastructure and associated access roads are located in areas of bog woodland, most notably at Lisclogher East and Bracklin Bogs.

Plate 4-2 Area of birch dominated bog woodland at Bracklin Bog

4.4.1.1.2 *Scrub (WS1)*

Birch dominated **scrub (WS1)** is also common throughout the study area, where it has developed on drier areas of the cutover bog (Plate 4-3). Scrub is generally dominated by downy birch, along with willow species. The ground flora is generally comprised of ling heather (*Calluna vulgaris*), purple moor grass (*Molinia caerulea*) and common cottongrass (*Eriophorum angustifolium*). Scrub habitat within the site often forms mosaics with heath-type vegetation described below. Where scrub was greater than 4 metres in height, it was classified as Bog Woodland (as per Fossit, 2000).

Plate 4-3 Example of birch dominated scrub in the background

4.4.1.1.3 Cutover bog supporting Secondary dry heath (HH1) type communities

This habitat type covers a broad range of conditions from bare peat and dry but vegetated peat to much wetter areas that grade into poor fen (Plate 4-4 to Plate 4-6). The habitat frequently occurred in a mosaic alongside scrub and pioneer poor fen habitat.

Secondary **dry heath (HH1)** type communities throughout the Proposed Development Site are largely dominated by ling heather (*Calluna vulgaris*) along with common cottongrass (*Eriophorum angustifolium*) on dry peats with little to no Sphagnum present. Areas of bare peat are common, particularly where the cutover bog has begun to revegetate more recently. Cross-leaved heath (*Erica tetralix*), hare's tail cottongrass (*Eriophorum vaginatum*) and purple moor grass (*Molina caerulea*) are also frequent components of the vegetation of these communities and occasional birch and self-seeded lodgepole pine and/or larch saplings are also common.

Wetter areas are characterised by a greater abundance of common cottongrass and also supported occasional deergrass (*Trichophorum germanicum*) and bog asphodel (*Narthecium ossifragum*). These areas occasionally graded into poor fen.

According to Smith and Crowley (2020) cutover bogs should only rarely be considered examples of dry siliceous heath (HH1) or wet heath (HH3). These habitats are defined by peat depths of <0.5m which rarely occur on cutover bog. *Only where a habitat is underlain by shallow peat and good indicators of heath are present, such as Carex binervis, Galium saxatile and Juncus squarrosus, should heath habitats be considered for cutover bog.* The vast majority of heath and heath mosaic habitat within the study area occurs on peat with a depth of >0.5m and none of these heath indicator species were recorded within this habitat during the field surveys undertaken. Therefore the secondary heath type communities within the site do not conform to Annex I heath habitats. They are secondary, cutover raised bog habitats that are located on deep peat and level ground. They do not conform to Annex I wet heath habitat as defined by the Irish Wildlife Manual (Perrin et.al. 2014). Neither do they conform to Annex I Raised Bog habitats or any other Annex I habitat.

Plate 4-4 Dry heath type vegetation with areas of bare peat and encroaching scrub at Lisclogher East Bog

Plate 4-5 Dry ling heather dominated dry heath type vegetation in the foreground grading into wetter common cottongrass dominated vegetation in the background at Ballivor Bog.

Plate 4-6 Mosaic of ling heather dominated dry heath and scrub at Bracklin Bog

4.4.1.1.4 *Poor Fen (PF2)*

This habitat occurs within the Proposed Development Site predominantly as pioneer poor fen vegetation with established poor fen and flush being less common within the site.

Many sections of the site supported cutaway bog characterised by pioneer common cottongrass dominated **poor fen** (PF2) communities, most notably Lisclogher East and Bracklin Bogs. This is one of the first vegetation communities to colonise bare peat following cessation of peat cutting. The habitat was widespread but highly variable mostly occurring as a habitat mosaic along with bare peat, dry heath type vegetation and scrub (Plate 4-7).

Wetter sections of the cutover bog associated with areas of standing water and with a more established poor fen vegetation are also present throughout the site. These areas are dominated by common cottongrass with soft rush (*Juncus effusus*) and *Sphagnum cuspidatum* also present (Plate 4-8) These areas also supported abundant purple moor grass and hummocks of the moss *Polytrichum commune,* whilst the wettest areas with pools of standing water were characterised by bottle sedge (*Carex rostrata*) alongside marsh pennywort (*Hydrocotyle vulgaris*), heath bedstraw (*Galium saxatile*), cuckoo flower (*Cardamine pratensis*) and occasional willow (*Salix* sp.) saplings (Error! Reference source not found.).

Plate 4-7 Pioneer common cottongrass dominated poor fen vegetation forming a mosaic with scrub and heath type vegetation at Lisclogher Bog

Plate 4-8 Area of common cottongrass dominated poor fen at Bracklin Bog

Plate 4-9 Example of poor fen with bottle sedge at Lisclogher Bog

4.4.1.1.5 Open water

No significant areas of permanent open water are present within the Proposed Development Site.

Numerous smaller areas of open water are present in the wettest and lower lying areas of the study area, often associated with poor fen and flush communities (Plate 4-10). These areas have previously been subject to peat extraction and are often revegetating with bottle sedge (*Carex rostrata*) and common cottongrass. Areas of standing water were also recorded in association with low lying regenerating areas of cutaway bog where embryonic Sphagnum communities were beginning to establish comprising abundant *Sphagnum cuspidatum* and common cottongrass.

Plate 4-10 Small area of open water associated with poor fen and flush vegetation

4.4.1.1.6 Other Artificial Lakes and Ponds (FL8)

Silt ponds are present at various locations throughout the site and have been classified as **other artificial lakes and ponds** (FL8). Drainage ditches throughout the study area are directed to these silt ponds prior to discharge from the site.

4.4.1.1.7 Drainage Channels (FW4)

The Proposed Development Site is extensively drained with drainage channels that run through the site. Drainage ditches ranged from approximately 0.3m in width to approximately 3m in width. Whilst many of the drains within the site have a poor structure and were devoid of vegetation, common components of vegetated drains included bulrush (*Typha latifolia*), horsetails (*Equisetum* sp.), willowherbs (*Epilobium* sp.), hard rush (*Juncus effusus*), and occasionally floating vegetation such as pondweeds. Substrates were predominantly silt/peat. In the areas where the drains are surrounded by heath, scrub and woodland the vegetation within them is sparse and the substrate comprises of bare silt (Plates 4-11 and 4-12)


Plate 4-11 Drainage ditch through an area of birch woodland

Plate 4-12 Example of typical drainage ditch within the site

4.4.1.1.8 Lowland depositing streams (FW2)

The Proposed Development Site is drained by a number of watercourses within and surrounding the site including the Cartenstown Stream, Stonestown River, Ballinn Stream, Bolandstown River, Woodtown West Stream, Stonyford River, Carranstown Little River, Killaconnigan Stream, Kilballivor Stream, Ballivor River and two unnamed tributaries, Graffanstown stream, Ballynaskeagh Stream, Mucklin Stream, River Deel, Craddanstown stream and Clondalee More stream. A map showing watercourses draining and in proximity to the Proposed Development site boundary is included in Figure 4-3. The watercourses above are described in the Aquatic Survey report in Appendix 4-4.

The Deel (Raharney) river is located approximately 2km to the west of the Proposed Development Site and the Stonyford River is located approximately 430m to the east of the Proposed Development Site. Both rivers are designated as the River Boyne and River Blackwater SAC. A number of the streams within and adjacent to the Proposed Development Site discharge to these rivers which in turn discharge to the River Boyne downstream of the site.

Map Legend

Propsoed Development site

WFD Watercourses

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Government of Ireland

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Drawing Title Watercourses draining the Proposed Development Site	
Project Title Propsoed Ballivor Windfarm	
Drawn By PD	Checked By SM
Project No. 191137	Drawing No. Figure 4-3
Scale 1:50000	Date 2023.03.24

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4.4.1.2 Grasslands Habitats

4.4.1.2.1 *Dry calcareous and neutral grassland (GS1) and Dry meadows and grassy verges (GS2)*

Small areas of dry grassland are present within the Proposed Development Site, along the sides of the railway lines and existing track verges as well as in areas where underlying glacial till has been exposed (Plate 4-13). The majority of grassland areas are classified as **dry meadows and grassy verges** (**GS2**) with grass species including Yorkshire fog (*Holcus lanatus*), cocks foot (*Dactylis glomerata),* sweet vernal grass (*Anthoxanthum odoratum*) and false oat grass (*Arrhenatherum elatius*). Encroaching scrub was common comprising bramble (*Rubus fruticosus* agg.) and bilberry (*Vaccinium myrtillus*). Other species recorded include bird's foot trefoil (*Lotus corniculatus*), knapweed (*Centaurea nigra*), meadowsweet (*Filipendula ulmaria*), tormentil (*Potentilla erecta*), ribwort plantain (*Plantago lanceolata*), silverweed (*Potentilla anserina*), germander speedwell (*Veronica chamaedrys*) and occasional devil's bit scabious (*Succisa pratensis*). Smaller areas of Dry calcareous and neutral grassland (GS1) were also present throughout the site.

A number of orchid species were recorded in grassy verges along the existing railway lines including twayblade (*Listera ovata*), heath spotted orchid (*Dactylorhiza maculata*), common spotted orchid (*Dactylorhiza fuchsii*) and butterfly orchid (*Platanthera* sp.).

Other areas of grassland habitats comprised of a mix of species typical of both calcareous and peatland habitats. This diversity in species recorded has resulted from the importing of stone for the construction of railway tracks throughout the peatland.

Plate 4-13 Example of dry grassland adjacent to the railway line within the site

4.4.1.3 Grassland Habitats: Improved agricultural grassland (GA1), Wet grassland (GS4), Amenity Grassland (GA2)

The Ballivor Bog group is surrounded by agricultural fields classified as **improved agricultural grassland (GA1)** and **wet grassland (GS4)**. Small areas of Improved agricultural grassland are present in the Proposed Development Site, close to the entrance to Ballivor Bog at its northern extent and at the southern extent of Lisclogher Bog. Improved agricultural grassland is also present at the location of proposed borrow pit no. 2 to the south of Bracklin Bog (Plate 4-14). The fields are characterised by species including perennial rye grass (*Lolium perenne*), cocksfoot (*Dactylis glomerata*), Yorkshire fog (*Holcus lanatus*), creeping buttercup (*Ranunculus repens*), common sorrel (*Rumex acetosa*), broadleaved dock (*Rumex obtusifolius*), and dandelion (*Taraxacum officinale*).

Wet grassland occurs mainly around the edges of the Proposed Development site associated with wetter agricultural fields with abundant soft rush (*Juncus effusus*). Small areas of wet grassland dominated by purple moor grass are also present throughout the site on cutover bog, however, these areas occur predominantly as a habitat mosaic alongside scrub and dry heath type communities.

A small area of **amenity grassland (GA2)** is present at the northern extent of Ballivor Bog in the built area around the Bord na Móna buildings.

Plate 4-14 Improved agricultural grassland at the location of the proposed borrow pit no. 2 in third party land

4.4.1.4 Oak-ash-hazel woodland (WN2)

Two small mineral islands are located on the Carranstown Bog site; these areas contain woodland that is dominated by hazel (*Corylus avellana*), downy birch and ash (*Fraxinus excelsior*) with smaller amounts of young oak (*Quercus robur*) and are classified as **oak-ash-hazel woodland (WN2)**.

A small woodland copse area with elements of oak-ash-hazel woodland is also present at Bracklin Bog where it has developed on a mound close to the remains of an old Famine House (Plate 4-15). There are several mature Sycamore (*Acer pseudoplatanus*) trees around the house forming the woodland copse. Other species present include hazel (*Coryllus avelana*), holly (*Ilex aquifolium*), hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*).

Plate 4-15 Oak-ash-hazel woodland close to the remnants of the Famine House at Bracklin Bog

4.4.1.5 Uncut raised bog (PB1)

There are a number of areas of remnant uncut raised bog habitat within the Proposed Development Site. These are classified as **raised bog (PB1).**

Whilst many areas of remnant raised bog recorded within the Proposed Development Site boundary are typically small in area and very dry, with little to no *Sphagnum* cover, other areas are in relatively good condition, slightly wetter and support a more diverse raised bog vegetation with a greater abundance and cover of *Sphagnum* species.

Some areas of remnant raised bog have been subject to previous extensive drainage measures, with several parallel drainage channels inserted throughout, but never put into peat production and as a result these areas are extremely dry e.g. northern sections of Bracklin Bog and Lisclogher East. Other sections of remnant raised bog at Lisclogher Bog and Bracklin Bog had also been burned in recent years and, although recovering, still remained relatively dry and degraded. The driest, drained areas of remnant raised bog within the Proposed Development Site are generally dominated almost exclusively by ling heather. Other species recorded in the drier raised bog remnants included *Cladonia* sp., cross leaved heath (*Erica tetralix*), cottongrasses and deergrass (*Trichphorum germanicum*). These dry areas were characterised by very low and in some cases no *Sphagnum* cover and variable areas of bare ground.

The wettest areas of remnant raised bog within the Proposed Development Site support bog asphodel (*Narthecium ossifragum*), areas of white beak sedge (*Rhychospora alba*) and a greater abundance and cover of *Sphagnum* species. However, in general, Sphagnum cover did not exceed 30% cover and was more typically < 10% cover. These wetter areas were not characterised by standing water/pools and were not associated with lawns of *Sphagnum*.

The Proposed Development has been specifically designed to avoid areas of uncut raised bog wherever possible as part of an iterative layout design process. The wettest and largest areas of undrained and uncut remnant raised bog within the site have been avoided by the Proposed Development. However, approximately 1.03ha of highly degraded, uncut raised bog is located within the construction footprint of the Proposed Development. Sections of the proposed turbine infrastructure for T13, T23 and T24 traverse areas of highly degraded, dry and fragmented remnant raised bog at Lisclogher East Bog and Bracklin Bogs. The proposed floating access track linking Lisclogher East and Bracklin Bogs also traverses an area of degraded remnant raised bog, surrounded by facebanks and cutover bare peat, while the temporary floating access road to Borrowpit No. 2 to the south of Bracklin Bog will also traverse a small area of dry but uncut remnant raised bog. These areas of remnant raised bog habitat within the Proposed Development footprint were found to be highly degraded, either being very small and fragmented in nature, surrounded by extensive cutover bog and/or subject to extensive drainage through the insertion of parallel drainage ditches and very dry underfoot with little to no *Sphagnum* cover (Plates 4-16 – 4-20). Detailed botanical assessments were undertaken at these locations and are presented in Appendix 6-1.

The potential for these raised bog fragments within the Proposed Development footprint to conform to the Annex I habitats Active Raised Bog (7110) and Degraded Raised Bog still capable of Natural Regeneration (7120) was considered. '*The Status of EU Protected Habitats in Ireland*' (Article 17 report (NPWS, 2013) provides definitions for both Active Raised Bog (7110) and Degraded Raised Bog still capable of Natural Regeneration (7120).

According to the above Article 17 report, Active Raised Bog (ARB) '*is characterised by the presence of an acrotelm, which is defined as the living, actively growing upper later of a raised bog, the surface of which is composed mainly of living bog mosses (Sphagnum species)*'. In addition, as outlined in Smith and Crowley (2020), previous raised bog research in Ireland indicated that ARB, at least in the midlands, generally supports cover of *Sphagnum* greater than 40% (Fernandez Valverde et al. 2005, 2012).

The raised bog remnants within the construction footprint, lacked a diverse or abundant *Sphagnum* component. *Sphagnum* cover was generally <10% or absent within these areas, with the exception of the raised bog remnant along the proposed temporary access track to the Borrowpit 2 to the south of Bracklin Bog. Typical Raised bog microtopography, including hummocks, bog pools and *Sphagnum* lawns were absent from these habitats. The areas of remnant raised bog within the construction footprint, given their highly degraded and fragmented nature, and absence of typical raised bog micro-topography, do not conform to the Annex I habitat Active Raised Bog [7110].

According to the above Article 17 report, Degraded Raised Bog (DRB) is characterised by the complete absence, or at best the presence of only a patchy thin cover of an 'acrotelm' layer. According the report, while previously all the vegetated areas of high bog which were not delineated as Active Raised Bog (ARB) were classified as DRB, on the assumption that most of it could be restored to active peat-forming condition after implementation of comprehensive restoration works, the results of recent research show that only those areas with the right combination of physical conditions (including surface shape, slope and drainage patterns) ultimately capable of supporting ARB are now considered DRB. To qualify as DRB, these areas must still be capable of natural regeneration to active bog within 30 years if their hydrology is repaired (usually after restoration works, particularly blocking of drains).

The conditions outlined in the Article 17 report as being suitable for supporting DRB include:

'*a) sites over 30ha of high bog with typical bog vegetation which were part of a larger bog and contain drains which could be blocked and b) smaller sites (< 30 ha) which are part of small basins with drains present which could be blocked.....The occurrence of DRB is ruled out from those sites where the high bog area is below 30ha, which were once part of a much larger site and are now surrounded by facebanks and without drains to be blocked.*'

The 1.03ha of uncut raised bog within the Proposed Development footprint is made up of small marginal sections of the habitat, located within six separate fragments of highly degraded bog. They are in general of a very small size and are drained on all sides.

One section located at the northern extent of Lisclogher Bog, whilst highly degraded and heavily drained through the insertion of parallel drainage ditches, is of a larger size and exhibits some potential for re-wetting and restoration, given its size and the presence of drains. However, the section of this area of remnant raised bog within the construction footprint was highly degraded, dominated almost exclusively by ling heather and cottongrass and was characterised by an absence of *Sphagnum* cover and the presence of areas of bare, disturbed ground.

Plate 4-16 Highly degraded raised bog habitat at the northern extent of Lisclogher Bog (within the construction footprint)

Plate 4-17 Dry degraded raised bog within the construction footprint at Lisclogher Bog

Plate 4-18 Example of uncut but drained and dry raised bog between Lisclogher East and Bracklin Bogs

Plate 4-19 Uncut raised bog along the proposed floating access track to Borrowpit 2

Plate 4-20 Dry degraded raised bog at Bracklin Bog, south of T13

4.4.1.6 Conifer Plantation (WD4)

Small areas of **conifer plantation (WD4)** are present at the very northern extent of Ballivor Bog.

4.4.1.7 Spoil and bare ground (ED2) and Recolonising bare ground (ED3)

Existing unpaved access tracks throughout the study area are classified as **spoil and bare ground (ED2)**. Areas of spoil and bare ground and recolonising bare ground are also present in works areas associated with the Bord na Móna buildings at the northern extent of Ballivor Bog.

Plate 4-21 Access track at Bracklin Bog classified as Spoil and bare ground

4.4.1.8 Buildings and Artificial Surfaces (BL3)

There are some areas of **buildings and artificial surfaces (BL3)** within the Proposed Development Site. including the existing railway infrastructure and associated road crossing, existing local roads throughout the Proposed Development Site and storage buildings associated with the Bord na Mona works area at Ballivor Bog. The main works buildings themselves are located outside the Proposed Development Site boundary.

4.4.1.9 Treeline and Hedgerow (WL2 & WL1)

Treeline (WL2) and hedgerow (WL1) habitats make up a very small proportion of the habitats within the site. Hedgerows of hawthorn (*Crataegus monogyna*) and immature willow, with scattered ash trees, are present in the land-take areas along the proposed haul route and are described in Section 4.4.1.11 below.

A hedgerow with scattered ash trees is also located at the location of borrow pit No. 2 bisecting an area of agricultural grassland and a conifer treeline is present at the northern extent of Ballivor Bog.

4.4.1.10 Invasive species

No invasive species, listed on the Third Schedule of the S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011, were recorded within or in close proximity to the construction footprint of the Proposed Developmentduring the walkover surveys undertaken.

4.4.1.11 Habitats along the proposed haul route

The proposed turbine component haul route is located predominantly within existing road infrastructure. Where road widening works are required to accommodate the proposed haul route at 2 locations, the habitats within the footprint of the works are described below.

Junction between the R156 and the R161

The land-take area at this location consists of an **improved agricultural grassland (GA1) field** bordered by a **hedgerow (WL**1) with some sparsely distributed semi-mature Ash (*Fraxinus excelsior*) trees (Plate 4-22).

Species found within the field include perennial rye grass (*Lolium perenne*), Cow parsley (*Anthriscus sylvestris*), Mouse-ear chickweed (*Cerastium fontanum*), Nettles (Urtica dioica), Broad-leaved dock (*Rumex obtusifolius*), and Ragwort (*Jacobaea vulgaris*). Giant Hogweed (*Heracleum mantegazzianum*), Ivy (*Hedera helix*) and Hart's-tongue fern (*Asplenium scolopendrium*) were identified in drainage ditches at the base of the hedgerow.

The hedgerow itself comprised of bracken (*Pteridium aquilinum*), bramble (*Rubus fruiticosus*), juvenile willow (*Salix* spp.) trees and semi-mature Ash (*Fraxinus excelsior*) trees.

Plate 4-22 Improved agricultural grassland and hedgerow along the propsoed haul route

East of Ballivor Village on the R156

The northern land-take area along the haul route at this location consists of **improved agricultural grassland (GA1)** which contains species including perennial rye grass (*Lolium perenne),* white clover (*Trifolium repens),* broad-leaved plantain (*Plantago major),* dandelion (*Taraxacum officinale agg.),* creeping buttercup (*Ranunculus repens),* mouse-ear chickweed (*Cerastium fontanum),* and occasional red clover (*Trifolium pratense),* Yorkshire fog (*Holcus lanatus),* cock's foot (*Dactylus glomerata),* pineapple weed (*Matricaria discoidea),* shepherd's purse (*Capsella bursa-pastoris)* and creeping thistle (*Cirsium arvense)* .

A **hedgerow (WL1)** runs along the south of the area containing hawthorn (*Crataegus monogyna),* common hogweed (*Heracleum sphondylium),* bramble (*Rubus fruticosus),* nettle (*Urtica dioica),* false oat grass (*Arrhenatherum elatius),* immature ash (*Fraxinus excelsior),* and blackthorn (*Prunus spinosa)* (Plate 4-23). A hedgerow running south-north separates two fields, which consists of hawthorn, ivy (*Hedera helix),* nettles and spear thistle (*Cirsium vulgare).* Two ash trees are also found within the land-take area along this hedgerow. A large ash tree is situated to the west of the land-take area.

The agricultural grassland to the east of the hedgerow described above contains similar species to the eastern field, as well as a small, disturbed, quarried area which contains common poppy (*Papaver rhoeas)* (Plate 4-24). A wooden fence runs along the south of this field.

Plate 4-23 Agricultural grassland and hedgerow along the south within western field of northern land-take area.

Plate 4-24 Eastern field of northern land-take area, with disturbed ground.

4.4.2 Faunal Surveys

4.4.2.1 Otter

No otter resting or breeding sites were recorded within the Proposed Development Site during the dedicated otter surveys undertaken by MKO or during the dedicated fisheries assessment or kick sampling of the watercourses surrounding the site undertaken by Triturus Environmental Ltd.

Otter sprains were recorded within the Proposed Development Site in proximity to a drainage ditch in Lisclogher Bog during the multi-disciplinary walkover surveys undertaken in May 2020. Otter prints were recorded in Lisclogher Bog during the otter surveys in May 2021 in proximity to a wide drainage ditch. No signs of otter were recorded within the Proposed Development Site during the aquatic surveys undertaken by Triturus Environmental Ltd in July 2021. However, signs of otter (spraints and/or prints) were recorded outside of and downstream of the site in the Craddanstown stream to the west of Ballivor Bog and in the Ballivor river to the east of Ballivor Bog during these surveys. The River Stoneyford and River Deel (Raharney), both located outside of the site also provide suitable habitat for otter.

The majority of the drainage ditches within the site are small and provide poor quality habitat for otter given their small size and highly modified channels of low fisheries value, however it is likely that otter utilise the streams and some of the larger drains for foraging and commuting on occasion. The main watercourses/larger artificial drainage channels were assessed as providing suitable commuting and foraging habitat for the species.

4.4.2.2 Kingfisher

No kingfisher nesting sites were recorded within the Proposed Development Site and the artificial drains and small watercourses within the site do not provide significant suitable nesting habitat for this species. Kingfisher was observed flying through the site across cutover bog and silt ponds during bird surveys undertaken by MKO. Kingfisher was also observed travelling along the River Deel (Raharney) to the west of and outside the Proposed Development Site during the bird surveys undertaken in 2021. The results of the MKO bird surveys, relevant to kingfisher, are outlined in the sections below. Maps showing records of kingfisher recorded within and surrounding the Proposed Development Site during the surveys are included as Figure 4-4a to 4-4d below.

Vantage Point Surveys

Kingfisher were observed on only two occasions during vantage point surveys between April 2020 and September 2022. Both observations were of individuals travelling along silt ponds. There were no flights observed at the potential collision height. Both observations were outside the Proposed Development Site and further than 1.5km from the nearest proposed turbine.

Breeding Walkover Surveys

There were four observations of kingfisher during the breeding walkover surveys. All observations were in July 2020 and consisted of individuals flying, fishing or being flushed by the observer. There were two observations at the Proposed Development Site in cutover bog habitat and all observations were greater than 690m from the nearest proposed turbine.

Waterbird Distribution Surveys

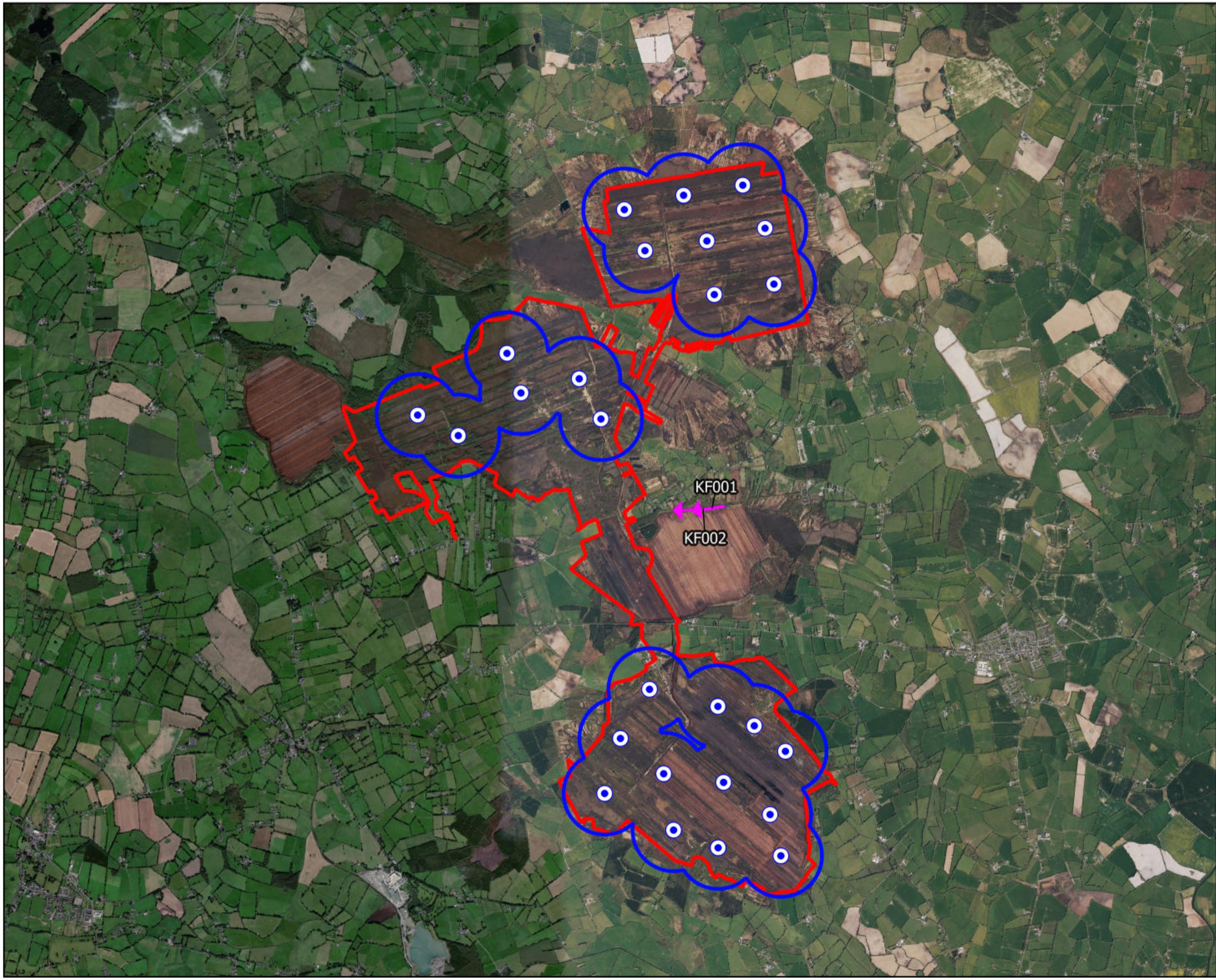
Kingfisher were observed on 15 occasions during the waterbird distribution surveys, up to 5km from the Proposed Development site. All observations were of birds travelling, hunting, perched or heard calling by the observer. Observations ranged from an individual to two birds and were between 1.8km and 6.6km from the nearest proposed turbine.

Connectivity Vantage Point Surveys

Kingfisher were only observed on one occasion during the connectivity vantage point surveys. This observation was of an individual approximately 6.8km to the southwest of the nearest proposed turbine. This observation was not mapped.

Incidental Observations

There were three incidental observations of kingfisher during surveys between April 2020 and September 2022. All observations were of individuals commuting or being flushed by the surveyor. There were two observations within the Proposed Development site and one observation approximately 9.7km from the nearest proposed turbine.



Map Legend

- Wind Farm Site
- Proposed Turbine Layout
- 500m Turbine Buffer
- Flightline

N

Drawing Title	
Kingfisher Observations Vantage Point Surveys	
Project Title	
Ballivor Wind Farm	
Drawn By: P. Manley	Checked By: P Cregg
Project No.: 191137	Drawing No.: Fig. 4-4a
Scale: 1:60000	Date: 14.02.23

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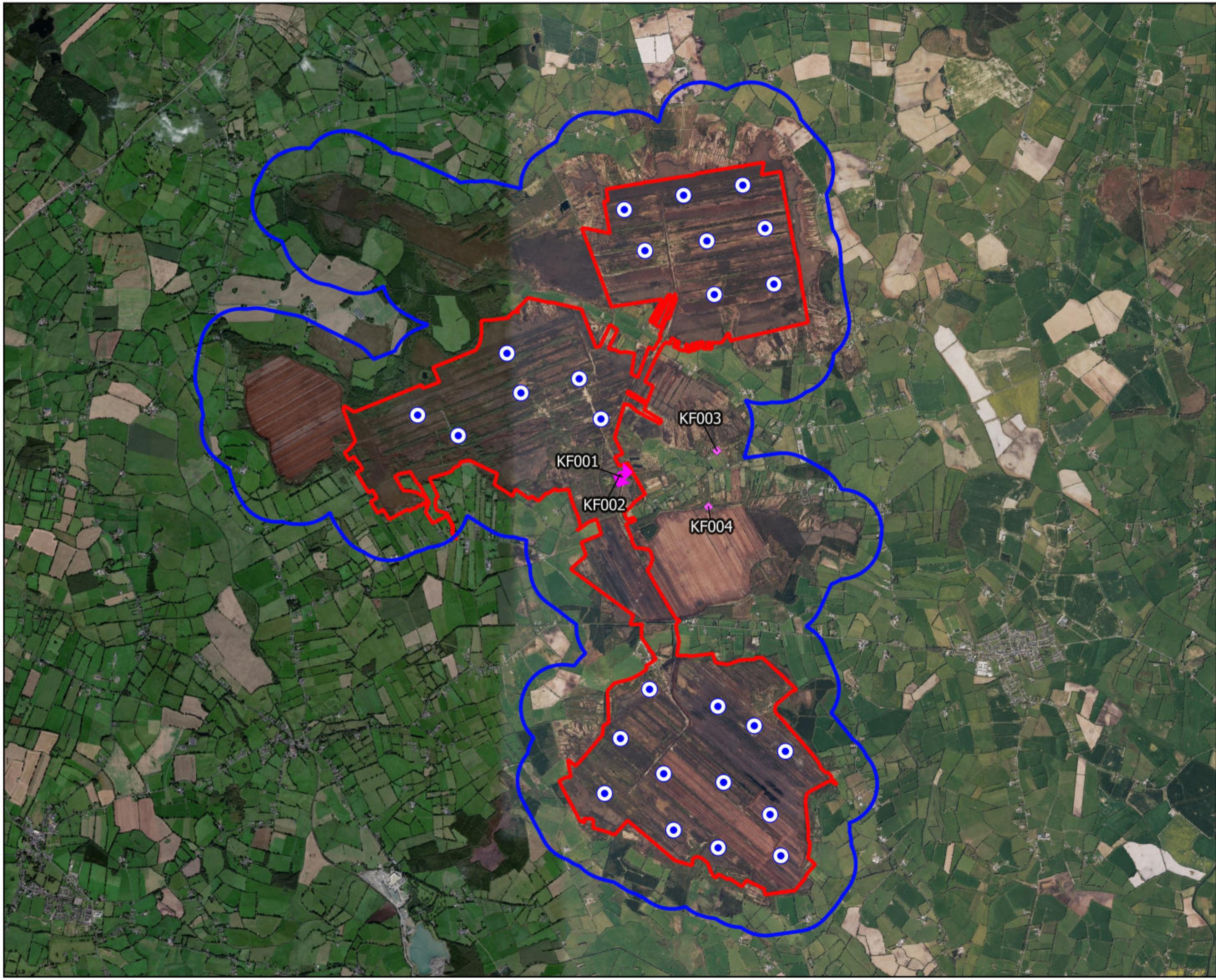

Map Legend

- Wind Farm Site
- Proposed Turbine Layout
- Survey Area
- Flightline
- Observation

N

Drawing Title	
Kingfisher Observations Breeding Walkover Surveys	
Project Title	
Ballivor Wind Farm	
Drawn By	Checked By
P. Manley	P. Cregg
Project No.	Drawing No.
191137	4-4b
Scale	Date
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Map Legend

Wind Farm Site

Proposed Turbine Layout

Survey Area

Observation

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Drawing Title Kingfisher Observations Waterbird Distribution Surveys	
Project Title Ballivor Wind Farm	
Drawn By P. Manley	Checked By P. Cregg
Project No. 191137	Drawing No. Fig. 7.8.2
Scale 1:105000	Date 14.02.23

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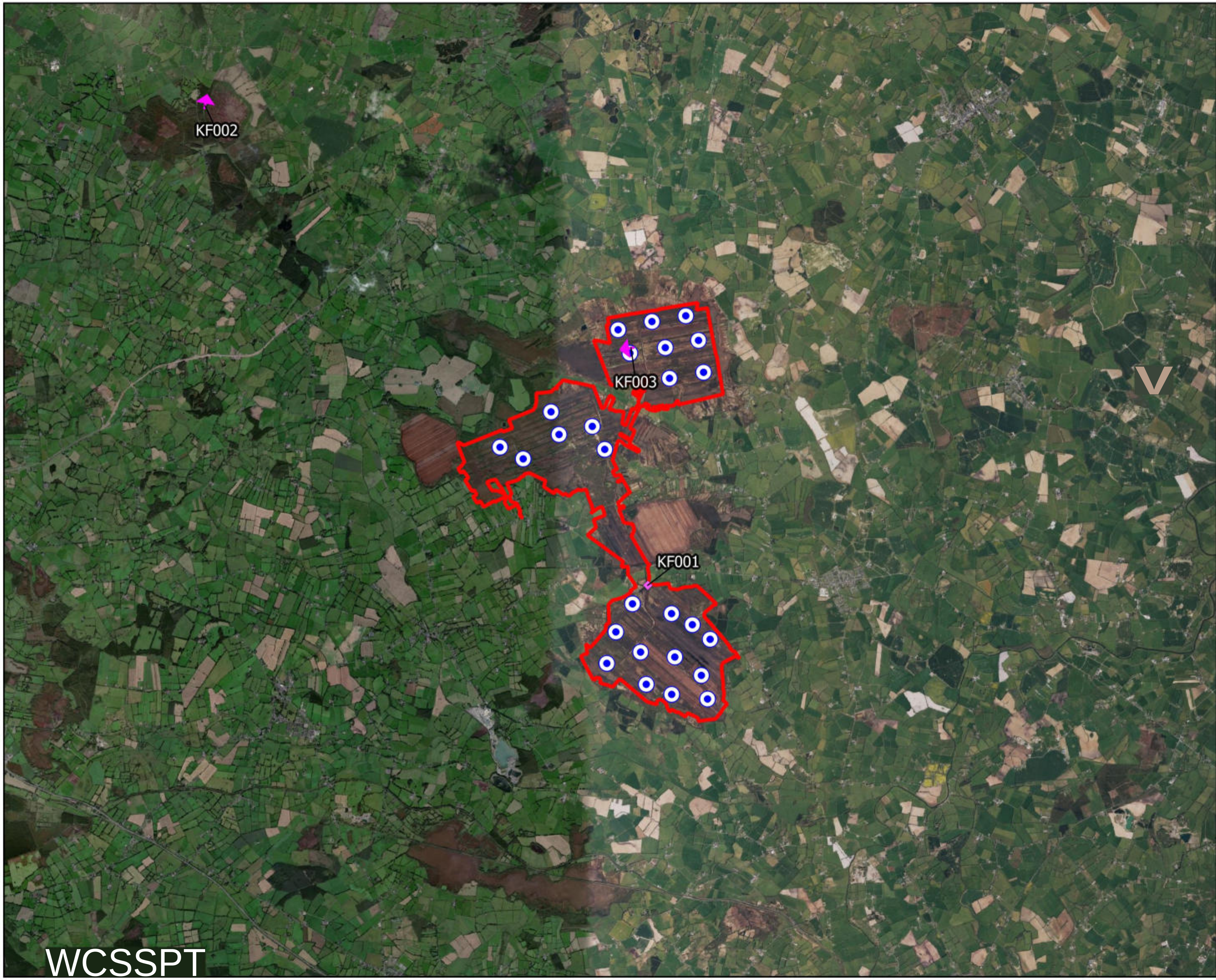

Map Legend

- Wind Farm Site
- Proposed Turbine Layout
- Flightline
- Observation

N

Drawing Title	
Kingfisher Incidental Observations	
Project Title	
Ballivor Wind Farm	
Drawn By	**Checked By**
P. Manley	P. Cregg
Project No.	**Drawing No.**
191137	Fig. 4-4d
Scale	**Date**
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5. ASSESSMENT OF POTENTIAL EFFECTS & ASSOCIATED MITIGATION

5.1 Potential for Direct Effects on the European Sites

Whilst no works associated with the Proposed Development will be undertaken within the boundaries of the River Boyne and River Blackwater SAC or SPA, the section below considers the potential for direct effects on these species due to ex-situ habitat loss where they occur outside of the SAC and SPA and within the Proposed Development Site.

5.1.1 Ex-situ Habitat Loss – Otter and Kingfisher

The Proposed Development Site lies entirely outside of the boundaries of any European designated sites. Taking a precautionary approach, a potential pathway for direct effects on the QI otter and SCI species kingfisher in the form of ex-situ habitat loss, where these species occur outside the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA, but within the Proposed Development Site, was identified. Direct habitat loss could potentially occur if any otter resting or breeding sites or kingfisher nesting sites are present within small watercourses within the construction footprint at the time of construction works.

During the site walkover surveys and dedicated otter and bird surveys undertaken at the Proposed Development Site between 2019 and 2023, the site was not found to support significant suitable habitat for these species. The drainage ditches and watercourses within the site are small and do not provide optimal habitat for otter or kingfisher given their small size and highly modified channels of low fisheries value. While it is likely that otter utilise the streams, which are mostly located towards the peripheries of the site, and some of the larger drains for foraging and commuting, no otter resting or breeding sites were recorded within or adjacent to the Proposed Development Site.

Likewise, while kingfisher have been recorded flying within the site along bog drains, no kingfisher nesting sites were recorded within or adjacent to the Proposed Development Site and the drains and small watercourses within the site were not found to provide significant suitable nesting habitat for kingfisher.

Instream works proposed as part of the Proposed Development are confined to artificial drains which provide poor quality habitat for these species. No instream works are proposed within any streams or natural watercourses. No kingfisher nest sites or otter resting or breeding sites were recorded within the Proposed Development site during the surveys undertaken.

Given the absence of otter and kingfisher resting or breeding sites within the Proposed Development Site, and the nature of the proposed works, i.e. instream works confined to artificial drainage ditches providing poor quality habitat for these species, no potential for direct effects on the QIs/SCIs of the River Boyne and River Blackwater SAC and SPA as a result of ex-situ habitat loss are anticipated.

5.1.1.1 Mitigation Measures

While no adverse effects on otter or kingfisher are anticipated, taking a highly precautionary approach, prior to any works being carried out, a pre-construction otter and kingfisher survey will be undertaken by a qualified ecologist to ensure that these species have not taken up residence within or in close proximity to the Proposed Development.

Should any otter holt be identified within 150m of the proposed works during the pre-construction surveys, it will be subject to exclusion procedures as outlined in the TII/NRA guidelines (2006) in consultation with the National Parks and Wildlife Service (NPWS).

The site does not provide significant suitable nesting sites for kingfisher and no kingfisher nest sites were recorded during the surveys undertaken. However, taking a precautionary approach, should any kingfisher nesting sites be identified within or adjacent to the Proposed Development footprint during the pre-commencement survey, any construction works in the footprint of or adjacent to the nest will be undertaken outside of the breeding season (March to July inclusive).

5.2 Potential for Indirect Effects on European Sites

There is hydrological connectivity between the Proposed Development Site and downstream European Sites via watercourses within and adjacent to the Site Boundary which discharge to the River Deel (Raharney) and Stonyford River which are designated as part of the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA.

Therefore there is potential for adverse effects on the integrity of these downstream European Sites as a result of the Proposed Development due to deterioration in water quality arising from run-off of and infiltration of pollutants during the construction, operational and decommissioning phases of the development. A potential pathway for indirect effects on the below European Sites and their aquatic QIs/SCIs as a result of construction, operational and decommissioning activities was identified:

- River Boyne and River Blackwater SAC
  - Alkaline fens [7230]
  - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]
  - *Lampetra fluviatilis* (River Lamprey) [1099]
  - *Salmo salar* (Salmon) [1106]
  - *Lutra lutra* (Otter) [1355]

- River Boyne and River Blackwater SPA
  - Kingfisher

Potential for adverse indirect effects on otter and kingfisher as a result of disturbance during construction works associated with the Proposed Development was also identified, as well as potential for adverse effects on kingfisher due to collision risk during the operational stage of the development.

The potential for indirect effects on European Sites is considered in greater detail in the sections below.

5.2.1 Deterioration of Water Quality

5.2.1.1 Construction Phase

The construction phase of the development will involve the construction of the turbine hardstand areas, windfarm access roads, substations, construction compounds, borrow pits and amenity tracks and associated carparks and other associated activities. These works and off-road works along the proposed haul route will involve excavations and earth moving which create the potential for pollution in various forms, e.g. the generation of suspended solids, release of cement-based products, the potential for spillage of fuels associated with the refuelling of excavation machinery. There is also a risk of surface water runoff from bare soil and soil storage areas during construction works.

There is hydrological connectivity between the Proposed Development and downstream European Sites via watercourses within the Site Boundary which discharge to the rivers Deel (Raharney) and Stonyford which are designated as part of the River Boyne and River Blackwater SAC and SPA. In the absence of mitigation, there is potential for the release of pollutants including suspended solids, cement-based products and/or hydrocarbons to watercourses within and in proximity to the Proposed Development Site and associated haul route land-take areas, which have connectivity downstream with the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA. Taking a precautionary approach, the release of pollutants has potential to cause deterioration of water quality in these downstream European Sites, potentially affecting their QI habitats and supporting habitat for QI/SCI species.

5.2.1.2 Operational Phase

The Proposed Development will result in an overall increase in the area of non-permeable hard-surfaces which has potential to result in increased surface water run-off from the Proposed Development Site, which in turn has potential to cause erosion of watercourses and impact on water quality. There is also potential for run-off of pollutants due to accidental spillage or release of hydrocarbons from site vehicles during any routine maintenance works during the operational phase of the proposed development. However, it is not envisaged that any significant refuelling works will be undertaken on site during the operational phase.

The potential for impacts on water quality during the operational phase of the Proposed Development are fully assessed in Chapter 9 'Hydrology' of the EIAR which accompanies the planning application, and which is included as Appendix 2 to this NIS.

5.2.1.3 Decommissioning Phase

The potential impacts on water quality associated with decommissioning of the Proposed Development will be similar to those associated with construction phase but of a reduced magnitude, due to the reduced scale of the proposed decommissioning works in comparison to construction phase works.

5.2.1.4 Mitigation to Avoid Impacts on Water Quality

The pathways that would allow potential impacts to occur due to deterioration of water quality were considered in the design of the proposed development. The environmental management framework to be adhered to during the construction phase of the Proposed Development includes comprehensive detail regarding site set up, pollution prevention and hydrocarbon management and incorporates mitigating measures as detailed in Chapter 9 'Hydrology' of the EIAR and in the CEMP for the Proposed Development which are attached here as Appendix 2 and 3 to ensure that there are no adverse effects on the integrity of any European Sites in light of their conservation objective during the construction, operational or decommissioning phases of the proposed development.

These are summarised below.

5.2.1.4.1 *Construction Phase Drainage*

The Project Hydrologist/Design Engineer will complete a site drainage and maintenance plan before construction commences and will attend the site to set out and assist with micro-siting of proposed drainage controls as outlined in Chapter 4 of the EIAR which accompanies the planning application. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site.

Drainage infrastructure will include:

- Interceptor drains will be maintained up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where

suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader.
- Swales/roadside drains will be maintained to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling.
- Check dams will be maintained at regular intervals along interceptor drains and swales/roadside drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds will be ongoing through the construction period.

In addition to the above, there will be no instream works within any natural watercourses.

Proposed mitigation measures for watercourse crossings are detailed below:

- All proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed. There will be no in-stream excavation works and therefore there will be no direct impact on the stream at the proposed crossing location
- Where the proposed underground cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road
- Works in proximity to watercourses will adhere to IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters.
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas; and,

All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent. All of the above works will be supervised by an Environmental Clerk of Works and the project hydrologist. Works in proximity to watercourses will adhere to IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters.

5.2.1.4.2 Operational Phase Drainage

The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will be maintained up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader.
- Swales/road side drains will be installed to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling;

- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds will be ongoing through the construction period.

5.2.1.4.3 *Refuelling, Fuel and Hazardous Materials Storage*

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling should occur at a controlled fuelling station.
- On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser will be re-filled off site, and will be towed by a 4x4 jeep to machinery is located. The 4x4 jeep will also carry fuel spill kits in the event of any spillages. The fuel bowser will be parked on a designated level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
- Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor.
- The electrical substation compound fuel storage area will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor.
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be developed. Spill kits will be available to deal with any spillage in and outside the refuelling area.

5.2.1.4.4 *Cement Based Products Control Measures*

The following mitigation measures are proposed to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site.
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used.
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site.
- Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.
- Use weather forecasting to plan dry days for pouring concrete.
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned

down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

5.2.1.4.5 *Dust Control*

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, peat, etc. and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions.
- The public roads outside the wind farm Site Boundary including the two access locations off the R156 will be regularly inspected by the ECoW for cleanliness, and cleaned as necessary.
- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind.
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions.
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary.
- All construction related traffic will have speed restrictions on un-surfaced roads to 20 kph;
- Daily inspection by the ECoW of construction sites to examine dust measures and their effectiveness.
- When necessary, sections of the haul route immediately outside the site entrances will be swept using a truck mounted vacuum sweeper; and,
- All vehicles leaving the construction areas of the site will pass through a wheel washing area prior to entering the local road network.

5.2.2 Disturbance

5.2.2.1 Otter

A potential pathway for indirect effects in the form of disturbance, due to increased noise during construction activities, of otter populations associated with The River Boyne and Blackwater SAC is considered below on a precautionary basis. As per the European Commission's Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2021), disturbance is defined as "*a change in existing environmental conditions (e.g. increased noise or light pollution, a greater frequentation of people and vehicles). Disturbance may cause, inter alia, the displacement of species individuals, changes in species behaviour, or the risk of morbidity or mortality*".

Although a small number of streams and rivers drain the site, the majority of these are located towards the peripheries of the site and the vast majority of watercourses within the site are artificial drainage channels with low suitability for otter, although they may be used on occasion for commuting or foraging. During the walkover surveys and dedicated otter surveys undertaken (refer to Sections 4.2.2 and 4.4.2.1 above), no otter resting or breeding sites were identified within or adjacent to the Proposed Development Site and the small, modified watercourses and drains within the site were not found to support significant suitable habitat for this species.

Otter are predominantly crepuscular in nature (prefer dim light and tend to be active during dawn/dusk) and are unlikely to be adversely impacted by the proposed works. Construction activity will be confined to daytime hours, thus minimizing potential disturbance related impacts to the species. The NPWS Threat Response Plan for Otter acknowledges that "Little evidence has come to light in recent studies to suggest that disturbance by recreation is a significant pressure." It also identifies that otter are known to travel significant distances from streams and lakes in search of new territory and feeding areas.

Channin P (2003)1 provides a literary review with regard to anthropogenic disturbance and refers to several reports which have found that disturbance is not detrimental to otters (Jefferies (1987), (Durbin 1993). (Green & Green 1997). The report also describes successful breeding in towns, under ferry terminals and under the jetties of one of Europe's largest oil and gas terminals at Sullom Voe in North Scotland.

Irish Wildlife Manual No 23 (National Otter Survey of Ireland 2004/2005) found no significant relationship between disturbance and otter occurrence. In addition, no significant difference in otter presence was found between sites with and without recreational activity. It also states, "the lowest percentage occurrence was found at the sites with the lowest recorded disturbance!" Irish Wildlife Manual No 76 (National Otter Survey of Ireland 2010/2012) notes that the occurrence of Otter was unaffected by perceived levels of disturbance at the survey sites. It also notes that there is little published evidence demonstrating any consistent relationship between Otter occurrence and human disturbance (Mason & Macdonald 1986, Delibes et al. 1991; Bailey & Rochford, 2006). No significant effects on the otter population associated with the River Boyne and River Blackwater SAC during the construction phase of the Proposed Development are anticipated.

The Proposed Development will not result in any significant increase in anthropogenic activity within the site during the operational phase, nor will there be any lighting associated with the proposed development. No potential for significant disturbance of otter during the operational phase of the Proposed Development was identified. Any potential for effects on this species during the decommissioning phase of the Proposed Development will be similar in nature to those of the construction phase, but to a much-reduced extent, given the reduced nature of construction activity.

Based on the above review of scientific literature, and the absence of significant suitable habitat for otter within the Proposed Development Site, the potential for adverse effects on the integrity of the Otter population associated with the River Boyne and River Blackwater SAC as a result of the construction, operational and decommissioning phases of the Proposed Development can be excluded.

1 Chanin P (2003). Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature,Peterborough

5.2.2.2 Kingfisher

A potential pathway for indirect effects in the form of disturbance of kingfisher populations associated with the River Boyne and Blackwater SPA is considered below on a precautionary basis.

The site has not been identified as an important site for kingfisher given the low frequency of occurrences observed within the Proposed Development Site during bird surveys undertaken between October 2019 and October 2022 (refer to Section 4.4.2.2). No kingfisher nesting sites were recorded within the Proposed Development Site and the site does not support significant suitable habitat for this species.

Goodship and Furness (2022), found that kingfisher showed a low to medium sensitivity to human disturbance, with birds being disturbed by human activity between 9.5m and 24.6m. A 50m buffer is in place between the main infrastructure of the Proposed Development and any watercourses within the Proposed Development Site. Therefore, the construction activity is unlikely to deter flight activity within the Proposed Development Site.

As kingfisher were not observed regularly using the Proposed Development Site during the bird surveys undertaken and given the sub-optimal nature of the habitats within the site for kingfisher, no potential for disturbance or displacement of the species during the operational phase of the Proposed Development are anticipated.

No potential for adverse effects on this species during the construction, operational or decommissioning phases of the Proposed Development was identified.

5.2.3 Collision Risk (Kingfisher)

Taking a highly precautionary approach, potential for mortality of kingfisher due to collision during the operational phase of the Proposed Development was identified.

This species was not recorded flying at potential collision height during the extensive vantage point survey work undertaken at the Proposed Development Site. Collision related mortality is not likely to significantly impact this species.

6. ASSESSMENT OF POTENTIAL SIGNIFICANT EFFECTS

The sections provided below detail the site-specific residual impact assessment in relation to the relevant QIs of the River Boyne and River Blackwater SAC and the relevant SCI of River Boyne and River Blackwater SPA in light of their conservation objectives. The assessment takes into consideration the proposed measures to avoid, reduce and block identified pathways for impact.

6.1 River Boyne and River Blackwater SAC

The potential for adverse effects on each of the individual Qualifying Interests that were identified as being at risk of potential effects in the AA Screening Report is assessed in this section in view of the Conservation Objectives of those habitats and species.

6.1.1 Alkaline Fens [7230]

The Site specific conservation objective for this QI is:

'*To maintain the favourable conservation condition of Alkaline fens in River Boyne and River Blackwater SAC,*

The attributes and targets for this habitat as per the Site-Specific Conservation Objectives (SSCOs) (NPWS Version 1, 2021) were reviewed and an assessment of the Proposed Development against the nominated attributes and targets is provided in Table 6-1.

Table 6-1 Targets and attributes associated with nominated site-specific conservation objectives for Alkaline fens [7230]

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes.	There are no works proposed within the SAC and alkaline fen habitat was not recorded within the Proposed Development Site during the site surveys. There is no potential for loss of this habitat and therefore no potential for adverse effects on alkaline fen in respect of habitat area or distribution as a result of the proposed development.
Habitat distribution	No decline, subject to natural processes.	
Ecosystem function: soil nutrients	Maintain soil pH and nutrient status within natural ranges	A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development(Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any European Site during the construction, operational and decommissioning phases of the proposed development. A detailed hydrological assessment of the Proposed Development has been
Ecosystem function: peat formation	Maintain active peat formation, where appropriate	
Ecosystem function: hydrology - groundwater levels	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	
Ecosystem function: hydrology - surface water flow	Maintain, or where necessary restore, as close as possible to natural or semi-natural, drainage conditions	

Ecosystem function: water quality	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	undertaken (refer to hydrology chapter of the EIAR Appendix 2) and concludes that there will be no significant impact on surface or groundwater hydrology as a result of the proposed development. Taking into consideration the preventative measures to avoid impact, it can be concluded that there is no potential for adverse effects on alkaline fen in respect of ecosystem function as a result of the proposed development.
Vegetation composition: community diversity	Maintain variety of vegetation communities, subject to natural processes	There are no works proposed within the SAC and alkaline fen habitat was not recorded within the Proposed Development Site during the site surveys. There will be no disturbance of this habitat and no changes to vegetation composition of this habitat. There is no potential for adverse effects on alkaline fen in respect of vegetation composition as a result of the proposed development. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any European Site during the construction, operational and decommissioning phases of the proposed development.
Vegetation composition: typical brown mosses	Maintain adequate cover of typical brown moss species	
Vegetation composition: typical vascular plants	Maintain adequate cover of typical vascular plant species	
Vegetation composition: native negative indicator species	Cover of native negative indicator species at insignificant levels	
Vegetation composition: non-native species	Cover of non-native species less than 1%	
Vegetation composition: native trees and shrubs	Cover of scattered native trees and shrubs less than 10%	
Vegetation composition: algal cover	Cover of algae less than 2%	
Vegetation structure: vegetation height	At least 50% of the live leaves/flowering shoots are more than either 5cm or 15cm above ground surface depending on community type	
Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%	There are no works proposed within the SAC and alkaline fen habitat was not recorded within the Proposed Development Site during the site surveys. There will be no works undertaken within alkaline fen and there is no potential for adverse effects on alkaline fen in respect of physical
Physical structure: tufa formations	Disturbed proportion of vegetation cover where tufa is present is less than 1%	

		structure as a result of the proposed development. Taking the above into consideration, it can be concluded that there is no potential for adverse effects on alkaline fen in respect of physical structure as a result of the proposed development.
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	There are no works proposed within the SAC and alkaline fen habitat was not recorded within the Proposed Development Site during the site surveys. There will be no works in this habitat and there is no potential for adverse effects on alkaline fen in respect of decline or distribution of indicators of local distinctiveness as a result of the proposed development. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development(Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any European Site during the construction, operational and decommissioning phases of the proposed development. Taking the above into consideration, there is no potential for adverse effects on alkaline fen in respect of indicators of local distinctiveness as a result of the proposed development.
Transitional areas between fen and adjacent habitats	Maintain adequate transitional areas to support/protect the alkaline fen ecosystem and the services it provides	There are no works proposed within the SAC and alkaline fen habitat or transitional areas between fen habitat associated with the SAC and adjacent habitat was not recorded within the Proposed Development Site during the site surveys. There will be no loss of or degradation of fen habitat associated with the SAC and adjacent habitats and there is no potential for adverse effects on transitional areas between fen and adjacent habitats as a result of the proposed development. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development(Appendix 2) and in the accompanying CEMP (Appendix 3)

		are in place to avoid water pollution within any European Site during the construction, operational and decommissioning phases of the proposed development.

6.1.1.1 Determination on potential for adverse effects

Based on the assessment in Table 6-1, it can be concluded, in view of best scientific knowledge and based on objective information that there is no potential for adverse effects on the QI Alkaline fen associated with the Boyne and River Blackwater SAC, in any phase of development.

6.1.2 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno- Padion, Alnionincanae, Salicion albae*)

The Site specific Conservation Objectives for this QI is:

> '*To restore the favourable conservation condition of Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)* in River Boyne and River Blackwater SAC*'

The attributes and targets for this habitat as per the Site-Specific Conservation Objectives (SSCOs) (NPWS Version 1, 2021) were reviewed and an assessment of the Proposed Developmentagainst the nominated attributes and targets is provided in Table 6-2.

Table 6-2 Targets and attributes associated with the conservation objectives for Alluvial forests

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes.	There are no works proposed within the SAC and alluvial forest habitat was not recorded within the Proposed Development Site during the site surveys. There will be no loss of this habitat. There is no potential for adverse effects on alluvial forest in respect of habitat area or distribution as a result of the proposed development. Taking the above into consideration, it can be concluded that there is no potential for adverse effects on alluvial forest in respect of habitat area or distribution as a result of the proposed development
Habitat distribution	No decline, subject to natural processes.	
Woodland Size	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size.	There are no works proposed within the SAC and alluvial forest habitat was not recorded within the Proposed Development Site during the site surveys. There will be no works within or adjacent to this habitat and therefore no loss of this habitat, no changes to community structure and no impediment to natural regeneration as a result of the proposed works. There will be no changes to size or structure
Woodland structure: cover and height	Total canopy cover at least 30%; median canopy height at least 7m; native shrub layer cover 10-75%; native herb/dwarf shrub layer cover	

Attribute	Target	Assessment
	at least 20% and height at least 20cm; bryophyte cover at least 4%	of alluvial woodlands as a result of the proposed development. There is no potential for adverse effects on alluvial forest in respect of woodland size and structure as a result of the proposed development. Taking the above into consideration, there is no potential for adverse effects on alluvial forest in respect of woodland size or structure as a result of the proposed development.
Woodland Structure: community diversity and extent	Maintain diversity and extent of community types.	
Woodland structure: natural regeneration	Seedlings, saplings and pole age-classes of target species for 91E0* woodlands and other native tree species occur in adequate proportions to ensure survival of woodland canopy.	
Hydrological regime: Flooding Depth/height of water table	Appropriate hydrological regime necessary for maintenance of alluvial vegetation.	There are no works proposed within the SAC and alluvial forest habitat was not recorded within the Proposed Development Site during the site surveys. There will be no changes to hydrological regime a result of the proposed development. A detailed hydrological assessment of the Proposed Development has been undertaken (refer to hydrology chapter of the EIAR Appendix 2) and concludes that there will be no significant impact on surface or groundwater hydrology as a result of the proposed development. There is therefore no potential for adverse effects on alluvial forest in respect hydrological regime as a result of the proposed development. Taking the above into consideration, there is no potential for adverse effects on alluvial forest in respect of habitat hydrological regime as a result of the proposed development.
Woodland structure: dead wood	At least 19 stems/ha of dead wood of at least 20cm diameter	There are no works proposed within the SAC and alluvial forest habitat was not recorded within the Proposed Development Site during the site surveys. There will be no works within or adjacent to this habitat and therefore no changes to the structure of alluvial woodlands as a result of the proposed development. There is no potential for adverse effects on alluvial forest in respect of woodland structure as a result of the proposed development.
Woodland structure: veteran trees	No decline	
Woodland structure: indicators of local distinctiveness.	No decline in distribution and, in the case of red listed and other rare or localised species, population size	
Woodland structure: indicators of overgrazing	All five indicators of overgrazing absent	
Vegetation composition: native tree cover	No decline. Native tree cover at least 90% of canopy; target species cover at least 50% of canopy	There are no works proposed within the SAC and alluvial forest habitat was not recorded within the Proposed Development Site during the site surveys. There will be works within or adjacent to this habitat and therefore no changes to vegetation composition of alluvial
Vegetation composition: typical species	At least 1 target species for 91E0* woodlands present; at least 6 positive indicator species for 91E0* woodlands present	

Attribute	Target	Assessment
Vegetation composition: negative indicator species	Negative indicator species cover not greater than 10%; regeneration of negative indicator species absent	woodland as a result of the proposed development. There is no potential for adverse effects on alluvial forest in respect of vegetation composition as a result of the proposed development.
Vegetation composition: problematic native species	Cover of common nettle (Urtica dioica) less than 75%	

6.1.3 Determination

Based on the assessment in Table 6-2, it can be concluded, in view of best scientific knowledge and objective information that the Proposed Development will not adversely affect the QI Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0] associated with the River Boyne and River Blackwater SAC, in any phase of development.

6.1.4 *Lampetra fluviatilis* (River lamprey) [1099]

The Site specific Conservation Objectives for this QI is:

> '*To restore the favourable conservation condition of River Lamprey (Lampetra fluviatilis)in River Boyne and River Blackwater SAC*'

The attributes and targets for this species as per the Site-Specific Conservation Objectives (SSCOs) (NPWS Version 1, 2021) were reviewed and an assessment of the Proposed Developmentagainst the nominated attributes and targets is provided in Table 6-3.

Table 6-3 Targets and attributes associated with the conservation objectives for river lamprey

Attribute	Target	Assessment
Distribution	Restore access to all water courses down to first order streams	There are no works proposed within the SAC. The small watercourses and drainage ditches within the Proposed Development Site do not support significant suitable supporting habitat for this species The Proposed Development will not result in any changes to the distribution of river lamprey within the SAC. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking the above into consideration, it can be concluded that there is no potential for adverse effects on lamprey in respect of distribution as a result of the proposed development.

Distribution of larvae	Not less than 50% of sample sites with suitable habitat positive for larval brook/river lamprey	There are no works proposed within the SAC. The small watercourses and drainage ditches within the Proposed Development Site do not support significant suitable supporting habitat for this species. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking the above into consideration it can be concluded that there is no potential for adverse effects on lamprey in respect of distribution of larvae or population structure of larvae as a result of the proposed development.
Population structure of larvae	At least three age/size classes of larval brook/river lamprey present	
Larval lamprey density in fine sediment	Mean density of brook/river larval lamprey in sites with suitable habitat more than 5/m²	There are no works proposed within the SAC. The small watercourses and drainage ditches within the Proposed Development Site do not support significant suitable supporting habitat for this species. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking the above into consideration it can be concluded that there is no potential for adverse effects on lamprey in respect of larval lamprey density in fine sediment as a result of the proposed development.
Extent and distribution of spawning nursery habitat	No decline in extent and distribution of spawning and nursery beds	There are no works proposed within the SAC. The small watercourses and drainage ditches within the Proposed Development Site do not support significant suitable supporting habitat for this species. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction,

		operational and decommissioning phases of the proposed development. Taking the above into consideration, it can be concluded that there is no potential for adverse effects on lamprey in respect of extent and distribution of spawning nursery habitat as a result of the proposed development.

6.1.5 Determination

Based on the assessment in Table 6-3, it can be concluded, in view of best scientific knowledge and based on objective information that the Proposed Development will not adversely affect the QI River lamprey [1099] associated with the River Boyne and River Blackwater SAC, in any phase of development.

6.1.6 *Salmo salar* (Atlantic salmon) [1106]

The Site specific Conservation Objectives for this QI is:

> '*To restore the favourable conservation condition of Atlantic salmon (Salmo salar) in River Boyne and River Blackwater SAC*'

The attributes and targets for this species as per the Site-Specific Conservation Objectives (SSCOs) (NPWS Version 1, 2021) were reviewed and an assessment of the Proposed Development against the nominated attributes and targets is provided in Table 6-4.

Table 6-4 Targets and attributes associated with the conservation objectives for Atlantic salmon

Attribute	Target	Assessment
Distribution: extent of anadromy	100% of river channels down to second order accessible from estuary	There are no works proposed within the SAC. The small watercourses and drainage ditches within the Proposed Development Site do not support significant suitable supporting habitat for this species. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses European Sites during the construction, operational and decommissioning phases of the proposed development. Taking the above into consideration, it can be concluded that there is no potential for adverse effects on Atlantic salmon in respect of distribution to occur as a result of the proposed development.
Adult spawning fish	Conservation Limit (CL) for each system consistently exceeded	There are no works proposed within the SAC. The small watercourses and drainage ditches within the Proposed Development Site do not support

Attribute	Target	Assessment
Salmon fry abundance	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	significant suitable supporting habitat for this species. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking the above into consideration, it can be concluded that there is no potential for adverse effects on Atlantic salmon in respect of adult spawning fish, salmon fry abundance, out-migrating smolt abundance or number and distribution of redds as a result of the proposed development.
Out-migrating smolt abundance	No significant decline	
Number and distribution of redds	No decline in number and distribution of spawning redds due to anthropogenic causes	
Water quality	At least Q4 at all sites sampled by EPA	A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking into consideration the preventative measures to avoid impact, it can be concluded that there is no potential for adverse effects on Atlantic salmon in respect of water quality as a result of the proposed development.

6.1.7 Determination

Based on the assessment in Table 6-4, it can be concluded, in view of best scientific knowledge and based on objective information that the Proposed Development will not adversely affect the QI Atlantic salmon [1106] associated with the River Boyne and River Blackwater SAC, in any phase of development.

6.1.8 *Lutra lutra* (Otter) [1355]

The Site specific Conservation Objectives for this QI is:

> '*To maintain the favourable conservation condition of Otter (Lutra lutra) in River Boyne and River Blackwater SAC*'

The attributes and targets for this species as per the Site-Specific Conservation Objectives (SSCOs) (NPWS Version 1, 2021) were reviewed and an assessment of the Proposed Development against the nominated attributes and targets is provided in Table 6-5.

Table 6-5 Targets and attributes associated with the conservation objectives for Otter

Attribute	Target	Assessment
Distribution	No significant decline	There are no works proposed within the SAC and the watercourses within the Proposed Development Site do not support significant suitable habitat for this species. No otter resting or breeding sites were recorded within the Proposed Development Site. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking into consideration the preventative measures to avoid impact, it can be concluded that there is no potential for adverse effects on otter distribution in respect of habitat loss, disturbance or deterioration of water quality as a result of the proposed development.
Extent of terrestrial habitat	No significant decline	There will be no changes to the extent of terrestrial or freshwater habitat for otter. There will be no works within the SAC and the watercourses within the Proposed Development Site do not support significant suitable habitat for this species. No otter resting or breeding sites were recorded within the Proposed Development Site. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking into consideration the preventative measures to avoid impact, it can be concluded that there is no potential for adverse effects on otter in respect of extent of habitat extent as a result of the proposed development.
Extent of freshwater (river) habitat	No significant decline	
Extent of freshwater (lake) habitat	No significant decline	
Couching sites and holts	No significant decline	There will be no decline in couching sites and holts for otter. There will be no works within the SAC. No couches or holts were identified within the

Attribute	Target	Assessment
		Proposed Development Site during the dedicated otter surveys and the site was not found to support significant suitable habitat for this species. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking into consideration the preventative measures to avoid impact, it can be concluded that there is no potential for adverse effects on otter in respect of couching sites and holts as a result of the proposed development.
Fish biomass available	No significant decline	There will be no decline in fish biomass. The watercourses within the Proposed Development do not provide significant suitable fisheries habitat. Pathways that would allow impacts to occur were considered in the design of the development. A range of mitigation measures, outlined in Section 5.2.1.4 of this report, in the hydrology chapter of the EIAR for the Proposed Development (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any watercourses or European Sites during the construction, operational and decommissioning phases of the proposed development. Taking into consideration the preventative measures to avoid impact, it can be concluded that there is no potential for adverse effects on otter in respect of fish biomass available as a result of the proposed development.
Barriers to connectivity	No significant decline	There will be no barriers to connectivity as a result of the proposed development. No works are proposed within the SAC and the watercourses within the Proposed Development Site do not support significant suitable habitat for this species. No otter resting or breeding sites were recorded within the Proposed Development Site. The Proposed Development will not result in any barriers to connectivity to watercourses. There is no potential for adverse effects on otter in respect of barriers to connectivity as a result of the proposed development.

6.1.9 Determination

Based on the assessment in Table 6-5, it can be concluded, in view of best scientific knowledge and based on objective information that the Proposed Development will not adversely affect the QI Otter associated with the River Boyne and River Blackwater SAC, in any phase of development.

6.1.10 Determination on Potential Adverse Effects in the River Boyne and River Blackwater SAC

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse effect on the integrity of The River Boyne and River Blackwater SAC in light of its conservation objectives.

6.2 River Boyne and River Blackwater SPA

The potential for adverse effects on the SCI species, kingfisher, that was identified as being at risk of potential effects in the AA Screening Report is assessed in this section. No detailed conservation objectives are available for the River Boyne and River Blackwater SPA. The site-specific conservation objective for this site is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (*Conservation objectives for River Boyne and River Blackwater SPA [004232]. First Order Site-specific Conservation Objectives Version 1.0. Department of Housing, Local Government and Heritage,* NPWS 2022).

Kingfisher were observed flying within the Proposed Development Site during dedicated bird surveys undertaken between October 2019 and September 2022, however, observations of this species were infrequent, with the species not recorded utilising the Proposed Development Site on a regular basis. Furthermore, no kingfisher nesting sites were identified within or adjacent to the Proposed Development Site during the walkover surveys or bird surveys undertaken between 2019 and 2022 and the artificial drains and small watercourses within the site do not support significant suitable habitat for this species, being highly modified, of low fisheries value. This species was not recorded flying at potential collision height during the extensive vantage point survey work undertaken at the Proposed Development Site. There is no potential for adverse effects on this species as a result of ex-situ habitat loss, disturbance or collision risk associated with the proposed development.

A range of mitigation measures, outlined in Section 5.2.1.4 above, in the hydrology chapter of the accompanying EIAR (Appendix 2) and in the accompanying CEMP (Appendix 3) are in place to avoid water pollution within any European Site during construction, operational and decommissioning phases. Taking into consideration the preventative measures to avoid impact, and the sub-optimal nature of the habitats within the Proposed Development Site for kingfisher, it can be concluded that there is no potential for adverse effects on kingfisher in respect of deterioration of water quality as a result of the proposed development.

6.3 Conclusion of Impact Assessment

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse effect on the integrity of any European Site or their site-specific conservation objectives.

It will not prevent the QIs/SCIs of any European Sites from achieving favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive. A definition of Favourable Conservation Status is provided below:

> *'conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2;*

The conservation status will be taken as 'favourable' when:

- *Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
- *The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.'*

Based on the assessments provided, it can be concluded in view of best scientific knowledge, on the basis of objective information that the Proposed Development will not adversely affect the Qualifying Interests/Special Conservation Interests associated with any European Designated Sites including in particular the following:

- River Boyne and River Blackwater SAC
- River Boyne and River Blackwater SPA

7. IN COMBINATION EFFECTS

A search and review in relation to plans and projects that may have the potential to result in cumulative and/or in-combination impacts on European Sites was conducted. This assessment focuses on the potential for cumulative in-combination effects on the European Sites where potential for adverse effects was identified at the screening stage (Appendix 1). This included a review of online Planning Registers, development plans and other available information and served to identify past and future plans and projects, their activities and their predicted environmental effects.

7.1 Development context – Ecological Plans and Policies

The following development plans have been reviewed and taken into consideration as part of this assessment:

- Westmeath County Development Plan 2021 – 2027
- Meath County Development Plan 2021-2027
- National Biodiversity Action Plan 2017-2021
- Regional Spatial and Economic Strategy, Eastern and Midland Regional Assembly 2019-2031
- County Westmeath Biodiversity Action Plan 2014-2020
- County Meath Biodiversity Plan 2015-2020

The review focused on policies and objectives that relate to Natura 2000 sites and natural heritage and associated environmental documentation. Policies and objectives relating to sustainable land use were also reviewed.

Table 7-1 Review of Plans

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
Westmeath County Development Plan 2021-2027	In relation to Natural Heritage and Green Infrastructure, the aim of the Development Plan is to: *Continue to protect and enhance the County's natural heritage and biodiversity and ensure that networks of green infrastructure are identified, created, protected and enhanced to provide a wide range of environmental, social and economic benefits to communities.* **Policies: Natural Heritage** It is the policy of the Council to: **CPO 12.1** - Contribute as appropriate towards the protection of designated sites in compliance with relevant EU Directives and applicable national legislation **CPO 12.2** - Support the implementation of any relevant recommendations contained in the National Biodiversity Plan, the All-Ireland Pollinator Plan and the National Peatlands Strategy. **Policies: Natura 2000** It is a policy of the Council to: **CPO 12.4** - Protect and conserve Special Areas of Conservation, candidate Special Areas of Conservation, Special Protection Areas and candidate Special Protection Areas, designated under the EU Birds and Habitats Directives respectively.	The Development plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. There will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development. The Proposed Development is not considered to be in contravention of the policies and objectives within the development plan. No potential for negative cumulative impacts when considered in combination with the current proposal were identified.

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	CPO 12.5 - Ensure that no plans, programmes, etc. or projects giving rise to significant cumulative, direct, indirect or secondary impacts on European Sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either individually or in combination with other plans, programmes, etc. or projects).* **CPO 12.6** - Ensure that any plan or project that could have a significant adverse impact (either by themselves or in combination with other plans and projects) upon the conservation objectives of any Natura 2000 Site or would result in the deterioration of any habitat or any species reliant on that habitat will not be permitted.* ** Except as provided for in Article 6(4) of the Habitats Directive, viz. There must be a) no alternative solution available, b) imperative reasons of overriding public interest for the project to proceed; and c) Adequate compensatory measures in place.* **Policies: Rare and Protected Sites** It is a policy of the Council to: **CPO 12.13** - Protect, manage, and enhance the natural heritage, biodiversity, landscape and environment of County Westmeath, in recognition of its importance as both a non-renewable resource and a natural asset. **CPO 12.18**	

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	- Consult with the National Parks and Wildlife Service (NPWS) in regard to any developments (those requiring permission and those not requiring planning permission) which the Council proposes to carry out within pNHAs, NHAs, SACs, SPAs, and other important ecological sites. **Policies: Invasive species** It is a policy of the Council to: **CPO 12.27** - Prevent the spread of invasive species within the plan area, including requiring landowners and developers to adhere to best practice guidance in relation to the control of invasive species. **CPO 12.29** - Support, as appropriate, the National Parks and Wildlife Service's efforts to seek to control and manage the spread of non-native invasive species on land and water. Where the presence of non-native invasive species is identified at the site of any Proposed Developmentor where the proposed activity has an elevated risk of resulting in the presence of these species, details of how these species will be managed and controlled will be required.	
Meath County Development Plan 2021-2027	**Policies and Objectives: Biodiversity** **HER POL 27** - To protect, conserve and enhance the County's biodiversity where appropriate	The Development plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. There will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	HER POL 28 - To integrate in the development management process the protection and enhancement of biodiversity and landscape features wherever possible, by minimising adverse impacts on existing habitats (whether designated or not) and by including mitigation and/or compensation measures, as appropriate. **HER POL 31** - To ensure that the ecological impact of all development proposals on habitats and species are appropriately assessed by suitably qualified professional(s) in accordance with best practice guidelines – e.g. the preparation of an Ecological Impact Assessment (EcIA), Screening Statement for Appropriate Assessment, Environmental Impact Assessment, Natura Impact Statement (NIS), species surveys etc. (as appropriate). **HER OBJ 30** - To implement, in partnership with the Department of Culture, Heritage and the Gaeltacht, relevant stakeholders and the community, the objectives and actions of Ireland's National Biodiversity Action Plan 2017 - 2021 which relate to the remit and functions of Meath County Council. **HER OBJ 31** - To implement, in partnership with the Department of Culture, Heritage and the Gaeltacht, relevant stakeholders and the community, the objectives and actions of the County Meath Biodiversity Plan 2015-2020 and any revisions thereof **HER OBJ 32** - To actively support the implementation of the All Ireland Pollinator Plan 2021-2025 and any revisions thereof.	any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development. The Proposed Development is not considered to be in contravention of the policies and objectives within the development plan. No potential for negative cumulative impacts when considered in combination with the current proposal were identified.

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	Policies and Objectives : Sites Designated for Nature Conservation **HER POL 32** › To permit development on or adjacent to designated Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas, Statutory Nature Reserves or those proposed to be designated over the period of the Plan, only where the development has been subject to the outcome of the Appropriate Assessment process and has been carried out to the satisfaction of the Planning Authority, in consultation with National Parks and Wildlife. **HER POL 33** › To have regard to the views and guidance of the National Parks and Wildlife Service in respect of Proposed Developmentwhere there is a possibility that such development may have an impact on a designated European or National site or a site proposed for such designation. **HER POL 34** › To undertake appropriate surveys and collect data to provide an evidence-base to assist the Council in meeting its obligations under Article 6 of the Habitats Directives (92/43/EEC) as transposed into Irish Law, subject to available resources. It is an objective of the Council: **HER OBJ 33** › To ensure an Appropriate Assessment in accordance with Article 6(3) and Article 6(4) of the Habitats Directives (92/43/EEC) and in accordance with the Department of Environment, Heritage and Local Government Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities, 2009 and relevant EPA and European Commission guidance	

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	documents, is Meath County Development Plan 2021-2027 Chapter 8 carried out in respect of any plan or project not directly connected with or necessary for the management of the site but likely to have a significant effect on a Natura 2000 site(s), either individually or in-combination with other plans or projects, in view of the site's conservation objectives. **HER OBJ 34** › To protect and conserve the conservation value of candidate Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas and proposed Natural Heritage Areas as identified by the Minister for the Department of Culture, Heritage and the Gaeltacht and any other sites that may be proposed for designation during the lifetime of this Plan in accordance with the provisions of the Habitats and Birds Directives and to permit development in or affecting same only in accordance with the provisions of those Directives as transposed into Irish Law. **Policies and Objectives : Non-Designated Sites** **HER POL 35** › To ensure, where appropriate, the protection and conservation of areas, sites, species and ecological/networks of biodiversity value outside designated sites and to require an appropriate level of ecological assessment by suitably qualified professional(s) to accompany development proposals likely to impact on such areas or species. **Policies and Objectives: Protected Species** **HER POL 36**	

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	- To consult with the National Parks and Wildlife Service and take account of their views and any licensing requirements, when undertaking, approving or authorising development which is likely to affect plant, animal or bird species protected by law. **HER OBJ 35** - To ensure that development does not have a significant adverse impact, incapable of satisfactory avoidance or mitigation, on plant, animal or bird species protected by law. **Policies and Objectives: Peatlands** **HER POL 45** - To ensure that peatland areas which are designated (or proposed for designation) as NHAs, SACs or SPAs are conserved for their ecological, climate regulation, archaeological, cultural and educational significance. **HER OBJ 39** - To work in partnership with relevant stakeholders on a suitable peatland site(s) to demonstrate best practice in sustainable peatland conservation, management and restoration techniques and to promote their heritage and educational value subject to Ecological Impact Assessment and Appropriate Assessment Screening, as appropriate, having regard to local and residential amenities.	
National Biodiversity Action Plan 2017-2021	**Objective 6: Expand and improve management of protected areas and species**	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. In addition the draft National Biodiversity

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	Target 6.2 - Sufficiency, coherence, connectivity and resilience of the protected areas network substantially enhanced by 2020.	Action Plan (2023 – 2027) available for public consultation was also reviewed in relation to objectives and targets relation to European Sites. There will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development. The Proposed Development is not considered to be in contravention of the policies and objectives within the development plan. No potential for negative cumulative impacts when considered in combination with the current proposal were identified.
Regional Spatial and Economic Strategy, Eastern and Midland Regional Assembly 2019-2031	**Biodiversity and Natural Heritage** Regional Policy Objective (RPO) 7.16 - Support the implementation of the Habitats Directives in achieving an improvement in the conservation status of protected species and habitats in the Region and to ensure alignment between the core objectives of the EU Birds and Habitats Directives and local authority development plans RPO 7.17: Facilitate cross boundary co-ordination between local authorities and the relevant agencies in the Region to provide clear governance arrangements and coordination mechanisms to support the development of ecological networks and enhanced connectivity between protected sites whilst also addressing the need for management of alien invasive species and the conservation of native species. **Water Quality**	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. There will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development. The Proposed Development is not considered to be in contravention of the policies and objectives within the plan. No potential for negative cumulative impacts when considered in combination with the current proposal were identified.

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
	RPO 7.10: Support the implementation of the Water Framework Directive in achieving and maintaining at least good environmental status for all water bodies in the Region and to ensure alignment between the core objectives of the Water Framework Directive and other relevant Directives, River Basin Management plans and local authority land use plans. RPO 7.11: For water bodies with 'high ecological status' objectives in the Region, local authorities shall incorporate measures for both their continued protection and to restore those water bodies that have fallen below high ecological status and areas 'At Risk' into the development of local planning policy and decision making any measures for the continued protection of areas with high ecological status in the Region and for mitigation of threats to waterbodies identified as 'At Risk' as part of a catchmentbased approach in consultation with the relevant agencies. This shall include recognition of the need to deliver efficient wastewater facilities with sufficient capacity and thus contribute to improved water quality in the Region.	
County Meath Biodiversity Action Plan 2015-2020	**Objective 1**: To raise awareness of biodiversity in Meath, its value and the issues facing it **Objective 2:** To better understand the biodiversity of Meath **Objective 3:** To conserve and enhance habitats and species in Meath, taking account of national and local priorities **Objective 4:** To foster active participation to help biodiversity in Meath, encouraging a partnership approach to help our species and habitats The specific actions in relation to the above listed biodiversity objectives set out in Section 8 of the plan were reviewed and taken into consideration in this assessment.	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. There will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development. The Proposed Development is not considered to be in contravention of the objectives within the plan. No potential for negative cumulative impacts when considered in combination with the current proposal were identified.

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
County Westmeath Biodiversity Action Plan 2014-2020	The Actions outlined in the plan for Westmeath County Council in relation to biodiversity fall under 3 main categories: • Protection and Development of the Ecological Network • Monitoring and Research • Raising Awareness The actions outlined in Chapter 6 of the plan were reviewed and taken into consideration in this cumulative assessment.	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. There will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development. The Proposed Development is not considered to be in contravention of the objectives within the plan. No potential for negative cumulative impacts when considered in combination with the current proposal were identified.

7.2 Other Projects

7.2.1 Applications within the Proposed Development Site

Planning applications which are recorded as being within and adjacent to the planning application redline boundary are set out in Table 7-2.

Industrial scale peat extraction was permanently ceased by the applicant within the Ballivor Bog Group in June 2020. Decommissioning and maintenance activities associated with the removal of existing peat stockpiles from the Bog Group and the Applicant's statutory duties to discharge the conditions of its Integrated Pollution Control Licence (IPC) Licence (Ref. P0501-01) from the Environmental Protection Agency (EPA) for the Derrygreenagh Bog Group, which in part comprises the Ballivor Bog Group, remain on-going. The on-going decommissioning and maintenance activities ensure compliance with the Applicant's extant IPC Licence and the post-peat extraction rehabilitation of the Ballivor Bog Group.

A number of peatland restoration measures have been undertaken or are proposed for the lands within and adjacent the Proposed Development Site boundary. Draft cutaway bog rehabilitation and decommissioning plans for each bog of the Derrygreenagh Bog Group, within which the Proposed Development Site boundary is located , have been prepared to meet the requirements of Condition 10 of the IPC licence for the Derrygreenagh Bog Group. These draft plans will be agreed by the EPA prior to implementation. The aim of the rehabilitation plans is to stabilise and rehabilitate the peatland habitats within the site and it is proposed that natural recolonisation will form the basis for the environmental stabilisation of these areas. Re-wetting through drain blocking will also be a rehabilitation strategy. The rehabilitation plans will contribute to improving the overall condition of peatland habitats within the Proposed Development Site as well as to improving the quality of water discharging from the site as water quality of discharges from restored peatlands generally improve as a result of bog restoration measures (Bonn et al. 2017).

Peatland Climate Action Scheme (PCAS) peatland restoration measures were carried out at Carranstown East, adjacent to the Proposed Development Site boundary in 2022. This form of enhanced peatland rehabilitation, which is above and beyond what is required under IPC licence was completed in 2022. Bracklin West, also adjacent to the Proposed Development Site boundary, has been selected for PCAS and it is expected to commence in 2023.

The PCAS scheme is supported by Government through the Climate Action Fund and Ireland's National Recovery and Resilience Plan administered by the Department of Environment, Climate and Communications (DECC). Please see https://www.bnmpcas.ie/ for details. The National Parks and Wildlife Service (NPWS) acts as the Scheme regulator and there is ongoing engagement with the EPA. This scheme is in addition to the IPC licence requirements and does not form part of the Proposed Development planning application.

Table 7-2 Applications within and adjacent to the Proposed Development Site boundary

Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
Westmeath	83382	01/01/1983	Bulk loading facility	Grangemore, Raharney	Conditional
Westmeath	90554	18/11/1990	Extension to storage facilities	Grangemore, Raharney	Conditional

Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
Westmeath	8814	01/01/1988	Erect tea centre	Grangemore, Raharney	Conditional
Westmeath	052348	01/11/2005	To construct a 10/20kv ESB substation, to service Ballivor horticulture factory	Grangemore, Raharney	Conditional
Westmeath	082218	12/09/2008	The extension of use of an existing quarry granted under planning reference 04/2153 for the extraction of sand and gravel on approximately 3.65 hectares. Permission also sought for reinstatement of the quarry to existing ground level with suitable materials, existing road access and entrance and all associated site works and services	Riverdale, Raharney	Conditional
Westmeath	092084	14/07/2009	The erection of a 30m high antenna support structure with 3 no. Panel antennas & 3 no. Dishes with the development forming part of the National Broadband Scheme (NBS)	Grangemore , Raharney	Conditional
Westmeath	092084	14/07/2009	The erection of a 30m high antenna support structure with 3 no. Panel antennas & 3 no. Dishes with the development forming part of the National Broadband Scheme (NBS)	Grangemore, Raharney (adjacent to the subject site)	Conditional
Westmeath	122067	05/12/2012	Laying two intersecting grass strips, 150m x 7m and 75m x 7m, for use as a take-off and landing area	Ballyhealy / Ballinure & Bracklyn	Conditional

Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
			for model aircraft and a grass area, 10m x 30m for car parking	(adjacent to the subject site)	
Meath	TA1300 56	01/02/2013	Continuance of use of an existing 30m lattice tower structure carrying telecommunications equipment, associated equipment container with palisade fencing as previously granted under Local Authority reference TA70722	Killaconnigan, Ballivor	Conditional
Westmeath	146082	05/06/2014	Permanent Retention Permission for existing 30m Multiuser Support Structure, carrying associated telecommunications equipment, associated equipment cabinet and Permission for additional telecommunications equipment and cabinet, all within existing secure compound, including access track	Grangemore Td, Raharney	Conditional
Meath	TA1406 15	16/07/2014	Retention of an existing 30-metre-high telecommunications support structure carrying antennas and link dishes together with associated equipment containers and security fencing which was previously granted under planning reference TA900185	Killaconnigan, Ballivor	Conditional

The Proposed Development has been designed to ensure that there will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development. No potential for negative cumulative impacts when considered in combination with the above listed and described projects were identified.

7.2.2 Wind Energy Applications Within 25km of the Proposed Development

On a precautionary basis a 25km zone of influence was used to identify wind farm developments in the wider area. The Wind Energy Development Guidelines (2006) recommend a 20km zone of influence is used from the Proposed Development Site boundary. There are no wind energy developments within 25km of the proposed development. The following permitted and proposed wind energy developments (Table 7-3) are located within 25km of the Proposed Development Site and considered in this cumulative impact assessment.

Table 7-3 Wind Energy Applications within 25km of the Proposed Development Site

Permitted Windfarms within 25km from subject site								
Wind Farm	**Pl. Ref.**	**Applicant**	**Lodgement**	**Description**	**Location**	**Local Authority Decision**	**Appeal/ABP decision**	**Operational Status**
Bracklyn	PA25M.311565	Bracklyn Wind Farm Limited	05/10/2021	Proposed 11 no turbine wind farm and 110kVloop-in/loop-out electricity substation	Bracklyn, Co. Westmeath (0.5km – 5km)	SID app	ABP – Conditional (07/07/2022)	No
Yellow River	PA19.PA0032	Greenwind Energy (Wexford) Ltd	28/11/2013	A 15 year permission for 32 turbines with a total height of 166m.	Derryarkin and other townlands – to the north of Rhode, Co. Offaly (c. 15.5 km southwest)	SID app	ABP Conditional (03/06/2014)	No
Cushaling /Cloncant	PL19.306924	Cloncant Renewable Energy Limited	18/03/2020	10-year planning permission with a 30-year operational life. The development will consist of up to 8 (eight) wind turbines. An Environmental Impact Assessment Report (EIAR) and A Natura Impact Statement (NIS) has been prepared in respect of the application	Ballykilleen Shean Kilcumber Cloncant & Cushaling , Edenderry , Co Offaly (24.1km South)	Refuse 21/02/2020 Offaly County Council	Grant 23/09/2020 ABP	Under Construction
Cloncreen	PA19.PA0047	Bord Na Móna Powergen Ltd	27/10/2016	Proposed Cloncreen Wind Farm comprising up to 21 no. Wind Turbines and all associated works	Esker More, Clongarret, Cloncreen, Ballykilleen, Ballynakill, Ballinrath, Rathvilla or Rathclonbrackan, Ballina and Ballingar, County Offaly (24.5km South)	SID Application	Grant 03/05/2017 ABP	Yes
Proposed Windfarms within 25km of subject site in pre-planning or early stage consultation								
Miltown Pass	N/A	Statkraft	N/A	Proposed 7 no. turbines and underground connection to Clonfad Substation (via public consultation website https://milltownpasswindfarm.ie/ accessed on 2023.02.23)	Miltown Pass, Co. Westmeath (c. 17 km southwest)	N/A	N/A	N/A

Permitted Windfarms within 25km from subject site								
Knockanarragh	N/A	Statkraft	N/A	Up to 8 no Turbines – via. public consultation website https://knockanarraghwindfarm.ie/ accessed on 2023.02.23	Newtown, Carnybrogan, Cavestown and Rosmead Co. Meath and Co. Westmeath. (c. 10km northwest)	N/A	N/A	N/A
Ballydermot	ABP 310143-21	Bord na Móna Powergen Ltd.	N/A	Construction of a wind energy development comprising approximately 50-55 no. wind turbines.	Ballydermot and other townlands, Co. Offaly and Lullybeg and other townlands, Co. Kildare.	Pre-application consultation	N/A	N/A

The Proposed Development has been designed to ensure that there will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development.

The above permitted and/or proposed wind farms have been or will be subject to Appropriate Assessment to ensure that there is no potential for adverse effects on any European Site.

No potential for negative cumulative impacts when considered in combination with the above listed wind energy developments were identified.

8.1.2 Applications within the Vicinity of the Wind Farm

Planning applications within the vicinity of the proposed development were collated following a review of the Meath and Westmeath County Council planning portals. Records of An Board Pleanála and the Department of Agriculture, Forestry and the Marine websites were also searched for other relevant planning applications and licences.

Applications within the vicinity of the proposed wind farm are predominately for the development of the following:

- Quarrying,
- Agriculture,
- Forestry,
- Renewable energy (including the permitted Bracklyn Wind Farm),
- Private turbary
- One off housing

A list of applications within the wider area is included in Appendix 5.

The Proposed Development has been designed to ensure that there will be no adverse effects on any European Site as a result of the proposed development. The site is located outside of any European Site and a range of mitigation measures are in place to ensure that there will be no adverse effects on any European Site due to deterioration of water quality, habitat loss or disturbance/displacement of QI/SCI species resulting from the proposed development.

No potential for negative cumulative impacts when considered in combination with any other planning applications were identified.

8.2 Conclusion of Cumulative Assessment

Following the assessment provided in the preceding sections, it is concluded that, the Proposed Development will not result in any adverse effects on the integrity of any European Sites. All pathways by which adverse effects could occur have been robustly blocked through the implementation of mitigation and best practice in the design of the development.

Having considered other projects in the area as listed above, no potential for the Proposed Development to contribute to any adverse cumulative effects on any European Sites was identified when considered in-combination with other plans and projects.

In the review of the projects that was undertaken, no connection, that could potentially result in additional or cumulative impacts was identified. Neither was there any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the proposed development.

9. CONCLUDING STATEMENT

This NIS has provided an assessment of all potential direct or indirect adverse effects on European Sites, taking into account all relevant guidance including the European Commission's Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2021).

Where the potential for any adverse effect on any European Site has been identified, the pathway by which any such effect may occur has been robustly blocked through the use of avoidance, appropriate design and mitigation measures as set out within this report and its appendices. The measures ensure that the construction, operation and decommissioning of the Proposed Development will not have an adverse effect on the integrity of any European sites in light of their conservation objectives.

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Sites, either alone or in combination with other plans or projects.

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APPENDIX 1

APPROPRIATE ASSESSMENT SCREENING REPORT

Planning and Environmental Consultants

Appropriate Assessment Screening Report

Proposed Ballivor Wind Farm Development

DOCUMENT DETAILS

Client:	**Bord Na Móna**
Project Title:	**Proposed Ballivor Wind Farm Development**
Project Number:	**191137**
Document Title:	**Appropriate Assessment Screening Report**
Document File Name:	**AASR – F – 2023.03.24– 191137**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

MKO
Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	21/01/2022	SM	PR
02	Draft	03/03/2023	SM	PR
03	Draft	14/03/2023	SM	PR
04	Final	24/03/2023	SM	PR

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APPENDICES

1. INTRODUCTION

MKO has been appointed to provide the information necessary to allow the competent authority to conduct an Article 6(3) Screening for Appropriate Assessment of a proposed wind energy development and all associated infrastructure located within the Ballivor Bog Group (Ballivor, Carranstown, Bracklin, Lisclogher bogs) located in Counties Meath and Westmeath.

Screening for Appropriate Assessment is required under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Part XAB of the Planning and Development Act 2000, as amended. Where it cannot be excluded that a project or plan, either alone or in combination with other projects or plans, would have a significant effect on a European Site then same shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. The proposed project is not directly connected with, or necessary for, the management of any European Site consequently the project has been subject to the Appropriate Assessment Screening process.

The data underpinning this AA Screening Report (AASR) was obtained through a desk study and field surveys undertaken in 2019, 2020, 2021, 2022 and 2023. Using this data, MKO has assessed the potential for the Proposed Development to result in significant effects on European Sites in the absence of any best practice, mitigation or standard preventative measures.

This Appropriate Assessment Screening Report has been prepared in compliance with Part XAB of the Planning and Development Acts 2000 (as amended), the Planning and Development Regulation 2001 - 2019 and relevant jurisprudence of the European and Irish Courts. It was also prepared in accordance with all relevant guidance including the European Commission's Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2021), *Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC* (EC, 2018), the Department of the Environment's *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities* (December 2009, amended 11 February 2010)) and OPR (2021) Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland.

1.1 Appropriate Assessment Process

1.1.1 Stage 1 Screening for Appropriate Assessment

Screening is the process of determining whether an Appropriate Assessment is required for a plan or project. Under Part XAB of the Planning and Development Act, 2000, as amended, screening must be carried out by the Competent Authority.

As per Section 177U of the Planning and Development Act, 2000, as amended '*screening for appropriate assessment of a draft Land use plan or application for consent for Proposed Development shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that landuse, plan or Proposed Development, individually or in combination with another plan or project is likely to have a significant effect on the European site.*

The competent authority shall determine that an appropriate assessment of a draft land use plan or a Proposed Development, ..., is required if it cannot be excluded, on the basis of objective information, that the draft Land use plan or Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site'.

The Competent Authority's determination as to whether an Appropriate Assessment is required must be made on the basis of objective information and should be recorded in writing. The Competent Authority may request information to be supplied to enable it to carry out screening.

Consultants or project proponents may provide for the competent authority, the information necessary for them to determine whether an Appropriate Assessment is required and provide advice to assist them in the Article 6(3) Appropriate Assessment Screening decision.

As per the European Commission's *Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (2021), a* Stage 1 Screening comprises four steps:

1. Ascertain whether the plan or project is directly connected with, or necessary to, the management of a Natura 2000 site.
2. Description of the plan or project and its impact factors (described in Section 2 below)
3. Identify which Natura 2000 sites may be affected by the plan or project (described in Section 3 below).
4. Assess whether likely significant effects can be ruled out in view of the site's conservation objectives (described in Section 3 below)

In relation to Step 1 above, the project is/was not directly connected with, or necessary for, the management of any European Site consequently the project has been subject to the Appropriate Assessment Screening process.

1.1.2 Stage 2 Appropriate Assessment

Where it cannot be excluded beyond reasonable scientific doubt at the Screening stage, that a proposed plan or project, individually or in combination with other plans and projects, would have a significant effect on the conservation objectives of a European site, an Appropriate Assessment is required.

Where an Appropriate Assessment is required, the Competent Authority may require the applicant to prepare a Natura Impact Statement.

The term Natura Impact Statement (NIS) is defined in legislation[1]. An NIS, where required, should present the data, information and analysis necessary to reach a definitive determination as to 1) the implications of the plan or project, alone or in combination with other plans and projects, for a European site in view of its conservation objectives, and 2) whether there will be adverse effects on the integrity of a European site. The NIS should be underpinned by best scientific knowledge, objective information and by the precautionary principle.

This Article 6(3) Appropriate Assessment Screening Report has been prepared in compliance with the provisions of section 177U of the Planning and Development Act 2000 as amended.

1.1.3 Statement of Authority

This report has been prepared by Sarah Mullen (B.Sc., M.Sc., Ph.D., ACIEEM) and Pat Roberts (B.Sc. MCIEEM). Pat Roberts is Principal Ecologist at MKO with over 16 years' experience. He currently manages the ecological team within MKO. Pat holds B.Sc. (Hons) in Environmental Science. He has extensive experience of providing ecological consultancy on large scale industrial and civil engineering

[1] As defined in Section 177T of the Planning and Development Act, 2000 as amended, an NIS means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a Proposed Development , on its own and in combination with other plans and projects, for a European site in view of its conservation objectives. It is required to include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for the European site in view of its conservation objectives

projects. He is highly experienced in the completion of ecological baseline surveys and impact assessment at the planning stage.

Sarah holds a B.Sc. (Hons) in Botany, an M.Sc. in Biodiversity and Conservation and a Ph.D. in Botany. Sarah has over 6 years' experience working in ecological consultancy and has extensive experience in undertaking habitat and species surveys and working on Ecological Impact Assessment and Appropriate Assessment.

The baseline ecological surveys undertaken to inform the assessment were undertaken between April 2020 and February 2023 by Pat Roberts (B.Sc., MCIEEM), John Hynes (B.Sc., M.Sc., MCIEEM), Sarah Mullen, Inga Reich (BSc., Ph.D.), Patrick Ellison (B.Sc., M.Sc., ACIEEM), Rachel Walsh (B.Sc.), Julie O'Sullivan (B.Sc., M.Sc.), Aoife Joyce (B.Sc., M.Sc.), Luke Dodebier (B.Sc.), Cathal Bergin (B.Sc.) Neansai O'Donovan (B.Sc.), Neill Campbell (B.Sc.), Laoise Kelly (B.Sc.), Patrick O'Boyle (B.Sc., M.Sc.), Rudraksh Gupta (B.Sc., M.Sc.) and Kailan Mitchell (B.Sc.) of MKO.

The bird surveys undertaken to inform the Environmental Impact Assessment Report (EIAR) for the Proposed Development, and the results of which were also used to inform this assessment, were undertaken between October 2019 and September 2022. The scope of surveys was devised by Senior Ornithologist Padraig Cregg (B.Sc., MSc.) of MKO and the surveys were undertaken by Andre Robinson, Conor Rowlands, Declan Manley, Donnacha Woods, Eric Dempsey, Eilis Hogan, Enda Flynn, Eric Dempsey, Ian Hynes, Jack Kennedy (B.Sc.), John Curtin (B.Sc.), John McMahon, Kate Bismilla (B.Sc.), Kathryn Sheridan, Niall McHugh, Padraig Webb, Patrick Manley (B.Sc.), Paul Troake, Peter Capsey, Sarah Jorgensen (née Ingham), Tom Rae and Tom Siekaniec of MKO.

MKO ecologists are trained in field ecology and are competent experts in undertaking botanical and faunal surveys.

1.1.4 Data Collected to Carry Out Assessment

In preparation of the report, the following sources were used to gather information:

- Review of NPWS Site Synopses and Conservation Objectives for the European Sites.
- Review of 2019, 2013 and 2007 EU Habitats Directive (Article 17) Reports.
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA, Water Framework Directive (WFD).
- Review of specially requested records from the NPWS Rare and Protected Species Database for the hectads which overlap with the study area.
- Review of OS maps and aerial photographs of the site of the proposed project.
- Review of relevant databases including National Biodiversity Ireland Database and available literature of previous surveys conducted in the area.
- Review of other plans and projects within the area including projects listed on online planning registers as well as the following plans:
    - Westmeath County Development Plan 2021 – 2027
    - Meath County Development Plan 2021-2027
    - National Biodiversity Action Plan 2017-2021
    - Regional Spatial and Economic Strategy, Eastern and Midland Regional Assembly 2019-2021
    - County Westmeath Biodiversity Action Plan 2014-2020
    - County Meath Biodiversity Plan 2015-2020
- MKO field assessments and bird surveys carried out between 2019 and 2022 and as described in detail in the Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) which accompany the planning application for the Proposed Development.

- Cummins et al. (2010). Assessment of the distribution and abundance of Kingfisher [Alcedo atthis] and other riparian birds on six SAC river systems in Ireland. A report commissioned by the National Parks and Wildlife Service and prepared by BirdWatch Ireland
- Sharrock, J.T.R. (1976) The atlas of breeding birds in Britain and Ireland.
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- Gibbons, D.W., Reid, J.B. & Chapman, R.A. (1993) The new atlas of breeding birds in Britain and Ireland: 1988-1991.
- Biosphere Environmental Services (BES) breeding and wintering bird survey reports for Ballivor Bog Group (2012-2020).
- Bord na Móna Habitat Mapping for the Ballivor Bog Group
    - The Ballivor Bog Group site was subject to detailed habitat surveys by Bord na Móna ecologists between 2011 and 2012 (with follow-up site visits in subsequent years as outlined below) and detailed habitat maps were prepared.
        - Ballivor: Site surveyed and mapped December 2011, May 2012. Follow up visits between 2011 and 2021 and habitat maps updated where required.
        - Bracklin Bog: Site surveyed and mapped July 2012. Additional walkover surveys undertaken between 2015-2017 and habitat maps updated where required.
        - Lisclogher: Site surveyed and mapped April 2010. Additional walkover surveys undertaken between 2010 and 2017 and habitat map updated where required.
        - Lisclogher West: Site surveyed and mapped July 2012. Additional site visits undertaken between 2012 and 2016 (visited winter 2016/2017) and habitat maps updated where required.
        - Carranstown: Site surveyed and mapped July 2012. Additional walkover surveys undertaken between 2012 and 2021 and habitat maps updated where required.
- Bord na Móna Draft Cutaway Bog Decommissioning and Rehabilitation Plans prepared to satisfy Condition 10.2 of IPC License Ref. P0501-01 under which activities at Ballivor Bog Group operate
    - Ballivor Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
    - Bracklin Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan
    - Lisclogher-West Draft Cutaway Bog Decommissioning and Rehabilitation Plan
    - Lisclogher Draft Cutaway Bog Decommissioning and Rehabilitation Plan
    - Carranstown Draft Cutaway Bog Decommissioning and Rehabilitation Plan

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Site Location

The Proposed Development, known as Ballivor Wind Farm, will be located on Ballivor bog, Carranstown bog, Bracklin bog, Lisclogher bog and adjacent third party land for the provision of a borrow pit.

The 'Application Site' which comprises the proposed wind farm site and two areas of temporary accommodating works along the haul route is illustrated in Figure 2-1.

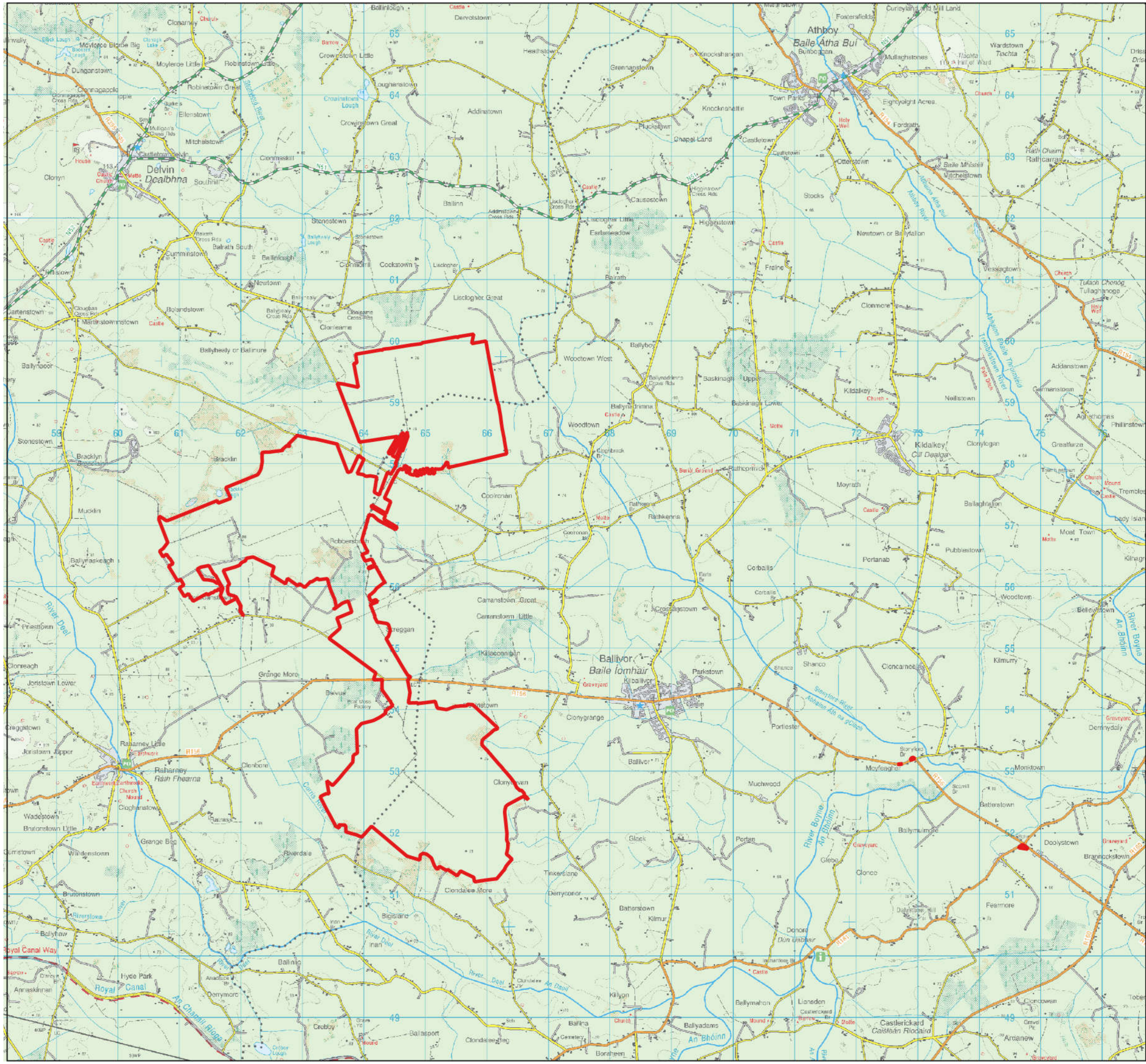
The Wind Farm Site Boundary for the purposes of this EIAR corresponds with the red-line boundary of the wind farm site proper and encompasses an area of approximately 1,170 hectares. This is illustrated on Figure 2-2

For the purposes of this AASR, the Proposed Development site/ site boundary refers to the 'Application Site' as shown on Figure 2-1. The Proposed Development refers to the construction footprint of the entire renewable energy development. The construction footprint in shown in Figure 2-3 which shows the layout of the Proposed Development.

The Wind Farm Site Boundary measures approximately 9 kilometres (km) in length from north to south and approximately 6 km from east to west, at its widest point with a topography range between 69 metres above ordnance datum (m AOD) at its lowest point to approximately 86 m AOD at its highest point. The closest settlements to the site are Delvin located 5km north, Raharney, 4km west and Ballivor, 3.5km east of the site. The townlands within which the Proposed Development falls are listed in Table 2-1.

Table 2-1 Townlands within which the Proposed Development is located

Wind Farm Site	
Bracklin	Craddanstown
Clondalee More	Derryconor
Clonleame	Grange More
Clonmorrill	Killagh
Clonycavan	Lisclogher Great
Cockstown	Riverdale
Coolronan	Robinstown
Haul Route Temporary Accommodating Works Areas	
Moyfeagher	Doolystown



Map Legend

Application Site Boundary

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Drawing Title	
Application Site Boundary	
Project Title	
Proposed Ballivor Wind Farm	
Drawn By: DOS	Checked By: KM
Project No.: 191137	Drawing No.: Figure 2-1
Scale: 1:60,000	Date: 2023-03-01

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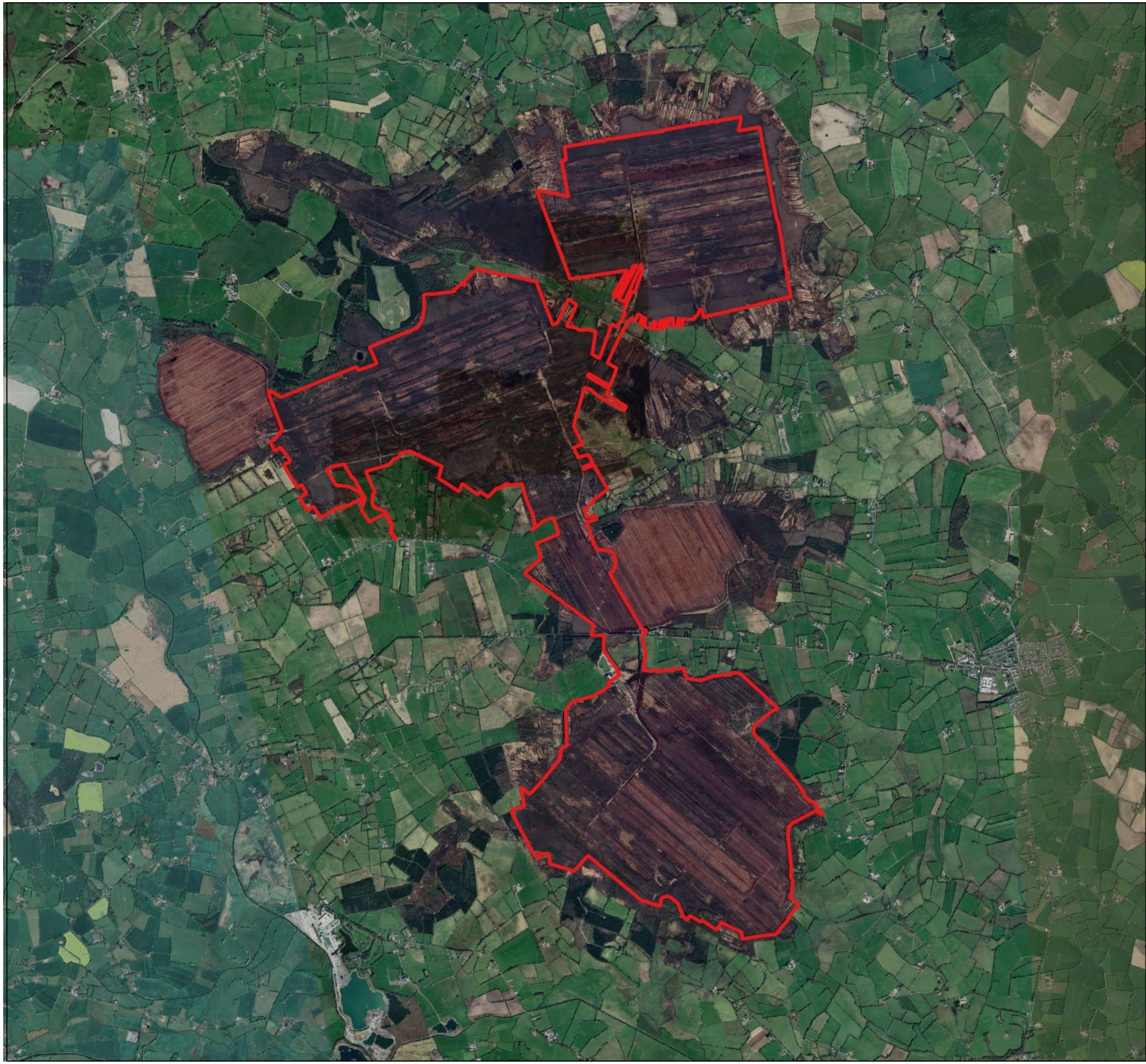

Map Legend

Wind Farm Site Boundary

N

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Drawing Title	
Wind Farm Site Boundary	
Project Title	
Proposed Ballivor Wind Farm	
Drawn By: DOS	Checked By: KM
Project No.: 191137	Drawing No.: Figure 2-2
Scale: 1:40,000	Date: 2023-03-01

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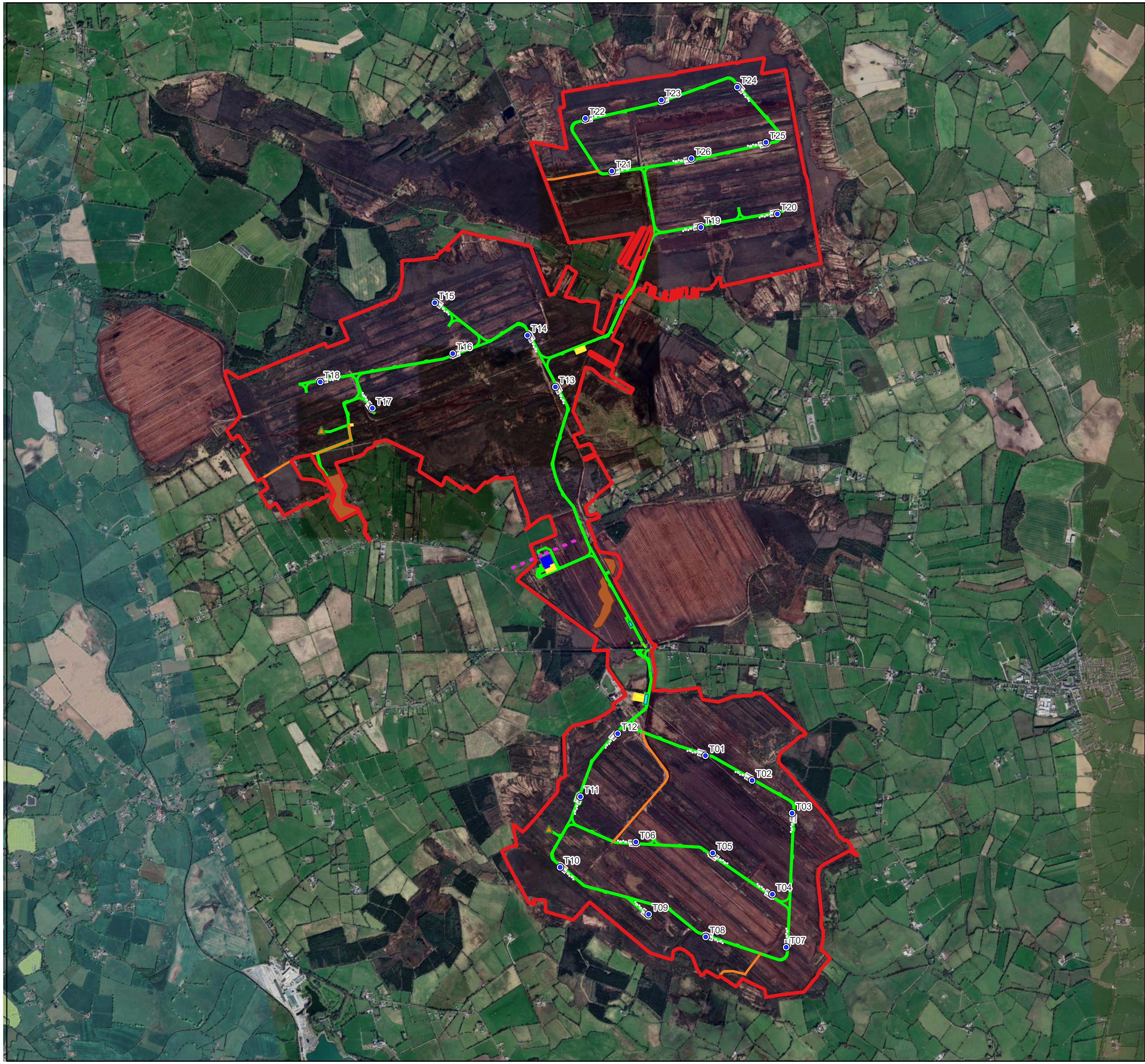

Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Locations
- Proposed Substation Location
- Proposed Met Mast
- Proposed Internal Roads
- Proposed Grid Connection
- Proposed Construction Compounds
- Proposed Borrowpit Locations
- Proposed Amenity Paths
- Amenity Carparks
- Proposed Security Cabins

N

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Drawing Title	
Wind Farm Site Layout	
Project Title	
Proposed Ballivor Wind Farm	
Drawn By: SM	Checked By: PR
Project No.: 191137	Drawing No.: Figure 2-3
Scale: 1:35000	Date: 2023-03-23

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2.2 Characteristics of the Proposed Development

2.2.1 Description of the Project

The Proposed Development will comprise 26 No. wind turbines and all associated site development works. The proposed turbines will have a blade tip height of 200 metres above the top of the turbine foundation. The Proposed Development will also provide public amenity walks and car parking. The applicant is seeking a ten-year planning permission for the following:

i. *26 No. wind turbines with a blade tip height of 200m and all associated hard-standing areas.*
ii. *2 No. permanent Meteorological Anemometry Masts with a height of 115 metres and removal of existing meteorological mast.*
iii. *4 No. temporary construction compounds, in the townlands of Bracklin and Grange More.*
iv. *5 No. temporary security cabins at the main construction site entrances as well as at a number of access points around the site, in the townland of Killagh, Grange More and Coolronan.*
v. *2 No. borrow pits located in Carranstown Bog, and in third party land in the townland of Craddanstown; All works associated with the opening, gravel and spoil extraction, and decommissioning of the borrow pits.*
vi. *1 No. 110 kV electrical substation, which will be constructed in the townland of Grange More. The electrical substation will have 2 No. control buildings, a 36 metre high telecom tower, associated electrical plant and equipment, a groundwater well and a wastewater holding tank. All associated underground electrical and communications cabling connecting the turbines and masts to the proposed electrical substation and all works associated with the connection of the proposed wind farm to the national electricity grid, which will be to the existing Mullingar – Corduff 110 kV overhead line via overhead line.*
vii. *Provision of new internal site access roads with passing bays measuring a total length of 28km and provision/upgrade of existing/new pathways for amenity uses measuring a total length of approximately 3.3km and associated drainage.*
viii. *Temporary accommodating works to existing public road infrastructure to facilitate delivery of abnormal loads at locations on the R156 and R161 in the townlands of Doolystown and Moyfeagher;*
ix. *Accommodating works to widen existing site entrances off the R156 into Ballivor and Carranstown Bogs to be used as main construction site entrances and to facilitate delivery of turbine components and construction materials; Previous site entrances to be reinstated and used for maintenance and amenity access for the operational period;*
x. *Permanent vertical realignment of the R156 in the vicinity of the site entrance to achieve required sight lines.*
xi. *Construction of permanent site entrances off a local road into Lisclogher and Bracklin Bogs to facilitate a crossing point for turbine components and construction materials and operation/amenity access;*
xii. *Provision of amenity access using existing entrances off the R156 and local roads in the townlands of Bracklin, Coolronan, Clondalee More and Craddanstown;*
xiii. *3 No. permanent amenity carparks in Ballivor Bog (50 car parking spaces), Carranstown (15 car parking spaces) and Bracklin Bog (15 car parking spaces).*
xiv. *All associated site works and ancillary development including access roads, amenity pathways, and signage.*
xv. *A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*

Current and future wind turbine generator technology will ensure that the wind turbine model, chosen for the Proposed Development, will have an operational lifespan greater than or equal to 30-years.

The overall layout of the Proposed Development is shown on Figure 2-3. This drawing shows the proposed locations of the wind turbines, electricity substation, construction compounds, internal roads layout and the site entrances. The sections below provide details of the Proposed Development. A full description of the Proposed Development is included in Chapter 4 of the Environmental Impact Assessment Report (EIAR) which accompanies the Proposed Development planning application.

Detailed layout drawings are included as Appendix 4-1 of the EIAR.

2.3 Development Components

2.3.1 Wind Turbines

2.3.1.1 Turbine Locations

The proposed wind turbine layout has been optimised using wind farm design software (a combination of WAsP and WindPro) to maximise the energy yield from the site, while maintaining sufficient distances between the proposed turbines to ensure turbulence and wake effects do not compromise turbine performance. The ITM Grid Reference coordinates of the proposed turbine locations are listed in Table 2-2 below.

Table 2-2 Proposed Wind Turbine Locations and Elevations

Turbine	ITM X	ITM Y	Top of Foundation Levels metre OD
1	665162	753511	75.3
2	665604	753275	73.9
3	665983	752965	73.9
4	665796	752196	72.6
5	665231	752587	73.1
6	664502	752692	72.2
7	665928	751694	72.4
8	665164	751792	72.9
9	664623	752007	74.4
10	663783	752452	74.1
11	663976	753121	75.0
12	664329	753719	78.1
13	663739	757007	73.8
14	663474	757496	74.9

15	662595	757805	78.1
16	662765	757323	74.9
17	662002	756804	79.0
18	661508	757054	77.0
19	665118	758520	73.3
20	665844	758647	73.2
21	664274	759054	73.3
22	664023	759553	75.2
23	664744	759727	75.0
24	665464	759850	75.1
25	665735	759326	73.9
26	665028	759172	73.5

2.3.1.2 Turbine Type

Wind turbines use the energy from the wind to generate electricity. A wind turbine, as shown in Plate 2-1 below, consists of four main components:

- Foundation unit
- Tower
- Nacelle (turbine housing)
- Rotor
- 3 no. blades

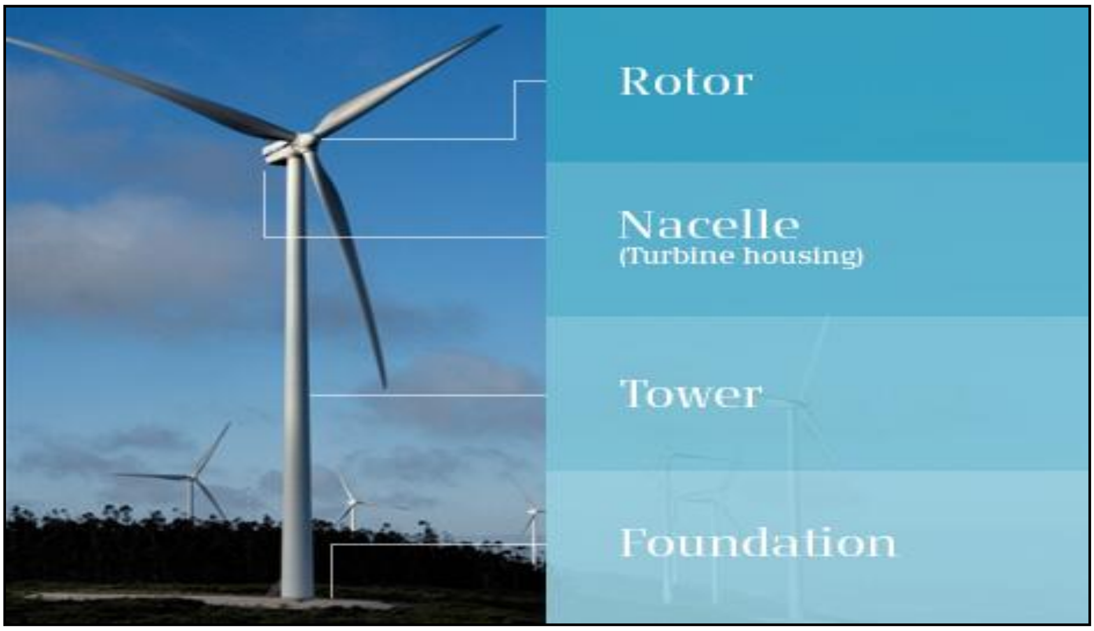


Plate 2-1 Wind Turbine Components

The proposed wind turbines to be installed on the site will have a ground-to-blade tip height, hub height and blade length within the following, limited, ranges:

- Turbine Tip Height –200 metres
- Hub Height –115 metres
- Blade Rotor Diameter: - 170 metres

The wind turbines that will be installed on the site will be conventional three-blade turbines, which will be geared to ensure the rotors of all turbines rotate in the same direction at all times.

It should also be noted that the assessment of the development footprint of the Ballivor Wind Farm project within this AASR, is based on the maximum potential footprint for all of the infrastructural elements.

The turbines will be multi-ply coated to protect against corrosion. It is proposed that the turbines would be of an off-white or light grey colour to blend into the sky background. This minimises visual impact as recommended by the following guidelines on wind energy development:

- *Wind Farm Development – Guidelines for Planning Authorities, Department of the Environment, Heritage and Local Government (DoEHLG, 2006);*
- *The Influence of Colour on the Aesthetics of Wind Turbine Generators (ETSU, 1999).*

The individual components of a geared wind turbine nacelle and hub are shown in Plate 2-2 below. Wind turbines without a gearbox (i.e. direct drive) may also be considered for use in the Proposed Development. This will have no impact on the external design.

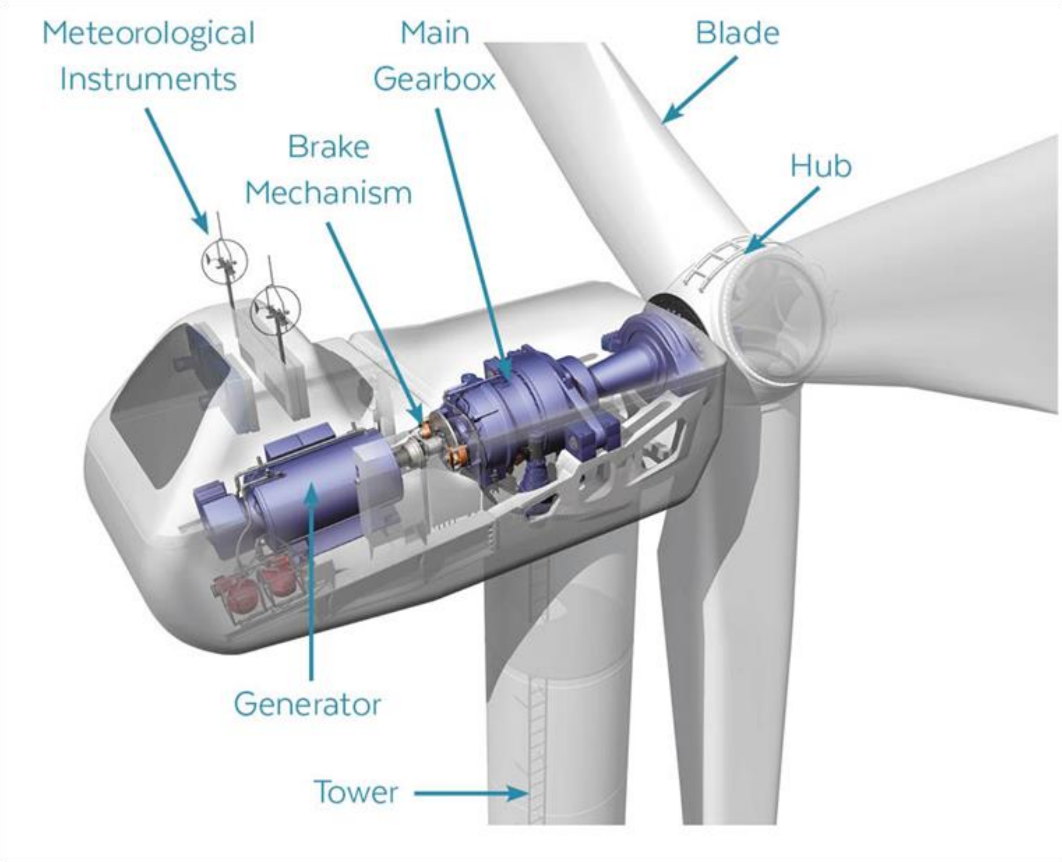


Plate 2-2 Turbine nacelle and hub components

2.3.1.3 Turbine Foundations

Turbine foundations are constructed by excavating peat and soil to sub-formation level. Imported structural fill and blinding is placed and compacted to formation level. A reinforced concrete base is cast in-situ. The turbine foundation transmits any load on the wind turbine into the ground. The approximate horizontal and vertical extent of the turbine foundation will be 26m and 4m respectively.

The top of the base is referred to as 'Top of Foundation Level'. Where ground conditions are unfavourable to excavate and replace, piles will be installed to formation level. The size of the concrete foundation will be approximately 25 m in diameter, based off current models of this scale, but will depend on the loads specified by the turbine manufacturer selected from the competitive tender process. After the formation level has been reached, the bottom section of the turbine tower "Anchor Cage" is levelled and reinforcing steel is built up around and through the anchor cage (Plate 2-3 below). The outside of the foundation is shuttered with formwork to allow the pouring of concrete and is backfilled with granular fill to finished surface level (Plate 2-4 below).

Plate 2-3 Turbine Base Anchor Cage

Plate 2-4 Finished Turbine Base

2.3.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted granular fill are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are typically used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The hard-standing area is intended to accommodate a crane during turbine assembly and erection.

2.3.1.5 Assembly Area

Levelled assembly areas will be located on either side of the hard-standing area. These assembly areas are required for offloading turbine blades or turbine blade segments, tower sections and hub from trucks until they are ready to be lifted into position by cranes and to assist the main crane during turbine assembly.

2.3.1.6 Segmented Blades

The wind farm has been designed to accommodate turbines with a blade length of 85m. The designated turbine delivery haul route allows for turbine blade segments of up to 76m and therefore segmented blade technology is proposed for turbines with a blade length of 85m. Whilst the specific turbine will be selected at procurement stage, the haul route assessment has considered a range of segment blade lengths that would be applicable for a turbine with a blade length of up to 85m. Based on a maximum possible segment length of 76m, the delivery scenario is the transfer of a 85m blade delivered to site in 2 segments over 2 no. deliveries, with the longer segment being up to 76m (expected range being 60-70m) and the shorter segment being up to 20m (expected range being 10-20m). These segment lengths are based on the segmented blade technologies currently available on the market, such as the LM 77.4m P blade from General Electric, which is supplied in two segments, a 65.4m root and a 12m tip[2]; however, the exact segment lengths with be determined at procurement based on available options on the market at the time.

2.3.2 Site Roads

2.3.2.1 Road Construction Types

To provide internal access to the development site to connect the wind turbines and associated infrastructure, approximately 30 kilometres of internal access roads will need to be constructed. Fehily Timoney & Company Ltd. (FTC) were appointed to assess the existing ground conditions and specify the type of road required to access all locations on site.

The road construction techniques to be considered are as follows:

- Construction of New Floating Roads over peat (majority)
- Construction of New Excavated Roads through peat

The construction methodology for each road type is detailed below.

2.3.2.1.1 *Construction of New Floating Roads*

Floating access roads are the predominant road construction type proposed for the site. The use of new floated access tracks will be limited on site to areas of flatter terrain with slopes typically less than 5°.

The construction methodology for floating roads is outlined below.

i. *Prior to commencing floating road construction movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
ii. *Floating road construction shall be to the line and level requirements as per design/planning conditions.*

[2] Details can be seen at https://www.windenergy.org.nz/store/doc/GE-Cyprus-5MW-and-product-overview_Chris-Holsonback-GE.pdf.

iii. *Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.*
iv. *Construction of road to be in accordance with appropriate design from the designer.*
v. *The typical make-up of the new floated access road is up to 1,200mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator. This may vary depending on designer requirements.*
vi. *Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 5m wide pressure berm (typically 1m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.*
vii. *The finished road surface width will be approximately 6m.*
viii. *Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.*
ix. *To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.*
x. *Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.*
xi. *Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.*
xii. *A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

2.3.2.1.2 Construction of New Excavated Roads

The construction methodology for the construction of excavated roads is outlined below.

i. *Prior to commencing the construction of the excavated roads movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
ii. *Interceptor drains should be installed upslope of the access road alignment to divert any surface water away from the construction area.*
iii. *Excavation of roads shall be to the line and level given in the design requirements. Excavation should take place to a competent stratum beneath the peat (as agreed with the site designer).*
iv. *Road construction should be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill unless otherwise agreed with the site designer or resident engineer on site.*
v. *All excavated peat shall be placed/spread alongside the excavations.*
vi. *Side slopes in peat shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations should be carried out as the excavation progresses.*
vii. *The surface of the finished excavated access road will be 1.2m above existing ground level.*
viii. *A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer).*
ix. *At transitions between floating and excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.*
x. *Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the*

adjacent peat and greatly reduces any risk of peat instability. It should be noted that slopes greater than 5 degrees are not envisaged on site.

xi. A final surface layer shall be placed over the excavated road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

2.3.3 Electricity Substation

It is proposed to construct a 110 kV electricity substation within the site of the Proposed Development as shown in Figure 2-3. The proposed substation site is located in the northwest of Carranstown Bog, in the townland of Grange More within proximity to the existing Mullingar- Corduff 110 kV overhead line which traverses the site. The construction and exact layout of electrical equipment in the onsite electricity substation will be to Eirgrid networks specifications and will be under the ownership of ESB Networks. Access to the substation will be from the R156 to facilitate Eirgrid and ESB Networks during the operational period of the Ballivor Wind Farm and beyond. Upon decommissioning of the wind farm, the 110kV substation within Carranstown Bog will remain in-situ and form part of the national grid infrastructure.

The footprint of the proposed onsite electricity substation compound measures approximately 14,600 m.^{2} It will include two control buildings and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid.

2.3.3.1 Wind Farm Control Buildings

Two substation control buildings will be located within the substation compound. The Transmission Asset Owner (TSO) Control Building will measure approximately 25 metres by 18 metres and approximately 9.7 metres in height. The Independent Power Provider (IPP) Control Building will measure approximately 19 metres by 12 metres and approximately 7 metres in height.

The wind farm control buildings will include staff welfare facilities that will work on the Proposed Development during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the Proposed Development, there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the Proposed Development does not necessitate a potable source. It is proposed to install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. A pump house is not currently envisaged as an in-well pump will direct water to a water tank within the roof space of the control building (subject to final design). Bottled water will be supplied for drinking, if required.

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewaters being tankered off site by an appropriately consented waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site.

The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the sites' turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site.

2.3.4 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 33kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in cable ducts approximately 1.2 metres below the ground surface, along the sides of or underneath the internal roadways. The route of the cable ducts will follow the access track to each turbine location.

Clay plugs will be installed at regular intervals of not greater than 50 metres along the length of the trenches to prevent the trenches becoming conduits for water. While the majority of the cable trenches will be backfilled with native material, clay subsoils of low permeability will be used to prevent conduit flow in the backfilled trenches. This material will be imported onto the site should sufficient volumes not be encountered during the excavation phase of roadway and turbine foundation construction.

2.3.5 Grid Connection

A connection between the Proposed Development and the national electricity grid will be necessary to export electricity on to the national grid. This connection from the proposed onsite substation to the national grid will occur within the vicinity of the proposed substation, via a new overhead line which will connect into the existing Mullingar-Corduff 110 kV transmission line located approximately 35m north of the proposed substation within the development site boundary. Approximately 35m of overhead line and two lattice loop in/loop out masts will be required to connect from the proposed substation to the existing overhead line. The proposed lattice masts will be located within the Application Site. Each mast will have a footprint of approximately 140m2 and an overall height of 12–15m. They will be lattice steel structures with cross-arms which can extend over the base footprint and internal bracing.

2.3.6 Rural (Local) Electricity Supply

A rural/local electricity supply will be required as a back-up power supply to the proposed substation for light, heat and power purposes. A rural/local supply pole is located within Carranstown Bog, approximately 10m from the proposed substation location. The rural/local supply will be designed and constructed by ESB Networks. The exact source of supply is to be confirmed by ESB Networks, however, the supply will enter the site by either MV overhead line or MV cable. The rural/local supply will have an associated step-down transformer (i.e., MV to LV) and will enter the substation building by underground cable and terminate onto the control building AC distribution board.

2.3.7 Anemometry Mast

Two permanent anemometry masts (met masts) are included in the design of the Proposed Development. The anemometry masts will be equipped with wind monitoring equipment at various heights. The masts will be located at ITM X661518, Y756596 and ITM X 663677, Y752816 as shown on the site layout in Figure 2-3 and will be slender structures 115 metres in height. The masts will be free-standing structures normally constructed with a reinforced concrete gravity foundation designed to cater for the mast loadings. A hard-standing area sufficiently large to accommodate the installation crane will be constructed adjacent to an existing track.

2.3.8 Temporary Construction Compounds

Four temporary construction compounds are proposed as part of the Proposed Development, one main compound at Ballivor bog, one sub-station compound, and two (2) smaller compounds. They will be located in the townlands of Grange More and Bracklyn.

Table 2-3 Temporary Construction Compound Scales

Compound No.	Bog	Scale	Total Area
1	Ballivor Bog (north)	130m by 70m	9,100m^2
2	Bracklin Bog (west)	40m x 25m	1,000m2
3	Bracklin Bog (east)	100m by 50m	5,000m^2
4	Carranstown Bog (substation)	100m by 50 – 60 m	4,800m^2

The location of the proposed construction compounds is shown on the site layout drawing in Figure 2-3.

The construction compounds will consist of temporary site offices, staff welfare facilities, storage areas, and car-parking areas for staff and visitors.

Temporary toilets will be used during the construction phase as part of the welfare facilities for site staff and visitors. Wastewater from toilets will be directed to a sealed storage tank, with all waste-water tankered off site by an appropriately consented waste collector to wastewater treatment plants.

2.3.9 Temporary Security Cabins

Five temporary security cabins will be installed within the site for the duration of the construction phase of the Proposed Development. The security cabins will be located close to the proposed temporary and permanent site entrances and at crossing points on local roads from one bog to another.

The security cabins will be prefabricated structures measuring approximately 7.2 metres by 2.5 metres and 2.85 metres in height. The cabins will serve as the check in and check out point for staff and visitors during the construction phase. The temporary cabins will be removed as part of the post-construction reinstatement works of the wind farm development.

2.3.10 Borrow Pits

It is intended to obtain significant volumes of crushed stone that will be required for the construction of the Proposed Development from two proposed onsite borrow pits.

Borrow Pit No. 1a is located in Carranstown Bog west of a proposed access track and the Bord na Móna railway line, approximately 440m southeast of the proposed 110kV substation. It measures approximately 52,700 m2 in total.

Borrow pit 1b is a smaller pit located approximately 80m east of borrow pit 1a, approximately 440m from the proposed 110kV substation.

Access to borrow pit 1a and 1b will be via internal roads constructed in the same manner as excavated turbine roads (see section 2.3.2.1.2 above), and measure 15m and 45m, respectively. Post-construction, both borrow pits in Carranstown will be reinstated with excavated peat or spoil, however, the access roads to both pits will be retained.

Borrow Pit No. 2 is located on third party land immediately south of the Bracklin Bog boundary. It is located approximately 700 m southwest of Turbine No. 17 and 440m south of the proposed Bracklin Bog Met Mast and measures approximately 57,800 m^2.

Initial access to the borrow pit field will be via the landowners farm access track off the local road 800m south of Bracklin Bog. This existing farm access track will be upgraded. From the borrow pit area, an access road connecting it to Bracklin Bog will be constructed; approximately 50m will be constructed through pastureland via the excavated road method and approximately 120m will be floated (over an existing drain) as per the methodologies in Section 2.3.2.1.1 above Once complete, machinery access to and from the borrow pit area during its construction, use and reinstatement will be via internal roads only, i.e. no local road use will be required by heavy goods vehicles for the purpose of transporting stone. Occasional employee access to the borrow pit and occasional movement of empty machinery to and from borrow pit may require use of the local road. Post-construction phase, the offsite borrow pit area and any construction access works will be permanently graded over and allowed to reseed.

The locations of the proposed borrow pits are shown on the site layout drawing in Figure 2-3.

The extraction of material from the borrow pits is a construction stage of the Proposed Development which will be a temporary operation run over a short period of time. No rock breakers or blasters are proposed for extracting material from these borrow pits. However, it is likely that processing and crushing of cobbles and boulders will be required at all borrow pits to achieve the grading requirements for use in construction.

The estimated volume to be extracted from the borrow pits for the construction of the Proposed Development is up to 674,000 m^3

The construction of the borrow pits will follow a standard sequence as follows:

1. Prior to work commencing, scan for hidden services will be carried out and services will be relocated where required.
2. The working area will be cordoned using temporary fencing.
3. Extraction plant and vehicles on low loaders will be mobilised to site.
4. Topsoil will be removed to a designated location within the borrow pit extents to be stored.
5. A designated impermeable re-fuelling area will be constructed (within the pit for dry working, outside the pit for wet working).
6. Material will be extracted using excavators. No rock ripping or blasting will be carried out at any borrow pits.
7. Excess peat will be sidecast and landscaped.
8. Other extracted materials deemed unsuitable for re-use will be reinstated within the borrow pits.
9. Material will be processed to crush cobbles and boulders.
10. The processed material will be stockpiled in designated areas.
11. A temporary access track will be constructed to tie in with the internal road infrastructure.
12. Processed material will be loaded into lorries and transported to deposition location.
13. Temporary excavation side slopes will be designed by a geotechnical engineer.
14. Upon completion, all faces of excavation will be constructed to safe permanent side slopes to be designed by a geotechnical engineer.
15. Topsoil will be replaced and reseeded.
16. Extraction plant and vehicles on low loaders will be demobilised via. internal site roads and main site entrance.

2.3.11 Sand and Stone Requirements

Construction grade granular fill and higher quality, final surfacing fill (including sand) will both be required for the construction of the Proposed Development.

- The peat beneath the substation, all proposed hardstanding areas including temporary construction compounds will be excavated and replaced with construction grade granular fill up to the existing ground level.
- Roads will generally be constructed as floating roads except in areas with shallow peat and highly trafficked areas (e.g. site entrances and access roads in and out of borrow pits).
- The hardstanding areas and roads will be constructed to the 100 year flood level. Roads will generally comprise approximately 650mm of granular fill and approximately 150 mm of final surfacing layer (or capping). Geotextiles separators will be placed on the subgrade and geogrids will be installed within the road build-up.
- The proposed substation compound will be constructed to approximately 76 metres OD. The peat and unsuitable soil excavated beneath the substation footprint will be replaced with select granular fill in accordance with Eirgrid requirements. The final 250 mm shall comprise capping material.
- The internal site underground cable trenches will be approximately 1200mm in depth. The cable trench will be backfilled up to approximately 600mm with sand, within which the ducting will be placed. Suitable materials from the excavations of the trenches will be reinstated to form the final layer of the trench.

2.3.12 Peat and Spoil Management

A peat and Spoil Management Plan has been prepared for the Proposed Development and is included as Appendix 4-2 of the EIAR which accompanies the planning application for the Proposed Development. The total estimated volume of peat and spoil requiring management within the site is 732,000m^3. The site which is generally flat consists predominantly of bare, locally re-vegetated cutaway peat and shallow peat with an established drainage network. The site has been harvested by Bord na Móna using mechanical harvesting equipment. Bord na Móna has experience managing peat in similar terrain, both during peat production operations and during wind farm construction projects, particularly Mountlucas, Bruckana, Cloncreen (under construction) and Oweninny wind farms. These projects have demonstrated safe and effective methods for peat management and storage. The proposed methodology is detailed in the Peat and Spoil Management Plan which is included as Appendix 4-2 of the EIAR accompanying the planning application.

2.3.13 Site Entrances

Turbine Component Entrances

There are 2 no. main site entrances proposed for the delivery of turbine components to the site. These two main entrances are located on the R156 and provide access and delivery of components into Ballivor Bog to the south, and into Carranstown Bog and on to the remaining bogs to the north. These existing entrances will be widened to facilitate the delivery to site of turbine components. The entrance locations are depicted on Figure 2-3 and can be described as follows:

- Widening of existing site entrance off the R156 into Ballivor Bog in the townland of Grange More;
- Widening of existing site entrance off the R156 into Carranstown Bog in the townland of Grange More.

In addition to the above, in order to deliver turbine components into Lisclogher Bog, an entrance will be inserted at Bracklin Bog onto a local road and an opposing entrance will be inserted into Lisclogher Bog. This will facilitate the direct travel of components from Bracklin Bog to Lisclogher Bog across the local road, thus minimising road and traffic impacts as the components will travel through Carranstown and Bracklin bogs rather than the local road network and cross the narrow road into Lisclogher Bog. This local road network will not be used to facilitate access for components to these bogs.

General Construction Entrances

The northern component entrance into Carranstown Bog will also facilitate the delivery of construction materials (e.g. stone, steel, concrete) and construction staff to Carranstown, Bracklin and Lisclogher Bogs. Adjacent to the southern entrance, a new construction entrance will be constructed for all non-component vehicles. Following construction, the northern entrance will be narrowed to provide permanent access to accommodate light goods vehicles (LGVs) for maintenance work and private vehicles belonging to recreational visitors using the amenity carpark at Carranstown Bog. The general constriction entrance into Ballivor Bog at the south will be retained for the operational phase for amenity and maintenance use. The larger component entrance will be reinstated and revegetated for the operational phase. Should replacement components be required during the lifetime of the development, the component entrances will be reopened to facilitate HGV and oversize component access to the site.

As discussed above, entrances will be inserted into Bracklin and Lisclogher Bogs to facilitate the movement of turbine components from Bracklin to Lisclogher Bog. These entrances will also be used to facilitate the direct travel of construction vehicles from Bracklin Bog to Lisclogher Bog across the local road. This local road network will not be used for general construction traffic to these bogs. For the operational period, these entrances will be upgraded to permanent site entrances for public amenity use and a permanent carpark will be provided off the Bracklin entrance.

Access to borrow pit no. 2 in Craddanstown is proposed via an initial use of an existing third party entrance and track, which will be upgraded, off a local road through a farmyard, 800m south of Bracklin Bog. At the commencement of the construction phase, machinery will enter the farmyard to the borrow pit area to commence construction of a temporary road from the pit area into Bracklin Bog. Once this temporary road is complete, access from the local road will not be required except for occasional employee access to the borrow pit and occasional movement of machinery from and to the borrow pit. The track and pit will be reinstated and reseeded during the construction phase.

2.3.14 Turbine Component Transport Route

There are a range of ports within the island of Ireland that have proven capability to accept and store large wind turbine components. These ports include Cork, Foynes, Galway and Dublin ports. Furthermore, subsequent access to the national motorway network during transportation from these ports has been demonstrated. The facilities within the ports and access to and from the ports is continually being upgraded as part of general improvements. It is on this basis that it is not foreseen that this project will require any material change to port selected should the project be consented and enter into the construction phase.

It is proposed that the large wind turbine components will be delivered to site via the M3, exiting at Junction 6 onto the R125 before turning northwest onto the R154 Trim Road. The delivery route enters Trim town before turning south onto the R161 for approximately 7.5km where it meets the R156. The delivery route continues west for approximately 11.1km along the R156 through Ballivor Village before reaching the proposed site entrances off the R156.

2.3.14.1 Turbine Delivery Route Accommodation Works

Temporary road widening works will be undertaken along the haul route at two locations to facilitate turbine component delivery and parking/storage:

- Junction between the R156 and the R161 approximately 6.5km southwest of Trim: The junction accommodation works will comprise the road-widening within third-party land in order to facilitate turning of delivery vehicles carrying turbine components and other abnormal loads, from the R161 onto the R156 as well as the provision of off-road parking and storage facilities. The proposed widening will measure 3,751m^2 and the area of land take for the proposed parking and storage facilities measure 5,375 m^2.
- East of Ballivor Village on the R156: Accommodating works will be required on the R156 approximately 3.6km east of Ballivor Village. Here, road-widening within third-party land will be required in order to facilitate turning west of delivery vehicles carrying turbine components and other abnormal loads, toward Ballivor Village on the R156. proposed accommodation works area on the road will measure 1,809m^2 and the area of land take for the proposed parking and storage facilities will measure 6,770m^2.

The proposed road widening works will be constructed as per the general construction methodology for new excavated roads as outlined in Section 2.3.2.1.2 above. The locations of these proposed accommodation works are shown in Figure 2-1 above and the accommodation works areas are shown on the layout drawings in Appendix 4-1 of the EIAR which accompanies the planning application. Temporary fencing will be installed at temporary road widening and parking/storage locations. This fencing will be removed to facilitate turbine component delivery and replaced following each delivery.

Following the completion of the construction phase of the Proposed Development, the temporary road widening locations and parking/storage areas will be covered with a layer of topsoil and reseeded. These locations would only be used again in the event that an oversized delivery was required for wind turbine maintenance purposes.

Additional temporary works in the form of signage and bollard removal, lowering of traffic islands, roundabout lowering at locations along the R125, R154, R156 and R161 are required and to allow for oversailing of turbine components. These works will be reinstated once turbine components have been delivered to site and have been agreed in principle with Meath County Council.

2.3.14.2 Other Road Accommodating Works

2.3.14.2.1 *Proposed Permanent Road Improvement Works at R156*

On the R156 in between the proposed component entrances to Ballivor and Carranstown Bogs, existing visibility is currently impacted by a trough and rise in the road. An assessment of the vertical alignment shown indicates that a 44m section of the R156 impedes on required sightlines and as a result, a maximum reduction of approximately 0.47m for 44m along the R156 is required in this area. This proposed work will be undertaken prior to any construction phase works and will be retained for the operational phase and beyond. This proposed lowering of the road section will enhance the road safety for both construction and operational phase users as well as local road users of the R156.

2.3.15 Amenity Pathways and Carparks

The Proposed Development will provide approximately 30km of internal road network, which is intended for amenity use (walkways and cycleways) when the wind farm becomes operational. The roads will be re-purposed following construction to form the amenity pathways, in addition to being used for maintenance access during operation. The amenity pathways will be surfaced with a granular material.

An additional 3.3 km (approximately) of a dedicated amenity link is also proposed in the form of new and upgraded tracks along in Ballivor Bog and at existing entrances into Lisclogher and Bracklin Bogs to provide a greater variety of walking loops. These amenity pathways are illustrated in Figure 2-3. The additional connections will be 3 metres in width and will be constructed using a similar methodology as outlined in Section 2.3.2.1 above.

Three new public car parks will also be provided for recreational use during the operational stage. The car parks will be located along the proposed existing southern access off the R156 into Ballivor Bog, the northern access off the R156 into Carranstown Bog and off the local road which runs northwest–southeast between Lisclogher and Bracklin Bogs. The location and configuration of the proposed car parks are shown in Figure 2-3. The main car park will be located in Ballivor and will accommodate approximately 50 vehicles; the Carranstown car park will accommodate approximately 15 vehicles. The Bracklin car park will provide parking for approximately 15 vehicles. Each car park will also provide bicycle rack facilities for those who want to cycle to the area and then utilise the amenity loops for walking.

2.4 Operation

The Proposed Development is expected to have a lifespan of approximately 30 years. Planning permission is being sought for a 30-year operation period commencing from the date of full operational commissioning of the wind farm. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding to inputs from meteorological equipment and control systems to changes in factors such as wind speed and wind direction.

The wind turbines will be interconnected, and data relayed from the wind turbines to an off-site control centre. The meteorological mast will be similarly interconnected. Each turbine will also be monitored off-site by the wind turbine supplier. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at an off-site control centre 24-hours per day.

Each turbine will be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. Each meteorological mast will be subject to a routine maintenance programme involving a number of checks and changing of instrumentation when required. In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically, maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substation and site tracks will also require periodic maintenance. Maintenance of the site roads will involve filling potholes and maintaining road edge markers. Drainage maintenance will typically involve cleaning of drainage ditches when required to prevent water backing up.

The Substation would be operational 24 hours per day, 7 days a week throughout the year. Supervisory operational and monitoring activities will be carried out remotely using a SCADA system, with the aid of computers connected via a telephone modem link. The following maintenance procedures will also be adhered.

- Periodic service and maintenance works which include some vehicle movement.
- For operational and inspection purposes, substation access is required.
- Servicing of the substation equipment will be carried out in accordance with the manufacturer's specifications, which would be expected to entail the following:
  - Six-month service – three-week visit
  - Annual service – six-week visit
  - Weekly visits as required

Occasional technical problems may require maintenance visits by technical staff. During the six-month and annual service visits, some waste (lubricating and cooling oils, packaging from spare parts or equipment, unused paint, etc.) will arise. This will be recorded and removed from the site and reused, recycled or disposed of in accordance with the relevant legislation in an authorised facility.

This means that day-to-day access to the infrastructure by persons and vehicles will be infrequent, only required to undertake minor routine maintenance and inspection.

2.5 Decommissioning

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their service life, the wind turbines may be replaced with a new set of turbines or components, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully. The onsite substation will remain in place as it will be under the ownership of the ESB/EirGrid.

During decommissioning of the Proposed Development, the wind turbines and meteorological masts would be disassembled. All above ground turbine and mast components would be separated and removed off-site for recycling. Turbine and mast foundations would remain underground and would be covered with earth and allowed to revegetate. Site roadways will be in use as amenity and recreational pathways, and therefore will not be removed during decommissioning. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required. Underground cables, including grid connection, will be removed and the ducting left in place. A decommissioning plan will be agreed with Meath and Westmeath County Council prior to decommissioning the Proposed Development. A Decommissioning Plan is included as Appendix 4-5 of the EIAR which accompanies the planning application for the Proposed Development.

3. IDENTIFICATION OF RELEVANT EUROPEAN SITES

3.1 Identification of the European Sites within the Likely Zone of Impact

The following methodology was used to establish which European Sites are within the Likely Zone of Impact of the Proposed Development:

- Initially the most up to date GIS spatial datasets for European designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on the 22/03/2023 The datasets were used to identify European Sites which could feasibly be affected by the Proposed Development.
- All European Sites that could potentially be affected were identified using a source-pathway - receptor model. Information on these sites with regard to their conservation objectives is provided in Table 3-1[3]. To provide context for the assessment, European Sites surrounding the development site are shown on Figure 3.1.
- The catchment mapping was used to establish or discount potential hydrological connectivity between the site of the Proposed Development and any European Sites. The hydrological catchments are also shown in Figure 3-1.
- Table 3-1 provides details of all relevant European Sites as identified in the preceding steps and assesses which are within the likely Zone of Impact.
- The results of the extensive bird surveys carried out by MKO between 2019 and 2022 were consulted in the course of this screening exercise and provided information on whether the birds recorded on the site could potentially be associated with any European Site.
- The Natura 2000 site synopses and conservation objectives of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of preparing this report. Figure 3.1 shows the location of the Proposed Development in relation to surrounding European sites.
- Where potential pathways for Significant Effect such as habitat or hydrological connectivity are identified, the site is included within the Likely Zone of Impact.

3.2 Assessment of Potential for Significant Effects on European Sites

Table 3.1 below identifies which European Sites are located within the Zone of Likely Impact and identifies pathways by which impacts may occur. Where Table 3-1 identifies a European Site as being within the Zone of Likely Impact, that site is 'screened in' following the precautionary principle and assessed further within the Natura Impact Statement which accompanies the planning application. In addition, the individual pathways by which effects may occur are identified in Table 3-1 below.

[3] Office of the Planning Regulator (2021) guidance; 'OPR Practice Note PN01 Appropriate Assessment Screening for Development Management', utilises the Source-Pathway-Receptor model. This Appropriate Assessment Screening Report follows this guidance as well as providing information on European sites located within 15km of the Proposed Development as recommended in guidance provided by DEHLG (2010).

Table 3-1 Identification of Designated Sites within the Likely Zone of Impact and assessment of potential for significant effects

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Special Area of Conservation (SAC)			
River Boyne and River Blackwater SAC [002299] Distance from Proposed Development Site: 412m Approximately 1.1km downstream of the site boundary at the closest point	• Alkaline fens [7230] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355]	Detailed conservation objectives for this site (Version 1, December 2021) were reviewed as part of the assessment and are available at www.npws.ie	This European Site is located 412m from the application site boundary at its closest point. Taking a precautionary approach, a potential pathway for direct effects on the QI otter where they occur outside the SAC as a result of ex-situ habitat loss within the Proposed Development site was identified. Ex-situ habitat loss could potentially occur if any otter resting or breeding sites are present within small watercourses within the construction footprint at the time of construction works. Taking a precautionary approach, a potential pathway for indirect effects on otter as a result of disturbance during construction works was also identified. There is hydrological connectivity between the Proposed Development and this SAC via watercourses within and adjacent to the site boundary which discharge to the Stonyford River to the east and the Deel (Raharney) River to the south-west, both of which are designated as part of the SAC at this location. Following the precautionary principal, given that there is hydrological connectivity between the Proposed Development and the SAC, a potential pathway for indirect effects on the aquatic QIs of this SAC was identified. The Proposed Development has the potential to cause deterioration in water quality due to

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			run off and infiltration of pollutants, including silt, hydrocarbons and cement-based products, during construction activities associated with the Proposed Development. These include construction of turbine hardstands, windfarm access roads, substations, borrow pits and amenity paths and associated carparks and other related activities. There is also potential for run-off of pollutants from turbine hardstand areas, access tracks and any other hard surfaces during the operational phase of the development as well as during activities associated with the decommissioning of the Proposed Development. The works along the proposed haul route will include temporary road widening works at two locations to facilitate turbine component delivery. Although there is no direct hydrological connectivity between these works and the SAC, and the SAC or nearest watercourse with connectivity to the SAC is located >200m from any land take/road widening works, taking the precautionary approach, there is potential for indirect effects on the aquatic QIs of the SAC due to deterioration in water quality as a result of overland release of silt laden waters or accidental spillage of hydrocarbons, during road widening works along the proposed haul route. **This SAC is therefore within the likely zone of impact and following the precautionary principle the potential for significant effect on the SAC exists. Further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Mount Hevey Bog SAC [002342] Distance from Proposed Development Site: 3.4km	• Active raised bogs [7110] • Degraded raised bogs still capable of natural regeneration [7120] • Depressions on peat substrates of the Rhynchosporion [7150]	Detailed conservation objectives for this site (Version 1, March 2016) were reviewed as part of the assessment and are available at www.npws.ie	No pathway for direct effects was identified as this European Site lies entirely outside of and >3km from the Proposed Development site boundary. There is no surface water or habitat connectivity between the Proposed Development and this SAC. Surface water from the Proposed Development site drains to the Deel (Raharney) River to the west and south of the site and to the Stonyford River to the east of the site, both of which discharge to the River Boyne which in turn flows east before discharging to the Irish Sea >70km downstream of the site. The site is not designated for ground-water dependent habitats or species and therefore no potential for indirect effects via groundwater pathways was identified. Taking the above into consideration, as well as the distance between the Proposed Development and this SAC there is no potential for indirect effects on this SAC due to deterioration of water quality or any other pathway. **There is no potential for significant effect on this European Site. It is not located within the Zone of Likely Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Girley (Drewstown) Bog SAC [002203] Distance from Proposed Development Site: 10.3km	• Degraded raised bogs still capable of natural regeneration [7120]	This site has the conservation objective; *'To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected,'* (NPWS First order site-specific conservation objectives, version 1, 2022).	No pathway for direct effects was identified as this European Site lies entirely outside of the site boundary and >10km from the Proposed Development. There is no identified surface water or habitat connectivity between the Proposed Development and this SAC. The SAC is located within a different surface water sub-catchment to the Proposed Development. The site is not designated for ground-water dependent habitats or species and therefore no potential for indirect effects via groundwater pathways was identified. Given the absence of hydrological connectivity and the distance between the Proposed Development and the SAC, no pathway for indirect effects on this European Site was identified. **There is no potential for significant effect on this European Site. It is not located within the Zone of Likely Impact and no further assessment is required**
Wooddown Bog SAC [002205] Distance from Proposed Development Site: 11.4km	• Degraded raised bogs still capable of natural regeneration [7120]	This site has the conservation objective; *'To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected,'* ((NPWS First	No pathway for direct effects was identified as this European Site lies entirely outside of and >11km the Proposed Development site boundary. No surface water or habitat connectivity was identified between the Proposed Development and this SAC. Surface water from the Proposed Development site drains to the Deel (Raharney) River to the west and

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		order site-specific conservation objectives, version 1, 2022).	south of the site and to the Stonyford River to the east of the site, both of which discharge to the River Boyne which in turn flows east before discharging to the Irish Sea >70km downstream of the Proposed Development site. The site is not designated for ground-water dependent habitats or species and therefore no potential for indirect effects via groundwater pathways was identified. Given the absence of hydrological connectivity between the Proposed Development and the SAC and the distance between the Proposed Development and the SAC, no pathway for indirect effects on this European Site was identified. **There is no potential for significant effect on this European Site. It is not located within the Zone of Likely Impact and no further assessment is required**
Lough Lene SAC [002121] Distance from Proposed Development Site: 13km	• Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092]	Detailed conservation objectives for this site (Version 1, October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as these European Sites lie entirely outside of and >13km from the Proposed Development site. There is no hydrological connectivity between the Proposed Development and these SACs, which are located in a different surface water sub-catchment to the majority of the Proposed Development site. Given the absence of hydrological connectivity and the distance between the Proposed Development and these SACs, there is no potential for indirect effects on these European Sites.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			There is no potential for significant effects on these European Sites. They are not located within the Zone of Likely Impact and no further assessment is required
Lough Bane and Lough Glass SAC [002120] Distance from Proposed Development Site: 13.4km	• Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092]	Detailed conservation objectives for this site (Version 1, October 2021) were reviewed as part of the assessment and are available at www.npws.ie	
White Lough, Ben Loughs and Lough Doo SAC [001810] Distance from Proposed Development Site: 15.8km	• Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092]	Detailed conservation objectives for this site (Version 1, October 2021) were reviewed as part of the assessment and are available at www.npws.ie	
Boyne Coast and Estuary SAC [001957] Distance from Proposed Development Site: 48km >70km downstream	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • *Salicornia* and other annuals colonising mud and sand [1310] • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] • Mediterranean salt meadows (Juncetalia maritimi) [1410] • Embryonic shifting dunes [2110]	Detailed conservation objectives for this site (Version 1, October 2012) were reviewed as part of the assessment and are available at www.npws.ie	No pathway for direct effects was identified as this European Site lies entirely outside of and approximately 48km from the Proposed Development site boundary. The potential for the development to result in indirect effects on this European Site was considered. There is hydrological connectivity between the Proposed Development and this SAC via watercourses within and adjacent to the site boundary which discharge to the

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
	• Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] • Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]		Stonyford River to the east and the Deel (Raharney) River to the south-west. These in turn discharge to the River Boyne which in turn discharges to the SAC. The SAC is located >70km downstream of the Proposed Development Site and designated for coastal habitats. Given the significant distance between the development and the SAC, and the attenuation properties of the intervening watercourses, no potential for significant indirect effects on this European Site was identified. **There is no potential for significant effect on this European Site. It is not located within the Zone of Likely Impact and no further assessment is required**
Special Protection Area (SPA)			
River Boyne and River Blackwater SPA [004232] Distance from Proposed Development Site: 486m Approximately 1.1km downstream of the site boundary at the closest point	• Kingfisher (*Alcedo atthis*) [A229]	This site has the conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." (NPWS First order site-specific conservation objectives, version 1, 2022).	This European Site is located approximately 486m from the Proposed Development site boundary at its nearest point. Taking a precautionary approach, a potential pathway for direct effects on the SCI species kingfisher, where it occurs outside the SAC, as a result of ex-situ habitat loss within the Proposed Development site was identified. If Kingfisher nesting habitat is present within the Proposed Development site at the time of construction, there is potential for loss of this habitat during windfarm construction works. Taking a precautionary approach, a potential pathway for indirect effects on kingfisher as a result of disturbance during the construction phase of the development and collision risk during the operational

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			stage of the development was also identified and considered. There is hydrological connectivity between the Proposed Development and this SPA via watercourses within and adjacent to the site boundary which discharge to the Stonyford River to the east, the Deel (Raharney) River to the south-west, both of which are designated as part of the SPA at this location. The Proposed Development has the potential to cause deterioration in water quality due to run off of and infiltration of pollutants, including silt, hydrocarbons and cement-based products, during construction activities associated with the Proposed Development. These include construction of turbine hardstands, windfarm access roads, substations, borrow pits and amenity paths and associated carparks and other related activities. There is also potential for run-off of pollutants from turbine hardstand areas, access tracks and any other hard surfaces during the operational phase of the development as well as during activities associated with the decommissioning of the Proposed Development. Deterioration of water quality could potentially affect availability of food resources for kingfisher. The works along the proposed haul route will include temporary road widening works at three locations to facilitate turbine component delivery. Although there is no direct hydrological connectivity between these

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			works and the SPA, and the SPA or nearest watercourse with connectivity to the SPA is located >200m from any land take/road widening works, taking the precautionary approach, there is also potential for indirect effects on the SPA due to deterioration in water quality as a result of overland release of silt laden waters. **This SPA is therefore within the likely zone of impact and following the precautionary principle the potential for significant effect on the SPA exists. Further assessment is required.**
Lough Derravaragh SPA [004030] Distance from the Proposed Development Site: 14.8km northwest of the development site.	• Whooper Swan (*Cygnus cygnus)* [A038] • Pochard (*Aythya ferina*) [A059] • Tufted Duck (*Aythya fuligula*) [A061] • Coot (*Fulica atra*) [A125] • Wetland and Waterbirds [A999]	This site has the conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at lough Derravarragh SPA as a resource for the regularly-occurring migratory	There will be no direct effects as this European Site lies entirely outside of and >14km from the development footprint. There is no hydrological connectivity between the Proposed Development and the SPA which is located in a different surface water catchment to the Proposed Development. Therefore no potential for indirect effects on supporting wetland habitat for SCI of bird species due to deterioration in water quality exists. The Proposed Development site lies outside the core foraging distance of the SCI species Whooper swan (core range of <5km) as per Scottish Natural Heritage Guidelines (SNH, 2016) and following extensive bird surveys undertaken by MKO (detailed in Chapter 7

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		waterbirds that utilise it." (NPWS First order site-specific conservation objectives, version 1, 2022).	'Ornithology' of the EIAR which accompanies the planning application for the Proposed Development), there is no evidence to suggest that the Proposed Development site lies on a migratory/regular commuting route for this species. None of the other SCI species were recorded utilising the site in significant numbers and the site does not support significant suitable habitat for pochard or tufted duck. Taking the above into consideration and given the distance between the Proposed Development and the SPA, i.e. >13km, there is no potential for significant indirect disturbance or displacement effects on the SCI species for which the SPA is designated as a result of the Proposed Development. Similarly, taking the above into consideration, there is no potential for significant effects on the SCI species of the SPA due to increased collision risk during the operational stage of the Proposed Development. **There is no potential for significant effect on this European Site, it is not located within the Zone of Likely Impact and no further assessment is required**
Lough Owel SPA [004030] Distance from the Proposed Development Site:18.3km	• Coot (*Fulica atra*) [A125] • Shoveler (*Anas clypeata*) [A056] • Wetland and Waterbirds [A999]	This site has the conservation objective: "To maintain or restore the favourable conservation condition of	There will be no direct effects as this European Site lies entirely outside of and >18km from the development footprint. There is no hydrological connectivity between the Proposed Development and the SPA which is located

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (NPWS First order site-specific conservation objectives, version 1, 2022).	in a different surface water catchment to the Proposed Development. Therefore no potential for indirect effects on supporting wetland habitat for SCI of bird species due to deterioration in water quality exists. During the extensive bird surveys undertaken by MKO, shoveler was not recorded utilising the site and coot was recorded on just a single occasion. Give the absence of/small number of observations of these species and given the distance between the Proposed Development and the SPA there is no potential for significant indirect disturbance or displacement effects on the SCI species for which the SPA is designated as a result of the Proposed Development. Similarly, taking the above into consideration, there is no potential for significant effects on the SCI species of the SPA due to increased collision risk during the operational stage of the Proposed Development. **There is no potential for significant effect on this European Site, it is not located within the Zone of Likely Impact and no further assessment is required**
Lough Ennell SPA [004044] Distance from the Proposed Development Site: 19.8km	• Pochard (*Aythya ferina*) [A059] • Tufted Duck (*Aythya fuligula*) [A061] • Coot (*Fulica atra*) [A125] • Wetland and Waterbirds [A999]	This site has the conservation objective: "To maintain or restore the favourable conservation condition of	There will be no direct effects as this European Site lies entirely outside of and >19km from the development footprint.

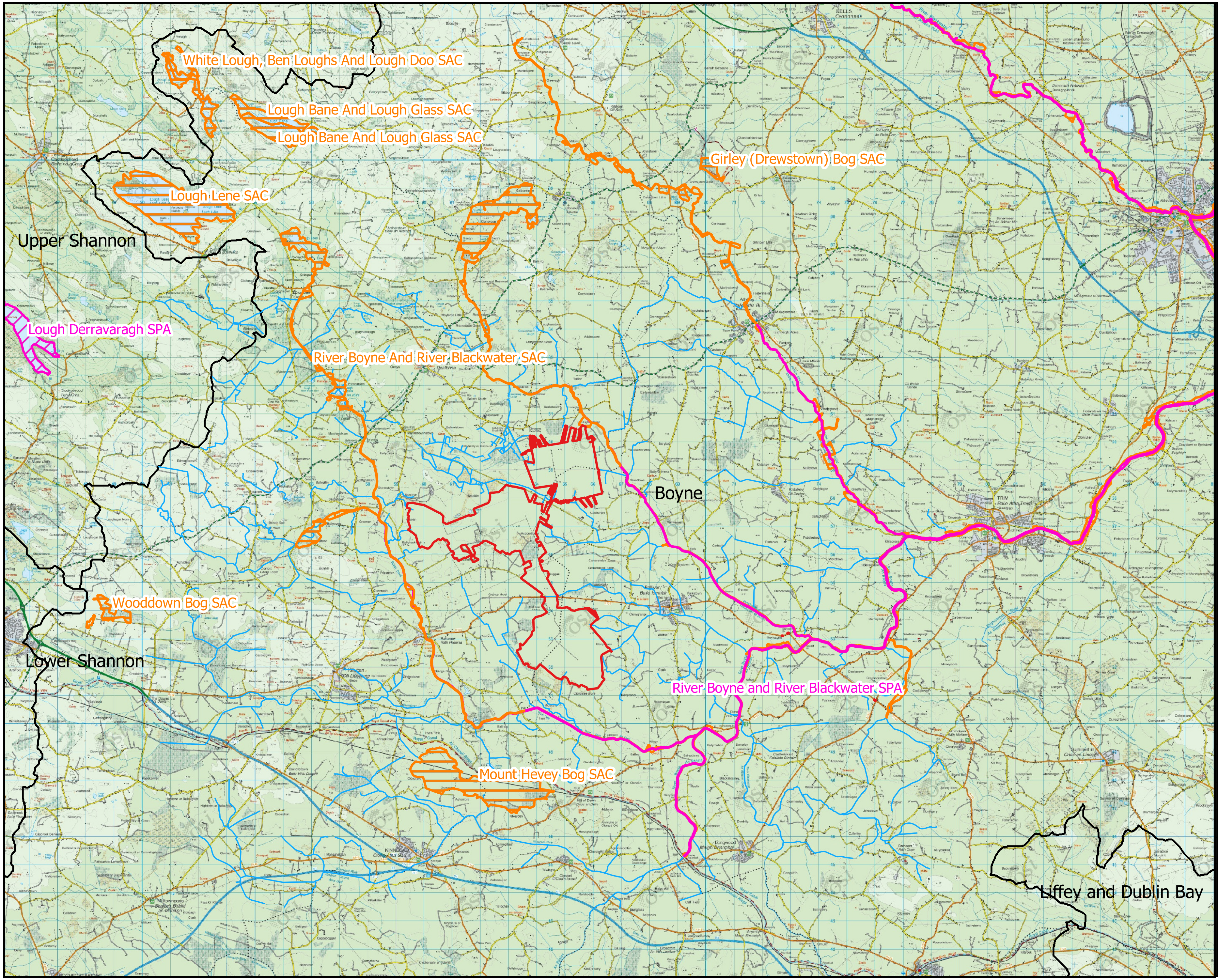
European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		the bird species listed as Special Conservation Interests for this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (NPWS First order site-specific conservation objectives, version 1, 2022).	There is no hydrological connectivity between the Proposed Development and the SPA which is located in a different surface water catchment to the Proposed Development. Therefore no potential for indirect effects on supporting wetland habitat for SCI of bird species due to deterioration in water quality exists. During the extensive bird surveys undertaken by MKO, pochard was not recorded utilising the site and coot and tufted duck were recorded only occasionally and in small numbers. Give the absence of/small number of observations of these species and given the distance between the Proposed Development and the SPA there is no potential for significant indirect disturbance or displacement effects on the SCI species for which the SPA is designated as a result of the Proposed Development. Similarly, taking the above into consideration, there is no potential for significant effects on the SCI species of the SPA due to increased collision risk during the operational stage of the Proposed Development. **There is no potential for significant effect on this European Site, it is not located within the Zone of Likely Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Garriskil Bog SPA [004102] Distance from the Proposed Development Site: 25.2km	• Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]	This site has the conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA." (NPWS First order site-specific conservation objectives, version 1, 2022).	There will be no direct effects as this European Site lies entirely outside of and >25km from the development footprint. There is no hydrological connectivity between the Proposed Development and the SPA which is located in a different surface water catchment to the Proposed Development. Therefore no potential for indirect effects on supporting wetland habitat for SCI of bird species due to deterioration in water quality exists. The Proposed Development site lies outside the core foraging distance of the SCI Greenland white-fronted goose (5-8km) as per Scottish Natural Heritage Guidelines (SNH, 2016) and the species was not recorded during the extensive bird surveys undertaken by MKO. Taking the above into consideration and given the distance between the Proposed Development and the SPA there is no potential for significant indirect disturbance or displacement effects on the SCI species for which the SPA is designated as a result of the Proposed Development. **There is no potential for significant effect on this European Site, it is not located within the Zone of Likely Impact and no further assessment is required.**
Lough Iron SPA [004046]	• Whooper Swan (*Cygnus cygnus*) [A038] • Wigeon (*Anas penelope*) [A050]	This site has the conservation objective:	There will be no direct effects as this European Site lies entirely outside of and >24km from the development footprint.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Distance from the Proposed Development Site: 24.4km	• Teal (*Anas crecca*) [A052] • Shoveler (*Anas clypeata*) [A056] • Coot (*Fulica atra*) [A125] • Golden Plover (*Pluvialis apricaria*) [A140] • Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] • Wetland and Waterbirds [A999]	"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Iron SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (NPWS First order site-specific conservation objectives, version 1, 2022).	There is no hydrological connectivity between the Proposed Development and the SPA which is located in a different surface water catchment to the Proposed Development. Therefore no potential for indirect effects on supporting wetland habitat for SCI of bird species due to deterioration in water quality exists. The Proposed Development site lies outside the core foraging distance of the SCI species Whooper swan (core range of <5km), golden plover (3km) and Greenland white-fronted goose (5-8km) as per Scottish Natural Heritage Guidelines (SNH, 2016). Following extensive bird surveys undertaken by MKO (detailed in Chapter 7 'Ornithology' of the EIAR which accompanies the planning application for the Proposed Development), there is no evidence to suggest that the Proposed Development site lies on a migratory/regular commuting route for whooper swan or golden plover. Greenland-white fronted goose was not recorded during the MKO bird surveys undertaken. None of the other SCI species were recorded utilising the site in significant numbers and the site does not support significant suitable habitat for wigeon, teal or shoveler. Taking the above into consideration and given the distance between the Proposed Development and the SPA there is no potential for significant indirect disturbance or displacement effects on the SCI species for which the SPA is designated as a result of the Proposed Development.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			Similarly, taking the above into consideration, there is no potential for significant effects on the SCI species of the SPA due to increased collision risk during the operational stage of the Proposed Development. **There is no potential for significant effect on this European Site, it is not located within the Zone of Likely Impact and no further assessment is required.**
Boyne Estuary SPA [004046] Distance from the Proposed Development Site: 47.3km >70km downstream	• Shelduck (*Tadorna tadorna*) [A048] • Oystercatcher (*Haematopus ostralegus*) [A130] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143 • Sanderling (*Calidris alba*) [A144 • Black-tailed Godwit (*Limosa limosa*) [A156] • Redshank (*Tringa totanus*) [A162] • Turnstone (*Arenaria interpres*) [A169] • Little Tern (*Sterna albifrons*) [A195] • Wetland and Waterbirds [A999]	Detailed conservation objectives for this site (Version 1, February 2013) were reviewed as part of the assessment and are available at www.npws.ie	No pathway for direct effects was identified as this European Site lies entirely outside of and approximately 47.3km from the Proposed Development site boundary. The potential for the development to result in indirect effects on this European Site was considered. There is hydrological connectivity between the Proposed Development and this SPA via watercourses within and adjacent to the site boundary which discharge to the Stonyford River to the east and the Deel (Raharney) River to the south-west. These in turn discharge to the River Boyne which in turn discharges to the SPA. The SPA is located >70km downstream of the Proposed Development site. Given the significant distance between the development and the SPA, and the attenuation properties of the intervening watercourses, no potential for significant indirect effects on this European Site due to deterioration of water quality was identified.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 22/03/2023)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			The site either lies outside the core foraging range (SNH 2016) or does not provide significant suitable habitat for the SCI species associated with the SPA. Therefore no potential for significant effects on the SPA as a result of disturbance or displacement of SCI species are anticipated. **There is no potential for significant effect on this European Site. It is not located within the Zone of Likely Impact and no further assessment is required**



Map Legend

- Propsoed Development site
- WFD Watercourses
- WFD Catchments
- Special Areas of Conservation (SACs)
- Special Protection Areas (SPAs)

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Drawing Title	
EU Designated Sites surrounding the Proposed Development site	
Project Title	
Proposed Ballivor Windfarm	
Drawn By	Checked By
PD	SM
Project No.	Drawing No.
191137	Figure 3-1
Scale	Date
1:175000	2023.03.24

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3.3 European Sites with the Potential to be Significantly Affected by the Proposed Development

The following European Sites have the potential to be significantly affected by the Proposed Development:

River Boyne and River Blackwater SAC

A potential pathway for direct effects on otter where the species occurs outside the SAC as a result of ex-situ habitat loss within the Proposed Development site boundary was identified. A potential pathway for indirect effects on otter as a result of disturbance during construction activities was also identified.

There is hydrological connectivity between the Proposed Development and this SAC via watercourses within and adjacent to the site boundary which discharge to the Stonyford River to the east and the Deel (Raharney) River to the south-west both of which are designated as part of the SAC at this location.

Taking a precautionary approach, the proposed works have the potential to cause deterioration in water quality during the construction, operational and decommissioning phases of the development potentially affecting the following aquatic QIs:

- Alkaline fens [7230]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]
- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Salmo salar* (Salmon) [1106]
- *Lutra lutra* (Otter) [1355]

River Boyne and River Blackwater SPA

A potential pathway for direct effects on kingfisher where the species occurs outside the SPA as a result of ex-situ habitat loss within the Proposed Development site boundary was identified. Taking a precautionary approach a potential pathway for indirect effects on kingfisher as a result of disturbance during the construction phase and collision risk during the operation phase of the development was also identified

There is hydrological connectivity between the Proposed Development and this SPA via watercourses within and adjacent to the site boundary which discharge to the Stonyford River to the east and the Deel (Raharney) River to the south-west both of which are designated as part of the SPA at this location.

Taking a precautionary approach, the Proposed Development has the potential to cause deterioration in water quality during the construction, operational and decommissioning phase of the development potentially affecting availability of food resources for kingfisher.

3.4 Likely Cumulative Impact of the Proposed Works on European Sites, in-combination with other plans and projects

A search and review in relation to plans and projects that may have the potential to result in cumulative and/or in-combination impacts on European Sites was conducted. This included a review of online Planning Registers, development plans and other available information and served to identify past and future plans and projects, their activities and their predicted environmental effects.

3.5 Development context – Ecological Plans and Policies

The following development plans have been reviewed and taken into consideration as part of this assessment:

- Westmeath County Development Plan 2021 – 2027
- Meath County Development Plan 2021-2027
- National Biodiversity Action Plan 2017-2021
- Regional Spatial and Economic Strategy, Eastern and Midland Regional Assembly 2019-2021
- County Westmeath Biodiversity Action Plan 2014-2020
- County Meath Biodiversity Plan 2015-2020

The review focused on policies and objectives that relate to Natura 2000 sites and natural heritage. Policies and objectives relating to sustainable land use were also reviewed.

Table 3-2 Review of Plans

Plans	Key Policies and Objectives directly related to European Sites and Biodiversity in the Zone of Influence	Assessment of Potential Impact on European Sites
Westmeath County Development Plan 2021-2027	In relation to Natural Heritage and Green Infrastructure, the aim of the Development Plan is to: *Continue to protect and enhance the County's natural heritage and biodiversity and ensure that networks of green infrastructure are identified, created, protected and enhanced to provide a wide range of environmental, social and economic benefits to communities.* **Policies: Natural Heritage** It is the policy of the Council to: **CPO 12.1** - Contribute as appropriate towards the protection of designated sites in compliance with relevant EU Directives and applicable national legislation **CPO 12.2** - Support the implementation of any relevant recommendations contained in the National Biodiversity Plan, the All-Ireland Pollinator Plan and the National Peatlands Strategy. **Policies: Natura 2000** It is a policy of the Council to: **CPO 12.4** - Protect and conserve Special Areas of Conservation, candidate Special Areas of Conservation, Special Protection Areas and candidate Special	The Development plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the plans listed here. This will be assessed in further detail in a Natura Impact Statement (NIS). Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.

	Protection Areas, designated under the EU Birds and Habitats Directives respectively. **CPO 12.5** - Ensure that no plans, programmes, etc. or projects giving rise to significant cumulative, direct, indirect or secondary impacts on European Sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either individually or in combination with other plans, programmes, etc. or projects).* **CPO 12.6** - Ensure that any plan or project that could have a significant adverse impact (either by themselves or in combination with other plans and projects) upon the conservation objectives of any Natura 2000 Site or would result in the deterioration of any habitat or any species reliant on that habitat will not be permitted.* ** Except as provided for in Article 6(4) of the Habitats Directive, viz. There must be a) no alternative solution available, b) imperative reasons of overriding public interest for the project to proceed; and c) Adequate compensatory measures in place.* **Policies: Rare and Protected Sites** It is a policy of the Council to: **CPO 12.13** - Protect, manage, and enhance the natural heritage, biodiversity, landscape and environment of County Westmeath, in recognition of its importance as both a non-renewable resource and a natural asset. **CPO 12.18**	

	- Consult with the National Parks and Wildlife Service (NPWS) in regard to any developments (those requiring permission and those not requiring planning permission) which the Council proposes to carry out within pNHAs, NHAs, SACs, SPAs, and other important ecological sites. **Policies: Invasive species** It is a policy of the Council to: **CPO 12.27** - Prevent the spread of invasive species within the plan area, including requiring landowners and developers to adhere to best practice guidance in relation to the control of invasive species. **CPO 12.29** Support, as appropriate, the National Parks and Wildlife Service's efforts to seek to control and manage the spread of non-native invasive species on land and water. Where the presence of non-native invasive species is identified at the site of any Proposed Development or where the proposed activity has an elevated risk of resulting in the presence of these species, details of how these species will be managed and controlled will be required.	
Meath County Development Plan 2021-2027	**Policies and Objectives: Biodiversity** **HER POL 27** - To protect, conserve and enhance the County's biodiversity where appropriate **HER POL 28**	The Development plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the plans listed here. This will

	- To integrate in the development management process the protection and enhancement of biodiversity and landscape features wherever possible, by minimising adverse impacts on existing habitats (whether designated or not) and by including mitigation and/or compensation measures, as appropriate. **HER POL 31** - To ensure that the ecological impact of all development proposals on habitats and species are appropriately assessed by suitably qualified professional(s) in accordance with best practice guidelines – e.g. the preparation of an Ecological Impact Assessment (EcIA), Screening Statement for Appropriate Assessment, Environmental Impact Assessment, Natura Impact Statement (NIS), species surveys etc. (as appropriate). **HER OBJ 30** - To implement, in partnership with the Department of Culture, Heritage and the Gaeltacht, relevant stakeholders and the community, the objectives and actions of Ireland's National Biodiversity Action Plan 2017 - 2021 which relate to the remit and functions of Meath County Council. **HER OBJ 31** - To implement, in partnership with the Department of Culture, Heritage and the Gaeltacht, relevant stakeholders and the community, the objectives and actions of the County Meath Biodiversity Plan 2015-2020 and any revisions thereof **HER OBJ 32** - To actively support the implementation of the All Ireland Pollinator Plan 2021-2025 and any revisions thereof.	be assessed in further detail in a Natura Impact Statement (NIS). Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.

	Policies and Objectives : Sites Designated for Nature Conservation **HER POL 32** - To permit development on or adjacent to designated Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas, Statutory Nature Reserves or those proposed to be designated over the period of the Plan, only where the development has been subject to the outcome of the Appropriate Assessment process and has been carried out to the satisfaction of the Planning Authority, in consultation with National Parks and Wildlife. **HER POL 33** - To have regard to the views and guidance of the National Parks and Wildlife Service in respect of Proposed Development where there is a possibility that such development may have an impact on a designated European or National site or a site proposed for such designation. **HER POL 34** - To undertake appropriate surveys and collect data to provide an evidence-base to assist the Council in meeting its obligations under Article 6 of the Habitats Directives (92/43/EEC) as transposed into Irish Law, subject to available resources. It is an objective of the Council: **HER OBJ 33** - To ensure an Appropriate Assessment in accordance with Article 6(3) and Article 6(4) of the Habitats Directives (92/43/EEC) and in accordance with the Department of Environment, Heritage and Local Government Appropriate	

	Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities, 2009 and relevant EPA and European Commission guidance documents, is Meath County Development Plan 2021-2027 Chapter 8 carried out in respect of any plan or project not directly connected with or necessary for the management of the site but likely to have a significant effect on a Natura 2000 site(s), either individually or in-combination with other plans or projects, in view of the site's conservation objectives. **HER OBJ 34** › To protect and conserve the conservation value of candidate Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas and proposed Natural Heritage Areas as identified by the Minister for the Department of Culture, Heritage and the Gaeltacht and any other sites that may be proposed for designation during the lifetime of this Plan in accordance with the provisions of the Habitats and Birds Directives and to permit development in or affecting same only in accordance with the provisions of those Directives as transposed into Irish Law. **Policies and Objectives : Non-Designated Sites** **HER POL 35** › To ensure, where appropriate, the protection and conservation of areas, sites, species and ecological/networks of biodiversity value outside designated sites and to require an appropriate level of ecological assessment by suitably qualified professional(s) to accompany development proposals likely to impact on such areas or species.	

	Policies and Objectives: Protected Species **HER POL 36** - To consult with the National Parks and Wildlife Service and take account of their views and any licensing requirements, when undertaking, approving or authorising development which is likely to affect plant, animal or bird species protected by law. **HER OBJ 35** - To ensure that development does not have a significant adverse impact, incapable of satisfactory avoidance or mitigation, on plant, animal or bird species protected by law. **Policies and Objectives: Peatlands** **HER POL 45** - To ensure that peatland areas which are designated (or proposed for designation) as NHAs, SACs or SPAs are conserved for their ecological, climate regulation, archaeological, cultural and educational significance. **HER OBJ 39** - To work in partnership with relevant stakeholders on a suitable peatland site(s) to demonstrate best practice in sustainable peatland conservation, management and restoration techniques and to promote their heritage and educational value subject to Ecological Impact Assessment and Appropriate Assessment Screening, as appropriate, having regard to local and residential amenities.	

National Biodiversity Action Plan 2017-2021	**Objective 6: Expand and improve management of protected areas and species** Target 6.2 - Sufficiency, coherence, connectivity and resilience of the protected areas network substantially enhanced by 2020.	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. In addition the draft National Biodiversity Action Plan (2023 – 2027) available for public consultation was also reviewed in relation to objectives and targets relation to European Sites. Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the plans listed here. This will be assessed in further detail in a Natura Impact Statement (NIS). Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites. No potential for negative cumulative impacts when considered in combination with the current proposal were identified
Regional Spatial and Economic Strategy, Eastern and Midland Regional Assembly 2019-2021	**Biodiversity and Natural Heritage** Regional Policy Objective (RPO) 7.16 - Support the implementation of the Habitats Directives in achieving an improvement in the conservation status of protected species and habitats in the Region and to ensure alignment between the core	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. Where the potential for significant effects on European Sites has been identified in Table 3-1

	objectives of the EU Birds and Habitats Directives and local authority development plans RPO 7.17: Facilitate cross boundary co-ordination between local authorities and the relevant agencies in the Region to provide clear governance arrangements and coordination mechanisms to support the development of ecological networks and enhanced connectivity between protected sites whilst also addressing the need for management of alien invasive species and the conservation of native species.	above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the plans listed here. This will be assessed in further detail in a Natura Impact Statement (NIS). Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.
County Meath Biodiversity Action Plan 2015-2020	**Objective 1**: To raise awareness of biodiversity in Meath, its value and the issues facing it **Objective 2:** To better understand the biodiversity of Meath **Objective 3:** To conserve and enhance habitats and species in Meath, taking account of national and local priorities **Objective 4:** To foster active participation to help biodiversity in Meath, encouraging a partnership approach to help our species and habitats The specific actions in relation to the above listed biodiversity objectives set out in Section 8 of the plan were reviewed and taken into consideration in this assessment.	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the plans listed here. This will be assessed in further detail in a Natura Impact Statement (NIS). Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.

County Westmeath Biodiversity Action Plan 2014-2020	The Actions outlined in the plan for Westmeath County Council in relation to biodiversity fall under 3 main categories: • Protection and Development of the Ecological Network • Monitoring and Research • Raising Awareness The actions outlined in Chapter 6 of the plan were reviewed and taken into consideration in this cumulative assessment.	The plan was reviewed, with particular reference to Policies and Objectives that relate to European Designated Sites. Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the plans listed here. This will be assessed in further detail in a Natura Impact Statement (NIS). Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.

3.6 Other Projects

3.6.1 Applications within and adjacent to the Proposed Development Site

Planning applications which are recorded as being within the planning application redline boundary are set out in Table 3-3.

Industrial scale peat extraction was permanently ceased by the applicant within the Ballivor Bog Group in June 2020. Decommissioning and maintenance activities associated with the removal of existing peat stockpiles from the Bog Group and the Applicant's statutory duties to discharge the conditions of its Integrated Pollution Control Licence (IPC) Licence (Ref. P0501-01) from the Environmental Protection Agency (EPA) for the Derrygreenagh Bog Group, which in part comprises the Ballivor Bog Group, remain on-going. The on-going decommissioning and maintenance activities ensure compliance with the Applicant's extant IPC Licence and the post-peat extraction rehabilitation of the Ballivor Bog Group.

A number of peatland restoration measures have been undertaken or are proposed for the lands within and adjacent the Proposed Development site boundary. Draft cutaway bog rehabilitation and decommissioning plans for each bog of the Derrygreenagh Bog Group, within which the Proposed Development site boundary is located , have been prepared to meet the requirements of Condition 10 of the IPC licence for the Derrygreenagh Bog Group. These draft plans will be agreed by the EPA prior to implementation. The aim of the rehabilitation plans is to stabilise and rehabilitate the peatland habitats within the site and it is proposed that natural recolonisation will form the basis for the environmental stabilisation of these areas. Re-wetting through drain blocking will also be a rehabilitation strategy. The rehabilitation plans will contribute to improving the overall condition of peatland habitats within the Proposed Development site as well as to improving the quality of water discharging from the site as water quality of discharges from restored peatlands generally improve as a result of bog restoration measures (Bonn et al. 2017).

Peatland Climate Action Scheme (PCAS) peatland restoration measures were carried out at Carranstown East, adjacent to the Proposed Development site boundary in 2022. This form of enhanced peatland rehabilitation, which is above and beyond what is required under IPC licence was completed in 2022. Bracklin West, also adjacent to the Proposed Development site boundary, has been selected for PCAS and it is expected to commence in 2023.

The PCAS scheme is supported by Government through the Climate Action Fund and Ireland's National Recovery and Resilience Plan administered by the Department of Environment, Climate and Communications (DECC). Please see https://www.bnmpcas.ie/ for details. The National Parks and Wildlife Service (NPWS) acts as the Scheme regulator and there is ongoing engagement with the EPA. This scheme is in addition to the IPC licence requirements and does not form part of the Proposed Development planning application.

An Application for Leave to apply for Substitute Consent for peat extraction and all peat extraction related activities that have been and are currently being carried out within the Ballivor Bog Group (Ballivor, Carranstown, Bracklin, Lisclogher and Lisclogher West bogs) has been made by Bord na Móna to An Bord Pleanála. The substitute consent application will be accompanied by an EIAR, AASR and NIS which will assess the impacts that historical peat extraction activities are likely to have had on biodiversity and Designated Sites. The reports will also assess the potential impacts of the implementation of the proposed rehabilitation plans (referred to above) for the Ballivor Bog Group, required under Condition 10 of its EPA Licence P0501-01.

Table 3-3 Applications within and adjacent to the Proposed Development site boundary

Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
Westmeath	83382	01/01/1983	Bulk loading facility	Grangemore, Raharney	Conditional
Westmeath	90554	18/11/1990	Extension to storage facilities	Grangemore, Raharney	Conditional
Westmeath	8814	01/01/1988	Erect tea centre	Grangemore, Raharney	Conditional
Westmeath	052348	01/11/2005	To construct a 10/20kv ESB substation, to service Ballivor horticulture factory	Grangemore, Raharney	Conditional
Westmeath	082218	12/09/2008	The extension of use of an existing quarry granted under planning reference 04/2153 for the extraction of sand and gravel on approximately 3.65 hectares. Permission also sought for reinstatement of the quarry to existing ground level with suitable materials, existing road access and entrance and all associated site works and services	Riverdale, Raharney	Conditional

Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
Westmeath	092084	14/07/2009	The erection of a 30m high antenna support structure with 3 no. Panel antennas & 3 no. Dishes with the development forming part of the National Broadband Scheme (NBS)	Grangemore , Raharney	Conditional
Westmeath	092084	14/07/2009	The erection of a 30m high antenna support structure with 3 no. Panel antennas & 3 no. Dishes with the development forming part of the National Broadband Scheme (NBS)	Grangemore, Raharney (adjacent to the subject site)	Conditional
Westmeath	122067	05/12/2012	Laying two intersecting grass strips, 150m x 7m and 75m x 7m, for use as a take-off and landing area for model aircraft and a grass area, 10m x 30m for car parking	Ballyhealy / Ballinure & Bracklyn (adjacent to the subject site)	Conditional
Meath	TA130056	01/02/2013	Continuance of an existing 30m lattice tower structure carrying telecommunications equipment, associated equipment container with palisade	Killaconnigan, Ballivor	Conditional

Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
			fencing as previously granted under Local Authority reference TA70722		
Westmeath	146082	05/06/2014	Permanent Retention Permission for existing 30m Multiuser Support Structure, carrying associated telecommunications equipment, associated equipment cabinet and Permission for additional telecommunications equipment and cabinet, all within existing secure compound, including access track	Grangemore Td, Raharney	Conditional
Meath	TA140615	16/07/2014	Retention of an existing 30-metre-high telecommunications support structure carrying antennas and link dishes together with associated equipment containers and security fencing which was previously granted under planning reference TA900185	Killaconnigan, Ballivor	Conditional

Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the projects listed in Table 3-3 above. This will be assessed in further detail in a Natura Impact Statement (NIS).

Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for significant cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.

3.6.2 Wind Energy Applications Within 25km of the Proposed Development

On a precautionary basis a 25km zone of influence was used to identify wind farm developments in the wider area. The Wind Energy Development Guidelines (2006) recommend a 20km zone of influence is used from the Proposed Development site boundary. There are no wind energy developments within 25km of the Proposed Development. The following permitted and proposed wind energy developments (Table 3-4) are located within 25km of the Proposed Development site and considered in this cumulative impact assessment.

Table 3-4 Wind Energy Applications within 25km of the Proposed Development Site

Permitted Windfarms within 25km from subject site								
Wind Farm	**Pl. Ref.**	**Applicant**	**Lodgement**	**Description**	**Location**	**Local Authority Decision**	**Appeal/ABP decision**	**Operational Status**
Bracklyn	PA25M.311565	Bracklyn Wind Farm Limited	05/10/2021	Proposed 11 no turbine wind farm and 110kVloop-in/loop-out electricity substation	Bracklyn, Co. Westmeath (0.5km – 5km)	SID app	ABP – Conditional (07/07/2022)	No
Yellow River	PA19.PA0032	Greenwind Energy (Wexford) Ltd	28/11/2013	A 15 year permission for 32 turbines with a total height of 166m.	Derryarkin and other townlands – to the north of Rhode, Co. Offaly (c. 15.5 km southwest)	SID app	ABP Conditional (03/06/2014)	No
Cushaling /Cloncant	PL19.306924	Cloncant Renewable Energy Limited	18/03/2020	10-year planning permission with a 30-year operational life. The development will consist of up to 8 (eight) wind turbines. An Environmental Impact Assessment Report (EIAR) and A Natura Impact Statement (NIS) has been prepared in respect of the application	Ballykilleen Shean Kilcumber Cloncant & Cushaling , Edenderry , Co Offaly (24.1km South)	Refuse 21/02/2020 Offaly County Council	Grant 23/09/2020 ABP	Under Construction

Permitted Windfarms within 25km from subject site								
Cloncreen	PA19.PA0047	Bord Na Móna Powergen Ltd	27/10/2016	Proposed Cloncreen Wind Farm comprising up to 21 no. Wind Turbines and all associated works	Esker More, Clongarret, Cloncreen, Ballykilleen, Ballynakill, Ballinrath, Rathvilla or Rathclonbrackan, Ballina and Ballingar, County Offaly (24.5km South)	SID Application	Grant 03/05/2017 ABP	Yes
Proposed Windfarms within 25km of subject site in pre-planning or early stage consultation								
Miltown Pass	N/A	Statkraft	N/A	Proposed 7 no. turbines and underground connection to Clonfad Substation (via public consultation website https://milltownpasswindfarm.ie/ accessed on 2023.02.23)	Miltown Pass, Co. Westmeath (c. 17 km southwest)	N/A	N/A	N/A
Knockanarragh	N/A	Statkraft	N/A	Up to 8 no Turbines – via. public consultation website https://knockanarraghwindfarm.ie/	Newtown, Carnybrogan, Cavestown and Rosmead Co. Meath and Co. Westmeath. (c. 10km northwest)	N/A	N/A	N/A

Permitted Windfarms within 25km from subject site								
				accessed on 2023.02.23				
Ballydermot	ABP 310143-21	Bord na Móna Powergen Ltd.	N/A	Construction of a wind energy development comprising approximately 50-55 no. wind turbines.	Ballydermot and other townlands, Co. Offaly and Lullybeg and other townlands, Co. Kildare.	Pre-application consultation	N/A	N/A

Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the projects listed in Table 3-4 above. This will be assessed in further detail in a Natura Impact Statement (NIS).

Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for significant cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.

4.1.2 Applications within the Vicinity of the Wind Farm

Planning applications within the vicinity of the Proposed Development were collated following a review of the Meath and Westmeath County Council planning portals. Records of An Board Pleanála and the Department of Agriculture, Forestry and the Marine websites were also searched for other relevant planning applications and licences.

Applications within the vicinity of the proposed wind farm are predominately for the development of the following:

- Quarrying,
- Agriculture,
- Forestry,
- Renewable energy (including the permitted Bracklyn Wind Farm),
- Private turbary
- One off housing

A list of applications within the wider area is included in Appendix 1.

Where the potential for significant effects on European Sites has been identified in Table 3-1 above, there is potential for the Proposed Development to result in cumulative effects on those European Sites when considered in combination with the projects listed in Appendix 1. This will be assessed in further detail in a Natura Impact Statement (NIS).

Where no pathway for effect on a particular European Site was identified in Table 3-1 above, no source-pathway-receptor chain for significant cumulative effects on these sites have been identified and no further assessment is required in relation to these European Sites.

5. ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING STATEMENT AND CONCLUSIONS

5.1 Concluding Statement

Following an examination, analysis and evaluation of the relevant data and information set out within this Appropriate Assessment Screening Report, it cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the Proposed Development, individually or in combination with other plans and projects, would be likely to have a significant effect on the following sites:

- River Boyne and River Blackwater SAC
- River Boyne and River Blackwater SPA

No potential for significant effects on any other European Site as a result of the Proposed Development was identified.

As a result of the potential identified for significant effects on the above listed European Sites, an Appropriate Assessment is required, and a Natura Impact Statement shall be prepared in respect of the Proposed Development in order to assess whether the Proposed Development will adversely impact the integrity of these European Sites.

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APPENDIX 1

Planning Applications

PLANNING HISTORY

Table 3-5 Planning Applications Within the Vicinity of the Proposed Development Site

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Meath	TA170047	23/01/2017	A single storey dwelling, a detached domestic garage, a proprietary domestic effluent treatment system, shared site entrance previously granted under Ref. TA/130317 and all associated site works	Coolronan, Ballivor	Conditional
Meath	TA170178	23/02/2017	Construction of a new club house, the development of training and playing pitches all with access road through pre-existing shared entrance, overall parking facilities, connection to public sewer and public watermain, the provision of a deep bore well.	Ballivor Gaelic Football Club, Killaconnigan, Ballivor	Conditional
Westmeath	176101	04/04/2017	Construction of a three bay cattle shed with ancillary facilities	Craddanstown, Raharney	Conditional
Westmeath	176129	26/04/2017	To demolish existing habitable dwelling and construct a new single storey replacement dwelling	Lisclogher Great, Delvin	Conditional
Westmeath	176145	12/05/2017	New storey and a half type dwelling house, domestic garage	Bellvue, Grangemore, Raharney	Conditional
Westmeath	176190	29/06/2017	New milking parlour and dairy and associated meal bin and new holding yard and all ancillary site works	Crowinstown Great, Delvin	Conditional
Meath	TA170809	11/07/2017	Conversion and extension to existing detached garage area, to include new home studio/office/workshop for collection/restoration of musical equipment, (a small-scale home based economic activity)	Ballynadrimna, Athboy	Conditional
Westmeath	176251	06/09/2017	Construction of a storey and half dwelling	Lisclogher Great, Delvin	Conditional
Meath	TA171125	27/09/2017	A new two storey type dwelling house, domestic garage	Big Ballivor, Ballivor	Conditional
Westmeath	176309	01/11/2017	Construction of an extension circa 925 sqm to the north western end of their existing clubhouse.	Billistown, Delvin	Conditional
Westmeath	176314	03/11/2017	Construction of a new two storey dwelling, domestic garage	Rathrass, Raharney	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Westmeath	176323	13/11/2017	Construction of a new two storey dwelling, domestic garage	Grangemore, Raharney	Conditional
Meath	TA171436	13/12/2017	Demolition of existing dwelling and domestic sheds on the site and construction of a replacement single storey dwelling, domestic garage	Croboy, Hill of Down	Conditional
Meath	TA180421	30/04/2018	A single storey dwelling, a detached domestic garage	Clonycavan, Ballivor	Conditional
Meath	TA180485	11/05/2018	Extension of duration of planning permission TA130317 - Single storey dwelling, detached domestic garage	Coolronan, Ballivor	Conditional
Westmeath	186211	06/07/2018	Permission for a dormer style bungalow dwelling	Balrath South, Delvin	Conditional
Westmeath	186246	15/08/2018	To develop an existing entrance and upgrade it to forestry harvesting standard(bell mouth entrance) onto public road to facilitate access to factory plantation	Bracklin, Delvin	Conditional
Westmeath	186322	25/10/2018	Demolition of existing dungstead, b) construction of an agricultural building to include Cubicles and underground slatted slurry tanks, c) construction of a Milking Parlour, Dairy & Ancillary Rooms, Livestock Waiting Yard, Livestock Handling Facilities	Craddanstown, Raharney	Conditional
Westmeath	186354	22/11/2018	Construction of a two storey dwelling, detached domestic garage & store	Bracklyn, Delvin	Conditional
Westmeath	196079	21/03/2019	Demolition of existing sunroom (21sqm), construction of single storey "granny flat" extension to north side (104sqm), single storey extension to south (36sq	Earlsmeadow, Lisclogher Little, Delvin	Conditional
Meath	TA190457	16/04/2019	The erection of a new 30.05m multiuser telecommunications support structure carrying 9 no. antennas and associated remote radio units. 6 no. communication dishes. 3 no. lighting finials and 7 no. outdoor cabinets, all enclosed within a security compound	Ballivor GAA Club, Killaconnigan, Ballivor	Conditional
Westmeath	196104	18/04/2019	Construction of a new two storey type dwelling, domestic garage	Grangemore, Raharney	Conditional
Westmeath	196155	13/06/2019	Two storey dwelling, associated domestic garage	Lisclogher Little, Delvin	Conditional
Westmeath	196174	27/06/2019	Private dwelling house	Craddenstown, Raharney	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
Westmeath	196197	18/07/2019	Provision of a two storey traditional farmhouse type dwelling & domestic use shed	Riverdale, Raharney	Conditional
Westmeath	196200	19/07/2019	Demolition of a vacant house and outbuildings and replace with a new two storey dwelling and detached garage	Balrath North, Delvin	Conditional
Westmeath	196211	02/08/2019	A dwelling, domestic garage	Addinstown, Delvin	Conditional
Meath	TA191441	31/10/2019	Erection of a new 30.05m multi-user telecommunications support structure carrying 9No. antennas and associated remote radio units, 6No. communications dishes, 3No. lighting finials and 7No. outdoor cabinets all enclosed within a security compound	Ballivor GAA Club, Killaconnigan, Ballivor	Conditional
Meath	TA191807	23/12/2019	Single storey dwelling, detached domestic garage	Killaconnigan , Ballivor	Conditional
Westmeath	206001	06/01/2020	To demolish existing single storey cottage, decommission an existing septic tank and erect storey-and-a-half style house	Castletown, Delvin	Conditional
Meath	TA200054	21/01/2020	A single-storey dwelling house, a detached domestic garage	Coolronan , Ballivor	Conditional
Meath	TA200231	25/02/2020	Planning permission is sought for retention and completion of a 2 storey dwelling, retention of foundations / floor slab level and completion of a new 2 storey house with waste water treatment system and all associated site works	Ballynadrimna, Athboy	Conditional
Westmeath	206053	13/03/2020	Construction of a 4-bay dry stock shed and a slatted shed incorporating cattle cubicles	Addinstown,, Delvin	Conditional
Westmeath	206054	13/03/2020	Construction of an 83.9 sq.m extension to existing storey and a half type dwelling and all ancillary site services.	Craddenstown, Raharney	Conditional
Meath	TA200857	03/07/2020	A two storey dwelling	Coolronan, Ballivor	Conditional
Westmeath	206179	14/07/2020	A private dwelling house & domestic garage and carport	Riverdale, Raharney	Conditional
Meath	TA201167	28/08/2020	Construction of detached single storey dwelling & domestic garage	Carranstown Great, Ballivor	Withdrawn
Meath	TA201180	31/08/2020	Construction of a new build two storey dwelling, connecting to existing two storey dwelling.	Condalee More, Hill Of Down	Refused
Meath	TA201217	04/09/2020	Change of house type from a single storey type dwelling to a storey and a half type dwelling and revisions to the site layout plan as previously granted under planning ref TA170047 and all associated site works	Coolronan, Ballivor	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Westmeath	206242	11/09/2020	One No. residential dwelling consisting of two part single, one part two-storey house, associated garage/shed/workshop	Mucklin, Delvin	Conditional
Westmeath	206331	25/11/2020	Construct dormer type house, domestic garage, site entrance & wastewater unit	Ballynacor, Delvin	Conditional
Meath	TA201841	02/12/2020	A single storey dwelling with domestic double garage	Carranstown Great, Ballivor	Withdrawn
Westmeath	206359	17/12/2020	Demolition of existing single storey dwelling, agricultural shed and domestic shed, and the construction of a single storey replacement dwelling and domestic garage	Balrath North, Delvin	Conditional
Meath	21129	25/01/2021	The proposed development will consist of; construct a two storey style dwelling and detached domestic garage, form new entrance from public road, install waste water treatment system and percolation area, together with all associated site works	Pluckstown, Athboy	Refused
Westmeath	2150	08/02/2021	Construct a new storey and a half type dwelling & domestic garage	Grangemore, Raharney	Conditional
Meath	21281	15/02/2021	Development consists of a Sheep Shed with Sheep Handling Yard, Meal Storage Bin, Concrete Apron, Farm Access Road, Agricultural Entrance and all site works	Woodtown West, Athboy	Conditional
Meath	21847	05/05/2021	A two-storey dwelling & domestic garage	Carranstown Great, Ballivor	Refused
Meath	21930	14/05/2021	The construction of a dwelling, garage, proprietary waste water treatment system and percolation area, new entrance and all associated services	Baskinagh Upper, Athboy	Conditional
Meath	211274	02/07/2021	The construction of 4 bay slatted shed for agricultural use and all associated site works	Clonycavan, Balivor	Conditional
Meath	211594	16/08/2021	Construction of a single storey dwelling, domestic garage, wastewater treatment system, well, change of use of existing agricultural entrance to domestic entrance and associated site works	Clondalee Beg, Hill Of Down, Enfield	Conditional
Westmeath	21401	03/09/2021	Erection of a slatted shed, roofed dungstead, silage slab and ancillary site works (extension of duration)	Belvue, Grangemore	Conditional
Westmeath	21574	27/10/2021	Two storey/dormer dwelling with new site entrance, septic tank/treatment unit, percolation area and all associated site works.	Addinstown, Devlin	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Westmeath	21380	01/11/2021	Permission to construct a single storey dwelling & install a proprietary wastewater treatment system and all associated site development works	Clonmorrill, Delvin	Conditional
Westmeath	21620	18/11/2021	Retention permission for continued use of an existing Guyed Wind Monitoring Mast with instruments, 100m in height on its lands at Lisclogher Bog, Lisclogher Great, Co. Westmeath for a further period of three years. The purpose of the mast is to assess the suitability of the company's adjacent lands for wind farm development. Previous planning application reference number 16/6259 refers.	Lisclogher Bog, Lisclogher Great.	Conditional
Meath	212235	26/11/2021	The development will consist of the retention of 1: minor variations made to single-storey dwelling and detached domestic garage at the time of construction and minor re-location of both and 2: revised site boundaries previously granted under p.82/424.	Woodtown West, Athboy	Conditional
Meath	212272	02/12/2021	The demolition of the existing single storey dwelling along with the decommissioning of the existing septic tank, the construction of a single storey replacement dwelling, a new wastewater disposal system, upgrade of the existing agricultural entrance t	Inan, Hill Of Down, Enfield	Conditional
Westmeath	21659	13/12/2021	A private dwelling house, proprietary effluent treatment system and percolation area, domestic garage, entrance onto public road and all ancillary site services	Craddenstown, Raherney	Conditional
Meath	212428	30/12/2021	Renovation of the existing dwelling and the construction of a new connecting two storey dwelling, upgrading of the existing entrance to facilitate entrance piers and gates, the installation of a packaged wastewater treatment system and polishing filter, and associated site works	Clondalee, Hill of Down	Conditional
Westmeath	2257	11/02/2022	To construct a new storey and a half type dwelling, domestic garage, installation of a new septic tank & percolation area, new vehicular entrance and all associated ancillary site services	Grangemore, Raharney	Conditional
Westmeath	2259	14/02/2022	Construct one number detached single storey dwelling, one number detached single storey garage, to create new entrance to public road, to connect to public watermain, to install a septic tank and percolation area and all associated site works	Ballynacor, Delvin	Refused
Meath	22186	14/02/2022	To retain and complete the construction of a recessed domestic entrance, a road frontage boundary wall and decorative masonry garden features. the	Cloneygrange, Ballivor	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
			development also includes permission to decommission the existing septic tank and percolation area and re		
Westmeath	22250	13/05/2022	Construct a two storey dwelling with detached domestic garage & store, install a proprietary wastewater treatment system and all associated site development works	Craddenstown, Raherney	Refused
Westmeath	22268	20/05/2022	To extend existing dwelling at the rear to include kitchen, dining, utility and bathroom with two bedrooms and 5 velux windows and construct a porch to the front and a detached garage to the rear and to close up existing entrance and to construct a new entrance and to decommission existing septic tank and install a new septic tank with percolation area with all ancillary site works	Corbetstown, Killucan	Conditional
Westmeath	22287	27/05/2022	Private dwelling house, proprietary effluent treatment system and percolation area, domestic garage, entrance onto public road and all ancillary site services	Killaugh, Bracklyn	Conditional
Westmeath	22315	13/06/2022	Construct a shed at the side of our existing dwelling and a garage at the rear with all ancillary site works	Balrath South, Delvin	Conditional
Meath	22856	29/06/2022	The development will consist of an application to retain (retention planning permission) the house as constructed, and with an external brick finish, a minor extension to the converted garage at the front elevation, the roadside boundary walls and entrance	Kilballivor, Ballivor	Conditional
Meath	22965	21/07/2022	The development will consist of 5 no. purpose-built community care dwellings including 1 no. shared unit for those with intellectual disabilities and associated needs, garage/storage building, proposed on-site well to serve the site, on-site wastewater	Baskinagh, Athboy	Refused
Westmeath	22245	15/08/2022	Construction of agricultural shed consisting of cubicles, feeding area and underground slatted slurry storage tanks and all associated site works.	Craddanstown, Raharney	Conditional
Meath	221555	01/12/2022	The construction of one and a half storey 4 bedroom dwelling, a domestic garage, new access through site, new well, new percolation area and treatment system and all associated site works	Coolronan, Ballivor	Further Information
Westmeath	122067	05/12/2012	Laying two intersecting grass strips, 150m x 7m and 75m x 7m, for use as a take-off and landing area for model aircraft and a grass area, 10m x 30m for car parking	Ballyhealy / Ballinure & Bracklyn	Conditional

Table 3-6 Approved Forestry Licences in the vicinity of the subject site available from the Department of Agriculture, Forestry and the Marine.

Forestry: Afforestation, Clear-fell, Forrest Roads						
Licence Details	Type	Date Approved	Status	Location	Area (ha)	Length (m) Roads
TFL00139818	Private Clearfell and Thinning	25-Jun-18	Approved	Balrath, Meath	29.59	
TFL00153618	Private Clearfell and Thinning	31-Jul-18	Approved	Killaconnigan, Meath	0.98	
CN81456	Forest Roads	02-Aug-18	Built	Balrath, Meath		648
MH04-FL0011	Coillte Clearfell	06-Nov-18	Approved	Killaconnigan, Carranstown Little, Meath	3.78	
TFL00232318	Private Clearfell and Thinning	21-Mar-19	Approved	Coolronan, Meath	4.81	
TFL00219018	Private Clearfell and Thinning	02-Apr-19	Approved	Bracklin, Westmeath	71.06	
TFL00188518	Private Clearfell and Thinning	29-Apr-19	Approved	Dysart, Westmeath	48.17	
CN82331	Forest Roads	11-Jun-19	Built	Bracklin, Westmeath		1865
CN84106	Afforestation	04-Nov-20	Planted	Stonestown, Clonmorrill, Westmeath	23.59	
MH04-FL0021	Coillte Clearfell	06-Jan-21	Approved	Killaconnigan, Meath	6.52	
CN85689	Afforestation	13-May-21	Planted	Clondalee more, Meath	3.74	
CN84476	Forest Roads	16-Nov-21	Approved	Dryderstown, Westmeath		85

CN83973	Forest Roads	15-Dec-21	Approved	Riverdale, Grange beg, Westmeath		1280
TFL00406619	Private Clearfell and Thinning	15-Dec-21	Approved	Riverdale, Grange beg, Westmeath	6.36	
CN90202	Afforestation	22-Jun-22	Approved	Craddanstown, Westmeath	0.8	
TFL00323219	Private Clearfell and Thinning	13-Sep-22	Approved	Dryderstown, Westmeath	3.65	
CN87335	Afforestation	27-Sep-22	Approved	Lisclogher great, Westmeath	3.29	
CN87479	Afforestation	09-Nov-22	Approved	Ballinure or Ballyhealy, Westmeath	21.77	
CN90393	Afforestation	10-Nov-22	Approved	Lisclogher great, Westmeath	22.95	
TFL00702621	Private Clearfell and Thinning		Decision Pending	Clonycavan, Meath	23.16	

APPENDIX 2

EIAR HYDROLOGY CHAPTER 9

9. HYDROLOGY AND HYDROGEOLOGY

9.1 Introduction

9.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to carry out an assessment of the potential effects of the proposed Ballivor wind farm development on the hydrological and hydrogeological environment. The proposed Ballivor wind farm site (the “proposed site” is a large area comprising 4 no. bog basins (Ballivor Bog, Carranstown Bog, Bracklin Bog, and Lisclogher Bog) situated between the towns of Raharney and Delvin, Co. Westmeath and the village of Ballivor, Co. Meath.

The Ballivor wind farm development (the “Proposed Development”) includes 26 no. wind turbines, associated access tracks and hardstands, an onsite 110 kV substation, met masts, temporary site compounds, borrow pits, drainage works, and all ancillary site and ground works. A full description of the Proposed Development is provided in Chapter 4: Description of Development.

The objectives of this assessment are:

- Produce a baseline study of the existing water environment (surface water and groundwater) in the area of the Proposed Development and associated works;
- Identify likely significant effects of the Proposed Development on surface water and groundwater during construction, operational and decommissioning phases of the development;
- Identify mitigation measures to avoid, reduce or offset significant negative effects;
- Assess significant residual effects; and
- Assess cumulative effects of the Proposed Development and other local developments.

9.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological, and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include upland/wetland hydrology, hydrogeology and windfarm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types.

This chapter of the EIAR was prepared by Michael Gill, Adam Keegan and Conor McGettigan.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years’ environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for Oweninny WF, Cloncreen WF, Derrinlough WF, and Yellow River WF, and over 100 other wind farm-related projects.

Adam Keegan (BSc, MSc) is a hydrogeologist with 5 years’ of experience in the environmental sector in Ireland. Adam has been involved in Environmental Impact Assessment Reports (EIARs) for numerous projects including wind farms, grid connections, quarries and small housing developments. Adam holds an MSc in Hydrogeology and Water Resource Management. Adam has worked on several wind farm

EIAR projects, including Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), Derrinlough WF (SID), and Fossy WF.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 3 years experience in the environmental sector in Ireland. Conor holds an MSc in Applied Environmental Science and a BSc in Geology. Conor routinely prepares the hydrology and hydrogeology EIAR chapters and has worked om the EIAR for several wind farm developments on peatlands.

9.1.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Chapter 2 of the EIAR. Consultation responses relating to the water environment were received from the Geological Survey of Ireland, Department of Agriculture, Food and the Marine (response was related to forestry) and the Health Services Executive. Details of these scoping responses and actions taken to address them are in Chapter 2 of this EIAR.

9.1.4 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The following legislation has been complied with:

- S.I. No. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1994, S.I. No. 101/1996, S.I. No. 351/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001, S.I. No. 134/2013 and the Minerals Development Act 2017), the Planning and Development Act, and S.I. No. 600/2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/337/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 94/1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC). Since 2000 water management in the EU has been directed by the Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council

Directive 2013/64/EU; and Commission Directive 2014/101/EU ("**WFD**"). The WFD was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003);
- S.I. No: 122/2010: European Communities (Assessment and Management of Flood Risks) Regulations, resulting from EU Directive 2007/60/EC;
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

9.1.5 Relevant Guidance

The Hydrology and Hydrogeology chapter of the EIAR was prepared having regard, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (2003) Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (2006): Environmental Management in the Extractive Industry;
- Environmental Protection Agency (2002) Guidelines on the Information to be Contained in Environmental Impact Statements;
- DoE/NIEA (2015): Wind farms and groundwater impacts - A guide to EIA and Planning considerations";
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (2006);
- OPW (2009): The Planning system and Flood Risk Management;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001.

9.2 Methodology

9.2.1 Desk Study

A desk study was completed by HES in late 2021 and early 2022 to collate all relevant hydrological, hydrogeological and meteorological data for the proposed site and the surrounding area. The desk study was completed to supplement site walkover surveys and site investigations. The desk study information has been checked and updated, where necessary, in February 2023.

The desk study involved consultation with the following sources:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Databases (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive "catchments.ie" Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 13 (Geology of Meath);Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Flood Mapping (www.floodmaps.ie); and,
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie).

9.2.2 Baseline Monitoring and Site Investigations

Hydrological walkover surveys, including detailed drainage mapping, was undertaken by HES on 18th May 2020, 15th – 17th September 2020, 05th October 2020, 01st December 2020, 22nd March 2021, 01st April 2021, 20th September 2021, 28th October 2021, 19th January 2022 and 22nd February 2023.

Hydrological monitoring, including flow monitoring, field hydrochemistry and grab sampling was completed by HES on 3 no. occasions during the study period (01st April 2021, 28th October 2021 and 19th January 2022). The monitoring and sampling completed in April 2021 occurred during a dry period with minimal rainfall. The sampling completed in October 2021 was preceded by several wet days while the January 2022 sampling was completed in a relatively dry period.

Reporting and site investigations and monitoring data used to compile the Hydrology and Hydrogeology Chapter of the EIAR included the following:

- Walkover surveys and hydrological mapping of the proposed site and the surrounding areas were undertaken whereby water flow directions and drainage patterns were recorded;
- A flood risk assessment for the proposed site;
- A total of over 457 no. peat probe/investigation points were carried out by HES, MKO and Fehily Timoney (FT) in Ballivor Bog, Carranstown Bog, Bracklin Bog and Lisclogher Bog. These investigations were completed to determine the thickness and geomorphology of the peat at the proposed site, and also to understand the subpeat geology across the proposed site;
- Ground investigations completed by FTC and IDL in the form of 78 no. trial pits, 16 no. boreholes and 5 no. rotary coreholes;
- Completion of 24 no. trial pits excavated by Bord na Móna;
- A geotechnical assessment of peat stability for the proposed site was completed by FT (FT, 2023) (Appendix 8-1);
- A peat and spoil management plan was completed by FT (FT, 2023) (Appendix 4-2);
- A series of groundwater monitoring wells were drilled at the locations of the 4 no. proposed borrow pits to facilitate groundwater monitoring in order to aid the understanding of the local hydrogeological regime at these locations;
- Seasonal groundwater level monitoring has been undertaken at the installed monitoring wells; and,
- A total of 36 no. surface water samples were undertaken to determine the baseline water quality of the primary surface waters originating from the proposed site.

9.2.3 Impact Assessment Methodology

The guideline criteria (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their quality (i.e. negative, positive or neutral), significance, extent, context, probability, duration, frequency and reversibility. The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1 of this EIAR. In addition, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Table 9-1 and Table 9-2 define levels of sensitivity for hydrology and hydrogeology respectively, and are used to assess the potential effect that the Proposed Development may have on them.

Table 9-1: Estimation of Importance of Hydrology Criteria (NRA, 2008)

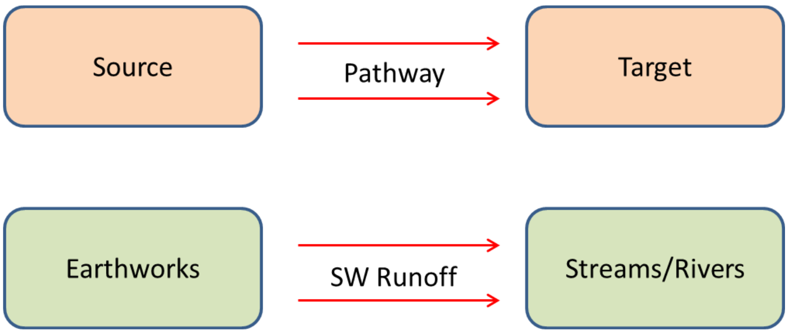
Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation, e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5). Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for a wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	Salmon fishery locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3). Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes. Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 9-2: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status. Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes.

9.2.4 Overview of Impact Assessment Process

The conventional source-pathway-target model (see below, top) was applied to assess potential effects on downstream environmental receptors (see below, bottom as an example) as a result of the Proposed Development.



Where potential effects are identified, the classification of impacts in the assessment follows the descriptors provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003); and,
- Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2002).

The description process clearly and consistently identifies the key aspects of any potential impact, namely its source, character, magnitude, duration, likelihood and whether it is of a direct or indirect nature (i.e., using EPA, 2022 EIAR terminology).

In order to provide an understanding of the stepwise impact assessment process applied below (Sections 9.4.2 to 9.4.4), a summary guide is presented below, which defines the steps (1 to 7) taken in each element of the impact assessment process. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

Using this defined approach, this impact assessment process is then applied to all construction, operation and decommissioning activities for the Proposed Development which have the potential to generate significant adverse impact on the hydrological and/or hydrogeological environment.

Table 9-3: Impact Assessment Process Steps

Step 1	Identification and Description of Potential Impact Source This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The significance of effects is briefly described.	
Step 2	Pathway / Mechanism:	The route by which a potential source of impact can transfer or migrate to an identified receptor. In terms of this type of development, surface water and groundwater flows are the primary pathways, or for example, excavation or soil erosion are physical mechanisms by which potential impacts are generated.
Step 3	Receptor:	A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present.
Step 4	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 5	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. In relation to the Proposed Development, these measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by (engineering) design.
Step 6	Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impacts after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant post-mitigation effects of the identified potential impact source on the receiving environment.

9.2.5 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Hydrology and Hydrogeology Chapter of the EIAR.

9.3 Baseline/Receiving Environment

9.3.1 Site Description and Topography

The Ballivor Wind Farm site ("the proposed site") comprises 4 no. Bord na Móna bogs which form part of the larger Derrygreenagh Bog Group situated between the towns of Kinnegad and Delvin, Co. Westmeath. The bogs comprising the proposed site include Ballivor Bog to the south, Carranstown and Bracklin Bogs towards the centre and Lisclogher Bog at the northern end of the proposed site. Lisclogher West Bog exists to the west of Lisclogher Bog and forms part of the Ballivor Sub-Group of bogs (a sub-group of the Derrygreenagh Group), however this bog does not form part of the proposed site. In addition, the western section of Bracklin Bog (Bracklin West) and the eastern section of Carranstown bog are omitted from the proposed site. The total area of the proposed site is 1,770ha (17.70km^2) and the area of each bog included within the proposed site is shown in Table 9-4.

The Meath-Westmeath county boundary runs through the centre of Lisclogher Bog, along the eastern boundary of Bracklin Bog and through the centre of both Carranstown and Ballivor Bogs. The closest settlements to the site are Delvin located 5km north, Raharney, 4km west and Ballivor, 3.5km east of the site.

The south of the proposed site is dissected by the R156 which joins the villages of Ballivor in the east to Raharney in the west. Ballivor Bog lies to the south of this regional road with the other 4 no. bogs which comprise the Ballivor Bog Sub-Group lying to the north. A Bord na Móna works area lies in the northwest of Ballivor Bog, in the townland of Grange More and contains offices, storage sheds, roads and a peat loading area. The remainder of Ballivor Bog is located in the townlands of Robinstown and Clonycavan in the east and Riverdale, Clondalee More and Derryconor in the west. Ballivor Bog has a total area of 635ha, all of which is included within the proposed site, and it was served by a Bord na Móna railway network which still extends from the loading area into the bog.

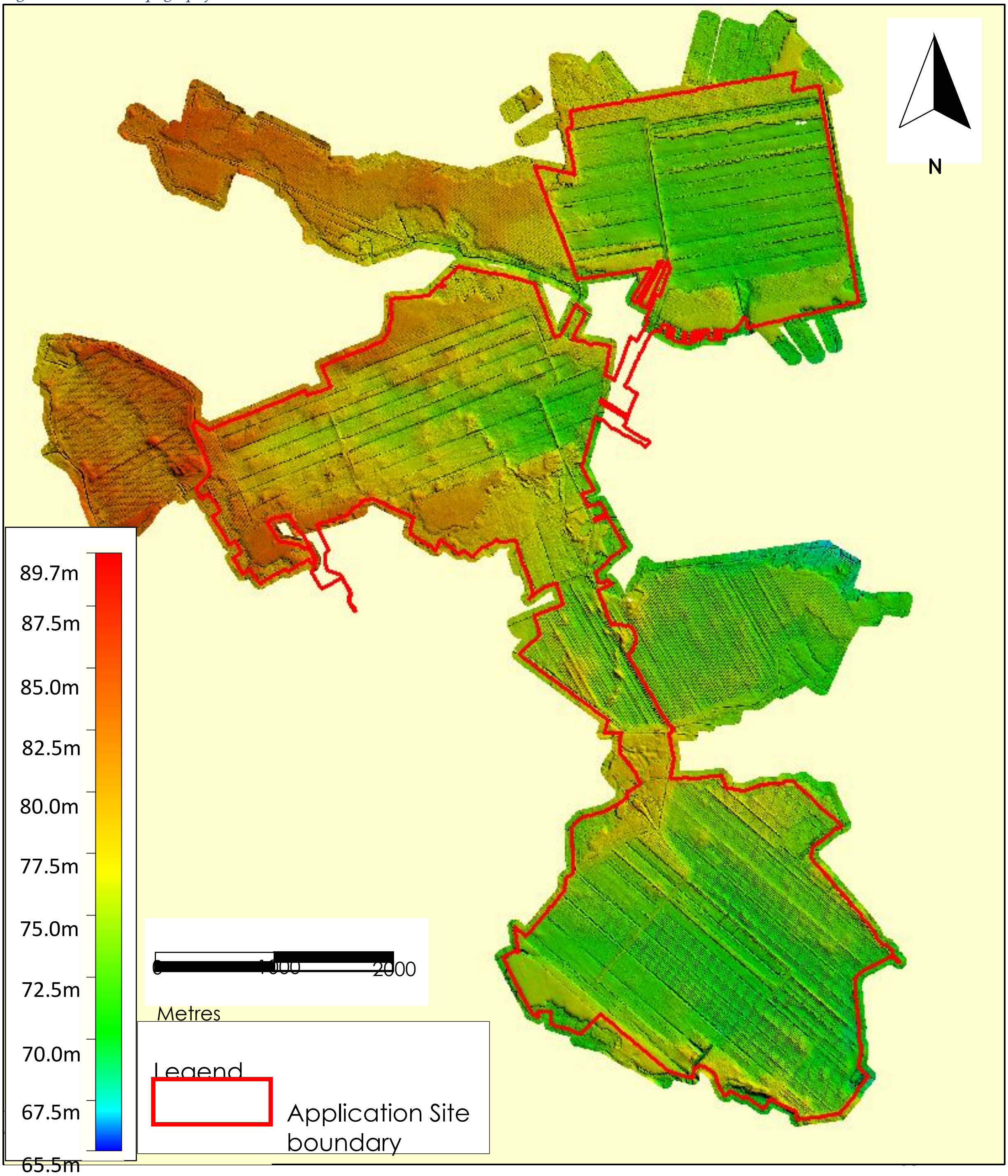
To the north of the R156, Carranstown Bog has an area of 306ha and lies in the townlands of Grange More in the West and Carranstown Great, Carranstown Little and Killaconnigan in the east. Approximately 79ha in the west of Carranstown Bog forms part of the proposed site. The Bord na Móna railway links Carranstown Bog to Ballivor Bog to the south and Bracklin Bog to the north. Towards the centre of the proposed site, Bracklin Bog has an area of 620ha, all of which is included within the proposed site. Bracklin Bog lies in the townlands of Coolronan in the east, Craddanstown and Bracklin in the centre and Ballynaskeagh, Mucklin and Killagh in the west. An extension of Bracklin Bog, referred to as Bracklin West is not included within the proposed site. A small bogland (~22ha) referred to as the Hill of Down lies to the east of Bracklin Bog in the townlands of Coolronan and Bracklin. Lisclogher Bog is located to the northeast of Bracklin Bog, approximately 4.3km southeast of the town of Delvin and has an area of 484ha, of which 436ha is included within the proposed site. This bog is located in the townlands of Lisclogher Great, Coolronan, Bracklin, Cockstown and Clonleame.

The current topography of the proposed site is relatively flat with an elevation range of between approximately 69 and 84mOD (metres above Ordnance Datum). Topography at the proposed site has been modified through the previous peat extraction activities and associated drainage. The highest elevations are found at headlands and remnant peat banks which create elevated boundary berms, forming a basin effect within the former extraction areas of the bogs. A local topography map is included as Figure 9-1.

Table 9-4: Proposed Site Area within the Ballivor Bog Sub-Group

Bog Name	Total Bog Area (ha)	Area included in Proposed Site (ha)
Ballivor Bog	635	635
Carranstown Bog	306	79
Bracklin Bog (excluding Bracklin West)	620	620
Lisclogher	484	436

Figure 9-1: Local Topography



9.3.2 Water Balance

Long term rainfall and evaporation data were sourced from Met Éireann. The 30-year annual average rainfall (AAR) recorded at the Ballivor rainfall station, located approximately 4.5km east of the proposed site are presented in Table 9-5.

Table 9-5 Local Average long-term Rainfall Data (mm)

Station		X-Coord		Y-Coord		Ht (MAOD)		Opened		Closed		
Ballivor		268500		254200		68		1943		N/A		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
86	61	65	55	62	58	54	76	75	83	80	85	839

The closest synoptic station where the average potential evapotranspiration (PE) is recorded is at Mullingar, approximately 17km west of the proposed site. The long-term average PE for this station is 445mm/yr. This value is used as the best estimate of the proposed site PE. Actual Evaporation (AE) at the proposed site is estimated as 423mm/yr (which is 0.95 × PE).

The effective rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the proposed site is calculated as follows:

Effective rainfall (ER) = AAR – AE

= 839 mm/yr – 423mm/yr

ER = 416mm/yr

The GSI estimate that the groundwater recharge coefficient for the proposed site is 4% (www.gsi.ie), with this estimate being provided based on the occurrence and extent of basin peat at the proposed site. Based on this recharge coefficient (4%) the average annual groundwater recharge for the proposed site is estimated to be 17mm/year (*i.e.* 4% of the effective rainfall (416mm) for the proposed site). This means that the hydrology of the proposed site is characterised by very high surface water runoff rates and very low groundwater recharge rates. Therefore, conservative annual recharge and runoff rates for the proposed site are estimated to be 17mm/yr and 399mm/yr respectively.

In addition to average long-term rainfall data, extreme value rainfall depths are available from Met Éireann (www.met.ie). A return period is an estimate of how long it will be between rainfall events of a given magnitude. For example, a 15 minute rainfall event of 5.7mm has the probability of occurring at the proposed site on an annual basis. However, a 15 minute rainfall event resulting in 19.9mm of precipitation has the probability of once every one hundred years. A summary of various return periods and duration rainfall depths for the proposed site are presented in Table 9-6. This data was used in the design of the Proposed Development drainage system.

Table 9-6 Return Period Rainfall depths (mm) for the proposed site

Return Period (Years)				
Storm Duration	1	5	30	100
5 mins	3.5	5.5	9.0	12.1
15 mins	5.7	9.1	14.7	19.9
30 mins	7.4	11.6	18.5	24.6
1 hour	9.6	14.8	23.1	30.4

Return Period (Years)				
Storm Duration	1	5	30	100
6 hours	19.1	28.0	41.3	52.6
12 hours	25.0	35.8	51.8	65.1
24 hours	32.6	45.7	64.8	80.5
2 days	38.5	52.8	73.2	89.5

9.3.3 Regional and Local Hydrology

On a regional scale, the proposed site is located in the River Boyne surface water catchment within Hydrometric Area 7[1] of the Eastern River Basin District. The River Boyne surface water catchment has a total area of 2,694km^2 and includes all areas drained by the River Boyne. The source of the Boyne is the Trinity Well, southeast of Carbury, Co. Kildare approximately 18km southeast of the proposed site. The Boyne flows west from the Trinity Well, turning north at Edenderry, passing through the raised bog landscape of north Kildare, after which it is joined by the Yellow River. The River Boyne continues to flow towards the northeast and the town of Trim, flowing approximately 5km east of the proposed site. In the vicinity of the proposed site, the main tributaries which discharge into the Boyne include the Deel (Raharney) and Stoneyford rivers. Further downstream the Athboy River confluences with the Boyne before flowing to the east through the town of Trim. The Boyne then flows towards Navan after which it continues eastwards before becoming tidal to the west of my M1 motorway. The Boyne then flows through Drogheda and out to the Irish Sea between Haven and Mornington Point. Figure 9-2 shows regional hydrology.

On a local scale, the majority of the proposed site is located in the River Boyne_SC_050 sub-catchment. Meanwhile, the southwest of the proposed site, including much of Ballivor Bog and small areas of Carranstown and Bracklin bogs, is located in the River Boyne_SC_040 sub-catchment. The west of Bracklin Bog (i.e. Bracklin West), which is not included in the proposed site is situated in the Deel[Raharney]_SC_010 sub-catchment.

The Deel River (EPA Code: 07D01) flows southwards approximately 2.1km west of the proposed site. The Deel River flows southwards through the town of Raharney and confluences with several small streams which drain the southwest of the proposed site. While these watercourses are largely unnamed, the Curris River is located immediately to the west of Ballivor Bog and flows to the south before discharging into the Deel River approximately 1.4km south of the proposed site. The Deel then continues to the southeast and confluence with the River Boyne (EPA Code: 07B04) approximately 4.5km south of Ballivor village.

The eastern section of the proposed site is drained by the Stonyford River (EPA Code: 07S02). The Stonyford River flowing to the southeast, approximately 700m east of Lisclogher Bog and continues to the southeast before it discharges into the River Boyne approximately 7km east of proposed site (Ballivor Bog). The proposed site is drained by several small 1st and 2nd order streams which flow to the east and discharge into the Stonyford River.

[1] *Ireland's hydrometric areas are used as management units for hydrological areas (EPA, OPW, ESBI, Local Authorities etc) and they are made up of an amalgamation of large river basins.*

An error has been observed in the EPA blueline watercourse mapping database in Lisclogher Bog. The EPA map a small watercourse (figure 9-3), referred to as the Cartenstown stream, to flow to the southeast across Lisclogher Bog. However, site walkover surveys and drainage mapping have shown that this watercourse does not exist on-site. The true drainage regime and flow directions in this area of the proposed site are shown on Figure 9-4. This drainage map has been produced following walkover surveys and drainage mapping of Lisclogher Bog. The on-site inspections were supplemented with the analysis of lidar data. A cross-section along the (original) EPA mapped watercourse has been produced and shows topographic variations along the course of the Cartenstown stream from Point A in the northwest to Point D in the south of Lisclogher Bog (Figure 9-5). The cross section profile does not indicate the presence of any channel that may be associated with a surface watercourse. Indeed there are several topographic highs located along the cross-section meaning that it would be impossible for surface water to flow unimpeded from Point A to D. This lidar analysis supports the on-site observations and drainage mapping meaning that there is a local error in the EPA watercourse mapping in Lisclogher Bog. Such small local errors are infrequent in EPA mapping, however they do exist where manmade drainage has been imposed upon natural drainage regime.

A local hydrology map is shown in Figure 9-6. (Note, this map includes the corrections to the drainage on and around Lisclogher bog).

Table 9-7 summarises the location and receiving waterbodies of each of the 5 no. bogs which comprise the site in accordance with the Water Framework Directive (WFD). Due to the error in EPA watercourse mapping, the WFD river subbasins are incorrectly mapped at Lisclogher Bog with the northwest of Lisclogher Bog draining northwards into the Stonyford_020 river waterbody.

Table 9-7: WFD Catchments, sub-catchments and river-basins and receiving waterbodies of the bog areas comprising the proposed site

Bog Name	WFD Catchment	WFD Sub-Catchment	WFD River Sub-Basin	Proposed Development Infrastructure
Ballivor	River Boyne	West: Boyne_SC_40 sub-catchment	Deel(Raharney)_060	T1, T2, T5, T6, T8-T12, 1 no. met mast, & 2 no. construction compounds
		East: Boyne_SC_050 sub-catchment	Boyne_060	T3, T4, T7
Carranstown	River Boyne	Boyne_SC_050 sub-catchment	South: Boyne_060	-
			North: Stonyford_040	1 no. construction compound, 2 no. borrow pits (BP1a and BP1b), onsite 110kV Substation, and the new transmission line pylons
Bracklin	River Boyne	East and Centre: Boyne_SC_050 sub-catchment	Stonyford_040	T13-T18, 2 no. construction compounds, 1 no. met mast & amenity car park
		Small area in SW located in Boyne_SC_040	Small area in the southwest of the bog is located in Deel(Raharney)_060	1 no. borrow pit (BP2)

Bog Name	WFD Catchment	WFD Sub-Catchment	WFD River Sub-Basin	Proposed Development Infrastructure
Lisclogher	River Boyne	Boyne_SC_050	Stonyford_040	T19-T21, T23-T26
			Small area in the north of the bog is located in Stonyford_030	T22
			Stonyford_020 EPA mapping and WFD river-sub basins are incorrectly mapped at Lisclogher Bog and some of the proposed site drains to the northwest into the Stonyford_020 SWB.	

Figure 9-2: Regional Hydrology Map

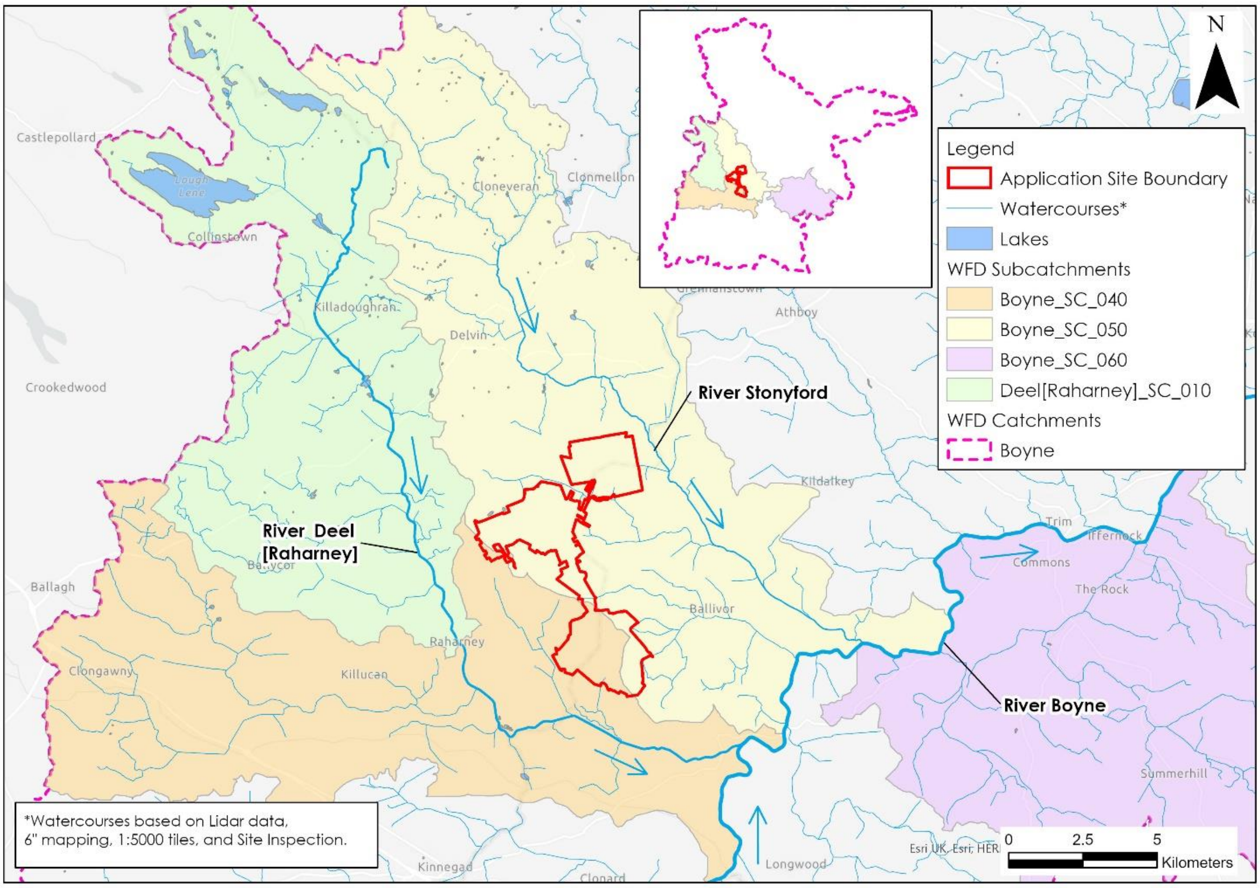


Figure 9-3: EPA Watercourse Mapping in Lisclogher Bog

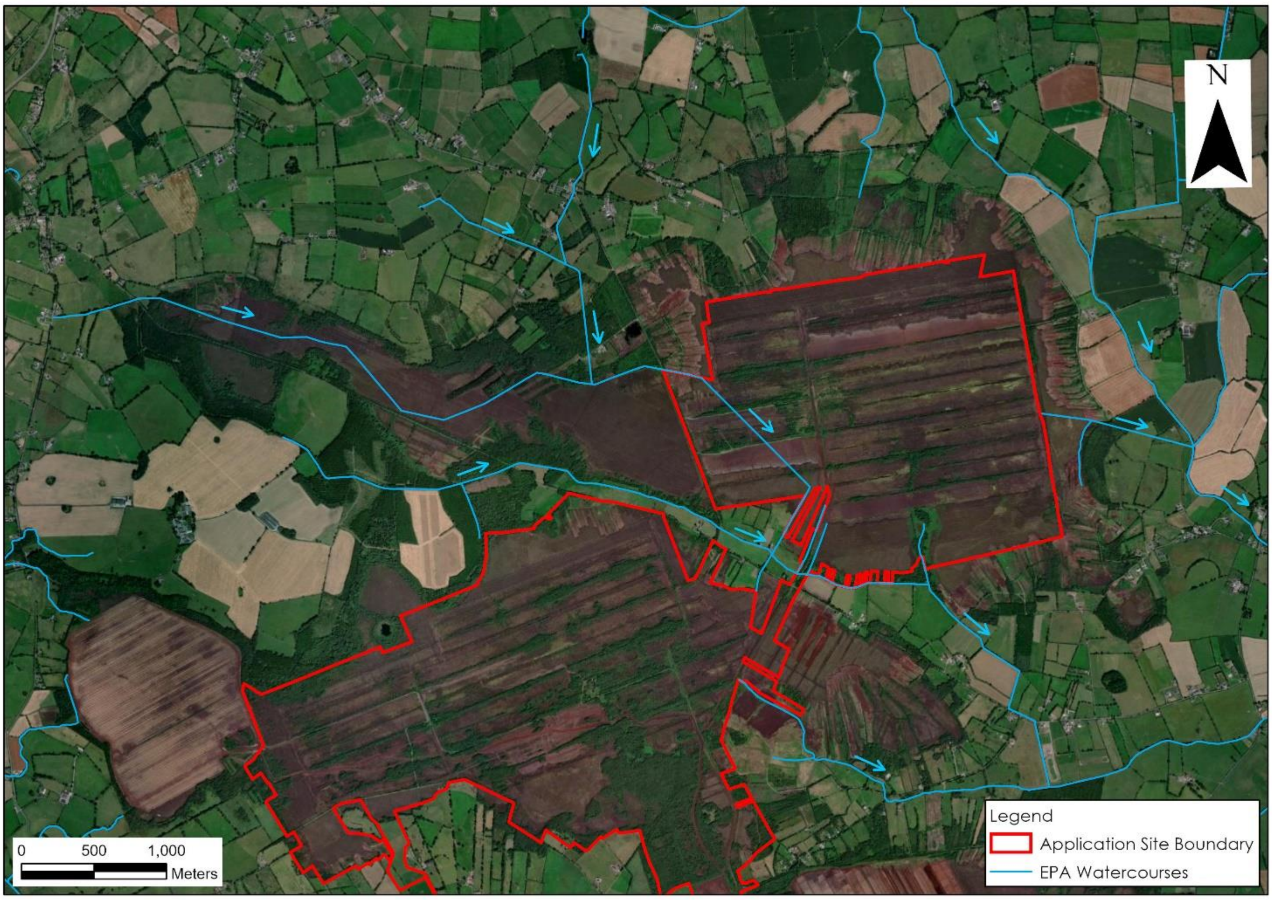


Figure 9-4: True Drainage of Lisclogher Bog Based on Site Walkovers and Lidar Data

Figure 9-5: Lidar Data along EPA Mapped Watercourse in Lisclogher Bog

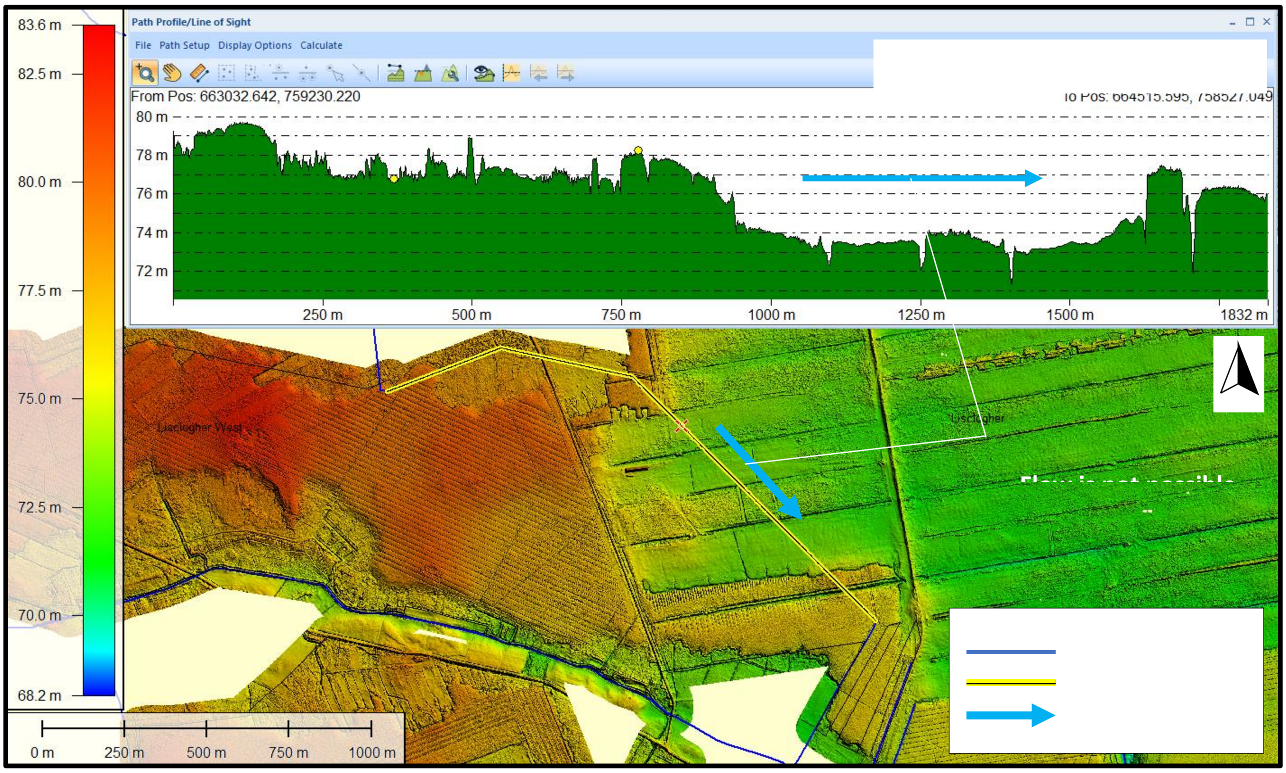
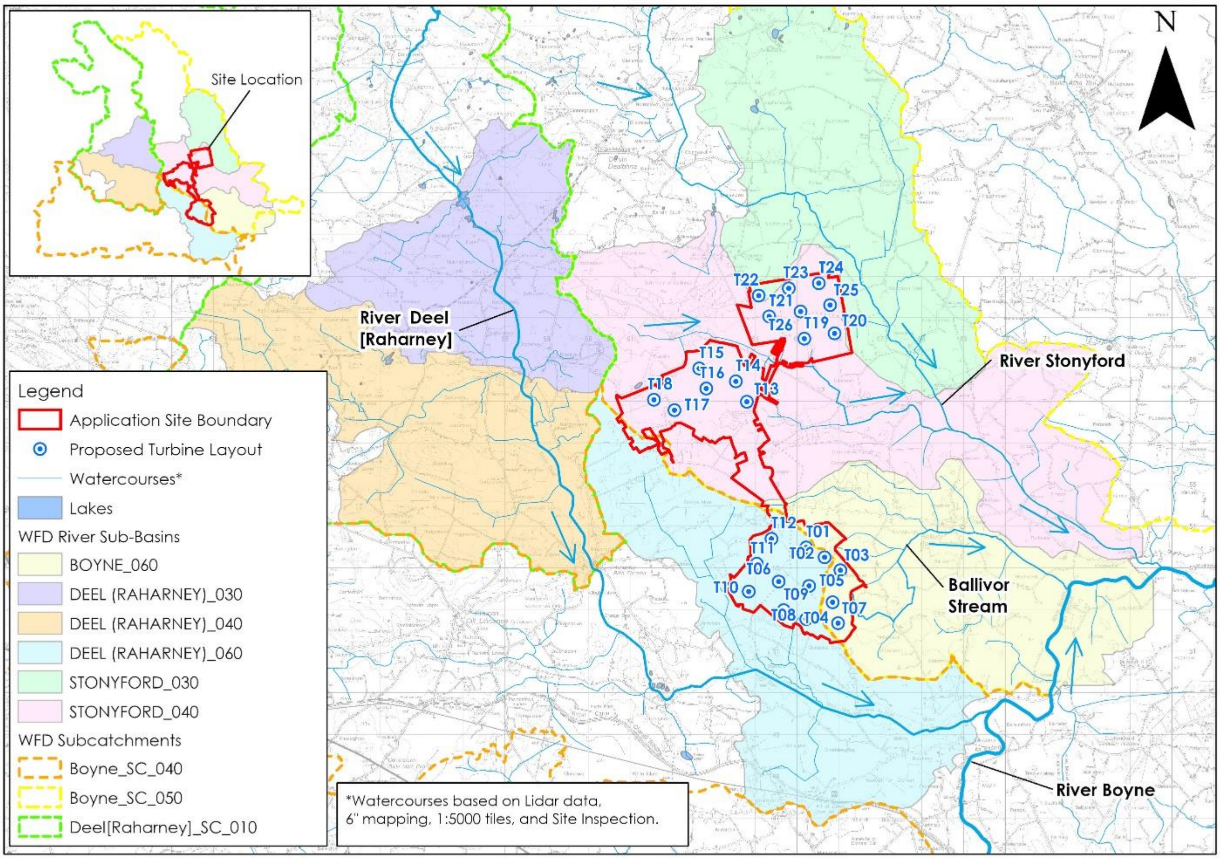


Figure 9-6: Local Hydrology Map



9.3.4 Wind Farm Site Drainage

Due to the historic peat extraction activities at the proposed site, the bogs comprising the proposed site (and the wider Ballivor Bog Group) have been artificially drained in order to lower the peat water table. Drainage ditches were inserted into the upper surface of the bogs at different stages. Ballivor Bog was the first bog to be drained between 1948 and 1953. Clearance and drainage work commenced at Bracklin Bog in 1952. Lisclogher was drained by 1960 while Carranstown Bog was drained between 1974 and 1987.

Currently surface water (or runoff water) is drained from the proposed site via a network of field drains typically spaced at 15 to 20m intervals, piped drains, main drains, headland drains, and silt ponds. The 4 bogs of the proposed site are all drained via gravity, with no pumping stations currently utilised at the proposed site. The field drains discharge to main drains which flow via gravity towards the perimeter of the bog where they discharge to larger headland drains. These headland drains eventually discharge to large silt (settlement) ponds. The silt ponds were used to trap sediment and prevent elevated levels of suspended sediment arising in effluent from the drained peatland. Treated surface water is then discharged at outfall points where the effluent flows into off-site drainage channels which in turn discharge into the local stream and river network.

Drainage of the proposed site and the wider Ballivor Bog Group is currently operating under licence from the EPA (P0501-01). The drainage system has been operating in accordance with this existing Integrated Pollution Control licence, with all drainage water from the bogs being discharged via an appropriately designed silt pond treatment arrangement. A surface water outflow map which formed part of the EPA application recorded a total of 25 no. silt ponds across the entire Ballivor Bog Group (7 no. silt ponds in Ballivor, 6 no. silt ponds in both Bracklin and Lisclogher West, 5 no. ponds in Carranstown and 1 no. pond in Lisclogher Bog). A total of 9 no. silt ponds are located within the proposed site boundaries (7 no. in Ballivor bog, 1 no. in Carranstown Bog and 1 no. in Lisclogher Bog). Whilst several silt ponds associated with the drainage of the Ballivor bog Group are located outside of the proposed site boundary, the drainage system of the proposed site is interlinked with the wider drainage system of the Ballivor Bog Group. A flow diagram of the existing drainage system is shown in Figure 9-7 below. Figure 9-8 to 9-11 illustrate existing drainage maps for each individual bog within the proposed site.

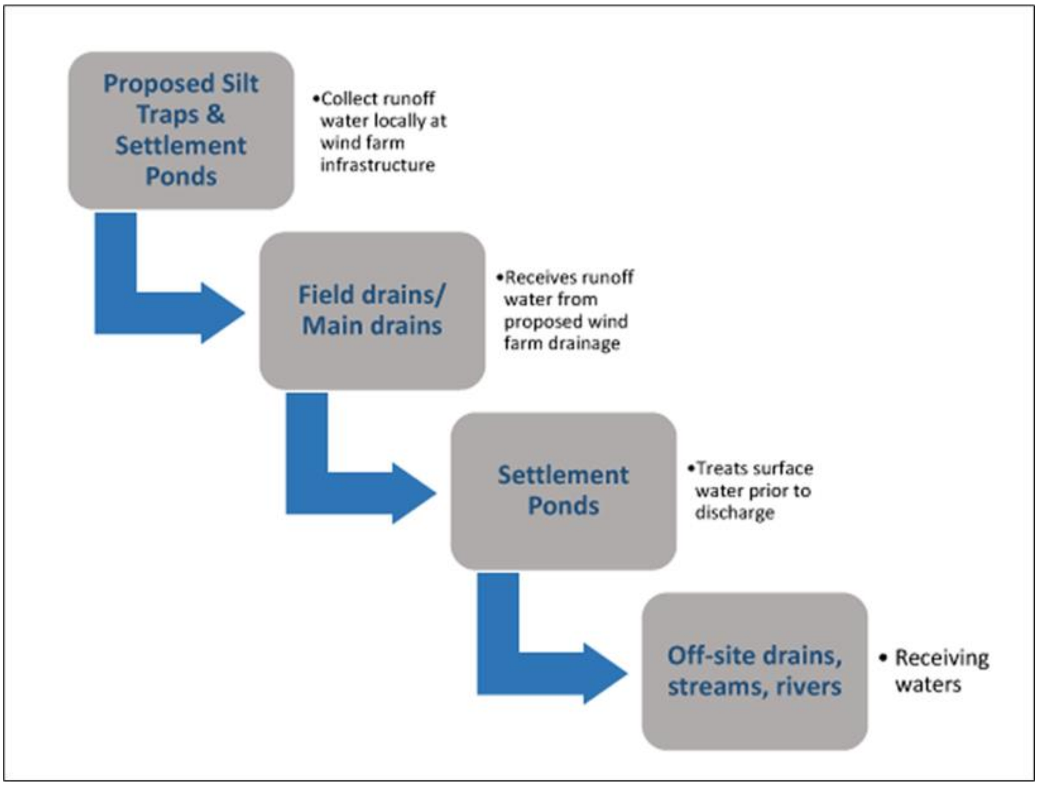


Figure 9-7: Process Flow Diagram for the Existing Drainage System

Figure 9-8: Existing drainage within Ballivor Bog

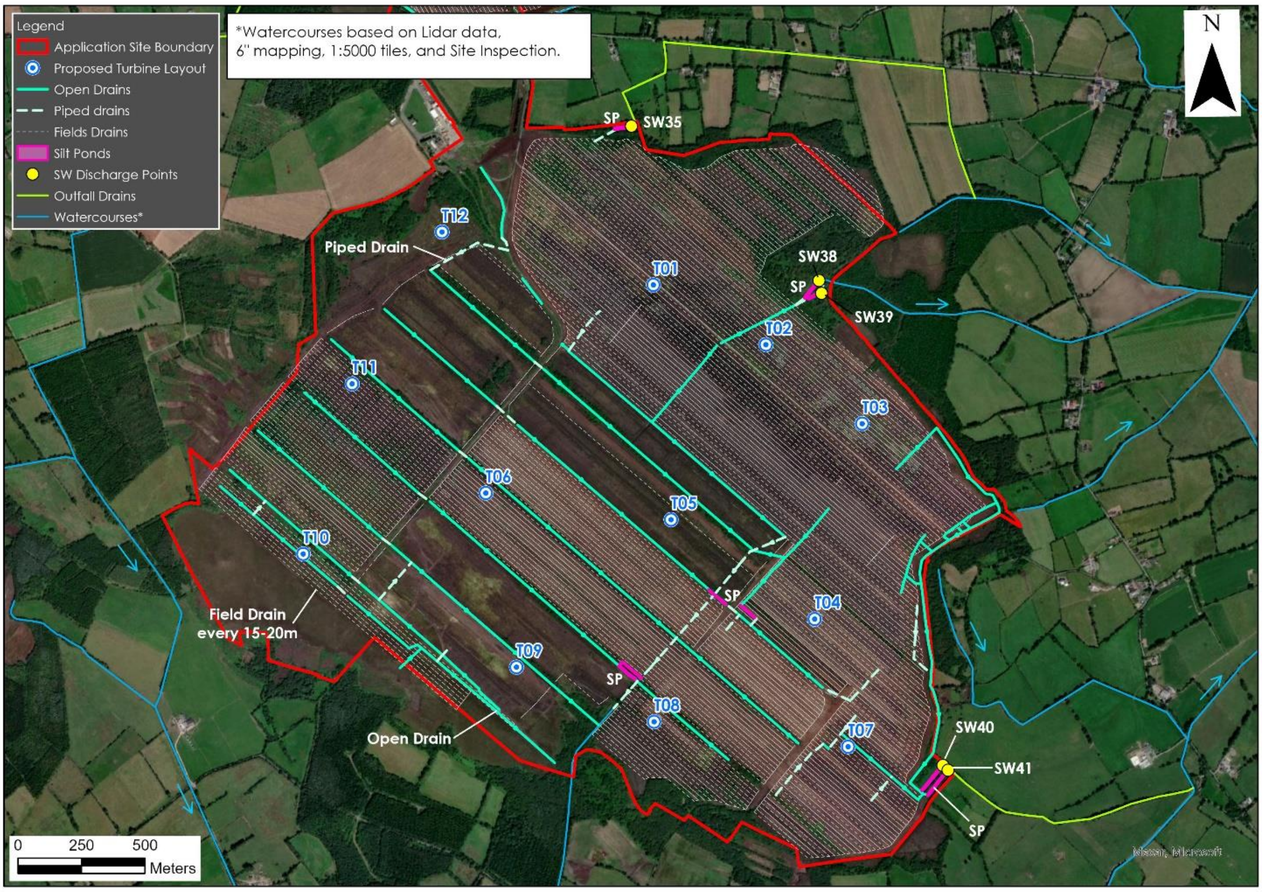


Figure 9-9: Existing drainage within Carranstown Bog

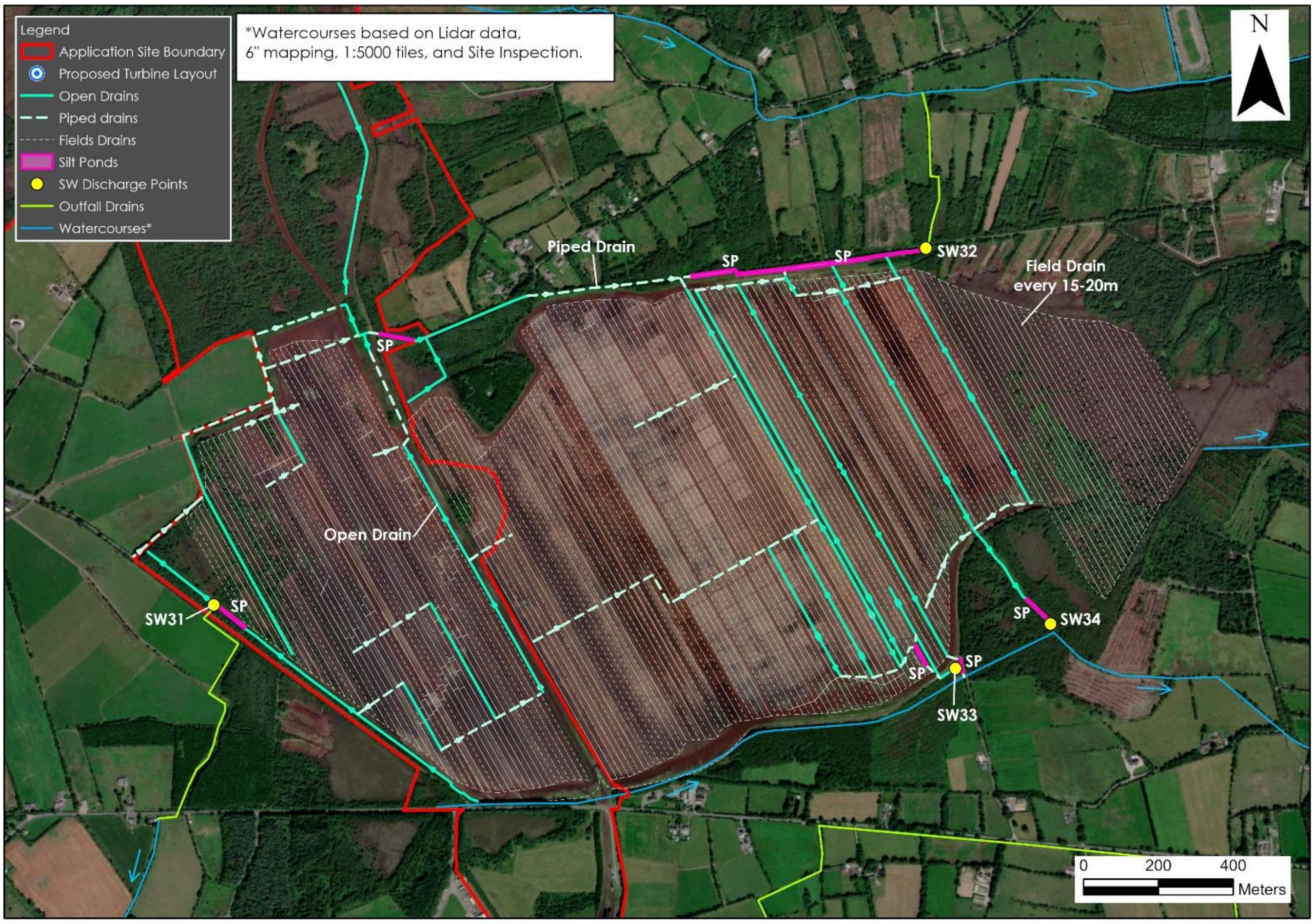


Figure 9-10: Existing drainage within Bracklin Bog

Figure 9-11: Existing drainage within Lisclogher Bog

Detailed hydrological audit of flow paths from each bog to its eventual discharge point at the regional catchment scale was conducted for the 4 no. bogs comprising the proposed site. The flowpaths have been traced using the River Waterbodies classification as outlined by the WFD. The flowpaths are shown as Figure 9-12 to Figure 9-15 below.

The surface of Ballivor Bog is drained by a network of northwest/ southeast orientated drains that are typically spaced every 15 to 20m. All 7 no. settlement ponds which form part of the drainage system for Ballivor Bog are located within the proposed site. Drainage from Ballivor Bog discharges through 6 no. outfalls (SW35, SW38, SW39, SW40, SW41 and SW41A) which discharge to off site drains and small local watercourses. Several of these watercourse have been named by the EPA (www.EPA.ie). In the southwest of Ballivor Bog, SW41A discharges to Clondalee_More stream which discharges to the Deel River. These waterbodies are mapped by the WFD as the Deel(Raharney)_060 surface waterbody (SWB). Further downstream, the Deel River discharges into the Boyne_050 SWB. The SW35, SW38 and SW39 outfalls, located in the northeast of the bog, discharge to several unnamed drains/streams, which then discharge to the Ballivor River. In the southeast of the bog outfalls SW40 and SW41 outfall to the Derryconor stream, which then discharges to the Ballivor River. The Ballivor River at this location is mapped as the Boyne_060 SWB by the WFD. Further downstream the Ballivor River confluences with the River Boyne (i.e Boyne_060 SWB). The River Boyne then continues through segments Boyne_070 to Boyne_180 before becoming tidal in the Boyne Estuary to the west of Drogheda.

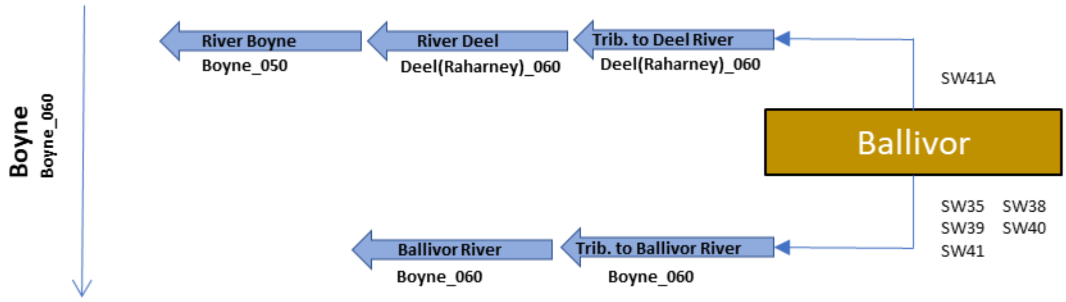


Figure 9-12: Hydrological Flow Path for Ballivor Bog

The surface of Carranstown Bog is drained by a network of northwest-southeast oriented drains, typically spaced at 15m intervals. Drainage from Carranstown Bog discharges via 4 no. outfalls (SW31, SW32, SW33 and SW34). In the west, SW31 discharges to the Grange More stream which in turn discharges to the Craddanstown stream before discharging into the Deel River to the southwest of Ballivor Bog. These waterbodies are mapped within the Deel(Raharney)_060 SWB. Downstream, the Deel River discharges into the Boyne_050 SWB. In the southeast of Carranstown Bog, and outside of the proposed site boundary, the SW34 outfall discharges to the Killaconnigan stream, which in turn discharges to the Ballivor River southwest of Ballivor village. Here the Ballivor River is mapped within the Boyne_060 SWB. In the northeast of the bog, and outside of the proposed site boundary, SW32 outfalls to the Craddanstown Little stream which discharges into the Cartenstown stream and eventually into the Stonyford River to the east of the Carranstown Bog. These waterbodies are mapped within the Stoneyford_040 SWB. Further downstream the Stoneyford River reaches a confluence with the River Boyne (Boyne_070 SWB). The river Boyne then continues through segments Boyne_080 to Boyne_180 before becoming tidal to the west of Drogheda.

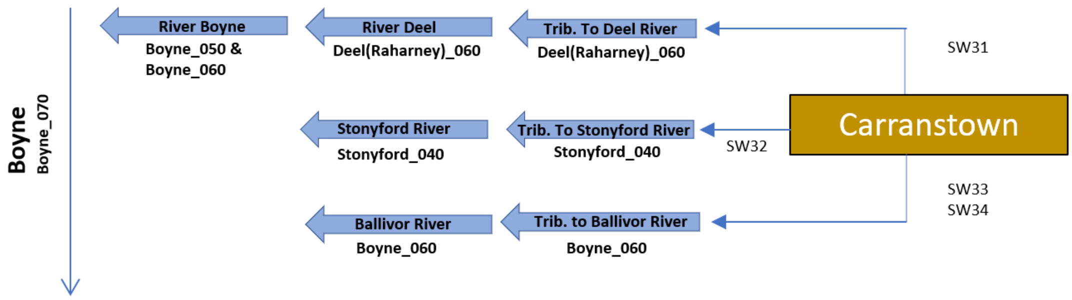


Figure 9-13: Hydrological Flow Path for Carranstown Bog

Bracklin Bog is drained by a series of drains spaced at approximately 15m intervals. These drains have become overgrown since production stopped within this bog. Mineral soil can be observed from aerial photographs, indicating the peat has been essentially stripped. The western portion of Bracklin Bog (i.e. Bracklin West) contains east-west oriented drains. Drainage from Bracklin Bog discharges via 5 no. outfalls (SW26, SW27, SW28, SW29 and SW30), with all outfalls being located in Bracklin West and outside of the proposed site boundary. SW28, SW29 and SW30 discharge to the Greenan stream and the Ballynaskeagh stream respectively before discharging into the Deel River. These waterbodies are mapped in the Deel(Raharney)_030 SWB. The Deel River continues through segments Deel(Raharney)_040 and Deel(Raharney)_050. SW26 and SW27 outfall to the Craddanstown stream which forms part of the Deel(Raharney)_060 SWB. Downstream the Deel River discharges into the Boyne_050 SWB.

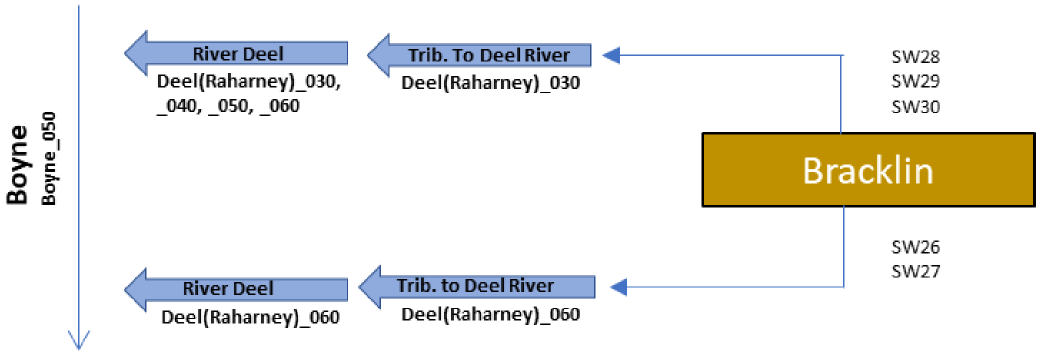


Figure 9-14: Hydrological Flow Path for Bracklin Bog

Lisclogher Bog is drained by east-west oriented drains, spaced at approximately 15m intervals. There are larger arterial drains running east-west also, but much of the drainage channels have become overgrown since production ceased in the 1990s. The Bord na Móna Decommissioning and Rehabilitation Plan for Lisclogher Bog (2022) states that the drainage system is beginning to break down with many drains becoming blocked and filling with water. Some minor drains along the northwestern perimeter of Liclogher Bog flow northwards towards the Stonyford_020 SWB. However, no dranage from within the proposed site is directed towards these perimeter drains and there is no outfall in this area of Lisclogher Bog. Drainage from Lisclogher Bog discharges via 1 no. outfall (SW25) located in the northeast of the bog. SW25 discharges to an unnamed stream which in turn discharges to the Stoneyford River. These waterbodies are mapped in the Stoneyford_030 SWB. The Stoneyford River continues through the Stoneyford_040 waterbody before discharging into the Boyne_070 SWB.

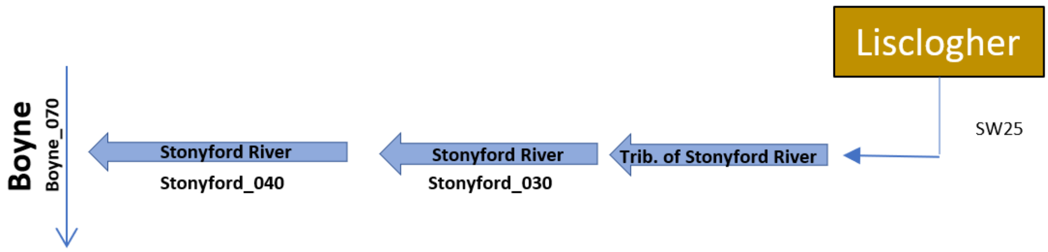


Figure 9-15: Hydrological Flow Path for Lisclogher Bog

9.3.5 Baseline Assessment of Site Runoff

This section presents a long-term water balance assessment and surface water runoff assessment for the baseline conditions at the proposed site.

The rainfall depths used in this water balance, are long-term averages. Please note that the long term averages are not used in the design of the sustainable drainage system for the Proposed Development as described in Section 9.4.1 below. The extreme rainfall depths shown in Table 9-5 above will be the basis of the Proposed Development drainage design which is described in Section 9.4.1.

The water balance calculations are carried out for the month with the highest average recorded rainfall minus evapotranspiration, for the current baseline site conditions (Table 9-8). It represents, therefore, the long-term average wettest monthly scenario in terms of volumes of surface water runoff from the proposed site pre-wind farm development. The surface water runoff co-efficient for the proposed site is estimated to be 96% based on the predominant peat coverage (refer to Section 9.3.2).

The highest long-term average monthly rainfall recorded at Ballivor over 30 years occurred in the month of January, at 86mm. The average monthly evapotranspiration for the synoptic station at Mullingar over the same period in January was 0.8mm. The water balance presented in **Table 9-9** indicates that a conservative estimate of surface water runoff for the proposed site during the highest rainfall month is approximately 1,332,810m^3/month or 42,993m^3/day.

Table 9-8: Water Balance and Baseline Runoff Estimates for Wettest Month (January)

Water Balance Component	Depth (m)
Average January Rainfall (R)	0.086
Average January Potential Evapotranspiration (PE)	0.008
(AE = PE x 0.95)	0.0076
Effective Rainfall January (ER = R - AE)	0.0784
Recharge (4% of ER)	0.0031
Runoff (96% of ER)	0.0753

Table 9-9: Baseline Runoff for the Proposed Site

Study Area	Approximate Area (ha)	Approximate Baseline Runoff per Wettest month (m^3)	Approximate Baseline Runoff per day (m^3/day) in wettest month
Proposed Site	1,770	1,332,810	42,994

9.3.6 Flood Risk Assessment

This section provides a summary of the Flood Risk Assessment (FRA) which has been undertaken by HES for the proposed site. The full FRA report is attached as Appendix 9.1. The FRA is completed in line with the guidelines provided in "The Planning system and Flood Risk Management" (OPW, 2009).

To identify those areas as being at risk of flooding, OPW's River Flood Extents Map, the National Indicative Fluvial Mapping, Past Flood Event Mapping (www.floodinfo.ie) and historical mapping (i.e. 6" and 25" base maps) were consulted.

No recurring flood incidents or instances of historical flooding were identified within the proposed site in historic OS maps or in OPW flood maps. Identifiable map text on local available historical 6" or 25" mapping for the proposed site does not identify any lands that are "liable to flood".

The closest mapped historical flood event is located approximately 300m to the east of Ballivor Bog where flooding occurred in August 2008 following "very heavy and prolonged rainfall in the Boyne Catchment".

The GSI's Winter 2015/2016 surface water flood map shows areas of fluvial and pluvial flooding during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas. This map does not record any flooding within the proposed site. In addition, the GSI Groundwater Flood mapping (available at www.floodinfo.ie) does not record any historic or predictive groundwater flood zones within the proposed site.

The Local Authority Strategic Flood Risk Assessment (SFRA) (www.floodinfo.ie) mapping indicates that areas in the northwest of Lisclogher Bog are vulnerable to fluvial flooding and mapped within Flood Zone A (100-year flood event) (refer to Figure 9-16). However, site walkovers have revealed that this section of the mapped watercourse does not exist (refer to Section 9.3.3 above and see existing drainage map for Lisclogher Bog included as Figure 9-11). This error also indicates that the SFRA flood zones mapped in this region are incorrect as they assume the presence of a surface watercourse. It is concluded that based on site observation, lack of flooding in winter 2015/2016, and the high drainage density within the bog at this location, that the actual flood risk in this area is the same for the entire Lisclogher Bog, and it should be mapped in Flood Zone C.

CFRAM mapping (www.floodinfo.ie) includes modelled flood levels for the 10-year and 100-year flood events. These levels, modelled near Ballivor village, range from 64.19 – 65.34m OD and are well above the current outfall pipe elevations at the proposed site (67.97 – 79.13m OD). Therefore the risk of fluvial flooding along the Ballivor River, located to the east of the proposed site, backing up into the site drainage network is currently very low. Local CFRAM mapping is shown below as Figure 9-17.

The main risk of flooding across much of the proposed site is via pluvial flooding due to the low permeability peat soils and subsoils. The surface of the cutover bog contains an extensive network of peat drains with surface water outflows from the bogs. This existing drainage network has reduced the risk of pluvial flooding across much of the proposed site. However, following periods of intense and prolonged rainfall events localised surface water ponding is still likely to occur in places.

Site walkover indicates the surface of the cutover bog contains an extensive network of peat drains with surface water outflows from the bogs. This existing drainage network has reduced the risk of pluvial flooding across much of the proposed site. However, following periods of intense and prolonged rainfall events localised surface water ponding is still likely to occur in places. Proposed site infrastructure will be raised above existing ground levels by approximately 1m, therefore risk from pluvial flooding is negligible.

The Proposed Development substation is particularly sensitive to flooding. A site-specific flood analysis has been completed for the substation location. Conservative volumetric analysis has determined the peak flood levels at the proposed substation site for 100-yr and 1000-yr rainfall events to be 74.3 and 74.6m OD respectively. The primary control in the analysis is the expanse of the bog in Carranstown West Bog which needs to fill with pluvial flood water before the substation site can flood. It is therefore recommended to give the substation a floor level of >74.9mOD (74.6mOD + 0.3m freeboard). The proposed final floor level of the substation is 75.9mOD. At this elevation the risk of flooding at the substation site is negligible.

Figure 9-16: Local Authority SFRA Flood Mapping

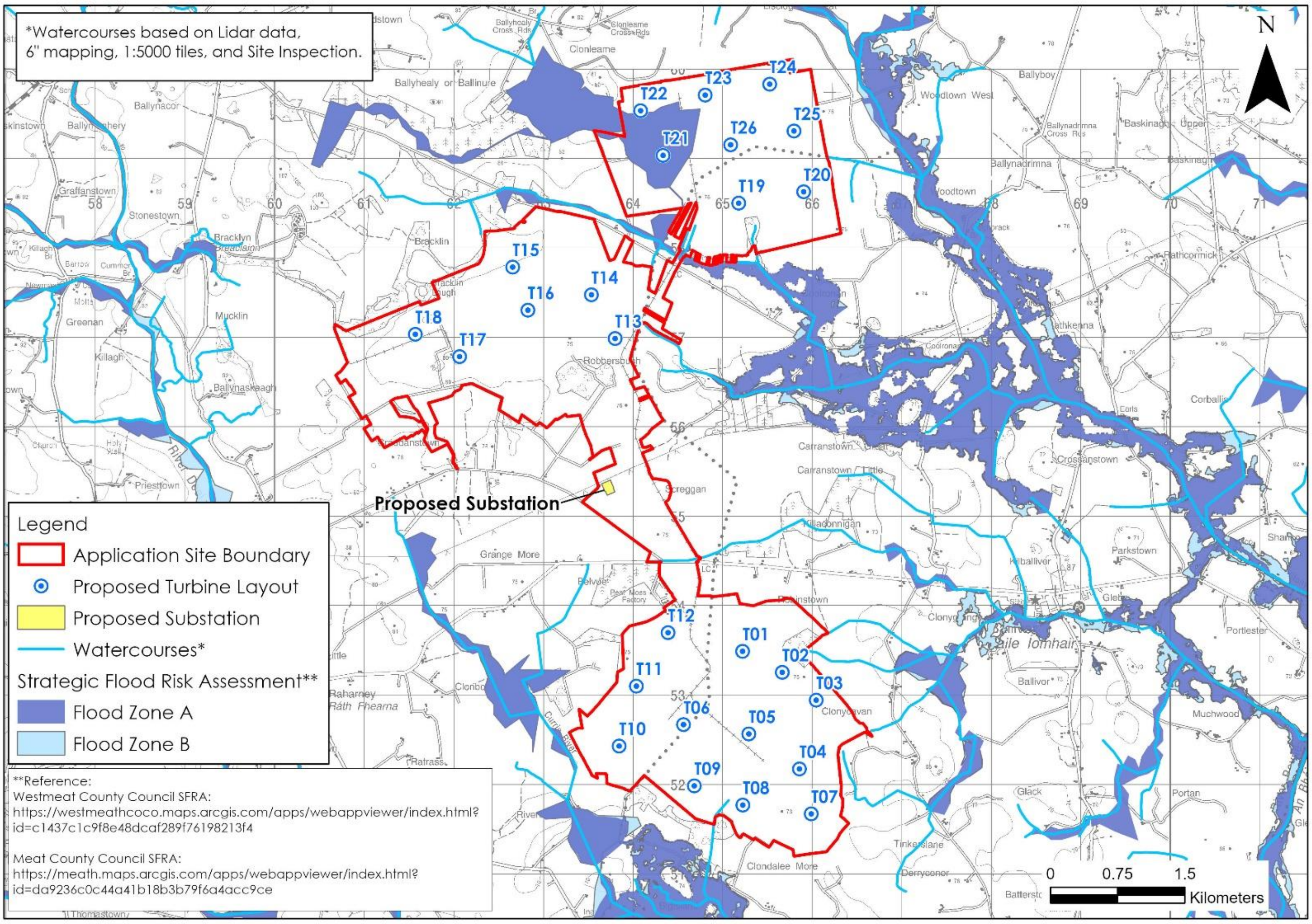
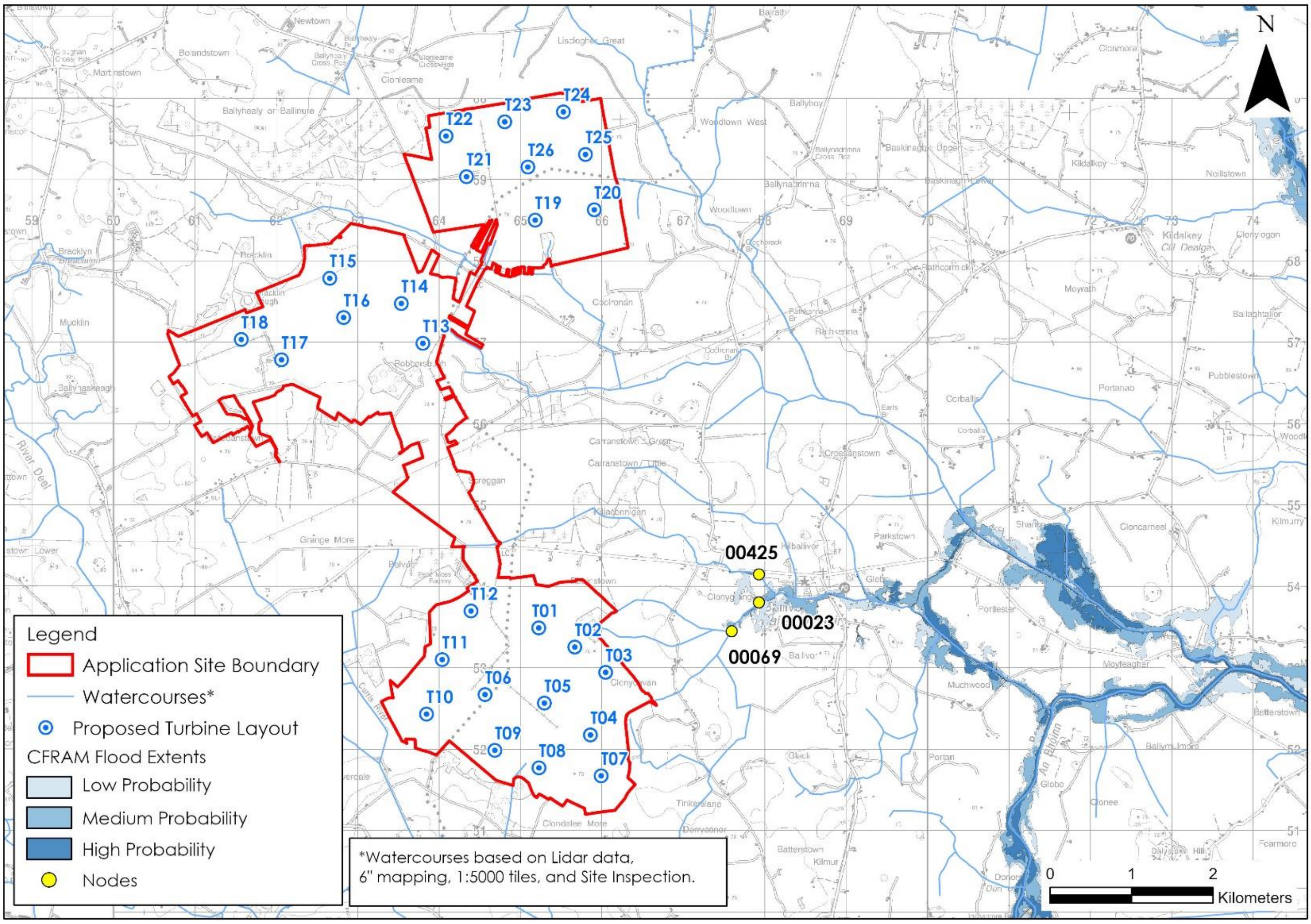


Figure 9-17: Local CFRAM Flood Zone Mapping



9.3.7 Surface Water Quality

Biological Q-rating data for EPA monitoring points on the Stonyford, Deel, Ballivor and Boyne rivers are shown in Table 9-10 below. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High).

The Q-rating for the rivers (Deel(Raharney), Stonyford and Boyne Rivers) in the vicinity and downstream of the proposed site range from 'Poor' to 'Good' in the latest WFD monitoring round (2020). No Q-ratings are available for any of the smaller watercourses which receive discharge from the proposed site.

To the west of the proposed site, the Deel(Raharney) River achieved 'Good' status at Cummer Bridge (Station ID: RS07D010200) and at Raharney Bridge (Station ID: RS07D010300) in 2020. Further downstream to the southwest of Ballivor Bog, the Deel(Raharney) River achieved a Q-score of Q3-4, *i.e.* Moderate status, at Inan Bridge (Station ID: RS07D010400). Upstream of its confluence (Station ID: RS07D010600) with the River Boyne, the Deel(Raharney) was of 'Good' status in 2020. Downstream of this confluence the Boyne was of 'Good' status (Station ID: RS07B040800 and RS07B040900).

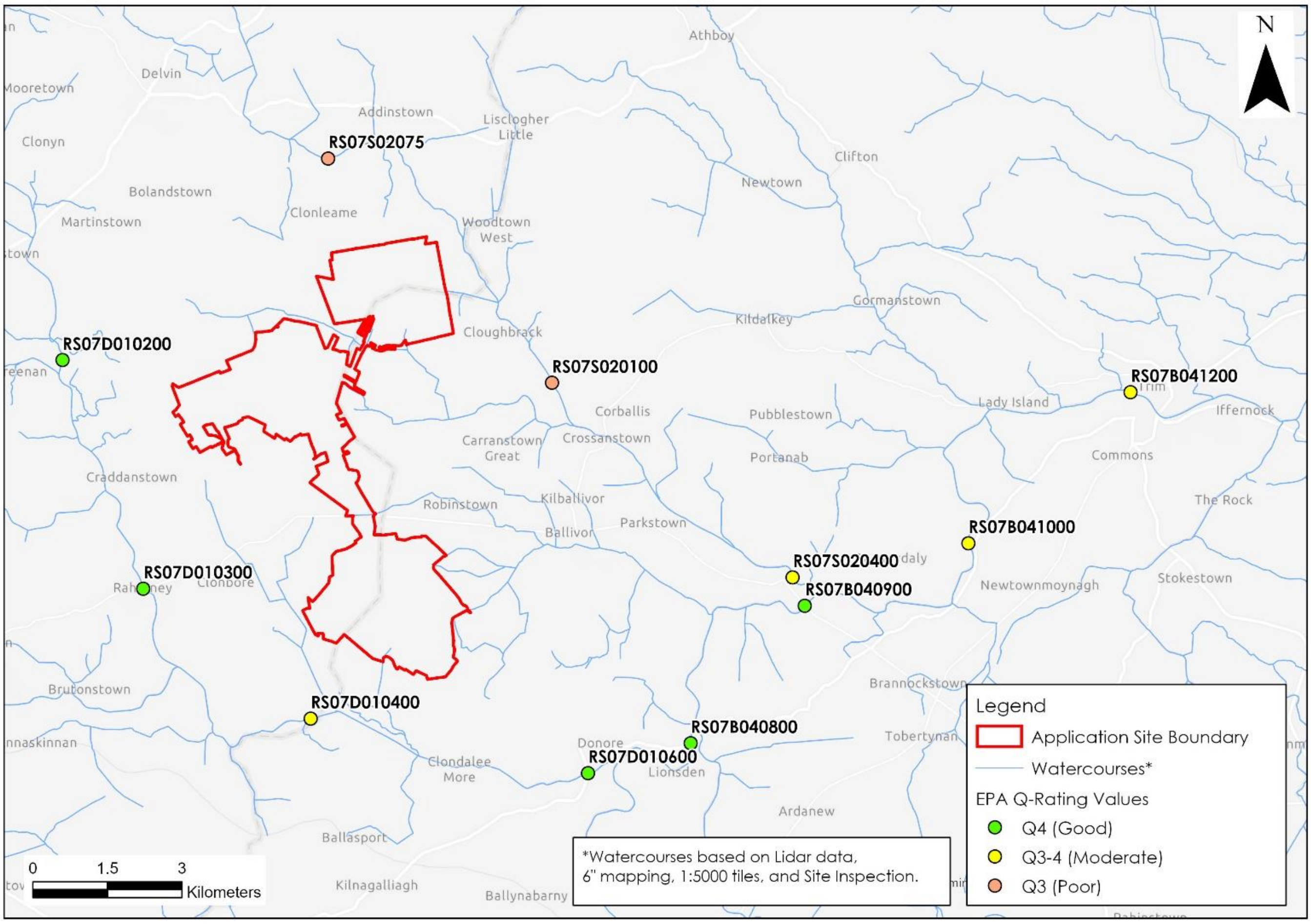
The Stonyford River was of 'Poor' status (Q3) at Stonestown Bridge (Station ID: RS07S020075) to the north and upstream of the proposed site. Further downstream the Stonyford also achieved 'Poor' status at a bridge upstream of Rathkenna Bridge (Station ID: RS07S020100). Upstream of its confluence with the Boyne River the Stonyford River was assigned a Q-status of Q3-4 (Station ID: RS07S020400). Downstream of this confluence the River Boyne was found to be of 'Moderate' status (Station ID: RS07B041000 and RS07B041200).

A map of local EPA monitoring stations is attached as Figure 9-18 below.

Table 9-10: Latest EPA Water Quality Monitoring Q-Rating Values (2020)

WFD SWB	Station ID	Easting	Northing	EPA Q-Rating Status
Deel(Raharney)_030	RS07D010200	258458	257621	Q4 (Good)
Deel(Raharney)_040	RS07D010300	260085	253021	Q4 (Good)
Deel(Raharney)_050	RS07D010400	263452	250407	Q3-4 (Moderate)
Deel(Raharney)_060	RS07D010600	269031	249313	Q4 (Good)
Boyne_050	RS07B040800	271093	249913	Q4 (Good)
Boyne_060	RS07B040900	273392	252679	Q4 (Good)
Stonyford_020	RS07S02075	263805	261681	Q3 (Poor)
Stonyford_030	RS07S020100	268303	257165	Q3 (Poor)
Stonyford_040	RS07S020400	273148	253252	Q3-4 (Moderate)
Boyne_070	RS07B041000	276679	253937	Q3-4 Moderate
Boyne_080	RS07B041200	279942	256977	Q3-4 Moderate

Figure 9-18: Map of EPA Monitoring Stations



Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at 18 no. surface water sampling locations during 3 no. monitoring rounds on 01st April 2021, 28th October 2021 and 19th January 2022 within surface watercourses directly downstream of the proposed site. The results are listed in Table 9-12. The monitoring locations were typically in small streams and drainage channels and are shown in Figure 9-19 below.

Electrical conductivity (EC) values at the monitoring locations ranged between 126 and 814µS/cm, with an average conductivity value of 581µS/cm. Turbidity ranged from 3.1 to 67.3NTU, with an average of 8.6NTU. The highest turbidity was recorded at SW1 within the Stonyford_030 SWB to the west of Lisclogher Bog. This (67.3NTU) turbidity value is anomalously high and most likely due to disturbance of sediment within the water column prior to sampling. Excluding this value, the turbidity ranged between 3.1 – 16.2NTU. Dissolved Oxygen ranged from 4.72 to 11.04mg/l.

The pH values were generally slightly basic, ranging between 6.57 and 7.94, with an average pH of 7.54. Slightly acidic pH values of surface waters would be typical of peatland environments due to the decomposition of peat.

Surface water samples were also taken at these locations for laboratory analysis. Results of the laboratory analysis are shown alongside relevant water quality regulations in Table 9-13 below. In addition, the European Communities Environmental Objectives (Surface Waters) Regulations (S.I. No. 272/2009, as amended) are shown in Table 9-11. Original laboratory reports are attached as Appendix 9.2.

Suspended solid concentrations ranged from <5 to 80mg/l. Suspended solids were above the S.I 293/1988 threshold limits of 25 mg/L in 8 of the 52 no. samples. Ammonia ranged between 0.03 to 0.74 mg/l, and were often above the threshold values for High (≤0.04 mg/L) and Good (≤0.065 mg/L) quality as set out in SI 272/2009. The presence of elevated ammonia is likely due to natural decomposition of peat.

Biological Oxygen Demand (BOD) ranged between <1 and 4 mg/l, with an average value of 2.07 mg/L, above the Good status[1] threshold value of 1.5 mg/L. Nitrate ranged between <5.0 and 35.4 mg/l and results were typically between 5-15 mg/l which is what would be expected in a peatland environment. Nitrite was below the limit of detection of the laboratory in 67% of the samples, with the nitrite concentration in the remaining samples ranging from <0.05 to 0.15mg/l.

In comparison to S.I. No. 272/2009, 33 of 52 results (63%) for BOD exceeded the "Good Status" and "High Status" threshold values. In relation to ammonia, 41 of 52 samples (79%) exceeded the "Good Status" threshold of -≤0.065mg/l. For orthophosphate, 19 of the 52 no. samples (37%) were below the laboratory limit of detection (0.02mg/L), while a total of 13 of the 52 no (25%). no samples exceed the "Good Status" threshold of 0.035mg/l.

*Table 9-11: Chemical Conditions Supporting Biological Elements**

Parameter	Threshold Values (mg/L)
BOD	High status ≤ 1.3 (mean)
	Good status ≤ 1.5 (mean)
Ammonia-N	High status ≤ 0.04 (mean)
	Good status ≤0.065 (mean)
Orthophosphate	High status ≤0.025 (mean)
	High status ≤0.025 (mean)
	Good status ≤0.035 (mean)

*S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).

Table 9-12: Field Parameters - Summary of Surface Water Chemistry Measurements (01/04/2021, 28/10/2021 and 19/01/22)

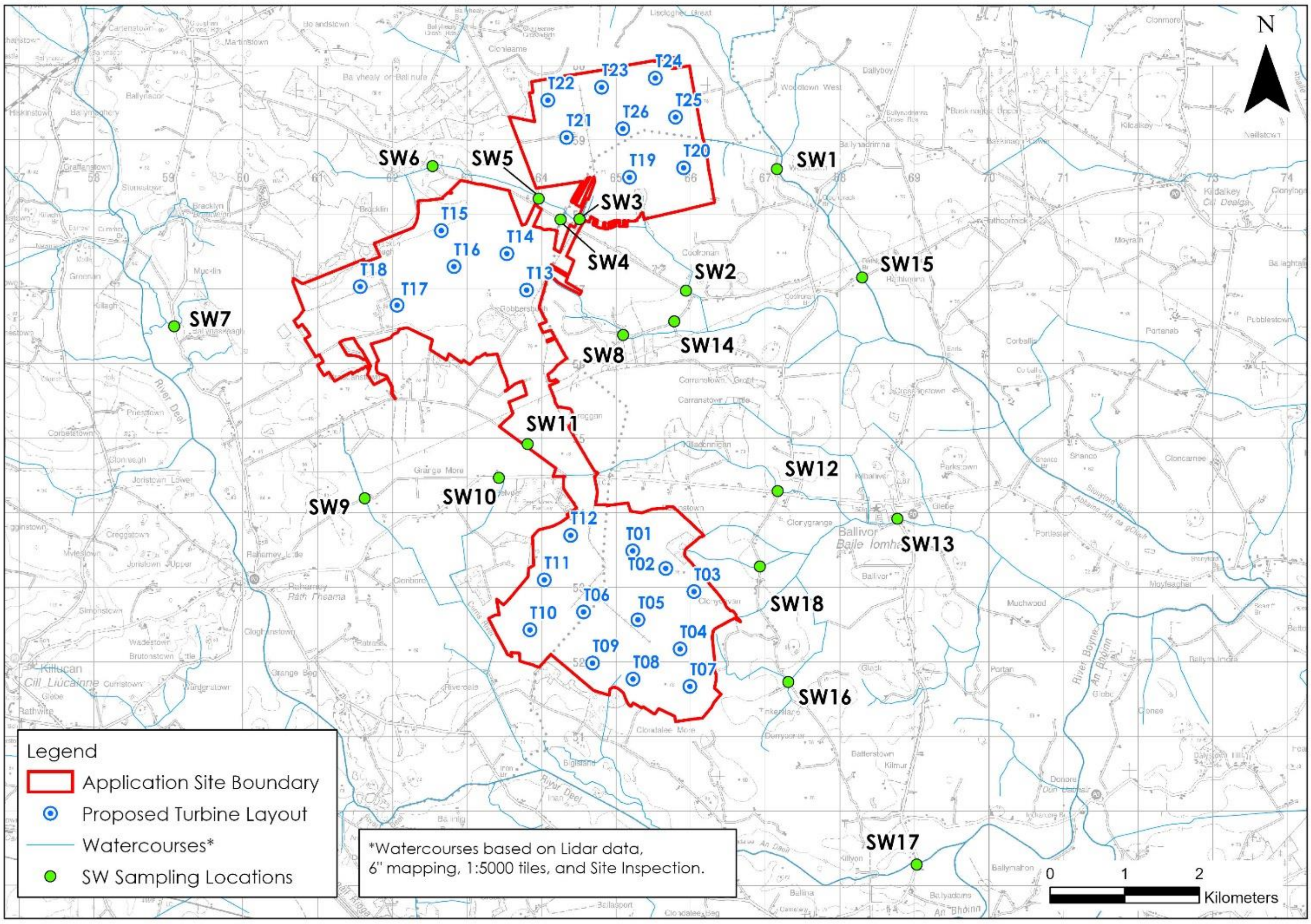
Location ID	Easting	Northing	Temp °C	DO (mg/l)	SPC (µS/cm)	pH	Turbidity	Flow (l/s)
SW1	267157	258608	7.7 – 12.7	7.7 – 8.74	602 – 655	6.98 - 7.43	6.4 - 67.3	5 – 20
SW2	265941	256979	8.4 – 12.6	7.76 - 10.5	488 – 620	7 - 7.74	4.2 - 7.34	250 – 500
SW3	264510	257940	8.6 – 12.5	7.82 - 10.41	520 – 655	6.73 - 7.7	6.4 – 11.3	40 – 200
SW4	264256	257932	9.1 – 12.4	7.21 - 7.38	240	6.5 - 6.8	6.6 – 7.2	Dry – 15
SW5	263963	258213	8 – 12.5	7.68 - 10.31	534 – 653	7.1 - 7.72	4.5 - 6.9	150 – 500
SW6	262538	258647	8.1 – 12.4	6.08 - 10.52	635 – 747	6.9 - 7.84	5.07 – 16.2	150 – 200
SW7	259076	256500	8.4 – 12.9	9.32 - 9.48	561 – 582	7.47 – 7.62	6.03 – 11.4	60 – 150
SW8	265096	256383	9.3 – 12.8	7 - 9.9	438 – 538	6.75 - 7.67	9.05 - 13.5	100 – 300
SW9	261633	254196	8.5 – 12.7	7.57 - 9.94	667 - 752	7.33- 7.65	4.71 – 7.9	50 – 150
SW10	263431	254466	7.7 – 12.3	6.59 - 8.18	668 – 818	7.05 – 7.37	5.03 - 5.8	20 – 50
SW11	263814	254919	5.4 – 11.7	4.72 - 7.87	126 - 169	6.9 - 7.42	7.3 – 8.7	0
SW12	267169	254292	7.8 - 12.9	7.92 - 9.98	695 – 760	7.52 - 7.65	4.55 - 7.26	30 – 180
SW13	268774	253917	7.4 – 13.1	7.62 - 9.81	656 – 759	7.49 - 7.77	6.52 – 6.9	240 – 500
SW14	265783	256564	10 - 12.4	7.48 - 7.74	304	6.77 - 7.24	6.1 - 6.42	Dry - 20
SW15	268302	257158	8.4 – 12.9	8.27 - 11	725 -814	7.58 - 7.94	3.1 - 3.43	5000
SW16	267309	251730	7.8 – 13.3	7.32 - 8.85	504 -733	7.34 - 7.53	3.7 - 5.73	50 – 250
SW17	269032	249280	8.2 – 12.9	7.64 - 10.09	663 – 708	7 - 7.89	6.45 - 6.56	5000
SW18	266930	253281	7.1 – 12.9	9.75 - 11.04	357 - 422	7.76 - 7.91	7.4 - 8.36	15 - 75

Table 9-13: Surface water quality data (01/04/2021, 28/10/2021 and 19/01/2022)

Location ID	Suspended Solids (mg/l)	BOD5 (mg/l)	Orthophosphate (mg/l)	Nitrate (mg/l NO3)	Ammonia (mg/l)	Chloride (mg/l)
EQS	≤25(2)	≤ 1.3 to ≤ 1.5(3)	-≤ 0.035 to ≤0.025(2)	-	-≤0.065 to ≤ 0.04(2)	-
SW1	13 - 40	1 - 4	<0.02 – 0.09	<5 – 13.2	0.2 – 0.6	12.9 – 22
SW2	6 - 19	1 - 4	0.02 - 0.09	11.8 – 21.5	0.13 - 0.25	11 – 15.2
SW3	<5 – 10	1 - 4	0.02 – 0.04	14.8 – 27.9	0.09 - 0.12	12.5 - 15.8
SW44	6 - 80	2 - 3	0.11 - 0.33	<5	0.03 – 0.05	10 - 18.4
SW5	<5 - 5	1 - 2	<0.02 – 0.03	<5 – 28.4	0.12 – 0.2	11 - 15.9
SW6	<5 - 6	1 - 4	<0.02 – 0.03	19.7 – 35.4	0.11 – 0.13	17.3 - 17.6
SW7	<5 - 14	1 - 3	<0.02 - 0.03	<5 – 5.2	0.23 - 0.46	4.6 - 13.6
SW8	<5 - 32	1 - 4	<0.02 - 0.03	6.3 – 8.5	0.14 - 0.74	8.1 - 10.8
SW9	<5	1 - 3	<0.02 – 0.02	5.5 – 10.2	0.03 - 0.08	8 – 13.1
SW10	<5 - 14	1 - 2	<0.02 – 0.05	6.1 – 21.8	0.04 - 0.39	22.8 – 28.5
SW11	<5 - 8	2 - 4	<0.02	<5	0.12 – 0.22	6.5 - 13.6
SW12	11 - 29	1 - 3	<0.02	<0.05 - 11.9	0.05 – 0.11	16.9 - 23.9
SW13	<5 - 13	1 - 3	0.02 - 0.04	7 – 11.8	0.06 – 0.18	13.7 – 20.9
SW145	6 - 9	2 - 4	0.06 - 0.3	<5	0.14 - 0.56	9.7 - 13
SW15	6 - 31	<1 - 3	<0.02	11.4 – 20.3	0.06 – 0.11	15.6 – 18.3
SW16	<5 - 6	<1 - 3	0.02 - 0.04	<5 – 9.8	0.2 - 0.37	10.7 - 18.3
SW17	5 - 12	<1 - 4	<0.02 – 0.03	9 – 15.3	0.04 – 0.09	12 - 15.5
SW18	6 - 51	1 - 3	0.02 – 0.04	<5 – 6.2	0.03 – 0.12	8.3 – 12.3

[2] *S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations*
[3] *S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).*
[4] *Only 2 no. rounds of sampling completed on 21/04/2021 and 28/10/2021.*
[5] *Only 2 no. rounds of sampling completed on 21/04/2021 and 28/10/2021.*

Figure 9-19: Surface Water Monitoring Locations



9.3.8 Hydrogeology

The majority of the bedrock geology underlying the proposed site is mapped as the Dinantian Pure Unbedded Limestones of the Waulsortian Limestone Formation and the Dinantian Upper Impure Limestones of the Lucan Formation. These bedrock geology formations are classified by the GSI as a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll). The Tober Colleen Formation which is mapped to underlie sections of Lisclogher Bog and Bracklin Bog is classified as a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl). A bedrock geology aquifer map is attached as Figure 9-20.

The 4 no. bogs comprising the proposed site are underlain by the Athboy Groundwater Body (GWB) (IE_EA_G_001) which is characterized by poorly productive bedrock. This is a large GWB that extends from Navan in the northeast to Tyrrellspass in Westmeath. The topography of the GWB is relatively low, with overall elevations falling from northwest to southeast. The GWB is composed primarily of moderate permeability rocks, although localized zones of enhanced permeability do occur. Groundwater flow will mainly occur laterally through the upper weathered zone of the aquifer. Below this, flow occurs along fractures, faults and karstic conduits. Recharge occurs diffusely through the subsoils and via outcrops and in some local areas direct recharge may be possible where via sinking streams. The aquifers are generally unconfined but may be locally confined where the subsoil is thicker and/or less permeable. Regional groundwater flow is from northwest to southeast, but locally, groundwater discharges to the streams and rivers crossing the aquifer. In general, groundwater flow paths will be less than a kilometre from recharge to discharge point; longer groundwater flow paths may develop where there is a higher degree of karstification. Groundwater discharges to the numerous small streams crossing the aquifer, and to the springs and seeps. There may also be some discharge to the Trim GWB to the east of this body.

Due to the presence of the peat at the proposed site and the bulk low permeability of the underlying mineral subsoil deposits, local groundwater recharge will be minimal. Recharge is likely to be limited to the perimeter of the bog where the peat is thin or absent (the presence of peat will prevent rapid recharge to underlying regional groundwater systems). Groundwater movement through the underlying subsoil glacial deposits will be relatively slow unless higher permeability sands and gravels are present. Based on topography and regional surface water drainage flows, local groundwater flow direction towards the southeast of the proposed site, towards the River Boyne. As stated above more localised groundwater flow directions will occur, with groundwater discharging to nearby streams and rivers such as the Deel(Raharney) river to the west of the proposed site and the Stonyford river to the east.

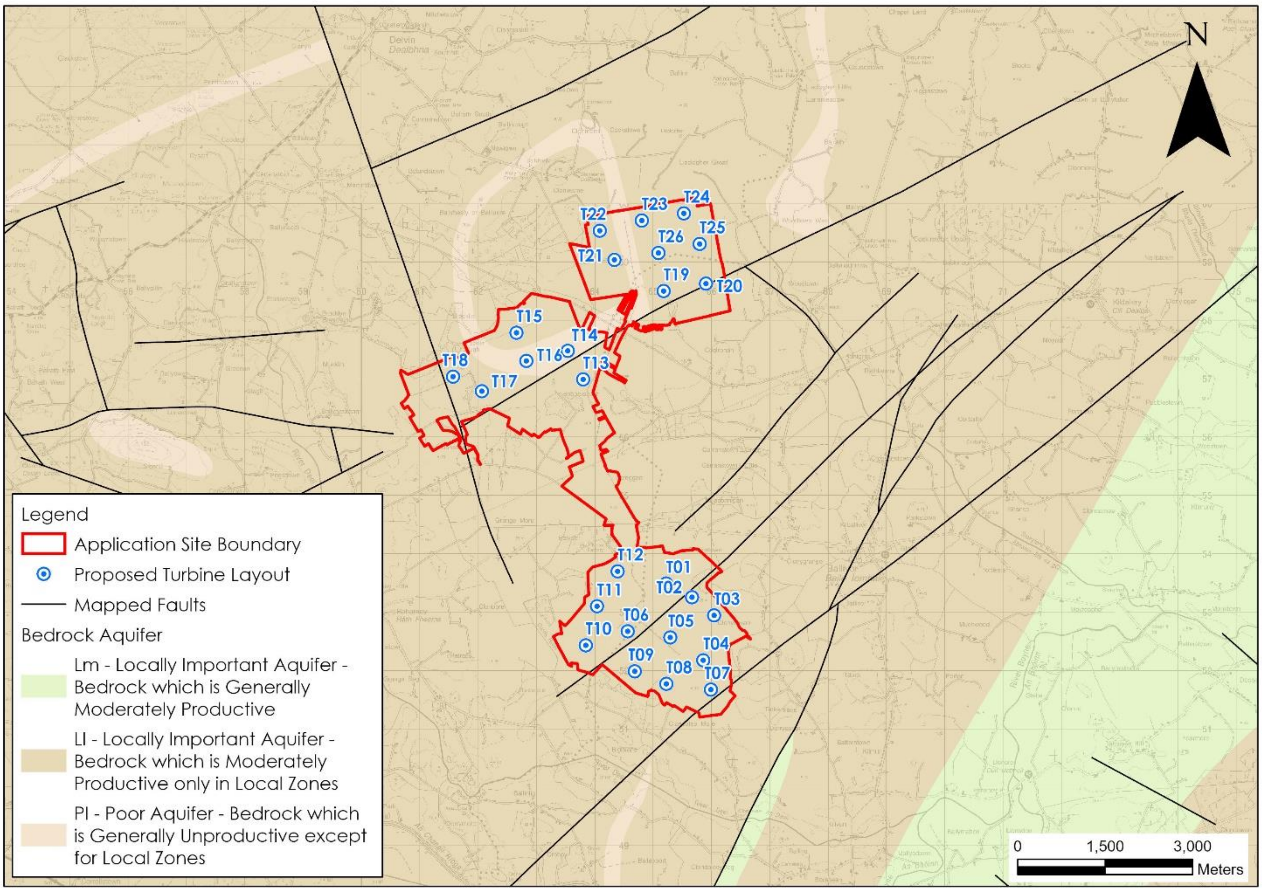
A shallow perched ground water table exists in the peat and is largely isolated from the underlying regional groundwater system (which occurs in the underlying till and bedrock). Groundwater monitoring has been completed at the 3 proposed borrow pit locations and at the proposed substation location. Summary data for the site investigations and groundwater monitoring are included in Table 9-14 below. Within the peat bog, the perched water table was generally encountered close to the ground surface. In the vicinity of the proposed substation groundwater levels ranged from 74.66 – 75.03mOD (2.03 – 2.4metres below ground level (mbgl)) at BH5 from 20th September 2021 to 22nd February 2023. Further to the west, groundwater levels are closer to the surface at BH8 (0.3 – 0.63mbgl) and BH12 (0.42 – 0.75mbgl). Groundwater levels at the 2 no. proposed borrow pits in Carranstown Bog ranged from 72.28 – 73.85mOD (2.51 – 4.78mbgl).

Table 9-14: Groundwater Monitoring at Borrow Pit and Substation Locations

Location	Location ID	Ground level (mOD)	BH depth (mbgl)	WL Range (mOD) (01/09/2021 – 22/02/2023)	Summary of Mineral Subsoil Lithology
BP2	FBP-W03	82.35	11.0	79.00 – 79.85	0-1.5 - no recovery 1.5-11.0 - Brown slightly gravelly silty fine and medium SAND with cobbles.
	FBP-W04	85.88	11.0	78.82 – 79.86	0-1.5 - no recovery 1.5-11.0 – Brownish grey slightly fine to coarse SAND with cobbles.
Carranstown BP (BP1B)	BPA-BH1	78.01	5.1	73.24	0-2.6 – peat 2.6-5.1- Greyish Brown limestone GRAVEL.
Carranstown BP (BP1a)	BPA-BH3a	76.36	4.5	73.57 – 73.85	0-0.6 – peat 0.6-2.5 - Greyish brown gravelly SILT 2.5-4.5 – Dark grey sandy/silty GRAVEL
	CMP-W05	76.84	11.0	72.28 – 72.48	0-1.5 - no recovery 1.5-11.0 – Greyish Brown limestone GRAVEL.
~130m S of Substation	BH12	74.85	4.6	74.1 – 74.4	0-2.4 – Soft Peat 2.4-4.3 - Greyish gravelly SILT

Location	Location ID	Ground level (mOD)	BH depth (mbgl)	WL Range (mOD) (01/09/2021 – 22/02/2023)	Summary of Mineral Subsoil Lithology
					4.3-4.6 – angular cobbles
~50m SE of Substation	BH8	74.7	6.4	74.08 – 74.4	0-3.4 – Soft Peat 3.4-5.0 - Grey slightly gravelly sandy clayey SILT 5.0-6.2 - Grey slightly sandy slightly gravelly CLAY 6.2-6.4 – angular cobbles
Substation	BH5	77.06	7.2	74.66 – 75.03	0-3.0 – Soft Peat 3.0-5.6 – Greyish green slightly sandy gravelly SILT 5.6-7.0 - Grey slightly sandy slightly gravelly CLAY 7.0-7.2 – angular cobbles

Figure 9-20: Bedrock Geology Aquifer Map



9.3.9 Groundwater Vulnerability

Groundwater Vulnerability is a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability is mapped by the GSI and groundwater vulnerability maps are available to view at www.gsi.ie.

The vulnerability rating of the bedrock aquifer underlying the proposed site is classified as "Moderate" to "Low" which is consistent with the presence of basin peat underlain by lacustrine/mineral soil clays and glacial deposits. This means there is a low potential for groundwater dispersion and movement within the aquifer, therefore surface water bodies, such as drains and streams, are more vulnerable to pollution than groundwater.

Groundwater vulnerability is extremely high in karst areas due to the high degree of interconnection between surface and groundwaters in these areas. The GSI does not record the presence of any karst features within the proposed site or in its immediate vicinity. The closest mapped karst feature is a spring (GSI Identifier: 2325SEK005) located in the townland of Dardistown, approximately 2.7km northwest of Bracklin Bog.

9.3.10 Groundwater Hydrochemistry

There is no groundwater quality data for the aquifers underlying the proposed site.

Groundwater sampling would generally not be undertaken for this type of development in terms of EIAR reporting, as groundwater quality effects are extremely unlikely. There are also no proposed discharges to ground associated with the Proposed Development.

Based on data from GSI on the Athboy GWB, groundwaters in this area are typically hard with a calcium-bicarbonate signature and alkalinities of over 250mg/l. Hardness generally ranges from 250 - 350 mg/l as $CaCO_3$, with high electrical conductivities (600 – 700 µS/cm). Table 9-15 provides a summary of the hydrogeological characteristics on each of the bogs comprising the proposed site.

Table 9-15: Hydrogeological characteristics of the Ballivor Bog Group.

Bog Name	Aquifer Type	GWB	GW Vulnerability	GW Hydrochemistry	Nearest Mapped Karst Feature
Ballivor	LI	Athboy	Generally Low, some Moderate vulnerability in south and east	Generally: $Ca\text{-}HCO_3$, with hard water	Spring located ~7.7km to the west
Carranstown	LI	Athboy	Moderate in the east and north, Low in the South and West.	Generally: $Ca\text{-}HCO_3$, with hard water	Spring located ~8.5km to the west
Bracklin	LI, PI	Athboy	Generally Moderate, Low in the West	Generally: $Ca\text{-}HCO_3$, with hard water	Spring located ~2.7km to the northwest
Lisclogher	LI, PI	Athboy	Low	Generally: $Ca\text{-}HCO_3$, with hard water	Spring located ~7km to the west

9.3.11 Water Framework Directive Water Body Status & Objectives

The River Basin Management Plan was adopted in 2018 and has amalgamated all previous river basin districts into one national river basin management district.

The Third Cycle River Basin Management Plan (2022-2027) objectives include the following:

- Ensure full compliance with relevant EU legislation;
- Build on the achievements on the 2nd Cycle;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at restoring impacted waters and protecting waters from deterioration.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all.

Strict mitigation measures (refer to Section 9.5.2 and 9.5.3) in relation to maintaining a high quality of surface water runoff from the development and groundwater protection will ensure that the status of both surface water and groundwater bodies in the vicinity of the proposed site will be at least maintained (see below for WFD water body status and objectives) regardless of their existing status.

9.3.12 Groundwater Body Status

Local Groundwater Body (GWB) and Surface water Body (SWB) status reports are available for download from (www.wfdireland.ie).

The Athboy GWB (IE_EA_G_001) underlies the Ballivor Bog Group. This GWB has been assigned 'Good Status' in all 3 no. WFD cycles (2010-2015, 2013-2018 and 2016-2021) (Table 9-16). This status is defined based on the quantitative status and chemical status of the GWB. The draft 3rd Cycle Boyne Catchment Report lists states that the Athboy GWB is "at risk" of not meeting its WFD objectives, and is under significant pressure from agricultural activities (EPA, 2021).

Table 9-16: WFD Groundwater Body Status

GroundWaterbody	Status 2010-2015	Status 2013-2018	Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Athboy	Good	Good	Good	At Risk	-

9.3.13 Surface Water Body Status

Table 9-17 is a summary of the WFD status and risk result of Surface Water Bodies (SWBs) in the vicinity and downstream of the proposed site. The western section of Bracklin Bog is drained by the Deel(Raharney)_030 SWB. The status of this SWB has improved from "Moderate" in the 2013-2018 cycle to "Good" in the latest cycle (2016-2021). Further downstream the Deel(Raharney)_040 SWB achieved "Good" status in all 3 no. monitoring rounds while the Deel(Raharney)_050 SWB was assigned "Moderate" status. The Deel(Raharney)_060 SWB drains the western section of Ballivor Bog and its status has increased from "Moderate" status in the 2010-2015 round to "Good" in the 2013-2018 round and has remained of "Good" status in the latest round. Further downstream the Boyne_050 achieved "good" status in all 3 no. WFD rounds.

The Boyne_060 SWB drains the eastern section of Ballivor Bog and Carranstown Bog. This SWB has also experienced an improved status from "Moderate" in 2010-2015 to "Good" in 2013-2018 and 2016-2021. The Stonyford River drains Lisclogher Bog, Lisclogher West Bog and Bracklin Bog. The Stonyford_020 and _030 SWBs have consistently deteriorated in status throughout each of the WFD rounds, having "Good" status in 2010-2015, to "Moderate" in 2013-2018, to "Poor" in 2016-2021. The Stonyford_040 however, received a deterioration in status from "Good" in 2010-2015 to "Moderate" in 2013-2018 and remained to be of "Moderate" status in 2016-2021. Further downstream the Boyne_070 and Boyne_080 both achieved "Moderate" status in the latest WFD round.

The majority of these SWBs have been deemed to be "At risk" of not meeting their WFD objectives.

The 3rd cycle Draft Boyne Catchment Report (EPA, 2021) states that agriculture is the most significant pressure in the Boyne Catchment. Agriculture has been identified as a significant pressure on several SWBs downstream of the proposed site. The primary issues relating to agricultural activities are phosphorus loss to surface waters, organic pollution associated with run-off from farmyards and the entrainment of sediment in surface waters due to land drainage works and bank erosion.

Hydromorphological (or physical) is also listed as a significant pressure in the Boyne Catchment, impacting SWBs downstream of the proposed site. Hydromorphological conditions including the input of excessive fine sediment and poor habitat quality are major issues for several SWBs in the vicinity of the proposed site (i.e. Deel(Raharney)_050, Deel(Raharney)_060 and Boyne_060). The River Basin Management Plan states that these SWBs have been subject to excessive modification due to the presence of drainage schemes. In addition, dams, barriers, locks and weirs were identified as a pressure on the Stonyford_020 SWB.

Meanwhile, the 3rd Cycle Draft Boyne Catchment Report (EPA, 2021) lists peat (peat drainage and extraction) as a significant pressure on 13 no. river waterbodies within the Boyne Catchment. This is a reduction from 18 no. waterbodies from the 2nd WFD Cycle. Downstream of the proposed site the Stonyford_030 SWB is listed as being under significant pressure from peat related activities in 3rd Cycle Draft Report. Meanwhile, peat was listed as a pressure on the Boyne_060 SWB in the 2nd Cycle. This SWB has been deemed to be no longer impacted by peat related activities in the 3rd Cycle. Peat pressures are related to increased sediment loads which alter habitats, morphology and hydrology. Peat extraction activities also result fluctuation in downstream ammonia concentrations.

Table 9-17: Summary WFD Information for Surface Water Bodies

River Waterbody	Status 2010-2015	Status 2013-2018	Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Deel (Raharney)_030	Good	Moderate	Good	At Risk	Agriculture
Deel (Raharney)_040	Good	Good	Good	Not at Risk	-
Deel (Raharney)_050	Moderate	Moderate	Moderate	At Risk	Hydromorphology
Deel (Raharney)_060	Moderate	Good	Good	Under Review	-
Boyne_050	Good	Good	Good	Not at Risk	-
Boyne_060	Moderate	Good	Good	At Risk	Hydromorphology
Stonyford_020	Good	Moderate	Poor	At risk	Agriculture & Hydromorphology
Stonyford_030	Good	Moderate	Poor	At Risk	Agriculture & Peat
Stonyford_040	Good	Moderate	Moderate	At Risk	Agriculture
Boyne_070	Good	Moderate	Moderate	At Risk	Agriculture
Boyne_080	Moderate	Moderate	Moderate	At Risk	Hydromorphology

9.3.14 Designated Sites and Habitats

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), candidate Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

Designated sites that lie downstream of the proposed site include:

- Natura 2000 sites:
  - River Boyne and River Blackwater SAC (Site Code: 002299), Deel (Raharney), Stonyford and Boyne rivers are mapped within this SAC;
  - River Boyne and River Blackwater SPA (Site Code: 004232), Deel (Raharney), Stonyford and Boyne rivers are mapped within this SPA; and,
  - Boyne Coast and Estuary SAC and pNHA(Site Code: 001957), 48km northeast of the Lisclogher Bog.
- NHA/pNHAs
  - Boyne Woods pNHA (Site Code: 001592), 26km northeast of Lisclogher Bog and to the east of Navan Town along the River Boyne;
  - Crewbane March pNHA (Site Code: 000553), 35km northeast of Lisclogher Bog along the River Boyne;

- Dowth Wetland pNHA (Site Code: 001861), 40km northeast of Lisclogher Bog; and,
- Boyne River Islands pNHA (Site Code: 001862), 42km northeast of Lisclogher Bog and to the west of Drogheda.

The proposed site is hydrologically connected to the River Boyne and River Blackwater SAC and SPA via several drains and streams which flow from the bog areas into the Deel (Raharney), Stonyford and Boyne rivers. These flowpaths are outlined in detail in Section 9.3.4.

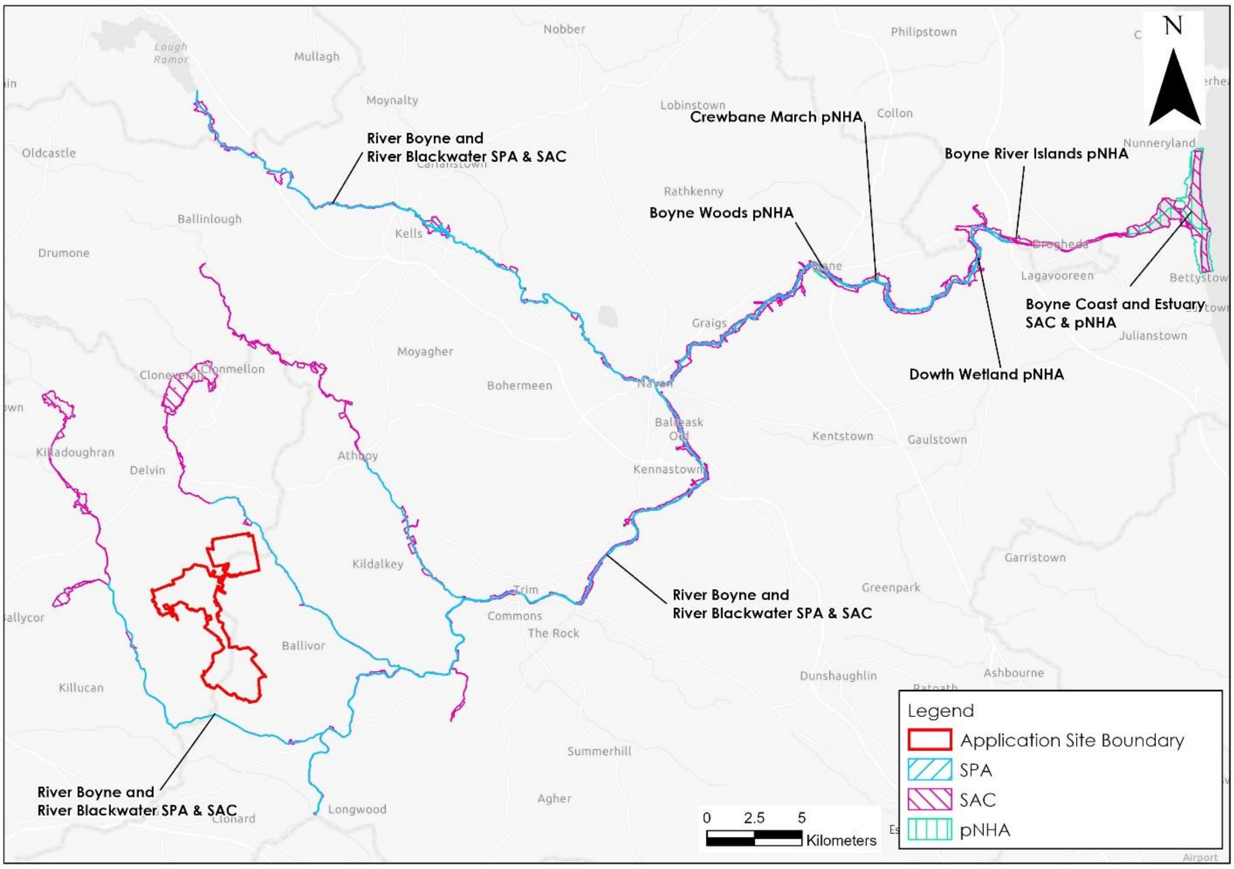
Several other designated sites are located downstream along the River Boyne and are therefore also hydrologically connected with the proposed site. However, these sites are located significant distances (>25km) from the proposed site. Consequently, the River Boyne and River Blackwater SAC/SPA remain the primary sensitive receptors due to their proximity to the proposed site and the direct hydrological linkage. This site was designated as a SAC in June 2003 and a SPA in November 2010.

Other sites located in the vicinity of the proposed site but are not directly linked via surface water pathways are considered below:

- Mount Hevey Bog SAC and Mount Hevey Bog pNHA is located approximately 3.4km west of the proposed site. This is a raised bog and is located upgradient of any drainage from the proposed site. In addition, the River Deel acts as a hydraulic barrier between the site and Hevey Bog. Therefore no hydrological or hydrogeological effects will occur on this designated site.
- The Royal Canal pNHA is located approximately 1.3km southwest of the proposed site. The River Deel acts as a hydraulic barrier between the proposed site and the pNHA. Therefore no hydrological or hydrogeological effects will occur on this designated site.

A map of local designated site is attached as Figure 9-21 below.

Figure 9-21: Designated Sites



9.3.15 Water Resources

9.3.15.1 Surface Water

There are 12 surface waterbodies within the Boyne catchment which have been identified as Drinking Water Protected Areas (DWPA).

The Stonyford_040 SWB in the vicinity of the proposed site is listed in Article 7: Abstraction for Drinking Water. Further downstream, and downstream of Trim, the Boyne River (Boyne_100) is also listed as a DWPA.

9.3.15.2 Groundwater

As outlined above, the groundwater body which underlies the Proposed Development is the Athboy GWB.

There is 1 no. mapped PWS (Public Water Supply Scheme) within 3 km of the proposed site. The Source Protection Area (SPA) for the Ballivor PWS is located to the east of Carranstown and Bracklin bogs, approximately 1.5 km north of Ballivor village. This SPA is more than 2km from the boundary of the proposed site.

The GSI well database, available at www.gsi.ie, was consulted in order to identify the occurrence of known and mapped groundwater wells within the proposed site and in the surrounding lands. The GSI well database maps wells with varying degrees of locational accuracy. Within the GSI database some well locations have a very good location accuracy of 50-100m while others have a poor location accuracy of 1km.

A search of private well locations, with a good location accuracy of 1–100m, were sought using the GSI well database (www.gsi.ie). One well (GSI Name: 2625SWW072) was identified in the east of Ballivor Bog in the townland of Clonycavan. This well reports a poor yield class of 8.7m^3/day. This well is not located within the Ballivor bog (based on inspection during site walkover surveys), and we expect that its location is likely associated with the house to the east.

Several additional wells with a location accuracy of 1km are mapped in the vicinity of the proposed site. These wells all have a poor yield class. As these wells are mapped only to an accuracy of 1km and therefore assessing potential effects on these wells cannot be undertaken in any reliable manner.

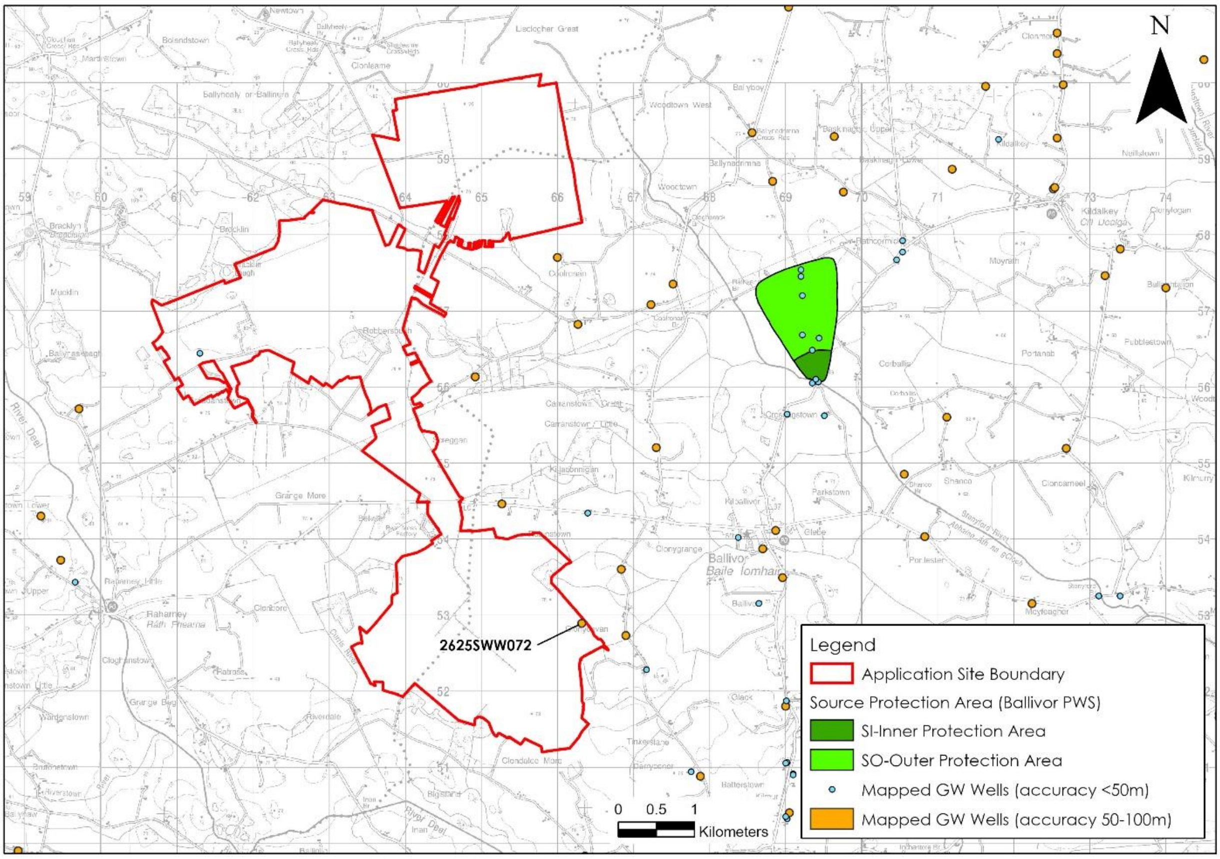
A map of local wells identified in the GSI database is attached as Figure 9-22.

To overcome the poor accuracy problem of other GSI mapped wells (>50m accuracy) it is conservatively assumed (for the purpose of assessment only) that every private dwelling in the area has a well supply and this impact assessment approach is described further below. (Please note wells may or may not exist at each property, but our conservative rationale here is that it is better to assume a well may exist at each downgradient property and assess the potential effects from the Proposed Development on such assumed wells, rather than make no assessment and find out later that groundwater wells do actually exist).

In addition to the above, a search of the EPA's groundwater Abstraction Register database[6] was also completed, and it was found that no registered groundwater abstractions are located within 4.8km of the proposed site (allowing for the 1km rounding to grid coordinates from the abstraction register database).

[6] The information / data provided (i.e. the Abstraction Register) have been generated from the Environmental Protection Agency's Water Abstraction Registration Database and relate to those water abstractions of 25 cubic meters (25,000 litres) or more per day that have been registered with the Environmental Protection Agency. In accordance with the protection of critical national infrastructure direction included under the EU Directive 2016/1148, the data do not include those water abstractions where the abstraction purpose has been identified as being for drinking water. Additionally, grid references are rounded to the nearest kilometre to protect the identity of individual households and businesses, who may also use the abstracted water for private domestic use.

Figure 9-22: Map of Groundwater Wells (www.gsi.ie)



9.3.16 Receptor Sensitivity

Due to the nature of wind farm developments, being near surface construction activities (i.e., shallow excavations and foundations), effects on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during water impact assessments. Piling works are proposed for foundations at the proposed site, and therefore in this instance the underlying groundwater aquifer is identified as a sensitive receptor.

The following sensitive groundwater receptors are identified for impact assessment:

- The Poor and Locally Important Aquifers underlying the proposed site can be classed as being of Low to Medium Importance (refer to Table 9-2).
- The local public and private groundwater abstractions in the lands surrounding the proposed site.

Surface waters are the main sensitive receptors associated with the Proposed Development due to the local hydrological regime which is characterised by high runoff rates and low rates of groundwater recharge. The primary potential contamination downstream surface waters is via elevated concentrations of suspended solids and nutrient enrichment.

The following surface water receptors are identified for impact assessment:

- The local surface waters downstream of the proposed site, including the Deel, Stonyford and Boyne rivers. These waters can be considered to be of Extremely High

Importance (refer to Table 9-1) due to their designation as part of the River Boyne and River Blackwater SAC/SPA.
- Downstream drinking water protected areas including the Stonyford_040 SWB.

Further to the information presented in Section 9.3.14, the following designated site is identified for impact assessment:

- River Boyne and River Blackwater SAC/SPA.

The Proposed Development has the potential to effect water quality in the River Boyne and therefore effect the qualifying interest of this designated site.

9.4 Characteristics of the Proposed Development

The Proposed Development consists of 26 no. wind turbines and associated infrastructure including hardstands, 2 no. meteorological masts, 4 no. temporary construction compounds, 2 no. borrow pits, a 110kV substation, 3 no. permanent amenity carparks as well as access roads and all associated development and drainage works. Please refer to Chapter 4 for a full description of the Proposed Development.

The main characteristics of the Proposed Development that could effect the hydrological and hydrogeological environment are:

- Opening of the 3 no. proposed on-site borrow pits (BP1a, BP1b and BP2), which will involve the stripping of peat and spoil (152,280m^3). No rock breaking or blasters are proposed for the extracting material from these borrow pits. However, it is likely that processing and crushing of cobbles and boulders will be required. The estimated volume of material to be extracted from the 3 no. borrow pits is 674,000m^3. Runoff and discharge from the borrow pits have the potential to effect surface water quality. Extraction at the borrow pits will be above and below the groundwater table and some pumping will be required to ensure borrow pits do not flood.
- Establishment of the 4 no. construction compounds (1 in Ballivor Bog, 2 in Bracklin and 1 in Carranstown) which will comprise of temporary site offices, staff welfare facilities, storage areas and car-parking. These compounds will be constructed using excavate and replace methods and may be floated or partially floated. All compounds are mapped on peat and it is estimated that construction will require the removal of ~28,000m^3 of peat and spoil. Runoff these construction areas have the potential to effect surface water quality. In addition, welfare facilities will be provided at the temporary construction compounds. Wastewater effluent will be collected in a wastewater holding tank and periodically emptied by a licenced contractor.
- Construction of ~28km of internal site access roads the site access roads. The proposed new access roads will be constructed predominantly using a floated technique. While some new excavated roads are also proposed. The construction methodologies are provided in the Peat and Spoil Management Plan attached as Appendix 4-2.The construction of the proposed roads will involve the removal of ~7,700m^3 of peat and spoil and will require the use of aggregate, sourced from the on-site borrow pits and imported from local quarries where required. Construction of these access tracks has the potential to effect surface water quality.
- Construction of the crane hardstand areas and turbine assemblage areas. This too will involve the use of aggregate, sourced from the onsite borrow pits and imported from local quarries where required. Construction of these areas has the potential to effect surface water quality.

- Construction of the 110kV on-site substation in the northwest of Carranstown Bog will likely be completed using a founded technique, and will require the excavation of ~50,000m^3 of peat and 5,500m^3 of non-peat materials. Welfare facilities will be provided at the substation. Wastewater effluent will be collected in an underground concrete holding tank and periodically emptied by a licenced contractor for the operational phase of the Proposed Development. Construction of the sub-station and associated parking area has the potential to effect surface water quality.
- Construction of the foundations for the 26 no. proposed wind turbines and the meteorological masts. Volumes of peat/subsoil to be removed at the turbine locations is estimated to be 376,900m^3 peat and 95,000m^3 of non-peat subsoils. The movement of large volumes of peat and spoil have the potential to effect surface water quality. Construction of the turbine foundations will require large volumes of concrete could effect surface water and groundwater quality.
- The majority of the foundations for the turbine and meteorological masts are expected to be piled. Where piled foundations are required, there is the potential groundwater quality effects.
- Construction of the underground grid cable trench which will connect to the 26 no. turbines to the substation. This will involve the excavation of a shallow trench (approximately 1.2m deep), placement of ducting and backfilling with aggregate, lean-mix concrete and excavated material, as appropriate (depending on the location of the cable trench). The ground will be reinstated once the works are completed. These works have the potential to effect surface water quality.
- Construction of the proposed new transmission cable which will connect the proposed substation to the existing Mullingar-Corduff 110kV overhead line. Construction activities include the excavation of peat and spoil at the proposed towers. Construction of the tower foundations will involve the use of concrete. These activities have the potential to effect surface and groundwater quality.
- Settlement ponds where constructed will be volume neutral, i.e. all material excavated will be used to form side bunds and landscaping around the ponds. There will be no excess material from settlement pond construction. The material will also be reinstated during decommissioning.
- Grey water will be supplied by rainwater harvesting and water tankered to the site where required. Bottled water will be used for potable supply.
- Temporary and permanent road improvement works along the Turbine Delivery Route (TDR).

9.4.1 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation measures to reduce potential effects on downstream surface water bodies. Drainage management with the proposed site will be risk based, and will employ various methods, building on the existing drainage systems within the proposed site. The main tenet of the proposed drainage plan is ensuring to 'keep clean water clean' by avoiding unnecessary or significant disturbance to existing drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas through the construction of interceptor drains. Where possible (depending on orientation), existing field drains can be used as interceptors drains. Otherwise new interceptors drains will be excavated and they will outfall to field drains downstream of the works areas.

The second method involves collecting any construction area drainage waters (from turbine base/hardstand areas, construction compounds, and the substation) and routing that water through new proposed temporary wind farm settlement ponds (or stilling ponds) prior to controlled release into the existing field drain network. There will be no discharges to the existing field drains without prior treatment.

Within the Proposed Development layout there are section of proposed floating road between turbine infrastructure. In these sections, and depending on intermediate topography, a collector drain (dirty water system as described above) may be used during construction stage, or over the edge (OTE) drainage will occur. Over the edge drainage allows runoff from access tracks to flow into local field drains and be managed via the existing site drainage system. OTE drainage will only occur where topography allows, and it is only proposed in areas of low risk and remote from outfall locations (at least 150m from bog outfall locations. Silt traps and check dams will be installed in field drains downstream of OTE drainage areas, and these will provide attenuation and treatment of dirty water.

During the construction phase, all runoff from works areas (i.e., dirty water) will be attenuated and treated prior to being released within the proposed site. All drainage outfall from the proposed site is routed through existing settlement ponds that remain in-situ from the previous site use.

9.4.2 Development Interaction with the Existing Bog Drainage Network

The Proposed Development drainage will not significantly alter the existing drainage regime at the proposed site. Moreover, the proposed drainage system will be fully integrated into the existing bog drainage systems.

Existing field drains and main drains will be routed under/around proposed access tracks using culverts as required.

Runoff from access tracks, turbine bases and hardstand areas (construction compounds, substation, and meteorological masts) will be collected and treated in local (proposed) wind farm settlement ponds and then discharged to existing peat field drains. From there this water will flow towards the relevant bog boundaries in existing field drains and main drains, and then be treated further in the existing main (bog) settlement ponds prior to discharge from the bog group in accordance with the existing IPC Licence.

One of the proposed ecological aspects of the drainage design is to re-wet the proposed site in small areas, where possible, to create wet areas as such wetland features which are good for overall site biodiversity. Ponding would occur in these areas to a very shallow depth, and only intermittently following heavy rainfall. No large open bodies of water are proposed, and where intermittent ponding occurs this will be broken up into small areas using peat berms.

9.5 Likely Significant Effects and Associated Mitigation Measures

9.5.1 Do -Nothing Scenario

If the Proposed Development were not to proceed, the proposed site would continue to be managed under the requirements of the relevant IPC licence and therefore the ongoing site management and environmental monitoring, peat stockpile removal (due to be completed by 2024), and wind measurement would continue. In addition, if the Proposed Development were not to proceed, the implementation of peatland rehabilitation plans as required under IPC License would occur. Likewise, the PCAS scheme in adjacent Bogs (where selected) would continue to be implemented. Other existing land use practices including local small scale turbary activities would continue along the margins of the proposed site. These land uses and activities will also continue if the Proposed Development does proceed.

Now that peat extraction activity has ceased across the Ballivor Bog Group, including the 4 no. bogs which comprise the proposed site, Bord na Móna's Decommissioning and Rehabilitation Plans will be implemented in accordance with the IPC licence requirements. These plans aim to environmentally stabilise the bogs through the encouragement of re-vegetation of bare peat areas, with targeted active management being used to enhance re-vegetation and the creation of small wetland areas (if required). The Rehabilitation Plan aims to rehabilitate the bogs as much as possible by placing the existing peatland environments on a path towards becoming naturally functioning peatlands. Certain targeted management techniques such as drain blocking would aim to alter the current baseline hydrology and hydrogeology of the proposed site, establishing conditions more suitable for colonisation by more typical bog communities. In addition to improving the local bog hydrogeological regime by raising the peat water table, the proposed rehabilitation will also have an indirect effect on downstream surface water quality as rehabilitated peatlands are associated with surface water quality improvements linked to reduced concentrations of suspended solids and nutrients in runoff from rehabilitated bogs. Rehabilitation of the proposed site will also provide improved surface water attenuation, thereby reducing the flood risk downstream.

In addition to the standard rehabilitation required by the IPC licence, enhanced rehabilitation measures will be implemented in certain areas of the Ballivor Bog Group (Carranstown East and Bracklin West). The enhanced decommissioning, rehabilitation and restoration measures, referred to as the Peatlands Climate Action Scheme (PCAS), are designed both to exceed/meet the standard requirements as defined by the IPC licence and to enhance ecosystem services by optimising climate action benefits. We note that work associated with PCAS has already begun in Carranstown East. The enhanced restoration, which will include more intensive drain blocking and ground re-profiling, will optimise hydrological conditions and will have benefits for water quality and storage attenuation as well as increased carbon storage and reduced emissions.

If the Proposed Development were not to proceed, the cumulative effect of the Do Nothing Scenario and the implementation of the Decommissioning and Rehabilitation Plans for the Ballivor Bog Group (including the PCAS scheme) would result in a moderate, positive, direct, long-term effect on bog hydrogeology and a moderate, positive, indirect, long-term effect on downstream surface water quality and quantity.

9.5.2 Construction Phase - Likely Significant Effects and Mitigation Measures

9.5.2.1 Earthworks Resulting in Suspended Solids Entrainment in Surface Waters

Construction phase activities including access road construction, turbine base/hardstanding construction, construction compound construction, meteorological mast construction, substation and grid connection construction, internal cable route excavations, amenity paths construction, entrance locations and amenity car parks will require varying degrees of earthworks resulting in excavation of peat and mineral subsoil where present. It is estimated that construction works will require the excavation of approximately 732,000m^3 of peat and non-peat materials which will be a significant potential source of sediment laden water. Other potential sources include:

- Drainage and seepage water resulting from excavations;
- Stockpiled excavated material providing a point source of exposed sediment; and,
- Erosion of sediment from emplaced site drainage channels.

These activities can result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality in downstream water bodies. Potential effects on all watercourses downstream of the proposed site could be significant if mitigation measures are not implemented.

Pathways: Drainage and surface water discharge routes.

Receptors: Down-gradient rivers (Deel, Ballivor, Stonyford and Boyne rivers and their associated tributaries) and associated dependent ecosystems (see chapter 6 - Biodiversity (excluding Birds).

Pre-Mitigation Potential Effect: Negative, significant, indirect, temporary, likely effect on down-gradient rivers and associated dependent ecosystems.

Proposed Mitigation Measures:

Mitigation by Avoidance:

The key mitigation measure during the construction phase is the avoidance of sensitive hydrological features where possible, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). All of the key Proposed Development areas (turbines, hardstands, substation, construction compounds etc.) are located significantly away from the delineated 50m watercourse buffer zones except for the upgrading of the existing watercourse crossings, new drain crossings and upgrades to the existing site access tracks. The Proposed Development includes upgrades to existing watercourse crossings and site access roads and a new proposed amenity path which cross EPA mapped watercourses at 3 no. locations within the proposed site:

- Upgrades to the existing crossing over the Killanconnigan stream between Ballivor and Carranstown bogs;
- Upgrades to the existing crossing over the Cartenstown stream between Bracklin and Lisclogher bogs;
- Proposed amenity path over the Cartenstown stream in the centre of Lisclogher bog. However as stated above in Section 9.3.6, walkover surveys have confirmed that there is no watercourse in this area of the proposed site).

The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be installed and operate effectively. The proposed buffer zone will:

- Minimise physical damage (river/stream banks and river/stream beds) to watercourses (where possible, this cannot be avoided at the watercourse crossing discussed above) and the associated release of sediment;
- Minimise excavations within close proximity to surface watercourses;
- Minimise the entry of suspended sediment from earthworks into watercourses; and,
- Minimise the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

In addition, and as outlined above the Proposed Development drainage system will link into the existing bog drainage system, and discharge from each of the bog sites via existing large settlement ponds, which are some distance from the Proposed Development footprint. As such, there is significant distance for Proposed Development related surface water to travel before it reaches the edge of the bogs and is released from the existing bog drainage system into downstream watercourses.

Mitigation by Design:

There is an extensive network of drains already existing at the 4 no. bogs comprising the proposed site. The existing drainage infrastructure is operating in accordance with IPC licence requirements, with environmental monitoring and silt control measures being implemented at these bogs. The existing drainage system at the proposed site will be maintained and expanded locally as required for use within the Proposed Development drainage system. The key elements are the upgrading and improvements to water treatment elements, such as in-line controls and treatment systems, including wind farm related silt traps and settlement ponds.

The elements of interaction with existing drains will be as follows:

- Interceptor drains will convey clean runoff water around works areas to the existing downstream drainage system (field drains and main drains). Where required, interceptor drains will be installed in advance of any construction works commencing. This will ensure that clean water is kept clear by diverting surface water flow around excavations, construction areas and temporary storage areas. Where possible (depending on orientation), existing field drains can be used as interceptors drains;
- Collector drains will be used to intercept and collect runoff from construction areas (from turbine base/hardstand areas, construction compounds, and the substation). During the construction phase temporary settlement ponds will be used to attenuate and treat runoff from the construction areas (from turbine base/hardstand areas, construction compounds, and the substation) and treated water will then discharge into existing field drains and main drains. Temporary settlement ponds will be removed at the end of the construction phase (end of high risk period), and wind farm runoff will discharge into existing field drains and main drains;
- During the construction phase, temporary silt traps (silt fences) will be used as an additional water protection measures around the existing bog drainage network, particularly where works are proposed within 50m of a natural watercourse. The silt fences will be placed in the existing drains downstream of construction works, and the associated construction area run-off water will be diverted into proposed interceptor drains, or culverted under/across the works area;
- During the construction phase, dewatering silt bags will also be used as required. They can be used downgradient of turbine bases, where temporary pumping is required. Discharge from dewatering silt bags will flow into settlement ponds and treated water from settlement ponds will outfall to existing field drains and main drains;

- Within the proposed site layout there are section of proposed floating road between turbine infrastructure. In these sections, and depending on intermediate topography, a collector drain (dirty water system as described above) may be used during construction stage, or over the edge (OTE) drainage will occur. Over the edge drainage allows runoff from access tracks to flow into local field drains and be managed via the existing site drainage system. OTE drainage will only occur where topography allows, and it is only proposed in areas of low risk and remote from outfall locations (at least 150m from bog outfall locations. Silt traps and check dams will be installed in field drains downstream of OTE drainage areas, and these will provide attenuation and treatment of dirty water; and,
- Culverts will be required where site roads and proposed hardstands cross the main bog drainage networks. These will be installed with a minimum gradient to reduce the entrainment of suspended solids. All culverts will be inspected regularly and maintained where appropriate. Culverts will remain in-situ during the Operational Phase of the Proposed Development.

Water Treatment Train:

If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'siltbuster' or similar equivalent treatment system) will be used to filter and treat all required surface discharge water collected in the dirty water drainage system. This will apply to all of the construction phase.

Silt Fences:

Silt fences will be located within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to the existing drainage network of sand and gravel-sized sediment, released from the excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Regular inspection and maintenance of silt fences during the construction phase are critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase.

Silt Bags:

Silt bags will be used where small to medium volumes of water need to be pumped from excavations (e.g. the proposed underpass locations). As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through.

Adverse Weather Management:

The works programme for the construction stage of the development will also take account of weather forecasts and predicted heavy rainfall events in particular. Large excavations and movements of peat/subsoil or peat stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily/weekly basis, as required, to allow site staff to manage construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Éireann website (www.met.ie/forecasts). These provide general information on weather forecasts including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;

- Rainfall Radar Images: Images covering the entire country are freely available from the Met Éireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Éireann provide a 24-hour telephone consultancy service. The forecaster will provide an interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold of rainfall values given below will allow planned works to be safely executed (from a water quality perspective) or works to be postponed if a high rainfall intensity event is forecast.

Earthworks will be suspended if forecasting predicts any of the following is likely to occur:

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to earthworks being suspended the following further control measures will be completed:

- All open peat/spoil excavations will be secured and sealed;
- Temporary or emergency drainage will be created to prevent back-up of surface runoff; and,
- Working during heavy rainfall and for up to 24 hours after heavy events will not be allowed to ensure drainage systems are not overloaded.

Management of Runoff from Peat and Subsoil Storage Areas:

It is proposed that excavated peat will be used for landscaping close to its original extraction point. During the initial placement of peat and subsoil, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from the storage areas as required. Interceptor and collector drains will be used at storage areas. 'Siltbuster' treatment trains will be employed if previous treatment is not of a high quality.

Timing of Site Construction Works:

Construction of the site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during low rainfall periods will also ensure that attenuation features associated with the drainage system will be in place and operational for all subsequent construction works.

Proposed Drainage and Water Quality Monitoring

An inspection and maintenance plan for the on-site drainage system will be prepared in advance of the commencement of any works and will be included in the CEMP. Regular inspections of all installed drainage systems will be undertaken, especially before and after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt sediment levels at dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

During the construction phase field testing (visual, supplemented with pH, electrical conductivity, temperature, dissolved oxygen and turbidity monitoring), sampling and laboratory analysis of a range of parameters[7] with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly and event-based). The data will be processed and analysed and works will cease if elevated turbidity concentrations are recorded. In this event, all upstream silt traps and drainage routes will be inspected to identify the cause of the elevated turbidity levels. Works will not recommence until any issues have been resolved and the turbidity concentrations have returned to background concentrations.

Post-Mitigation Residual Effects: The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of release of sediment have been proposed above and will reduce the concentration of suspended sediment to acceptable levels. The residual effect is considered to be - Negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality and aquatic habitats.

Significance of Effects: For the reasons given above, and with the implementation of the detailed mitigation measures, no significant effects on the surface water quality will occur.

9.5.2.2 Potential Effects on Groundwater Levels During Excavation Works

4 no. borrow pits are proposed at the proposed site and associated dewatering works have the potential to effect local groundwater levels. In addition, smaller-scale temporary dewatering may occur at some excavations (i.e. turbine bases, cable trenches), and these also have the potential to affect local groundwater levels. However, temporary reductions in groundwater levels by temporary dewatering will be very localised and of small magnitude due to the nature and permeability of the local peat and subsoil geology, which comprises moderate to low permeability lacustrine and glacial deposits.

The installation of turbine bases in the underlying glacial deposits is also likely to require some temporary dewatering arrangements, where deeper excavations are required. However, due to the dominance of moderate to low permeability glacial till subsoils and lacustrine deposits below the bogs the effects on groundwater levels will be localized to the excavation and only for a temporary basis during the construction work. Water level impacts will be temporary and are unlikely to be significant beyond 50m from any excavation (the GSI do not record any groundwater wells within 100m of the proposed borrow pits, refer to Section 9.5.2.8).

Pathway: Groundwater flow paths.

Receptor: Groundwater levels.

Pre-Mitigation Potential Effect: Slight, direct, negative, temporary, unlikely effects on local groundwater levels.

Impact Assessment:

- There are large separation distances between proposed works and local houses, and associated water wells. Except for houses located approximately 100m south of BP2, the closest houses are at least 450m from any proposed dewatering works associated with the borrow pits. The GSI does not map any groundwater wells in the properties to the south of BP2;
- Similarly, main streams and rivers are at least 150-500m away from any turbine and mast bases, and at these distances potential effects will be imperceptible;

[7] *example suite: pH (field measured), Electrical Conductivity (field measured), temperature (field measured), Dissolved Oxygen (field measured), Turbidity (NTU) (sonde measured), Flow (m/s), Total Suspended Solids (mg/l), Ammonia, Nitrite (NO_2) (mg/l), Ortho-Phosphate (P) (mg/l), Nitrate (NO_3) (mg/l), Phosphorus (unfiltered) (mg/l), Chloride (mg/l), and BOD (mg/l).*

- The proposed underground cable trench is designed to be shallow and will only be approximately 1.2m in depth. At this depth, it will only potentially interact with shallow perched water within the peat profile. No interaction with deeper regional groundwater will occur. Therefore, no effects on the local groundwater table or flows will occur from this element of the development;
- The construction of the proposed electrical substation and grid connection (pylons), the temporary construction compounds, roads and amenity carparks will be relatively shallow and will only have the potential to interact with the shallow perched water table within the peat bog. No interaction with the deeper regional groundwater regime will occur. Therefore, no impacts on the local groundwater table or flows will occur; and,
- The potential effect of the proposed piling works on groundwater is assessed separately in Section 9.5.2.4.

Post-Mitigation Residual Effects: Due to large separation distances between proposed works and water wells and local streams and rivers, and the relatively shallow nature of the proposed works, and also the prevailing geology of the proposed site the potential for water level drawdown impacts at receptor locations are considered negligible. The residual effect is considered to be - Imperceptible, direct, temporary, unlikely effects on local groundwater levels.

Significance of Effects: For the reasons given above, no significant effects on groundwater levels are likely to occur.

9.5.2.3 Excavation Dewatering and Potential Effects on Surface Water Quality

Groundwater seepages will likely occur in turbine base, substation and construction compound excavations and at the borrow pits, and these will create additional volumes of water to surface water (i.e. rainfall water) to be treated by the drainage management system. Groundwater inflows may be more significant where lenses of sand and gravel are intercepted within the glacial till deposits.

Inflows will likely require management and treatment to reduce suspended sediments. No contaminated land was noted at the proposed site and therefore pollution issues are not anticipated in this respect. The main potential significant effects are as a result of turbidity and suspended solids on downstream surface water receptors such as the Deel, Stonyford and Boyne rivers. Poor water quality in downstream streams and rivers has the potential to affect aquatic habitats and species (e.g. fish and invertebrates).

Pathway: Groundwater pumped into the site drainage network.

Receptor: Down-gradient surface water bodies (Deel, Stonyford, Ballivor and Boyne rivers and their associated tributaries).

Pre-Mitigation Potential Effect: Negative, significant, indirect, temporary, unlikely effects on surface water quality.

Proposed Mitigation Measures:

Management of excavation seepages and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent the build-up of groundwater in the excavation;
- The interceptor drainage will be discharged to the existing drainage system or onto the bog surface within the overall bog drainage and treatment system;

- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a “Siltbuster” unit;
- There will be no direct discharge to the existing bog drainage network and therefore no risk of hydraulic loading or contamination will occur; and,
- Daily monitoring of excavations and the water treatment system by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped, and a geotechnical assessment will be undertaken.

Post-Mitigation Residual Effects: The potential for the release of suspended solids to watercourse receptors is a risk to water quality of these receptors. Proven and effective measures to minimise the levels of sediment from the proposed site have been proposed above and will maximise the drainage pathway length between the potential sources and the receptor. The residual effect is considered to be - Imperceptible, indirect, temporary, unlikely effects on local surface water quality within the Deel, Stonyford, Ballivor and Boyne rivers and their associated tributaries.

Significance of Effects: For the reasons given above, and with the implementation of the above-listed mitigation measures, no significant effects on the surface water quality will occur.

9.5.2.4 Potential Effects Associated with Piled Foundations

Due to the depth of peat at the proposed turbines locations, a range of foundation scenarios are proposed, including:

- Gravity foundations;
- Piled foundation with a configuration of up to 50 no. 300mm square concrete driven piles. These piles could extend to a depth of between 5 to ~18metres below ground level; and,
- Piled foundation with a configuration of up to 20 no. 900 to 1200mm cylindrical bored piles. These piles could extend to a depth of between 5 to ~18metres below ground level.

The following potential scenarios arise in respect of proposed piling works:

- Creation of preferential pathways, through a low permeability subsurface layer (an aquitard such as lacustrine clay), to allow downward flow into the underlying aquifer;
- Creation of preferential pathways, through a low permeability subsurface layer (an aquitard such as lacustrine clay), to allow upward migration alkaline groundwater to the acidic bog surface, thus potentially altering local hydrochemistry and therefore vegetation at the bog surface; and,
- Creation of a blockage to regional groundwater flow within the underlying aquifer due to placement of pile clusters.

These pathways are analogous to pathways described for piling works associated with contaminated land sites, as detailed in Environment Agency (2001).

Pathway: Groundwater flowpaths (upward and/or downward pathways, and regional groundwater flows).

Receptor: Groundwater quality in the underlying Athboy GWB and groundwater hydrochemistry at the surface of the within the peat bog.

Pre-Mitigation Potential Effect: Negative, moderate, direct, short term, likely effect on groundwater quality/hydrochemistry.

Proposed Mitigation Measures:

The proposed mitigation measures designed for the protection of downstream surface water quality and groundwater quality within the peat bog will be implemented at all construction work areas.

- Mitigation measures for sediment control are detailed in Section 9.5.2.1.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6.

Proposed mitigation measures relative to piling works will comprise:

- Where driven piles are used, they will have a cross section without re-entrant angles;
- Strict QA/QC procedures for piling works will be followed;
- Piles will be kept vertical during piling works;
- Good workmanship will be employed during all piling works; and,
- Where required use bentonite seal to prevent upward/downward movement of surface water/groundwater.

Impact Assessment:
The ground conditions at the proposed site can be typically categorised into the following deposits (based on data presented in Chapter 8):

- **Peat** – Typically described as orangish brown to dark brown amorphous to fibrous peat. Peat thicknesses from ranged from 1.1 to >4.5m from trial pits and 0.4 to 3.8m from the boreholes.
- **Lacustrine Clay** – Light grey to brown, soft to stiff slightly gravelly organic Silt/Clay with some cobbles. The thickness of the layer is variable across the proposed site.
- **Fluvioglacial Sand and Gravel** – Typically described as grey silty sandy Gravel/silty fine Sand with cobbles and some boulders. The thickness of the layer is variable across the proposed site.
- **Glacial Till** – Typically described as soft to stiff greenish grey to blueish grey slightly sandy slightly gravelly Silt/Clay. The thickness of the layer is variable across the proposed site.
- **Groundwater** - was recorded in thirty-two of the trial pits and boreholes on site and varied between 0.0 and 7.4mbgl.

Proposed piles will penetrate through peat deposits and lacustrine clay deposits where they occur, and then into underlying glacial tills. Where present the clay layer is likely to act as an aquitard/low permeability layer, through which only very small amounts of water can flow.

Peat water is perched above the regional groundwater table. Peat water occurs in the bog basins, while regional groundwater flow will occur in the underlying bedrock aquifer. Glacial tills that occur between the base of the peat/lacustrine clays may be permeable in local zones, but in general will have a moderate to low permeability. Therefore, the two main groundwater systems are the upper acidic peat water, and the lower regional bedrock groundwater water. As the underlying bedrock is mainly limestone, the groundwater occurring within this aquifer will be alkaline.

For the driven piles the clay and also the glacial tills are likely to 'self-seal' around the piles, meaning that a long term pathway between the upper peat/bog water and the lower bedrock aquifer will not be sustained.

Research indicates that provided the aquitard layer is of a reasonable thickness and the piles driven through have a cross section without re-entrant angles, the likelihood of creating preferential flow paths for downward migration of leachate (i.e. peat water) is very low. This hypothesis is consistent with the results obtained by Hayman et al (1993) and Boutwell et al (2000).

For bored piles, as the temporary steel casing is removed, a steel reinforcement cage is added to the pile column and then concrete is added to the toe of the pile using a tremie pipe. Vermiculite is used to create a plug between the concrete and the displaced water, therefore the concrete seals the entire pile column and pushes the vermiculite plug to the surface as concrete is added. The temporary steel casing is removed carefully as the concreting works are being completed. This concreting process is similar to that used when grouting a water supply production well (IGI (2007), and EPA (2013)). This means that a long term pathway between the upper peat/bog water and the lower bedrock aquifer will not be sustained.

Scenario 1: Creating a Pathway for Downward Flow
To ensure downward flow of peat water and/or pollutants from the piling works does not occur, a bentonite seal will be used in a starter pit for each driven pile, and the mitigation measures outlined above will be implemented. The concrete added to the bored pile will seal the pile annulus. As a result, the potential for either piling work option to create pathways for downward flow of peat water or pollutants that could affect groundwater quality in the underlying aquifer is imperceptible.

Scenario 2: Creating a Pathway for Upward Flow
No upwelling of groundwater to the peat surface water recorded in any of the site investigation locations recorded across the proposed site.

Notwithstanding this, to ensure upward flow of underlying groundwater via potential pathways created by piling works does not occur, a bentonite seal will be used in a starter pit for each driven pile, and the mitigation measures outlined above will be implemented. The concrete added to the bored pile will seal the pile annulus. As a result, the potential for piling works to create pathways for upward flow of alkaline groundwater to the bog surface is imperceptible.

Scenario 3: Blocking Regional Groundwater Flow
The scale of the proposed site is important, and it means that the development footprint (including temporary works) occurs over ~2.9% (51.17 Ha) of the proposed site (1,770 Ha) (refer to Section 9.5.3.1). Note the permanent footprint is 32.4ha or 1.8% of the proposed site.

If a piling array of 50 no. 300mm piles is applied at each turbine base (as piling Option 1), this combined area of piling footprint amounts to ~92m^2, or 3.53m^2 per turbine base. Each turbine base is >490m apart (with the average distance between turbines being 786m). The area of the piles driven into the ground is distributed over a very large area, and that area only amounts to 0.02% of the development footprint, or 0.0005% of the proposed site area. Also, none of the proposed piles would penetrate into the underlying bedrock aquifer, as they will find sufficient resistance, either in the over lying glacial tills/mineral subsoils or upon reaching the top of bedrock. At such wide separation distance, the ability of clusters of piles, with a plan area of ~3.53m^2 per turbine, to alter or affect regional groundwater flow is imperceptible.

If a piling array of 20 no. 900 to 1200mm cylindrical bored piles is applied at each turbine base (as piling Option 2a and 2b), this combined area of piling footprint amounts to:

- **Option 2a (900mm piles)** – this combined area of piling footprint amounts to ~265m^2, or 10.180m^2 per turbine base. Each turbine base is >490m apart (with the average distance between turbines being 786m). The area of the piles bored into the ground is distributed over a very large area, and that area only amounts to 0.05% of the development footprint, or 0.001% of the proposed site area.
- **Option 2b (1200mm piles)** – this combined area of piling footprint amounts to ~470m^2, or 18.10m^2 per turbine base. Each turbine base is >490m apart (with the average distance between turbines being 786m). The area of the piles bored into the ground is distributed over a very large area, and that area only amounts to 0.09% of the development footprint, or 0.003% of the proposed site area.

Also, none of the proposed piling options would penetrate into the underlying bedrock aquifer, as they will find sufficient resistance, either in the over lying glacial tills/mineral subsoils or upon reaching the top of bedrock. At such wide separation distance, the ability of clusters of piles, with a plan area of between ~3.53m^2 per turbine to 32.17m^2 per turbine, to alter or affect regional groundwater flow is imperceptible. Groundwater will simply flow through and/or around these very localised insertions.

Post-Mitigation Residual Effects: The proposed piling works potentially pose a threat to groundwater quality in the underlying regional groundwater system, and also could potentially create a pathway for upward migration of alkaline groundwater to the peat surface. These potential effects will not arise at the proposed site due to a combination of the prevailing ground conditions, groundwater conditions, and proposed mitigation measures that will ensure the potential pathways for interaction of shallow (acidic peat water) and deeper (alkaline) groundwater are prevented from occurring. In additional, due to the small footprint of proposed pile clusters, and the significant spacing between turbine bases where pile clusters are proposed, the potential for such pile clusters to block regional groundwater flow is imperceptible at that scale. The proposed piled foundations therefore have no potential to change the WFD status or impact the WFD objectives of the underlying Athboy GWB. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely effect on groundwater flow, and ground quality/peat water hydrochemistry.

Significance of Effects: For the reasons given above, no significant effects on regional groundwater and the Athboy GWB will occur, and no significant effects on peat water hydrochemistry will occur from proposed piling works.

9.5.2.5 Potential Release of Hydrocarbons

Accidental spillage of petroleum hydrocarbons during refuelling of construction plant can cause significant pollution risk to groundwater, surface water quality and associated aquatic ecosystems, and to terrestrial ecology (refer to Chapter 6). In addition, the accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Pathway: Groundwater flowpaths and site drainage network.

Receptors: Surface water quality in down-gradient rivers (Deel, Ballivor, Stonyford and Boyne rivers and their associated tributaries) and groundwater quality in the peat bog.

Pre-Mitigation Potential Effects: Negative, direct, slight, short term, likely effect on local groundwater quality in the peat bog. Indirect, negative, significant, short term, likely effect on downstream surface water quality.

Proposed Mitigation Measures:

- All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on site;
- On-site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer or truck will be re-filled off site and will be towed/driven around the proposed site to where machinery is located. The 4x4 jeep/fuel truck will also carry fuel absorbent materials for the event of any accidental spillages. The fuel bowser will be parked in a designated location on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be available during all refuelling operations and used when required;
- Fuel volumes stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume during the construction phase;

- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (Appendix 4-3). Spill kits will be available to deal with accidental spillages.

Post-Mitigation Residual Effect: The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be - Negative, imperceptible, indirect, temporary, unlikely effect on groundwater quality within the peat bog and surface water quality in down-gradient rivers (Deel, Ballivor, Stonyford and Boyne rivers and their associated tributaries).

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on surface water or groundwater quality will occur.

9.5.2.6 Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative effects on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations, with artificial variations not in excess of ± 0.5 of a pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to water quality.

Peat ecosystems are dependent on low pH hydrochemistry. They are extremely sensitive to the introduction of high pH alkaline waters into the system. Batching of wet concrete on site and the washing out of concrete transport and placement machinery are the activities that will generate a risk of cement-based pollution.

Pathways: Site drainage network and groundwater flows.

Receptors: Peat water hydrochemistry and downstream surface watercourses including the Deel, Stonyford, Ballivor and Boyne rivers and their associated tributaries.

Pre-Mitigation Potential Effect:

Negative, moderate, indirect, short term, likely effect to surface water quality.

Negative, imperceptible, indirect, short term, likely effect on peat water hydrochemistry.

Proposed Mitigation Measures:

Mitigation by Avoidance:

- No batching of wet-cement products on-site is proposed. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will be the design approach;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of the main body of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the concrete truck chute will be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be isolated in temporary lined wash-out pits located

near proposed site compounds. These temporary lined wash-out pits will be removed from the site their utility is no longer required or at the end of the construction phase;
- Any washing out of concrete pumping plant will also be into the temporary lined wash-out pits.
- Weather forecasts will be used to plan dry days for pouring concrete; and,
- Construction contractors will ensure each concrete pour site is free of standing water and plastic covers will be available in case of a sudden rainfall event.

No specific mitigation measures are required for potential groundwater impacts as the proposed mitigation measures will ensure minimal release of cement based products to ground. Furthermore the potential groundwater effects are imperceptible at the outset.

Post-Mitigation Residual Effect: The potential for the release of cement-based products or cement truck wash water to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases cement-based products or cement truck wash water have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely effect on peat water hydrochemistry and the hydrochemistry of downstream surface watercourses including the Deel, Stonyford, Ballivor and Boyne rivers and their associated tributaries, and – Negative, indirect, imperceptible, long-term, unlikely effect on peat water hydrochemistry.

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on surface water or groundwater quality will occur.

9.5.2.7 Groundwater and Surface Water Contamination from Wastewater Disposal

Release of effluent from on-site temporary staff welfare facilities has the potential to effect groundwater and surface water quality if site conditions are not suitable for an on-site percolation unit. Impacts on surface water quality could affect fish stocks and aquatic habitats.

Pathways: Groundwater flowpaths and site drainage network.

Receptors: Down-gradient well supplies, groundwater quality (Athboy GWB) and surface water quality in the Deel, Stonyford, Ballivor and Boyne rivers and associated tributaries.

Pre-mitigation Effects:

Negative, significant, indirect, temporary, unlikely effect on surface water quality.

Negative, slight, indirect, temporary, unlikely effect on local groundwater.

Proposed Mitigation Measures:

- There are a total of 4 no. proposed construction compounds associated with the Proposed Development;
- During the construction phase, self-contained port-a-loo with an integrated waste holding tank will be used at each of the site compounds, maintained by the providing contractor, and removed from the site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use by a licensed contractor to be discharged at a suitable off-site treatment location; and,
- No water or wastewater will be sourced on the site, nor discharged to the site.

Post-Mitigation Residual Effects: The potential for contamination resulting from wastewater disposal is a risk to surface and groundwater quality. This is a risk common to all construction sites containing staff welfare facilities. Proven and effective measures to prevent the release of wastewater on site have been proposed above and will the potential source and each receptor. The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely effect on surface water (Deel, Stonyford, Ballivor and Boyne rivers and associated tributaries) or groundwater quality (Athboy GWB).

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on surface water or groundwater quality will occur.

9.5.2.8 Potential Effects on Local Groundwater Well Supplies

As stated in Section 9.3.8 above, the groundwater flow in the mineral soil deposits (silts, sands and gravels) beneath the peat at the proposed site is expected to discharge into the local surface waterbody network, i.e. the existing bog drainage network which discharges to tributaries of the Deel, Stonyford and Boyne river. Groundwater flow in the western section of the proposed site will discharge into the River Deel while groundwater flow in the east of Ballivor Bog and Carranstown Bog will discharge into the Ballivor River (a tributary of the River Boyne) to the east. Further north in the east of Bracklin Bog and in Lisclogher Bog groundwater flow directions will be to the east towards the Stonyford River.

Using this conceptual model of groundwater flow an impact assessment for local wells is undertaken below. This assessment is completed in accordance with "Wind farms and groundwater impacts - A guide to EIA and Planning considerations" (DoE/NIEA, 2015).

There are no public or group scheme or EPA registered abstraction groundwater supplies down-gradient of the proposed site that can be impacted by the Proposed Development.

The GSI map one well with a location accuracy of up to 100m in the east of Ballivor Bog and within the proposed site boundaries. Well ID 26255WW072, as illustrated on Figure 9-22, does not exist within the proposed site boundary. We expect that this well is associated with the dwelling house to the east, and that house is ~800m from T3. The GSI also map several additional wells surrounding the Ballivor Bog Group with varying locational accuracies.

The biggest risk to groundwater wells will be from where deep excavations are required such as the borrow pits and turbines bases. Construction of the Proposed Development site access road, underground cable route trench between the turbines and the substation and the construction of substation and the grid connection will not have the potential to affect local wells due to the shallow nature of the works.

We have completed an assessment of private wells in the lands surrounding the proposed site. In order to be conservative and following the worst case assumption, we have assumed that all dwellings in the surrounding lands have a private groundwater well. A number of private dwelling houses were identified along the local roads near to and down-gradient (i.e., downslope) of the Proposed Development, specifically the proposed borrow pit and substation locations).

Using the conceptual model of groundwater flow detailed above, dwellings that are potentially located down-gradient of the Proposed Development footprint are identified and an impact assessment for these actual and potential well locations is undertaken as outlined below.

The majority of proposed key infrastructure elements (i.e. Proposed Development elements which have deep excavations and a potential to effect the regional groundwater system below the peat basin) are located a significant distance (>500m) from dwellings. Due to the high drainage density of the peat bog and the surrounding lands, it is expected that the majority of groundwater flow will discharge to local watercourses, as well as to the larger drainage ditches around the bog. These drainage systems and water bodies will act as hydraulic barriers between the development locations and the location of potential groundwater wells.

However, there are a number of dwellings situated along the local road to the south of BP2. Groundwater flow direction in this area is assumed to be southwest from Bracklin Bog towards the Craddanstown stream (a tributary of the Deel River). Therefore, these dwellings are downgradient and within close proximity (150-600m) to the proposed borrow pit (BP2). There is no hydraulic boundary (local stream/watercourse) between these dwellings and the proposed borrow pit. Consequently, this excavation has the potential to impact local groundwater wells if they are present.

The other 2 no. proposed borrow pits (BP1a and BP1b) in Carranstown Bog, are located a significant distance from dwellings (>650m). Meanwhile, a dwelling is located approximately 450m northwest of the proposed construction/substation compound in the northwest of Carranstown Bog. This dwelling is not located downgradient of the development location. Due to the shallow nature of the excavation works associated with the substation, no effects on groundwater levels or local wells will likely occur.

All turbines are located in excess of 800m from surrounding dwellings. Access roads and the internal cable networking trench and the grid connection works and amenity path are not considered a potential risk due to the shallow nature of those works.

The closest proposed infrastructure up-gradient of the dwellings within the setback distance is shown in Table 9-18 below.

Table 9-18: Excavations and distances to nearby dwellings and potential groundwater wells

Development Footprint Location	WFD River Sub-Basin	Approximate Distance from Closest Private Dwelling (m)	Comments
BP2	Deel(Raharney)_060	~100m	Dwellings are located downgradient (south) of the development location. No surface watercourse to act as a hydraulic barrier.
Substation in NW of Carranstown Bog	Stonyford_040	~460m	Dwelling is not located downgradient of groundwater flow. Groundwater flow paths are likely to be towards the east and south.
BP1a	Stonyford_040	~580m	Dwelling is located to the SE of the proposed BP1a location. Local bog drainage network and the Killconnigan stream act as hydraulic boundaries.
BP1b	Stonyford_040	~540m	Dwelling is located to the NE of the proposed BP1b location

Note:
1. Distance from closest Proposed Development Infrastructure (including borrow pits, construction compound, or substation (i.e. excavation/earthworks location). Access roads and the cable trench nor amenity path are not considered a potential risk due to the shallow nature of those works. The distances listed above are from the nearest wind farm infrastructure within the same surface water catchment as the dwelling.
2. Each dwelling is assumed to have an on-site private water well as outlined above (this is for assessment purposes only, wells may or may not actually exist).

Pathway: Groundwater flowpaths.

Receptor: Groundwater Supplies.

Pre-Mitigation Potential Effect: Negative, imperceptible, indirect, long term, unlikely effect.

Impact Assessment

BP2 will be adjacent to an existing borrow pit. No significant groundwater effects have been reported in relation to this borrow pit. Therefore the proposed BP2 will not have the potential to significantly effect local groundwater supplies. All other wells are located at sufficient distance from the Proposed Development to be affected by any of the proposed works.

Post-Mitigation Residual Effects: For the reasons given in the impact assessment above (separation distances, and prevailing geology, topography and groundwater flow directions), we consider the residual effects to be - negative, imperceptible, indirect, long term, unlikely effect in terms of quality or quantity on local groundwater abstractions.

Significance of Effects: For the reasons outlined above, no significant effects on existing groundwater supplies will occur.

9.5.2.9 Potential Effects on Surface Water Drinking Supplies

The Stonyford River in the vicinity of the proposed site has been identified as a Drinking Water Protected Area (DWPA.

Surface water connections from the proposed site to the Stonyford River could transfer poor quality surface water that may affect this DWPA.

Due to physical and hydrological and hydrogeological separation all other DWPAs have no potential to be affected by the Proposed Development.

Pathways: Surface water flowpaths, and groundwater levels.

Receptors: Down-gradient water quality in the Stonyford_040 DWPA.

Pre-Mitigation Potential Effect: Negative, significant, indirect, short term, likely effect on downstream DWPA.

Proposed Mitigation Measures:

Mitigation measures for sediment control are detailed in Section 9.5.2.1.

Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5.

Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6.

Implementation of these mitigation measures will ensure the protection of water quality in receiving waters.

Furthermore, groundwater from below the proposed site may also discharge as baseflow to the Deel, Stonyford, Ballivor and Boyne Rivers or their tributaries, thus entering the Stonyford and Boyne rivers. Groundwater quality and quantity will not be affected by the Proposed Development as detailed in Section 9.5.2.2, Section 9.5.2.5, Section 9.5.2.6, and Section 9.5.2.8.

Post-Mitigation Residual Effects: Construction activities at the proposed site pose a threat to surface water DWPA linked with the Proposed Development. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the proposed site will be equivalent to baseline conditions and will therefore have no effect on downstream water quality. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely effect on downstream water quality within the Stonyford_040 DWPA.

Significance of Effects: For the reasons given above, no significant effects on any designated sites will occur.

9.5.2.10 Potential Effects of the Proposed Amenity Links

Approximately 28 km of internal roads will be provided as part of the construction of the Proposed Development. This internal road network will link all infrastructure together and following construction will form the amenity pathways when the wind farm becomes operational. The roads will be repurposed to form amenity pathways which will be surface with granular material. An additional 3.3km of a dedicated amenity link is also proposed to provide greater variety of walking loops.

The construction of these dedicated amenity tracks, the repurposing of the Proposed Development access roads and the upgrading of the site entrances to form car parking facilities have the potential to effect downgradient surface water quality.

Pathway: Extraction/excavation of soil/subsoil.

Receptor: Surface water quality in downstream rivers including the Deel, Stonyford and Boyne rivers and their associated tributaries and groundwater quality in the peat bog.

Pre-Mitigation Potential Effect:

Negative, slight, indirect, unlikely, short-term effect on surface water quality.

Negative, imperceptible, indirect, unlikely, long-term effect on groundwater quality.

Proposed Mitigation Measures:

Detailed mitigation measures for sediment control are outlined in Section 9.5.2.1. and detailed mitigation measures for control of hydrocarbons during construction works are outlined in Section 9.5.2.5.

No additional mitigation measures are required due to the small scale nature of the proposed works.

Post-Mitigation Residual Effects: For the reasons outlined in the impact assessment above, we consider the residual effects to be - Negative, imperceptible, indirect, unlikely, short-term effects on surface water quality in downstream rivers including the Deel, Stonyford and Boyne rivers and their associated tributaries and groundwater quality in the peat bog.

Significance of Effects: For the reasons given above, no significant effects on surface water and groundwater quality will occur.

9.5.2.11 Potential Effects Due to Turbine Delivery Route Works

Minor temporary haul route works are required at 2 no. locations listed below, however all proposed road works are small-scale and localised, and no significant water quality effects are anticipated.

- Junction accommodation between the R156 and R161 ~6.5km southwest of Trim.
- Road widening east of Ballivor village on the R156.

Permanent road improvement works are also proposed on the R156 between the proposed entrances to Ballivor and Carranstown Bogs for 44m and will involve the lowering of the road by ~0.5m for 44m in order to improve sightlines.

Due to the shallow nature of the temporary and permanent works effects on groundwater flows and levels are not anticipated. However there is a potential for effects on groundwater and surface water quality from fuels and other chemicals during the construction phase.

Pathway: Surface water and groundwater flow paths.

Receptor: Down-gradient water quality.

Pre-Mitigation Potential Effects:

Indirect, negative, slight, temporary, unlikely effect on surface water quality.

Indirect, negative, slight, temporary, unlikely effect on groundwater quality.

Proposed Mitigation Measures

The following mitigation measures are proposed:

Mitigation by Avoidance:

A constraint/buffer zone will be maintained for all upgrade works locations where possible. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The purpose of the constraint zone is to:

- Avoid physical damage to surface water channels;
- Provide a buffer against hydraulic loading by additional surface water run-off;
- Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks;
- Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and,
- Provide a buffer against construction plant and materials entering any watercourse.

General Best Practice Pollution Prevention Measures will also include:

- No stock-piling of construction materials will take place within the constraints zone. No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast;
- Plant will travel slowly across bare ground at a maximum of 5km/hr.
- Machinery deliveries shall be arranged using existing structures along the public road;
- All machinery operations shall take place away from the stream and ditch banks, although no instream works are proposed or will occur;
- Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility or the on-site spoil management areas;
- No stockpiling of materials will be permitted in the constraint zones;

- Spill kits shall be available in each item of plant required; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

Mitigation Measures relating to the use and storage of fuels and chemicals in terms of groundwater protection:

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser, as described in Section **Error! Reference source not found.**. No maintenance of c onstruction vehicles or plant will take place along the temporary junction works areas;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- Spill kits will be available to deal with accidental spillage.

Post-Mitigation Residual Effect: The temporary road improvement works has the potential to negatively impact the local surface water and groundwater quality, through increased sediment supply to the river channel, and the potential for fuel/oil spills which could impact surface water and groundwater. Proven and effective measures to mitigate the risk of excess runoff and fuel/oil spills have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be - Indirect, negative, imperceptible, temporary, unlikely effect on surface water quality.

Significance of Effects: For the reasons outlined above, no significant effects on surface water or groundwater quality are anticipated.

9.5.2.12 Potential Effects on Hydrologically Connected Designated Sites

The proposed site is not located within any designated conservation site. However, as stated in Section 9.3.14 above, the proposed site is located in the River Boyne regional catchment and the River Boyne and River Blackwater SAC and SPA is located immediately downstream and is hydrologically linked with the proposed site. The surface water connections from the proposed site to the Deel, Stoneyford and Boyne rivers could transfer poor quality surface water that may affect the conservation objectives of the designated sites.

Due to physical and hydrological and hydrogeological separation all other designated sites have no potential to be affected by the Proposed Development.

The potential effects of the Proposed Development on designated sites as also been completed as part of a detailed WFD Compliance Assessment Report and is included in Appendix 9-3.

Pathways: Surface water flowpaths, and groundwater levels.

Receptors: Down-gradient water quality in the River Boyne and River Blackwater SAC and SPA.

Pre-Mitigation Potential Effect: Negative, significant, indirect, short term, likely effect on downstream designated sites.

Proposed Mitigation Measures:

Mitigation measures for sediment control are detailed in Section 9.5.2.1.

Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5.

Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6.

Implementation of these mitigation measures will ensure the protection of water quality in receiving waters.

Furthermore, groundwater from below the proposed site may also discharge as baseflow to the Deel, Stonyford, Ballivor and Boyne Rivers or their tributaries, thus entering the designated sites. Groundwater quality and quantity will not be affected by the Proposed Development as detailed in Section 9.5.2.2, Section 9.5.2.5, Section 9.5.2.6, and Section 9.5.2.8.

Post-Mitigation Residual Effects: Construction activities at the proposed site pose a threat to designated sites hydrologically linked with the Proposed Development. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the proposed site will be equivalent to baseline conditions and will therefore have no effect on downstream water quality. No adverse effects are anticipated on hydrologically connected Designated Sites. Please see Chapter 6 Biodiversity for details.

Significance of Effects: For the reasons given above, no significant effects on any designated sites will occur.

9.5.2.13 Assessment of Potential Effects on WFD Objectives

The WFD status for GWBs and SWBs underlying and downstream of the Proposed Development are defined in Section 9.3.12 and Section 0 respectively. The WFD status for the Deel, Stonyford and Boyne rivers in the vicinity and downstream of the proposed site are typically of "Good" or "Moderate" status, while the Stonyford_030 SWB achieved "Poor" status in the latest WFD round. Many of these SWBs have been deemed to be "at risk" of failing to meet their respective WFD objectives. Meanwhile, the Athboy GWB is also of "Good" status and is " not at risk".

Changes in surface water of groundwater flow regimes and water quality has the potential to impact on the objectives and status of the associated GWB and SWBs.

A detailed WFD Compliance Assessment Report has been completed in combination with this EIAR Chapter and is included in **Appendix 9-3**.

Pathways: Groundwater flowpaths and surface water flowpaths within the proposed site.

Receptors: WFD Groundwater Bodies and Surface Water Bodies.

Pre-mitigation Potential Effect:
Indirect, negative, moderate, temporary, unlikely effect on downstream SWBs.

Indirect, negative, slight, temporary, unlikely effect on the underlying Athboy GWB.

Proposed Mitigation Measures:

- Mitigation measures for sediment control are detailed in Section 9.5.2.1.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6.

Implementation of these mitigation measures will ensure the protection of water quality in receiving waters.

Furthermore the mitigation measures previously outlined for the protection of groundwater quality and groundwater quantity are detailed above:

- Mitigation measures for excavation works and dewatering are detailed in Section 9.5.2.2.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6.

Post-Mitigation Residual Effects:
There is no direct discharge from the proposed site to downstream receiving surface waters or the underlying GWB. Mitigation for the protection of surface and groundwater during the construction phase of the Proposed Development will ensure the qualitative and quantitative status of the receiving waters will not be altered by the Proposed Development.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Proposed Development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration.

The residual effect on Groundwater Bodies is considered to be - No residual effect.
The residual effect on Surface Water Bodies is considered to be - No residual effect.

Significance of Effects: For the reasons outlined above, no significant effects on WFD Groundwater Bodies and Surface Water Bodies status, risk or future objectives will occur as a result of the Proposed Development.

9.5.3 Operational Phase - Likely Significant Effects and Mitigation Measures

9.5.3.1 Replacement of Natural Surface with Lower Permeability Surfaces

Progressive replacement of the peat or vegetated surface with impermeable surfaces will likely result in an increase in surface water runoff rates in the surface water drainage network. This could potentially increase discharge rates from the proposed site and increase flood risk downstream of the development. In reality, the access roads will have a higher permeability than the underlying peat. However, in the baseline scenario runoff rates are high as a result of the prevailing peat soils (96% runoff). In order to assess the potential change as a result of access road and hardstand footprints we have increased the runoff rate to the maximum, i.e., 100% (4% higher than normal). The assessed footprint comprises turbine bases and hardstandings, access roads, amenity links and carparks, site entrances, substation and temporary construction compounds. During storm rainfall events, additional runoff coupled with the increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on water quality.

The emplacement of the proposed permanent development footprint within the proposed site, as described in Chapter 4 of the EIAR, (assuming emplacement of impermeable materials result in an increase from 96% to 100% runoff) could result in an average total site increase in surface water runoff of approximately 1,606m^3/month (Table 9-19). This represents a potential increase of approximately 0.12% in the average daily/monthly volume of runoff from the site in comparison to the baseline pre-development site runoff conditions (Table 9-9). This is a very small increase in average runoff and results from the naturally high surface water runoff rates and the relatively small area of the proposed site being developed, with the proposed development footprint including temporary works being approximately 52.17ha, representing 2.9% of the total proposed site (1,770ha), while the permanent development footprint is approximately 32.4ha or 1.8% of the total proposed site.

Table 9-19: Baseline Site Runoff V Development Runoff

Development Type	Site Baseline Runoff/month (m^3)	Baseline Runoff/day (m^3)	Permanent Hardstanding Area (m^2)	Hardstanding Area 100% Runoff/month (m^3)	Hardstanding Area 96% Runoff/month (m^3)	Net Increase/month (m^3)	Net Increase/day (m3)	% Increase from Baseline Conditions at Hardstands (m^3)	% Increase from Baseline Conditions across Site (m^3)
Wind Farm	1,332,810	42,993	521,700	40,889	39,284	1,606	51.8	3.9%	0.12%

The additional water runoff volume is low due to the fact that the runoff potential from the proposed site is naturally high (96%). Also, the calculation assumes that all hardstanding areas will be impermeable which will not be the case as access tracks will be constructed of permeable stone aggregate. The increase in runoff from the Proposed Development will, therefore, be negligible. This is even before mitigation measures are considered. Therefore, there will be no risk of exacerbated flooding downstream of the proposed site.

The onsite substation and temporary construction compounds are located within the proposed site and, as such, as discussed above.

Pathway: Site drainage network.

Receptor: Surface waters and dependent ecosystems.

Pre-Mitigation Potential Effect: Negative, slight, direct, permanent, unlikely effect on all downstream surface water bodies.

Proposed Mitigation Measures:

As part of the Proposed Developments drainage design, it is proposed that runoff from the proposed infrastructure will be collected locally in new proposed silt traps, settlement ponds and vegetated buffer areas prior to release into the existing bog drainage network. The new proposed drainage measures will then create significant additional attenuation to what is already present. The operational phase drainage system will be installed and constructed in conjunction with the existing bog drainage network and will include the following mitigation measures:

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed into downstream field drains;
- Collector drains will be used to gather runoff from access roads and turbine hardstanding areas of the site likely to have entrained suspended sediment, and channel it to new local settlement ponds for sediment settling;

- On sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/roadside drains;
- Check dams will be used along sections of access road drains to intercept silt at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of access road sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to existing drains;
- Settlement ponds will be designed in consideration of the greenfield runoff rate, existing bog settlement ponds will also buffer discharges from the bogs; and,
- Finally, all surface water runoff from the development will pass through the existing settlement ponds at the existing bog outfall locations.

Post-Mitigation Impact Assessment

As stated above in Section 9.3.4 there are existing surface water control measures at the proposed site which comprise high level bog surface drains, low level main drains and settlement ponds. All these existing drainage measures offer some surface water attenuation during rainfall events. However, as part of the Proposed Development drainage (which is detailed further in Section 9.4.1 and Section 9.4.2 above), it is proposed that runoff from the proposed infrastructure will be collected locally in new proposed collector drains, silt traps and settlement ponds prior to release into the existing drainage network. The new proposed drainage measures will then in effect create significant additional attenuation to what is already present at the proposed site. The net effect of this will be a reduction in the overall runoff coefficient of the bog as demonstrated by the use of the Rational Method in

Table 9-20 below. Based on a conservative reduction in the runoff coefficient from 0.96 to 0.85 for the proposed site, there would a potential 11% reduction in runoff volumes from the proposed site. This assessment demonstrates that there will be no risk of exacerbated flooding down-gradient of the proposed site as a result of the Proposed Development. The Proposed Development will in effect retain water within the bog for longer periods.

Table 9-20: Surface Water Runoff Assessment for Proposed Wind Farm Drainage

Site Area	C(1)	Area (m^2)	Rc (2)	100-Year 6hr Rainfall Depth (m)	Runoff Volume (m^3)	Total Site Runoff Volume (m^3)
Without Wind Farm Drainage Control						
Undeveloped Area	2.78	17,178,300	0.96	0.0526	867,435	894,876
Development Footprint	2.78	521,700	1.00	0.0526	27,441	
With Wind Farm Drainage Control						
Undeveloped Area	2.78	17,178,300	0.85	0.0526	768,041	794,110
Development Footprint	2.78	521,700	0.95	0.0526	26,069	
Estimated Potential Reduction in Site Runoff Volumes (%)						11%

Notes: 1 – Constant, 2- Runoff Coefficient

Post-Mitigation Residual Effect: With the implementation of the Proposed Development drainage measures as detailed above, and based on the post-mitigation assessment of runoff, we consider that residual effects are - Negative, imperceptible, direct, long-term, likely effect on all downstream surface water bodies.

Significance of Effects: For the reasons given above, no significant effects on downstream flood risk will occur.

9.5.3.2 Runoff Resulting in Contamination of Surface Waters

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads, hardstand areas and amenity pathways. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

These minor activities could, however, result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality of downstream water bodies. Potential effects could be significant if not mitigated.

During such maintenance works there is a small risk associated with the release of hydrocarbons from site vehicles, although it is not envisaged that any significant refuelling works will be undertaken on site during the operational phase.

Pathways: Drainage and surface water discharge routes.

Receptors: Down-gradient rivers (Deel, Stonyford, Ballivor, Boyne rivers and their associated tributaries) and dependent aquatic ecosystems in the River Boyne and River Blackwater SAC/SPA.

Pre-Mitigation Potential Effect: Negative, slight, direct, temporary, unlikely effect.

Proposed Mitigation Measures:

Mitigation measures for sediment control are the same as those detailed in Section 9.5.2.1.

Mitigation measures for the control of hydrocarbons during maintenance works are the same to those outlined in Section 9.5.2.5

Post-Mitigation Residual Effects: With the implementation of the Proposed Development drainage measures as detailed above, and based on the post-mitigation assessment of runoff, we consider that residual effects are - Negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality in the Deel, Stonyford, Ballivor, Boyne rivers and their associated tributaries.

Significance of Effects: For the reasons given above, no significant effects on the surface water quality are likely to occur.

9.5.3.3 Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative effects on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations, with artificial variations not in excess of ± 0.5 of a pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to water quality.

Placed concrete in turbine bases and foundations can also have minor local effects on groundwater quality over time. However, due to the limited surface area of exposed concrete, the anoxic conditions below ground, and the high rate of dilution from the wider groundwater system relative to the small volumes of groundwater that would come in contact with the concrete, the potential for impacts considered to be imperceptible.

Pathways: Site drainage network and groundwater flows.

Receptors: Peat water hydrochemistry and downstream surface watercourses including the Deel, Stonyford, Ballivor and Boyne rivers and their associated tributaries.

Pre-Mitigation Potential Effect:

Negative, slight, indirect, short term, likely effect to surface water quality.

Negative, imperceptible, indirect, short term, likely effect on peat water hydrochemistry.

Proposed Mitigation Measures:

None required. The concrete in turbine bases sets within 3 days of concrete pour.

Post-Mitigation Residual Effect: Negative, imperceptible, indirect, long term, likely effect to surface water quality. Negative, imperceptible, indirect, long term, likely effect on peat water hydrochemistry.

Significance of Effects: For the reasons given above, no significant effects on the surface water quality are likely to occur.

9.5.3.4 Water Supply at Substation

It is proposed to install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. An in-well pump will direct water to a water tank within the roof space of the control building.

The proposed groundwater well and associated extraction has the potential to effect local groundwater levels in the surrounding lands.

Pathway: Groundwater flowpaths

Receptor: Groundwater levels

Pre-Mitigation Potential Effect: Direct, negative, imperceptible, permanent, likely effect on local groundwater levels.

Impact Assessment

The abstraction rate for the proposed groundwater well at the substation will be comparable to a domestic well, with a well supplying a single household typically abstracting less than $1m^3$/day. The well is proposed in a locally important aquifer which is moderately productive only in local zones. This aquifer forms part of the Athboy GWB which is comprised of only moderate permeability rocks where groundwater flow is concentrated in the upper weathered zone of the aquifer. Therefore due to the nature of the bedrock aquifer and the proposed extraction rate, no effects on local groundwater levels will occur.

For these reasons no mitigation measures are required.

Post-Mitigation Residual Effects: Due to the scale of the proposed abstraction and the nature of the bedrock aquifer, we consider the residual effect to be direct, negative, imperceptible, permanent, likely effect on local groundwater levels.

Significance of Effects: For the reasons given above, and with the implementation of the above mitigation measures, no significant effects on surface water quality or quantity, or groundwater quality will occur.

9.5.3.5 Potential Contamination Due to Wastewater

Release of effluent from on-site temporary staff welfare facilities has the potential to effect groundwater and surface water quality if site conditions are not suitable for an on-site percolation unit. Impacts on surface water quality could affect fish stocks and aquatic habitats.

Pathways: Groundwater flowpaths and site drainage network.

Receptors: Down-gradient well supplies, groundwater quality (Athboy GWB) and surface water quality in the Deel, Stonyford, Ballivor and Boyne rivers and associated tributaries.

Pre-mitigation Effects:

Negative, significant, indirect, temporary, unlikely effect on surface water quality.

Negative, slight, indirect, temporary, unlikely effect on local groundwater.

Proposed Mitigation Measures:

It is proposed to install a sealed underground holding tank for effluent (wastewater) from the substation building. The tank shall be routinely emptied by a licensed contractor. A level sensor will be installed in the tank which shall be linked to the on-site SCADA system. If the level of the tank contents rise to a predetermined 'high' level a warning shall appear on the overall SCADA system for the site and automatic notification shall be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on site. There will be no discharge of wastewater to ground at the proposed site, and therefore there is no potential to impact groundwater or surface water quality.

Post-Mitigation Residual Effects: The potential for contamination resulting from wastewater disposal is a risk to surface and groundwater quality. This is a risk common to all wind farm sites containing staff welfare facilities. Proven and effective measures to prevent the release of wastewater on site have been proposed above and will the potential source and each receptor. The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely effect on surface water (Deel, Stonyford, Ballivor and Boyne rivers and associated tributaries) or groundwater quality (Athboy GWB).

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on surface water or groundwater quality will occur.

9.5.3.6 Assessment of Effects on WFD Objectives

There is no direct discharge from the Proposed Development to downstream receiving waters. Mitigation for the protection of surface water during the operational phase of the Proposed Development will ensure the qualitative status of the receiving SWBs will not be altered by the Proposed Development.

Similarly there is no direct discharge to groundwaters associated with the Proposed Development. Mitigation for the protection of groundwater during the operational phase of the Proposed Development will ensure that the qualitative status of the receiving GWB will not be altered by the Proposed Development.

A full assessment of the potential effects of the operational phase of the Proposed Development on the status of the receiving waterbodies is included in WFD Compliance Assessment Report attached as **Appendix 9-3**.

9.5.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The Proposed Development is expected to have a lifespan of ~30 years. Upon decommissioning, the wind turbines the wind turbines and meteorological masts will be dismantled and all above ground components would be removed off-site for recycling.

The potential effects associated with decommissioning of the Proposed Development will be similar to those associated with construction but of a reduced magnitude, due to the reduced scale of the proposed decommissioning works in comparison to construction phase works. Turbine and mast foundations will remain and will be covered with earth and allowed to revegetate. Site roads will continue to be used as amenity pathways and will therefore not be removed. The underground cables will be cut and tied and the ducting will be left in place. Excavation and removal of this infrastructure would result in considerable disturbance to the local environment in terms of disturbance to underlying soils and an increased sedimentation (if turbine foundations and hardstands are being reinstated there is a risk of silt-laden run-off entering receiving waters) and an increased possibility of contamination of local groundwater.

A decommissioning plan will be agreed with Meath and Westmeath County Council prior to decommissioning of the Proposed Development. A decommissioning plan is included as Appendix 4-5.

However, as noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is, therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

No significant effects on the hydrological and hydrogeological environment are envisaged during the decommissioning stage of the Proposed Development.

9.5.5 Risk of Major Accidents and Disaster

The main risk of MADs at peatland sites is related to peat stability. However, there is no record of peat instability or historic peat slides at the proposed site. A peat stability risk assessment (Appendix 8-1) has been completed for the proposed site and it concludes that with the implementation of the proposed mitigation measures that the risk of a peat failure at the proposed site is negligible/none.

Flooding can also result in downstream MADs. However, the rehabilitation and restoration of the proposed site will increase surface water retention/attenuation at the proposed site through drain blocking, re-profiling and the restoration of the bog hydrogeological regime. This will reduce the risk of flooding downstream of the proposed site.

9.5.6 Assessment of Health Effects

Potential health effects arise mainly through the potential for surface and groundwater contamination which may have negative effects on public and private water supplies. There are no mapped public or group water scheme groundwater protection zones in the area of the proposed site. Notwithstanding this, the proposed site design and mitigation measures ensures that the potential for effects on the water environment will not be significant.

Flooding of property can cause inundation with contaminated flood water. Flood waters can carry waterborne disease and contamination/effluent. Exposure to such flood waters can cause temporary health issues. A detailed Stage III Flood Risk Assessment has been caried out for the Proposed Development, summarised in Section 9.3.6. This Flood Risk Assessment, combined with the assessment of changes in permeable surfaces (Section 9.5.3.1) demonstrates that the risk of the Proposed Development contributing to downstream flooding is insignificant. On-site (construction and operation phase) drainage control measures will ensure no downstream increase in local flood risk.

9.5.7 Cumulative Effects

This section presents an assessment of the potential cumulative effects associated with the Proposed Development and other developments (existing and/or proposed) on the hydrological and hydrogeological environment.

The main likelihood of cumulative effects is assessed to be hydrological (surface water quality) rather than hydrogeological (groundwater). Due to the hydrogeological setting of the proposed site (i.e. low permeability peat, silts and clays overlying a poor bedrock aquifer) and the near surface nature of construction activities, cumulative impacts with regard groundwater quality or quantity arising from the Proposed Development are assessed as not likely.

9.5.7.1 Cumulative Effects with Turbary Peat Cutting

Private peat cutting on turbary plots will likely continue at the Ballivor Bog Group. The construction phase of the Proposed Development may interact with these turbary activities and result in a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However, the areas of private peat cutting will be infinitely small, significantly limiting the potential for cumulative effects to arise with the Proposed Development. Nevertheless, the mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Proposed Development will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with turbary activities.

9.5.7.2 Cumulative Effects with Agriculture

The proposed site and the wider Ballivor Bog Group is situated in the River Boyne surface water catchment within which agriculture is the largest land use. Corine land cover maps (1990 – 2018) show that the majority of lands in the Boyne catchment are being used for agricultural purposes.

Agriculture is the largest pressure on water quality in Ireland. Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative impact on local and downstream surface water quality.

The Proposed Development would have the potential to interact with these agricultural activities and contribute to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However the mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Proposed Development will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with turbary activities.

9.5.7.3 Cumulative Effects with Commercial Forestry

There are a total of 9 no. approved private felling licences and 2 no. approved Coillte felling licences in the lands surrounding the proposed site and the wider Ballivor Bog Group. In addition there are 5 no. approved licences for afforestation.

The most common water quality problems arising from forestry relate to the release of sediment and nutrients to the aquatic environment, and impacts from acidification. Forestry may also give rise to modified stream flow regimes caused by associated land drainage.

Due to the close proximity of these areas of these forestry activities to the proposed site and given that they drain to the same river waterbodies (Deel, Stonyford and Boyne rivers) as the proposed site, the potential cumulative impacts on downstream water quality and quantity need to be assessed.

However the mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Proposed Development will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with turbary activities.

9.5.7.4 Cumulative Effects with One Off Housing Developments

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within a combined river sub-basin zone within the vicinity of the proposed site. This combined sub basin area encompasses the area of the Deel([Raharney]_SC_010, the Boyne_SC_040 and the Boyne_SC_050 sub-catchments. There will be no potential for cumulative impacts within the Boyne_SC_060 sub-catchment due to increased flow volume (as the catchment area increases) and increased distance from the Proposed Development. All sections of the river Boyne downstream of the Boyne_060 SWB have a total upstream catchment area in excess of 1,000km^2 and have no potential to be effected by the Proposed Development.

Planning applications have been consulted within the sub-basin zone described above. These applications are for new dwellings or renovations of existing dwellings, as well as for the erection of farm buildings. Based on the scale of the works, their proximity to the proposed site and the temporal period of likely works, no cumulative effects will occur as a result of the Proposed Development (construction, operation and decommissioning phases).

9.5.7.5 Cumulative Effects with Proposed Decommissioning and Rehabilitation Plans for the Ballivor Bog Group

Bord na Móna intend to utilise the Ballivor Bog Group for both peatland rehabilitation and wind energy infrastructure in order to facilitate environmental stabilisation of the bog group. In addition PCAS will be implemented in certain areas of the bog group (Carranstown East and Bracklin West) and will optimise climate benefits.

The Decommissioning and Rehabilitation Plans will be implemented in order to meet the requirements of the IPC licence. These plans, attached as Appendix 6-6, detail the proposed restoration and rehabilitation measures to be implemented, and will be subject to consultation as well as input from the EPA prior to their implementation.

The overall footprint of the Proposed Development is <2% of the total area of the Ballivor Bog Group (2,419ha). The decommissioning and rehabilitation plans for each of the bogs comprising the proposed site will be updated to incorporate the Proposed Development infrastructure, with the key objectives of the rehabilitation plans *i.e.* rewetting and revegetation, occurring between and surrounding the Proposed Development infrastructure.

The main risk to downstream surface water quality and the underlying groundwater quality will occur whilst the restoration measures are being implemented. The construction phase of the Proposed Development will overlap with the implementation of the rehabilitation plans. This will result in increased activity at the proposed site and in the wider bog area. The increased activity will result in greater peat disturbance which has the potential to result in elevated concentrations of suspended solids in runoff. The increased activity will also heighten the risk of hydrocarbon spills and leaks. However, all works completed as part of the Decommissioning and Rehabilitation Plans, including PCAS actions, will be completed in accordance with IPC licence requirements and using standard best practice measures. This will ensure that there will be no negative effect on downstream surface water quality or quantity or underlying groundwater quality.

During the operational phase of the Decommissioning and Rehabilitation Plans, the majority of the remedial works, such as drain blocking, will have been completed and there will be little activity on-site with the exception of monitoring and maintenance. The additional volumes of surface water runoff created by the construction of the Proposed Development infrastructure will be further attenuated within the proposed site following the implementation of the rehabilitation measures. The rehabilitation plans will improve both surface water quality and attenuation within the proposed site and in the wider bog area, by slowing the movement of water and the stabilisation of substrates.

There will be no cumulative effects associated with the construction, operational or decommissioning phases of the Proposed Development and the existing Decommissioning and Rehabilitation Plans and PCAS actions for the Ballivor Bog Group.

9.5.7.6 Cumulative Effects with the Consented Bracklyn Wind Farm

The consented Bracklyn Wind Farm development comprises of a 9 no. turbine wind farm and associated site development works together with ~6.3km of an underground grid connection. The Bracklyn Wind Farm site is located in the townland of Bracklyn, Co. Westmeath, immediately to the northwest of Bracklin Bog. Meanwhile the grid connection infrastructure will be located within the townlands of Bracklin, Co. Westmeath and Coolronan, Co. Meath, with the underground connection passing along a local road which separates Bracklin and Lisclogher bogs.

A 10-year planning permission has been granted for the construction of Bracklyn Wind Farm with a 30-year operational period from the date of first commissioning of the wind farm. Therefore, if the Proposed Development is permitted the construction phases of these 2 no. wind farms will likely overlap. The Bracklyn Wind Farm site and the grid connection route are located in the catchment to the Stonyford River. A small area of the Bracklyn Wind Farm site is located in the catchment to the Deel River, however no infrastructure is located in the River Deel surface water catchment.

In terms of the likely effects of wind farm developments on downstream surface water bodies, the greatest risk is during the construction phase as this is the phase when earthworks and excavations will be undertaken at the sites. Therefore, in the absence of mitigation measures, cumulative effects may arise. The Stonyford River will be particularly vulnerable to potential cumulative effects due to its small upstream catchment while the River Boyne will be less vulnerable due to the increased flow volumes in this waterbody.

The EIAR for the consented Bracklyn Wind Farm development details the potential hydrological and hydrogeological issues relating to the construction, operation and decommissioning phases of the proposed wind farm and proposes a suite of best practice mitigation measures designed to ensure that the development does not in any way have a negative impact on downstream surface water quality and quantity. Similarly, the mitigation and best practice measures proposed in this EIAR chapter will ensure that the Proposed Development does not have the potential to result in significant effects on the hydrological environment.

Therefore, with the implementation of the proposed mitigation measures (both for the Proposed Development and for the Bracklyn Wind Farm development) there will be no cumulative effects associated with the construction, operational or decommissioning phases of the Proposed Development and the consented Bracklyn Wind Farm.

9.5.8 Post Consent Monitoring

Environmental monitoring will continue as per the existing IPC licence conditions at the Ballivor Bog Group until the current IPC Licence is surrendered.

This monitoring will encompass surface water sampling to ensure that the discharge from the bogs remains below the existing IPC emission limit values, thereby protecting downstream surface water quality.

APPENDIX 9-1

FLOOD RISK ASSESSMENT

DOCUMENT INFORMATION

Document Title:	**PROPOSED BALLIVOR WIND FARM, CO. WESTMEATH/MEATH – FLOOD RISK ASSESSMENT**
Issue Date:	**22nd March 2023**
Project Number:	**P1510**
Project Reporting History:	**-**
Current Revision No:	**P1510-FRA_Rev F0**
Author(s):	**MICHAEL GILL** **ADAM KEEGAN** **CONOR MCGETTIGAN**
Signed:	Michael Gill ______________________________ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site-specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO), on behalf of Bord Na Móna Powergen Ltd, to undertake a Flood Risk Assessment (FRA) for the proposed Ballivor wind farm, Co. Meath and Co. Westmeath.

The Ballivor Wind Farm site ("the proposed site") forms part of the Ballivor Bog Sub-Group situated between the towns of Kinnegad and Delvin, Co. Westmeath. The proposed site comprises of 4 no. Bord na Móna bogs (Ballivor, Bracklin, Lisclogher and the western portion of Carranstown bog). The proposed site is a Bord na Móna peat bog, and as such the site is extensively modified, cutover and drained.

The proposed site boundary map is presented as **Figure A** below.

The Proposed Development comprises 26 no. turbines and associated access tracks, construction compounds, sub-station, cable trench route, grid connection, amenity pathways, carpark and other ancillary works.

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009).

1.2 STATEMENT OF QUALIFICATIONS

Hydro-Environmental Services ("HES") are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience in hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

Michael Gill PGeo (BA, BAI, MSc, MIEI) is an Environmental Engineer and Hydrogeologist with 22' years of environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. Michael has significant experience in surface water drainage issues, SUDs design, and flood risk assessment.

Adam Keegan (BSc, MSc) is a junior hydrogeologist with 5 years of experience in the environmental/engineering sector. Adam has assisted in the preparation of several flood risk assessments for various proposed developments, including wind energy developments.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 3 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science and a B.Sc. in Geology. Conor routinely prepares flood risk assessments for a wide variety of proposed developments including wind farm developments on peatlands.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the proposed site setting and details of the Proposed Development;
- Section 3 outlines the hydrological and geological characteristics of the proposed site and downstream surface water catchments and the existing and proposed site drainage;

- Section 4 presents a site-specific flood risk assessment (FRA) undertaken for the Proposed Development which was carried out in accordance with the above-mentioned guidelines;
- Section 5 assesses the Proposed Development in terms of local planning policies and presents a Justification Test for parts of the Proposed Development; and,
- Section 6 presents the FRA report conclusions.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the proposed site along with a description of the proposed site.

2.2 SITE LOCATION AND TOPOGRAPHY

The Ballivor Wind Farm site ("the proposed site") comprises 4 no. Bord na Móna bogs which form part of the larger Derrygreenagh Bog Group situated between the towns of Kinnegad and Delvin, Co. Westmeath. The bogs comprising the proposed site include Ballivor Bog to the south, Carranstown and Bracklin Bogs towards the centre and Lisclogher Bog at the northern end of the proposed site. Lisclogher West Bog exists to the west of Lisclogher Bog and forms part of the Ballivor Sub-Group of bogs (a sub-group of the Derrygreenagh Group), however this bog does not form part of the proposed site. In addition, the western section of Bracklin Bog (Bracklin West) and the eastern section of Carranstown bog are omitted from the proposed site. The total area of the proposed site is 1,770ha (17.70km^2).

The Meath-Westmeath county boundary runs through the centre of Lisclogher Bog, along the eastern boundary of Bracklin Bog and through the centre of both Carranstown and Ballivor Bogs. The proposed site is located approximately 3.7km west of the village of Raharney, 4.5km south of Delvin town, Co. Westmeath and 2.5km east of Ballivor village, Co. Meath.

The south of the proposed site is dissected by the R156 which joins the villages of Ballivor in the east to Raharney in the west. Ballivor Bog lies to the south of this regional road with the other 4 no. bogs which comprise the Ballivor Bog Sub-Group lying to the north. A Bord na Móna works area lies in the northwest of Ballivor Bog, in the townland of Grange More and contains offices, storage sheds, roads and a peat loading area. The remainder of Ballivor Bog is located in the townlands of Robinstown and Clonycavan in the east and Riverdale, Clondalee More and Derryconor in the west. Ballivor Bog has a total area of 635ha, all of which is included within the proposed site, and it was served by a Bord na Móna railway network which still extends from the loading area into the bog.

To the north of the R156, Carranstown Bog has an area of 306ha and lies in the townlands of Grangemore in the West and Carranstown Great, Carranstown Little and Killaconnigan in the east. Approximately 79ha in the west of Carranstown Bog forms part of the proposed site. The Bord na Móna railway links Carranstown Bog to Ballivor Bog to the south and Bracklin Bog to the north. Towards the centre of the proposed site, Bracklin Bog has an area of 620ha, all of which is included within the proposed site. Bracklin Bog lies in the townlands of Coolronan in the east, Craddanstown and Bracklin in the centre and Ballynaskeagh, Mucklin and Killagh in the west. An extension of Bracklin Bog, referred to as Bracklin West is not included within the proposed site. A small bogland (~22ha) referred to as the Hill of Down lies to the east of Bracklin Bog in the townlands of Coolronan and Bracklin. Lisclogher Bog is located to the northeast of Bracklin Bog, approximately 4.3km southeast of the town of Delvin and has an area of 484ha, of which 436ha is included within the proposed site. This bog is located in the townlands of Lisclogher Great, Coolronan, Bracklin, Cockstown and Clonleame.

The current topography of the proposed site is relatively flat with an elevation range of between approximately 69 and 84mOD (metres above Ordnance Datum). Topography at the proposed site has been modified through the previous peat extraction activities and associated drainage. The highest elevations are found at headlands and remnant peat banks which create elevated boundary berms, forming a basin effect within the former extraction areas of the bogs.

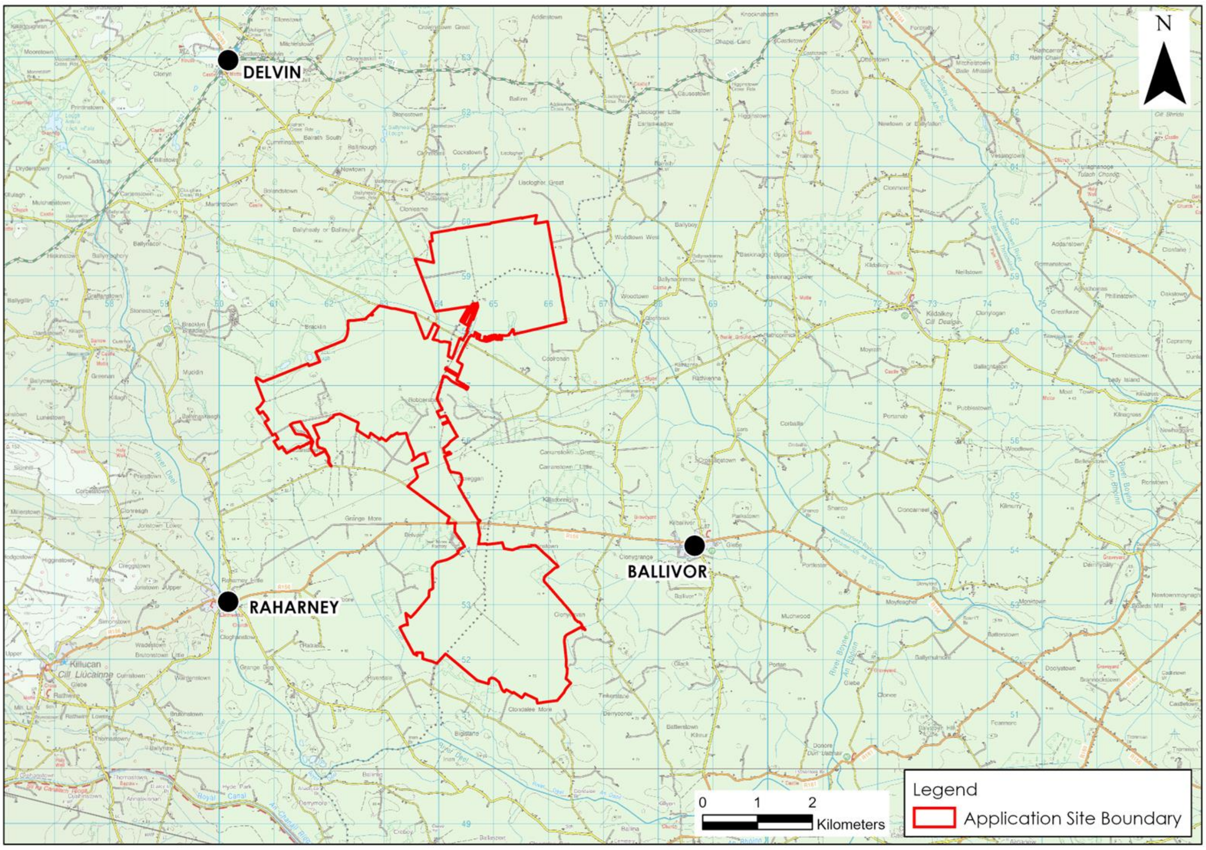

Figure A: Site Location Map

2.3 PROPOSED DEVELOPMENT DETAILS

The Proposed Development comprises of the following:

- Construction of 26 no. wind turbines;
- Turbine hardstand areas;
- Provision of 2 no. permanent meteorological masts;
- 5 no. temporary construction compounds;
- 2 no. borrow pits;
- 1 onsite 110kV substation, control building and plant, groundwater well and associated security fencing;
- 3 no. permanent amenity carparks;
- Upgrade of existing roads and access junctions;
- Provision of new site entrances, roads and hardstand areas;
- All site drainage works;
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation; and,
- All ancillary site and ground works, apparatus and signage.

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the region and the proposed site.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

Hydrometric Area 7[1] of the Eastern River Basin District.

The River Boyne surface water catchment has a total area of 2,694km^2 and includes all areas drained by the River Boyne. The source of the Boyne is the Trinity Well, southeast of Carbury, Co. Kildare approximately 18km southeast of the proposed site. The Boyne flows west from the Trinity Well, turning north at Edenderry, passing through the raised bog landscape of north Kildare, after which it is joined by the Yellow River. The River Boyne continues to flow towards the northeast and the town of Trim, flowing approximately 5km east of the proposed site. In the vicinity of the proposed site, the main tributaries which discharge into the Boyne include the Deel (Raharney) and Stoneyford rivers. Further downstream the Athboy River confluences with the Boyne before flowing to the east through the town of Trim. The Boyne then flows towards Navan after which it continues eastwards before becoming tidal to the west of my M1 motorway. The Boyne then flows through Drogheda and out to the Irish Sea between Haven and Mornington Point.

A regional hydrology map of the is shown in **Figure B** below.

On a local scale, the majority of the proposed site is located in the River Boyne_SC_050 sub-catchment. Meanwhile, the southwest of the proposed site, including much of Ballivor Bog and small areas of Carranstown and Bracklin bogs, is located in the River Boyne_SC_040 sub-catchment. The west of Bracklin Bog (i.e. Bracklin West), which is not included in the proposed site is situated in the Deel[Raharney]_SC_010 sub-catchment.

The Deel River (EPA Code: 07D01) flows southwards approximately 2.1km west of the proposed site. The Deel River flows southwards through the town of Raharney and confluences with several small streams which drain the southwest of the proposed site. While these watercourses are largely unnamed, the Curris River is located immediately to the west of Ballivor Bog and flows to the south before discharging into the Deel River approximately 1.4km south of the proposed site. The Deel then continues to the southeast and confluence with the River Boyne (EPA Code: 07B04) approximately 4.5km south of Ballivor village.

The eastern section of the proposed site is drained by the Stonyford River (EPA Code: 07S02). The Stonyford River flowing to the southeast, approximately 700m east of Lisclogher Bog and continues to the southeast before it discharges into the River Boyne approximately 7km east of proposed site (Ballivor Bog). The proposed site is drained by several small 1st and 2nd order streams which flow to the east and discharge into the Stonyford River.

[1] *Ireland's hydrometric areas are used as management units for hydrological areas (EPA, OPW, ESBI, Local Authorities etc) and they are made up of an amalgamation of large river basins.*

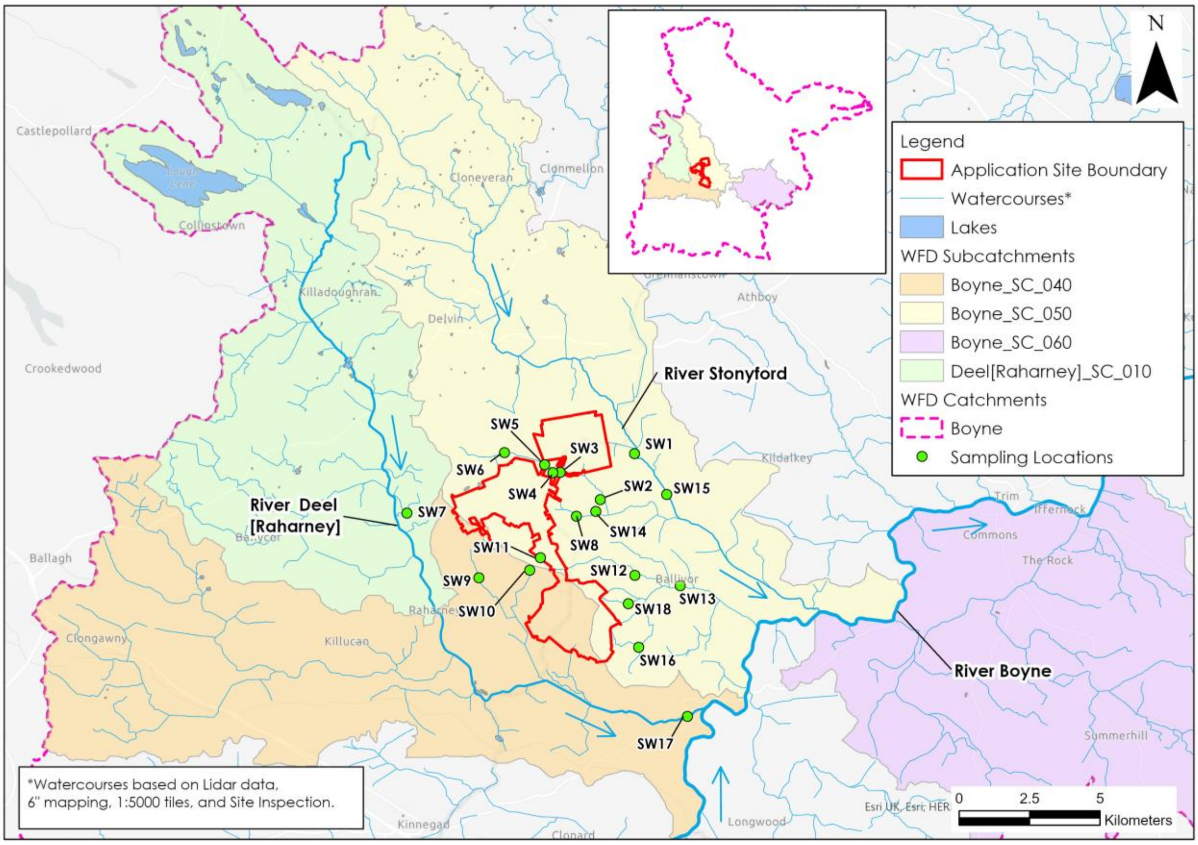

Figure B: Regional Hydrology Map

3.2.2 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall) recorded at Ballivor (~4.5km to the east), the closest rainfall station to the proposed site with long term SAAR data, is 839mm (www.met.ie). The average potential evapotranspiration (PE) at Mullingar, approximately 17km west of the proposed site is taken to be 445mm (www.met.ie). The actual evapotranspiration (AE) is calculated to be 423mm (95% PE). Using the above values, the effective rainfall (ER)[2] for the area is calculated to be (ER = SAAR – AE) ~416mm/yr.

Based on recharge coefficient estimates from the GSI (www.gsi.ie), an estimate of 4% recharge is taken for the proposed site as an overall average. This value is for "Peat" with a "Low" to "Moderate" vulnerability rating. Areas, where peat is absent, may have slightly higher recharge rates, but on this proposed site, these areas are generally very small and localised. The high drainage density in the area would also suggest that recharge rates are very low.

The lowest value in the available range was chosen to reflect the large coverage of blanket peat and high drainage density. Therefore, annual recharge and runoff rates for the proposed site are estimated to be 17mm/year and 399mm/year respectively.

Table A below presents return period rainfall depths for the area of the proposed site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year). These extreme rainfall depths will be the basis of the proposed wind farm drainage hydraulic design as described further below.

[2] ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.

Table A. Ballivor WF Site Rainfall Return Period Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.5	5.5	9.0	12.1
15 mins	5.7	9.1	14.7	19.9
30 mins	7.4	11.6	18.5	24.7
1 hours	9.6	14.8	23.1	30.4
6 hours	19.1	28.0	41.3	52.6
12 hours	25.0	35.8	51.8	65.1
24 hours	32.6	45.7	64.8	80.5
2 days	38.5	52.8	73.2	89.5

**Estimated using growth factors as data not available from (www.met.ie)*

3.3 GEOLOGY

The published soils map (www.epa.ie) for the area shows that cutover/cutaway peat is mapped almost exclusively over the proposed site. Soils in the surrounding lands are predominantly basic deep well drained mineral soils (BminDW) with smaller areas of basic deep poorly drained mineral soils (BminPD), poorly drained soils with a peaty topsoil (BminPDPT) and basic shallow well drained soils (BminSW). Mineral alluvium (AlluvMin) is mapped along local watercourses surrounding the proposed site.

The published subsoils map (www.gsi.ie) shows cut over raised peat (Cut) underlies the proposed site. Other subsoil types mapped in the wider area include Glacial Tills derived from Limestone (TLs) and Gravels derived from Limestone (GLs). An area of Till derived from cherts (TCh) is mapped to the southeast of Lisclogher Bog. The borrow pit (BP2) to the south of Bracklin Bog is mapped on limestone derived gravels.

The soils and subsoils present at the proposed site have been verified during site walkover surveys and intrusive site investigations. A total of 457 no. peat probes completed at the proposed site reveal a peat depth range of 0.4 to 5.7m with an average of 1.93m. Subsoils encountered during the peat probing investigations and 78 no. trial pits consisted of glacial tills comprising slightly sandy gravelly silt/clay and/or silty sands and gravels with come cobbles and boulders. A local subsoils map is attached below as **Figure C**.

The underlying bedrock geology at the proposed site is mapped by the GSI as being Dinantian Pure Unbedded Limestones (DPUL, comprising Waulsortion Limestone) and Dinantian Upper Impure Limestones (DUIL) (comprising the Lucan Formation and the Tober Colleen Formation) (refer to **Figure D** below). These types of rocks are classified as Locally Important Aquifer - bedrock which is Moderately Productive only in Local Zones – and as a Poor Aquifer – bedrock which is generally unproductive except for Local Zones – respectively by the GSI (www.gsi.ie).

The Waulsortian Limestones, of lower Visean age, underlie the majority of the proposed site and consist of dominantly grey, crudely bedded or massive limestones. Meanwhile, the northeast of Bracklin Bog and the west of Lisclogher Bog are underlain by the limestone shales of the Lucan Formation and calcareous shale and limestone conglomerates of the Tober Colleen Formation which are Dinantian in age. No bedrock exposures were noted during the walkover surveys.

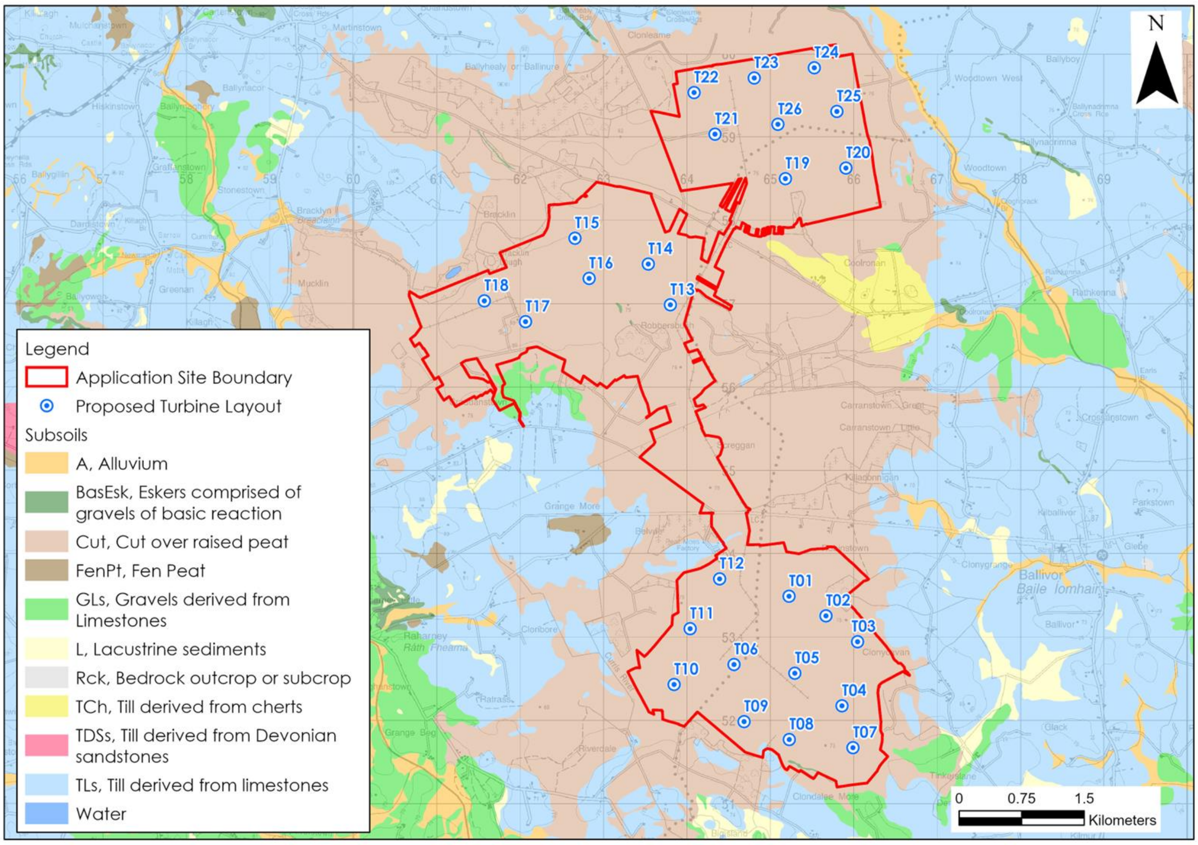

Figure C: Local Subsoils Map

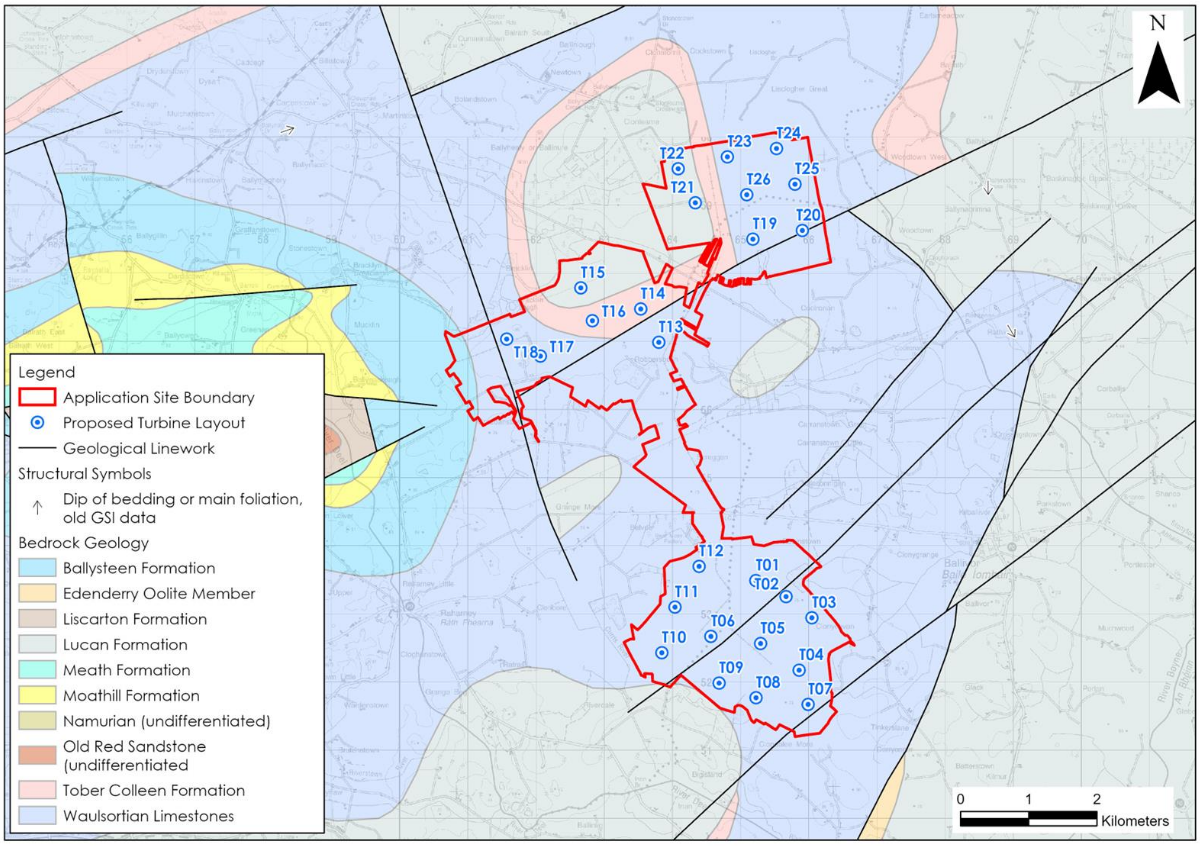

Figure D: Bedrock Geology Map

3.4 SITE DRAINAGE

3.4.1 Existing Site Drainage

Surface water is drained from the proposed site via a network of field drains typically spaced at 15 to 20m intervals, piped drained drains, main drains, headland drains, and silt ponds. These drains discharge to collector/headland drains along the perimeter of the bog, which eventually discharges to a series of large silt (settlement) ponds. Drainage is then discharged to off-site drainage channels which flow into the local river network. The proposed site is primarily drained by gravity however historical records do indicate that pumps have been used in the past to facilitate the drainage of Ballivor bog. They are no longer in operation.

A flow diagram for the existing drainage system is shown as **Figure E** below.

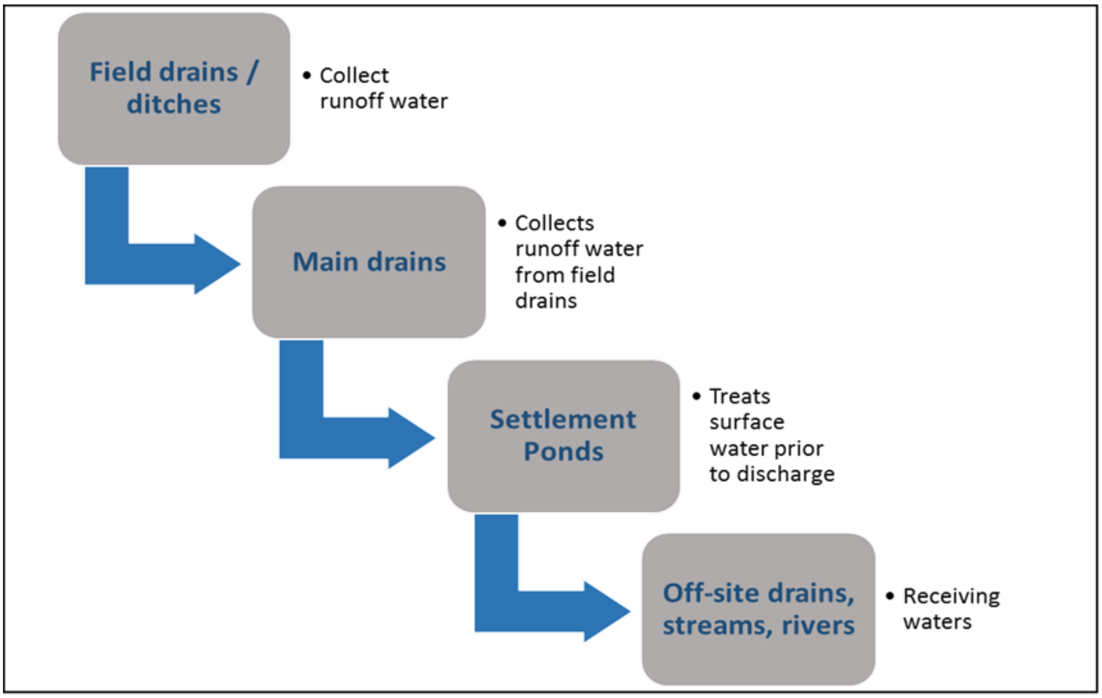

Figure E: Process Flow Diagram for the Existing Site Drainage System

A detailed hydrological audit of flowpaths from each bog to its eventual discharge point at the regional catchment scale was conducted for the 4 no. bogs comprising the proposed site. The flowpaths are shown as **Figure F** to **Figure I**.

The surface of Ballivor Bog is drained by a network of northwest/ southeast orientated drains that are typically spaced every 15 to 20m.. All 7 no. settlement ponds which form part of the drainage system for Ballivor Bog are located within the proposed site. Drainage from Ballivor Bog discharges through 6 no. outfalls (SW35, SW38, SW39, SW40, SW41 and SW41A) which discharge to off site drains and small local watercourses. Several of these watercourse have been named by the EPA (www.EPA.ie). In the southwest of Ballivor Bog, SW41A discharges to Clondalee_More stream which discharges to the Deel River. These waterbodies are mapped by the WFD as the Deel(Raharney)_060 surface waterbody (SWB). Further downstream, the Deel River discharges into the Boyne_050 SWB. The SW35, SW38 and SW39 outfalls, located in the northeast of the bog, discharge to several unnamed drains/streams, which then discharge to the Ballivor River. In the southeast of the bog outfalls SW40 and SW41 outfall to the Derryconor stream, which then discharges to the Ballivor River. The Ballivor River at this location is mapped as the Boyne_060 SWB by the WFD. Further downstream the Ballivor River confluences with the River Boyne (i.e Boyne_060 SWB). The River Boyne then continues through segments Boyne_070 to Boyne_180 before becoming tidal in the Boyne Estuary to the west of Drogheda.

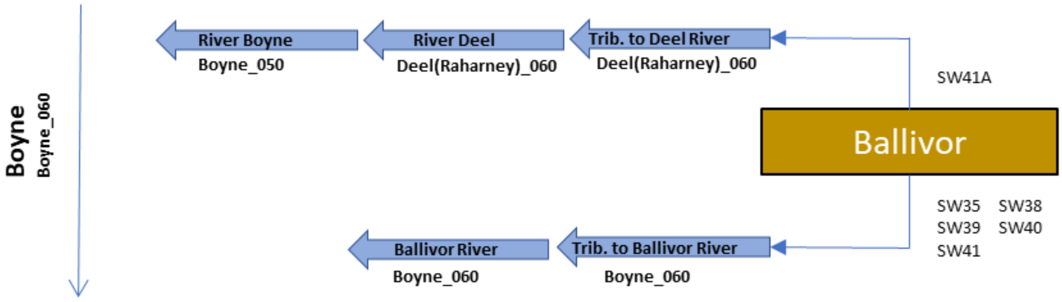

Figure F: Existing Drainage Within Ballivor Bog

The surface of Carranstown Bog is drained by a network of northwest-southeast oriented drains, typically spaced at 15m intervals. Drainage from Carranstown Bog discharges via 4 no. outfalls (SW31, SW32, SW33 and SW34). In the west, SW31 discharges to the Grange More stream which in turn discharges to the Craddanstown stream before discharging into the Deel River to the southwest of Ballivor Bog. These waterbodies are mapped within the Deel(Raharney)_060 SWB. Downstream, the Deel River discharges into the Boyne_050 SWB. In the southeast of Carranstown Bog, and outside of the proposed site boundary, the SW34 outfall discharges to the Killaconnigan stream, which in turn discharges to the Ballivor River southwest of Ballivor village. Here the Ballivor River is mapped within the Boyne_060 SWB. In the northeast of the bog, and outside of the proposed site boundary, SW32 outfalls to the Craddanstown Little stream which discharges into the Cartenstown stream and eventually into the Stonyford River to the east of the Carranstown Bog. These waterbodies are mapped within the Stoneyford_040 SWB. Further downstream the Stoneyford River reaches a confluence with the River Boyne (Boyne_070 SWB). The river Boyne then continues through segments Boyne_080 to Boyne_180 before becoming tidal to the west of Drogheda.

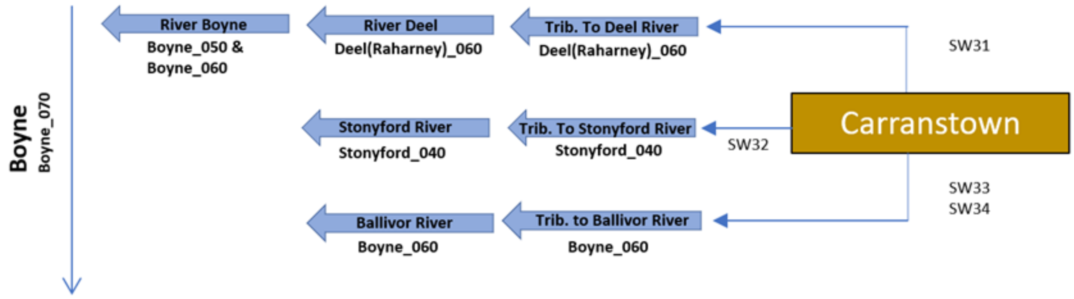

Figure G: Existing Drainage Within Carranstown Bog

Bracklin Bog is drained by a series of drains spaced at approximately 15m intervals. These drains have become overgrown since production stopped within this bog. Mineral soil can be observed from aerial photographs, indicating the peat has been essentially stripped. The western portion of Bracklin Bog (i.e. Bracklin West) contains east-west oriented drains. Drainage from Bracklin Bog discharges via 5 no. outfalls (SW26, SW27, SW28, SW29 and SW30), with all outfalls being located in Bracklin West and outside of the proposed site boundary. SW28, SW29 and SW30 discharge to the Greenan stream and the Ballynaskeagh stream respectively before discharging into the Deel River. These waterbodies are mapped in the Deel(Raharney)_030 SWB. The Deel River continues through segments Deel(Raharney)_040 and Deel(Raharney)_050. SW26 and SW27 outfall to the Craddanstown stream which forms part of the Deel(Raharney)_060 SWB. Downstream the Deel River discharges into the Boyne_050 SWB.

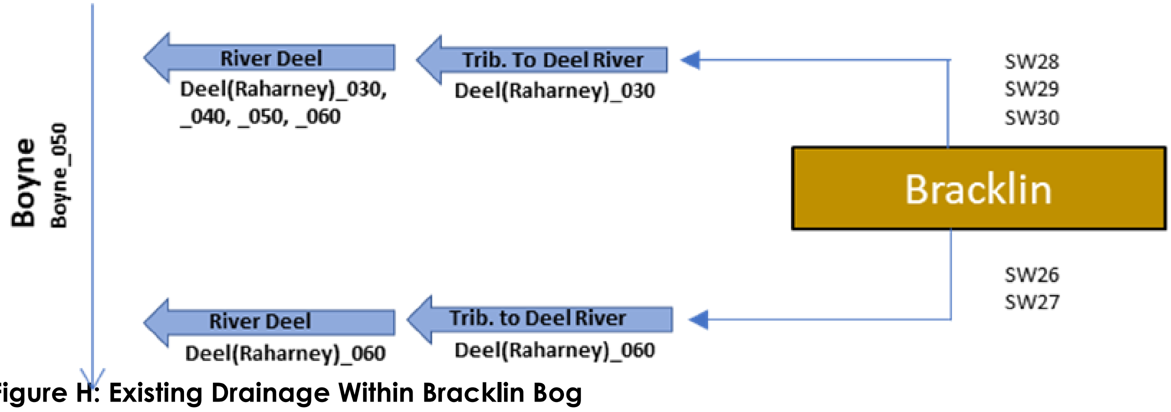

Figure H: Existing Drainage Within Bracklin Bog

Lisclogher Bog is drained by east-west oriented drains, spaced at approximately 15m intervals. There are larger arterial drains running east-west also, but much of the drainage channels have become overgrown since production ceased in the 1990s. The Bord na Móna Decommissioning and Rehabilitation Plan for Lisclogher Bog (2022) states that the drainage system is beginning to break down with many drains becoming blocked and filling with water. Drainage from Lisclogher Bog discharges via 1 no. outfall (SW25) located in the northeast of the bog. SW25 discharges to an unnamed stream which in turn discharges to the Stoneyford River. These waterbodies are mapped in the Stoneyford_030 SWB. The Stoneyford River continues through the Stoneyford_040 waterbody before discharging into the Boyne_070 SWB.

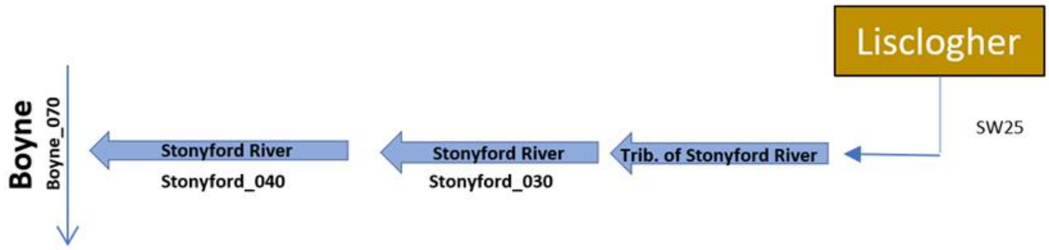

Figure I: Existing Drainage Within Lisclogher Bog

Additional, Bord na Móna drainage mapping is available for 3 of the 4 no. bogs comprising the proposed site (Ballivor, Bracklin and Carranstown bogs). The respective settlement ponds and their outfall pipe elevations are presented in **Table B** below.

Outfall pipe elevations range from 66.99 – 79.13m OD (metres above Ordnance Datum) with the greatest outfall elevations recorded in Bracklin bog. Outfalls generally discharge to nearby surface water bodies as mapped by the EPA or into smaller drains that flow towards these mapped watercourses.

Table B: Bord na Móna outfall elevations

Settlement Pond ID	Easting	Northing	Bog Name	Outfall Pipe Elevation (m OD)	Nearby Surface Waterbody
BR262	264995	251803	Ballivor	68.36	Clondalee More Stream
BR47	266375	251586	Ballivor	66.77	Ballivor River
BR48	266361	251599	Ballivor	66.99	Ballivor River
BR46	265879	253460	Ballivor	71.59	Unnamed waterbody which discharges into Ballivor River
BR45	265867	253506	Ballivor	71.47	Unnamed waterbody which discharges into Ballivor River
BR42	265139	254113	Ballivor	N/A	N/A
BN35&36	259502	257627	Bracklin	77.26	Graffasntown Stream

Settlement Pond ID	Easting	Northing	Bog Name	Outfall Pipe Elevation (m OD)	Nearby Surface Waterbody
BN33	259429	256879	Bracklin	77.95	Ballynaskeagh Stream
BN34	259437	256862	Bracklin	77.64	Ballynaskeagh Stream
BN31&32	260577	256515	Bracklin	79.13	N/A
BN39	260945	256769	Bracklin	N/A	N/A
CN38&39	265306	255941	Carranstown	67.97	N/A
CN40	265648	254796	Carranstown	70.08	Killaconnigan Stream
CN41	265874	254978	Carranstown	N/A	Killaconnigan Stream

3.4.2 Proposed Site Drainage

The proposed wind farm drainage will not significantly alter the existing drainage regime at the proposed site. Moreover, the proposed drainage system will be fully integrated into the existing bog drainage systems.

Existing field drains and main drains will be routed under/around proposed wind farm access tracks using culverts as required.

Runoff from access tracks, turbine bases, and developed areas (construction compounds, sub-station, met masts etc) will be collected and treated in local (proposed) silt traps and settlement ponds and then discharged to existing local peat field drains. From there this water will flow towards the proposed site boundaries in field drains and main drains) and be treated further in the existing main settlement ponds prior to discharge from the proposed site.

3.5 DEVELOPMENT WATER BALANCE

There are existing surface water control measures at the bog which comprise field drains, main drains, and settlement (silt) ponds. All these existing drainage measures offer some surface water attenuation during rainfall events.

However, as part of the proposed wind farm drainage, it is proposed that runoff from the proposed infrastructure will be collected locally in new proposed collector drains and settlement ponds prior to release into the existing bog drainage networks. The new proposed drainage measures will then in effect create additional attenuation to what is already present across each of the bog units. The net effect of this will be a reduction in the overall runoff coefficient of the bogs as demonstrated by the use of the Rational Method in **Table C** below.

Based on a conservative reduction in the runoff coefficient from 0.96 to 0.85 for the overall proposed site, there will be a potential 11% reduction in runoff volumes from the proposed site. This assessment demonstrates that there will be no risk of exacerbated flooding down-gradient of the proposed site as a result of the Proposed Development.

Table C. Ballivor – Water Balance Assessment

Site Area	C[1]	Area (m^2)	Rc[2]	Rainfall Intensity (mm/hr)	Runoff Rate (m^3/s)	Total Site Runoff Rate (m^3/s)
Without Wind Farm Drainage Control						
Undeveloped Area	2.78	17,178,300	0.96	0.0526	867,435	894,876
Proposed Development Footprint	2.78	521,700	1.00	0.0526	27,441	
With Wind Farm Drainage Control						
Undeveloped Area	2.78	17,178,300	0.85	0.0526	768,041	794,110
Proposed Development Footprint	2.78	521,700	0.95	0.0526	26,069	
Estimated Potential Reduction in Site Runoff Rate						**11%**

Notes: 1 – Constant, 2- Runoff Coefficient

4. SITE-SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the proposed site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment* – quantitative appraisal of the potential risk to a proposed development.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding, which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;
- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,
- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Coastal Flooding is not applicable to the proposed site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.

- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban stormwater drainage system, exceeds its discharge capacity and the system becomes blocked, and/or cannot discharge due to a high-water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.

- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water levels may rise slowly, they may be in place for extended periods. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.

- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e., the interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea, tending to increase water levels inland, which may flood over riverbanks.

The Flood Risk Management Guidelines (DoEHLG, 2009) provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk-based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range, and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest(greater than 1% (AEP)[3] or 1 in 100 for river flooding or 0.5% (AEP) or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% (AEP) or 1 in 1000 and 1% (AEP) or 1 in 100 for river flooding and between 0.1% (AEP) or 1 in 1000 year and 0.5% (AEP) or 1 in 200 for coastal flooding); and,

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% (AEP) or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the guidelines set out the different types of development appropriate to each identified zone (pg. 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for

3 *AEP – Annual Exceedance Probability*

through the application of a Justification Test (JT), where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test (JT) has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.

- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. For example, application of Development Management Justification Test would be required at a site-specific level, such as for this FRA assessment, if a Justification Test is required.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping was consulted and reviewed. There is no text on local available historical 6" or 25" mapping that identify areas that are "*prone to flooding*" within the proposed site.

4.3.2 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the proposed site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers deposits of transported silts/clays referred to as alluvium build up within the floodplain and hence the presence of these soils is a good indicator of potentially flood-prone areas.

Based on the EPA/GSI soil map for the area no regions of alluvium are mapped within the proposed site. Alluvium (fluvial deposits) is recorded along the Stoneyford River, to the east of the proposed site and the Deel River to the west. Alluvium is also mapped locally on many of the tributaries of these rivers which drain the wider bog group. In general, however, there is no significant alluvium deposition that would be associated with a flood plain or a large geographical area prone to flooding.

The EPA/GSI soil map for the area and on-site investigations reveal that the proposed site is underlain by poorly draining, waterlogged peaty soils. This would indicate that the area is historically prone to high water table levels. However, extensive drainage has occurred in the area for peat production and extraction and has lowered the local water table.

4.3.3 OPW National Flood Hazard Mapping

The OPW National Flood Hazard Maps have no records of any recurring or historic flood incidences within the proposed site (www.floodinfo.ie).

The closest mapped historic flood event is found approximately 300m east of Ballivor Bog at Cloneycavan (Flood ID: 10583). This flood event dates from 14th August 2008 and is described in as follows: "*After very heavy and prolonged rainfall in the Boyne Catchment area flooding occurred in several parts of the catchment*". A photograph taken of this flood event on 16th

August 2008 in Cloneycavan is included below as **Figure J**. A second historic flood event (Flood ID: 10586) dating from August 2008 is reported on the River Deel south of Raharney in the Anadruce area, approximately 3km southwest of Ballivor.

Several recurring flooding incidences (Flood ID: 2714, 2715, 2716) are mapped to the southwest of Raharney village along the R156 and in the vicinity of Kilucan (refer to **Figure K**) . A report from the Mullingar Area Engineer states that some of these recurring flood incidents are due to annual flooding of low-lying land after heavy rain (Flood ID: 2715 and 2716). While a stream to the east of Kilucan overflows its banks following heavy rainfall (Flood ID: 2714).

Meanwhile downstream of the proposed site a historic flood event (Flood ID: 1954) dating from November 2002 is mapped on the Boyne at Derrindaly Bridge. Further downstream several historic and recurring flood incidents on the Boyne are recorded at Trim.

Figure J: Flooding in the Cloneycavan area, to the east of Ballivor Bog on 16th August 2008 (www.floodmaps.ie).

According to the OPW (www.floodmaps.ie), sections of the proposed site are classified as "*Benefiting Lands*". Benefiting lands are defined as a dataset prepared by the Office of Public Works identifying land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage. These lands tend to be located around the main rivers and streams which drain the individual bog basins.

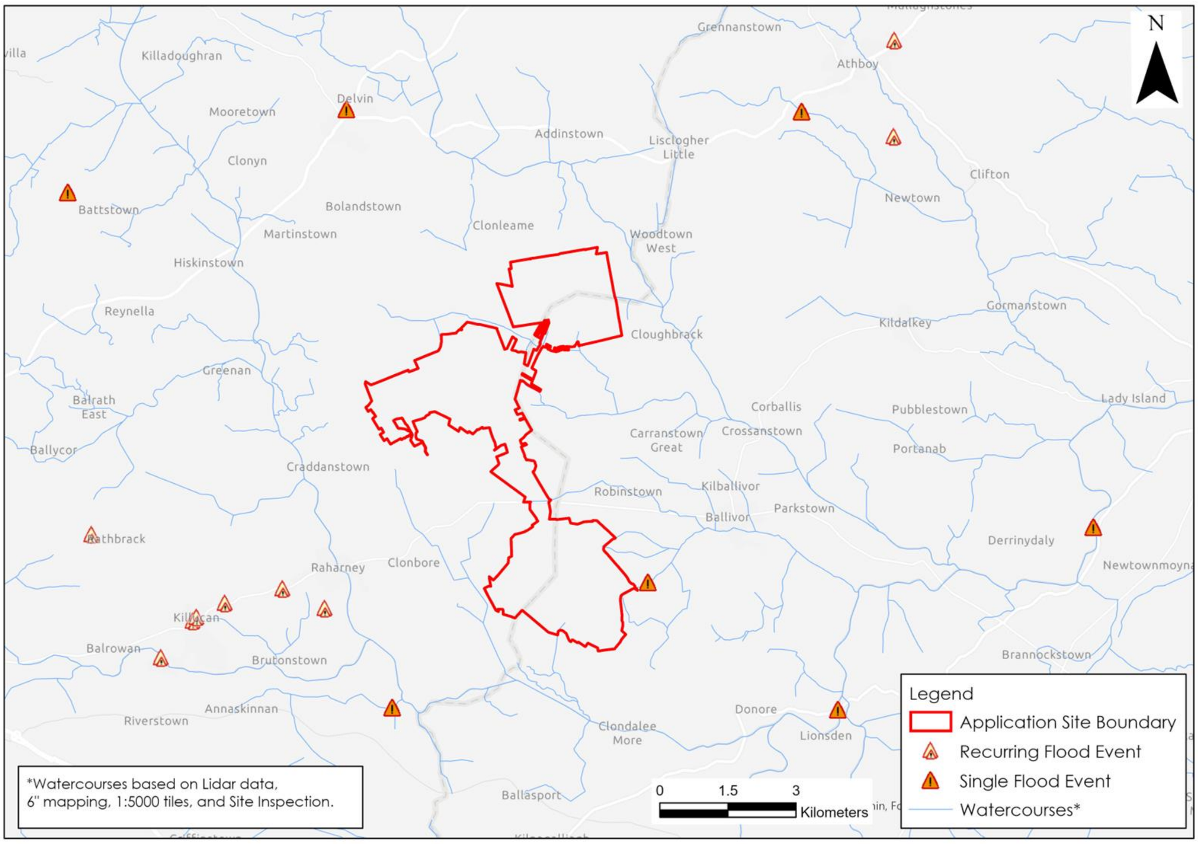

Figure K: OPW Indicative Flood Map (www.floods.ie)

4.3.4 OPW National Indicative Fluvial Flood Mapping

The OPW National Indicative Flood Maps (available at www.Floodinfo.ie) shows the modelled extent of land that might be flooded by rivers during a flood event with an estimated probability of occurrence. These flood maps have been produced for catchments greater than 5km^2 in areas for which flood maps were not produced under the National CFRAM Programme.

For the present day scenario, which does not consider the effects of climate change, the OPW have mapped potential flood extents for waterbodies draining the proposed site. The low (1,000-year flood event) and medium (100-year flood event) probability fluvial flood zones are recorded along the Stonyford and Deel (Raharney) Rivers to the east and west of the proposed site respectively. These modelled fluvial flood zones along these rivers remain largely localised to the immediate vicinity of the river channel. The vast majority of the proposed site is not mapped within the 100-year and 1,000-year flood zones and is therefore located in Flood Zone C and is at Low Risk of fluvial flooding.

However, fluvial flood zones however are also mapped along the Cartenstown stream, a tributary of the Stonyford River. These modelled flood extents encroach upon the proposed site, with areas towards the centre of Lisclogher Bog mapped within the medium probability fluvial flood zone. However site walkovers have revealed that Cartenstown Stream, mapped by the EPA to flow south-eastwards across Lisclogher Bog, does not exist. Such small local errors are infrequent in EPA mapping; however they do exist especially where manmade drainage has been imposed upon natural drainage regimes. This error casts doubt on the validity of the mapped flood zones as the modelling assumes the presence of the Cartenstown stream in this area of the proposed site.

No fluvial flood zones are mapped within Bracklin, Carranstown or Ballivor Bogs. The closest mapped fluvial flood zones to the west of Bracklin Bog are found along the Greenan stream to the northwest of the proposed site. Meanwhile, widespread fluvial Flood Zone A is mapped to the southwest of Ballivor Bog along the Craddanstown stream and the River Deel further south.

4.3.5 CFRAM Fluvial Flood Mapping

Catchment Flood Risk Assessment and Management (CFRAM)[4] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland.

CFRAM mapping has been completed downstream of the proposed site near Ballivor Village. CFRAM mapping has also been completed on the Stoneyford and Boyne Rivers further to the southeast and downstream of the proposed site.

The modelled CFRAM flood extents at Ballivor show flood levels of 64.19 to 65.34m OD for the 10-year and 100-year flood events respectively (refer to **Table D** below). Note these flood elevations are well below the pipe outfall elevations in **Table B**.

Table D: CFRAM Modelled Fluvial Water Levels (www.floodmaps.ie)

Node Label	Location Description	10% AEP WL (mOD)	1% AEP WL (mOD)	0.1% AEP WL (mOD)
00069	Ballivor River, ~1.4km east of Ballivor Bog	64.64	65.28	65.64
00023	Ballivor River, ~1.7km east of Ballivor Bog	64.19	64.77	65.11
00425	Stoneyford River, ~2km southeast of Carranstown Bog	64.82	65.34	65.66

4 CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.

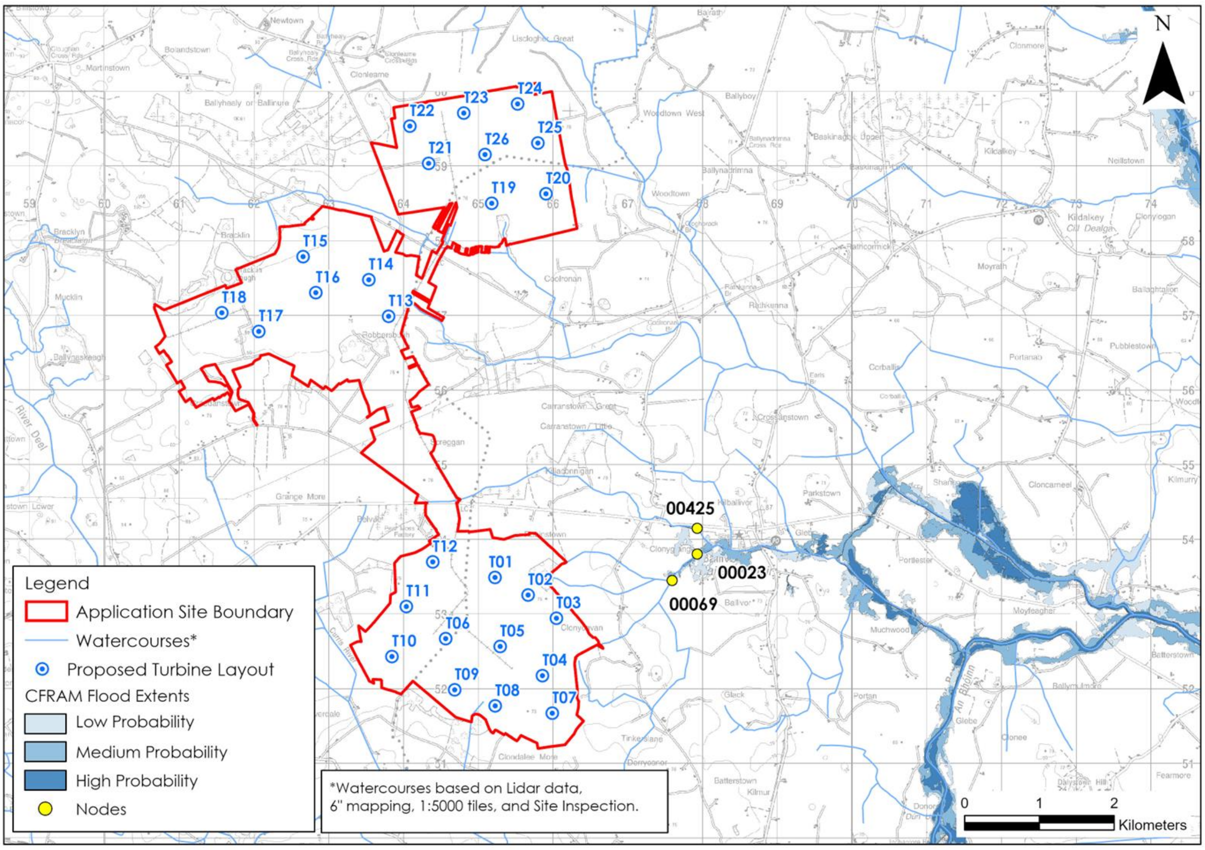

Figure L: CFRAM Fluvial Flood Mapping (www.floodinfo.ie)

4.3.6 GSI Historical Surface Water Flood Mapping

The GSI Historical 2015/2016 surface water flood map[5] does not record any mapped flood areas within the proposed site. A small area of surface water flooding is recorded to the northwest of Bracklin Bog and is associated with Bracklin Lough. No development infrastructure is located within 300m of this existing lake waterbody.

4.3.7 Local Authority SFRA Flood Mapping

Local Authority Strategic Flood Risk Assessment (SFRA) mapping obtained from Meath and Westmeath County Councils (www.westmeathcoco.maps.arcgis.com and www.meath.maps.arcgis.com) is shown below in **Figure M**.

Within County Meath, no significant fluvial flood zones are found to encroach onto the proposed site. SFRA mapping indicates flooding to the south of Lisclogher Bog on the Cartenstown stream and to the east of Bracklin and northeast of Carranstown bogs. These flood zones do not encroach upon the proposed site apart from a small area in the northeast of Carranstown Bog. Further south flood zones are also mapped along the Ballivor River to the east of Ballivor Bog at Cloneycavan and to the southwest along the Deel River in the townland of Clondalee More.

Within County Westmeath a significant portion of Lisclogher Bog is mapped as Fluvial Flood Zone A (100-yr event). Mapped flooding here is associated with an EPA mapped watercourse, which following on-site inspections and drainage mapping, is noted to be an error in the EPA database (refer to Section 9.3.3 of the EIAR for the discussion on drainage within Lisclogher Bog).

5 GSI Historical flood mapping principally developed using Sentinel-1 Satellite Imagery from the European Space Agency Copernicus Programme as well as any available historic records (from winter 2015/2016 or otherwise).

No fluvial flood zones are mapped within Bracklin Bog or the western region of Ballivor Bog. The closest mapped fluvial flood zones to the west of Bracklin Bog are found along the Greenan stream to the northwest of the proposed site. Meanwhile, widespread fluvial Flood Zone A is mapped to the southwest of Ballivor Bog along the Craddanstown stream and the River Deel further south.

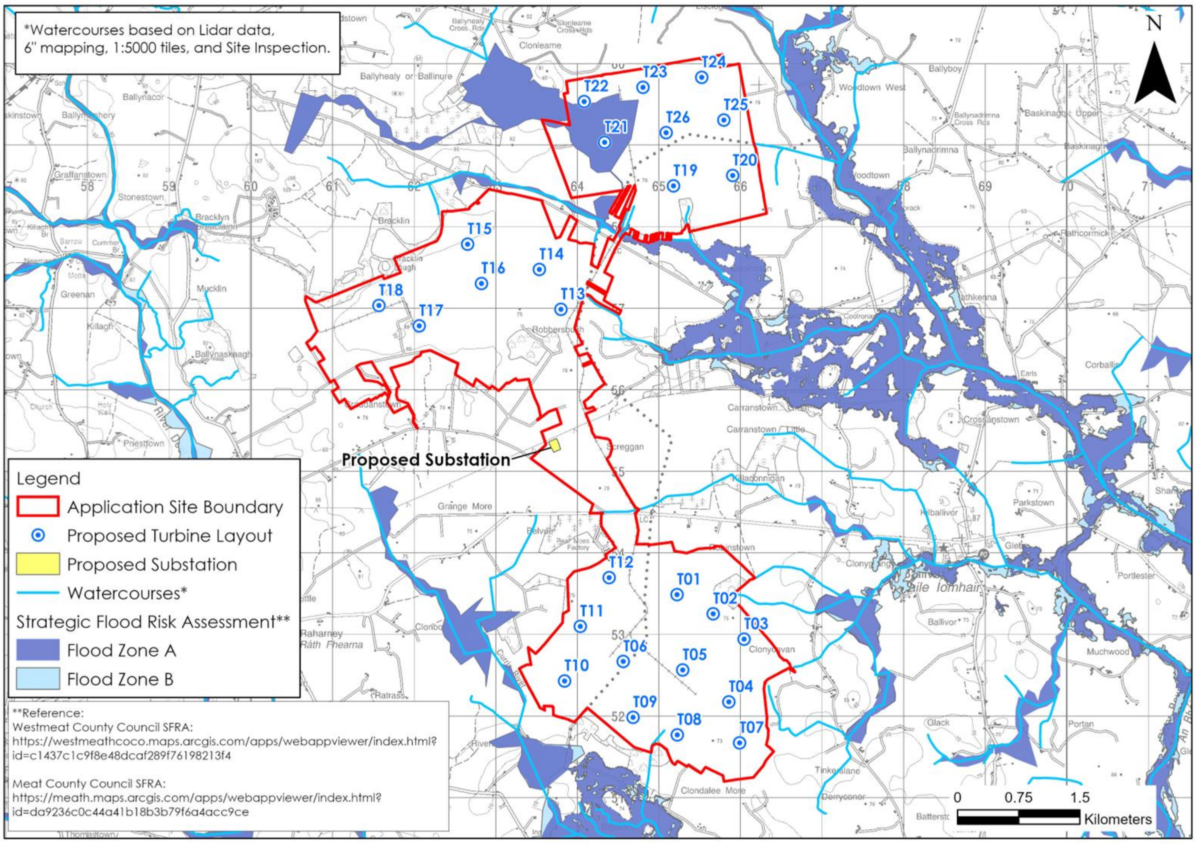

Figure M: Local Authority SFRA flood mapping

4.3.8 Groundwater Flooding

The GSI Historical 2015/2016 groundwater flood map does not record any groundwater flooding within the area of the proposed site. Areas of historic groundwater flooding are mapped in the surrounding lands, the closest of which is found approximately 200m to the south of the Bracklin Bog.

Other areas of groundwater flooding are mapped approximately 1km to the southeast of Ballivor Bog and approximately 1km to the northwest of Lisclogher Bog. These are small-localised areas of groundwater flooding and will not be impacted by the Proposed Development.

In addition the GSI predictive groundwater flood maps do not record any zones of groundwater flooding within the proposed site.

4.3.9 Climate Change

National Indicative Fluvial Flood Mapping has also been completed for several climate change scenarios which assesses the potential changes in fluvial flood extents associated with climate change. Fluvial flood modelling has been completed for 2 no. future scenarios, a Mid-Range Scenario and a High-End Future Scenario. The flood extents for the Mid-Range Future Scenario were modelled using a 20% increase in rainfall. Meanwhile the High-End Future Scenario was modelled using a 30% increase in rainfall and a sea level rise of 1,000mm.

For these future scenarios the modelled fluvial extents do not differ significantly from those described in **Section 4.3.4**. Fluvial flood zones associated with the High-End Future Scenario are shown in **Figure N** below.

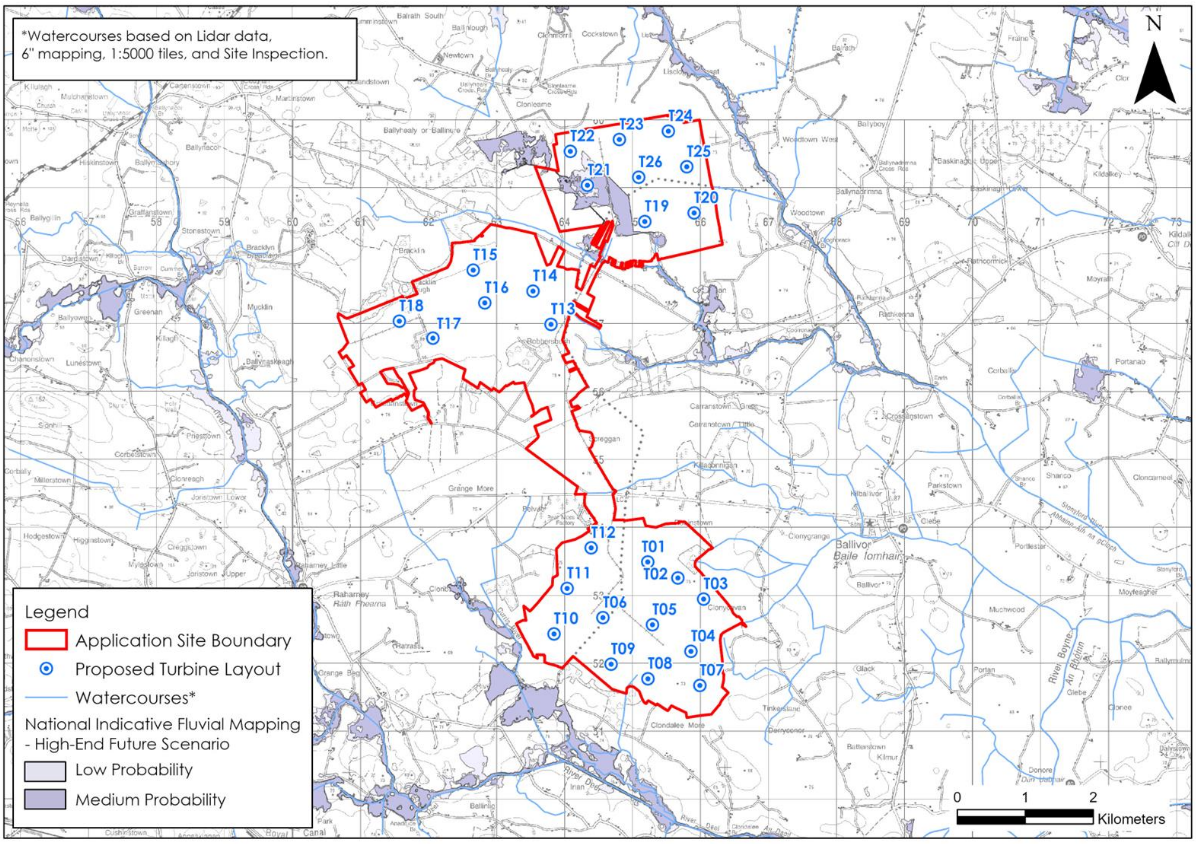

Figure N: High-End Future Scenario Fluvial Flood Zones

4.3.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process, it appears that part of the proposed site can be affected by fluvial flooding.

While the majority of the proposed site is mapped as Flood Zone C, areas in the northwest of Lisclogher Bog have a mapped high probability of flooding and are mapped within Fluvial Flood
Zone A.

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Walkover Survey

Hydrological walkover surveys and observations on the site drainage patterns were undertaken by HES on 18th May 2020, 15th – 17th September 2020, 05th October 2020, 01st December 2020, 22nd March 2021, 01st April 2021, 20th September 2021, 28th October 2021, 19th January 2022 and 22nd February 2023.

During the site walkover surveys landuse across much of the proposed site was noted as comprising of cutover bog where peat extraction has recently occurred. Note that peat extraction formally ceased at the Ballivor Bog Group in June 2020. The bogs were noted to be drained by regularly spaced field drains which drain towards larger arterial drains. Meanwhile certain areas of the proposed site have become overgrown, with peat production ceasing in these areas some time ago allowing vegetation to recover and recolonise the bare peat fields. At the boundaries of the bogs surface water draining from the site is routed via large settlement ponds prior to discharge to off-site drainage channels which flow into the local rivers and streams.

During the site walkover, an error was observed in the EPA map of local rivers. The EPA map shows the Cartenstown stream to flow to the southeast across Lisclogher Bog. However, site walkover surveys and lidar analysis (refer to Section 9.3.3 of the EIAR) have revealed that this section of mapped river does not exist. Such small (local) errors are infrequent in the digitised EPA river database, but they do exist, especially where manmade drainage has been imposed upon natural drainage patterns. This error also indicates that the SFRA flood zones mapped in this region are incorrect as they assume the presence of a surface watercourse.

Low lying areas within the proposed site were observed to hold surface water following heavy rainfall, but ponding only occurs to very shallow depths, (<0.2m) and only in certain areas does ponding persist in drier periods.

Monitoring of stream discharge in the main streams downstream of the proposed site was undertaken on several occasions at 18 no. monitoring locations on 1st April 2021, 28th October 2021 and 19th January 2021. These data are presented in **Table E** below. The monitoring locations are shown on **Figure B** above.

Table E: Surface Water Flow Monitoring

Location/Date	01/04/2021	28/10/2021	19/01/2022
	Flow(L/sec)	Flow (L/sec)	Flow (L/sec)
SW1	20	5	5
SW2	250	500	400
SW3	40	200	150
SW4	3	15	No flow
SW5	150	500	500
SW6	150	200	200
SW7	75	150	60
SW8	100	300	300
SW9	50	156	50
SW10	20	50	30
SW11	-	0	0
SW12	180	50	30
SW13	240	500	300
SW14	-	20	No Flow
SW15	5000	5000	5000
SW16	250	50	50
SW17	5000	5000	5000
SW18	15	75	40

4.4.2 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the proposed site can be described using the Source – Pathway – Receptor Model (S-P-R). The primary potential source of flooding in this area, and the one with the most consequence for the proposed site, is pluvial flooding.

During winter conditions the proposed site holds/retains rainwater following heavy rain. The depth of intermittent ponding is shallow (<0.2m). This retention of water on the bogs during such events will reduce downstream flooding risk. Potential receptors in the area are infrastructure, people, land and other private property.

4.4.3 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process the sources of flood risk for the site are outlined and assessed in **Table F.**

Table F. S-P-R Assessment of Flood Sources for the Proposed Site.

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the Cartenstown Stream	Land, People, property, infrastructure, River Shannon Callows SAC	According to SFRA mapping and OPW Flood Mapping, areas of Lisclogher Bog are mapped in Fluvial Flood Zone A. However, we have surveyed this area of the proposed site, and we confirm there are no watercourses in this area (refer to Section 9.3.3 of the EIAR), and therefore conclude the SFRA mapping is incorrect. This area of the proposed site was noted to contain a high density of surface water drains and should be included in Flood Zone C. The proposed site is located in Fluvial Flood Zone C (Low Risk).
Pluvial	Ponding of rainwater on-site	Land and infrastructure.	The proposed site is generally low lying and flat in places and therefore localised pluvial flood is very likely after heavy or prolonged rainfall.
Surface water	Surface ponding/ Overflow	Land and infrastructure.	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land and infrastructure.	Based on the local hydrogeological regime and GSI groundwater flood mapping, no apparent risk from groundwater flooding.
Coastal/tidal	Not applicable	Land and infrastructure	The proposed site is >50km from the coast and there is no risk of coastal flooding.

4.5 REQUIREMENT FOR A JUSTIFICATION TEST

A matrix of vulnerability versus flood zone is shown in **Table G**. This table is used to illustrate appropriate development types or indicate when a Justification Test[6] is required.

It may be considered that the proposed wind farm can be categorised as "Highly Vulnerable Development". The key development infrastructures including turbines, access roads and the proposed substation location are situated in Flood Zone C. Consequently, the Proposed Development is potentially not at risk of flooding and would not require further justification from a planning perspective.

However, in order to be conservative, and given the risk of pluvial flooding at the proposed site, the sensitivity of the substation and the level of the proposed turbine bases, we have completed a Justification test below in **Section 5.2**. A detailed site-specific flood risk assessment is also completed below (**Section 4.6**) for the proposed substation location.

[6] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

Table G: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	**Justification test**	**Justification test**	**Appropriate**
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: *Taken from Table 3.2 (DoEHLG, 2009)*
Bold: *Applies to this project.*

4.6 DETAILED FLOOD RISK ASSESSMENT FOR PROPOSED SUBSTATION

Due to the sensitivity of the proposed substation, we have completed a detailed assessment to determine a proposed floor level (or formation level) that is above the predicted 1-1000yr pluvial flood level.

The proposed substation is located in the western section of Carranstown Bog. The existing ground levels at the proposed substation location varies between 72.27 to 79.61mOD.

No part of Carranstown West is mapped in any available flood mapping (National Indicative Flood Mapping, CFRAM, Local Authority SFRA mapping, GSI Groundwater flood mapping).

In order to determine if the proposed substation location is above the 1-1000 year flood level (Low Probability) we modelled flood levels by applying 1,000-yr rainfall depths (including a climate change factor of +20%) to the western surface water catchment within Carranstown Bog. Based on available topography and the existing drainage regime at Carranstown Bog, the area to the west of the railway line is the only catchment that can contribute to flooding of the proposed substation location. The area of this catchment is ~0.62km^2. The western portion of Carranstown Bog outfalls to the north, and to the west, and the existing drainage outfalls have been surveyed by BnM and are recorded at elevations >74.12mOD.

For a catchment area of 0.62km^2, the mean annual flood (Using Institute of Hydrology Report 124) discharge from Carranstown West catchment is calculated at 0.15m^3/sec. The estimated 100-yr and 1000-yr flood flows (using growth factors and applying a climate change factor of 1.2) from the north-eastern catchment are (Q100) 0.48m^3/sec and (Q1000) 0.65m^3/sec respectively.

Extreme rainfall depths for the proposed site were determined using the Met Eireann 20 km by 20 km model of rainfall depth-duration-frequency model (www.met.ie). The rainfall totals at different durations and return periods are presented in **Table A**.

A lidar survey at a 2m grid interval of the entire Carranstown Bog unit was used to determine the flood volume available in the western catchment of the bog (0.62km^2 catchment) at various water elevations. This information is presented in **Table H**.

Table H shows that significant storage is available within Carranstown West, and this is due to the expanse of the open bog area (0.62km^2), the flat nature of the ground (small increases in water level requires large volumes of water), and the shallow bowl that has been created by previous peat extraction works.
As a preliminary assessment, a conservative volumetric (catchment area × rainfall depth for each return period and storm duration) and flood storage calculation with Q_{100} and Q_{1000} discharges from the catchment was undertaken for various rainfall durations. Under this

scenario, the peak storage occurs for a 1-day duration rainfall events in both return periods (T_{100} and T_{1000}), with the storage required for longer duration events being exceeded by the discharge from the catchment over time. A summary of these volumetric calculations is provided in **Table I**.

Using the stage-volume relationship presented in **Table H**, it is possible to calculate the flood elevation for each return period. These are shown in **Table J.**

Table H: Carranstown West – Storage-Volume Relationship

Stage mOD (Malin)	Volume (m^3)
73.25	0
73.50	2.9
73.75	176
74.00	2,175
74.25	9,757
74.5	27,171
74.75.	58,656
75.0	107,342

Table I: Carranstown West - Storage Volumes in T_{100} and T_{1000} rainfall events

Rainfall Event Duration	T_{100} Residual Storage Volume (m^3)	T_{1000} Residual Storage Volume (m^3)
24hrs (1 day)	11,258	28,698
2 days	Discharge > Storage	Discharge > Storage
3 days	Discharge > Storage	Discharge > Storage
4 days	Discharge > Storage	Discharge > Storage
25 days	Discharge > Storage	Discharge > Storage

Table J: Carranstown West – Estimated Flood Levels for T_{100} and T_{1000} rainfall events

Rainfall Event	Estimated Peak Flood Level (mOD Malin)
T_{100}	74.3
T_{1000}	74.6

<u>Summary – Detailed Flood Risk Assessment for Proposed Substation</u>

As outlined above a very conservative volumetric analysis has determined the peak flood levels at the proposed substation site for 100-yr and 1000-yr rainfall events.

The overriding factor in the analysis is the expanse of the bog to the east and southeast substation which has to be filled with pluvial flood water before the substation site can flood. In addition to the above analysis, a freeboard of 0.3m is added to the determined flood levels to define the required floor/formation level for the substation. Applying this to the T_{1000} flood level gives a required substation floor/formation level of **>74.9mOD**. At this elevation the risk of flooding at the substation site is negligible.

4.7 FLOOD RISK IMPLICATIONS ASSOCIATED WITH THE PROPOSED DECOMMISSIONING AND REHABILITATION PLANS FOR THE BALLIVOR BOG GROUP

Now that peat extraction activity has ceased across the Ballivor Bog Group, including the 4 no. bogs which comprise the proposed site, Bord na Móna's Decommissioning and Rehabilitation Plans will be implemented in in order to fulfil the requirements of Condition 10.2 of the IPC licence No. P0501.

Bord na Móna have devised rehabilitation plans to stabilise and rehabilitate the peat bogs within the Ballivor Bog Group. The plans use bespoke interventions designed to first stabilise the environment and secondly to rehabilitate the proposed site as much as possible by placing the existing peatland environments on a path towards naturally functioning peatlands. Rehabilitation allows a site to naturally colonise with vegetation to stabilise the bare peat production fields and minimise potential downstream water pollution and surface water runoff.

Decommissioning and rehabilitation plans for each bogs comprising the wider Ballivor Bog Group, including proposed site drainage, have been prepared and are summarised below in **Table K**.

Improvements in flow and water quality can be achieved through bog rehabilitation and rewetting at the Ballivor Bog Group. The plans will generally involve the rewetting and revegetation of the drained cutover bogs. The greatest hydrological/hydrogeological effects would be experienced in those areas selected for rewetting following ecological surveying. Rewetting would be achieved through measures such as drain blocking. These plans will likely have a positive effect on hydrogeology within the proposed site where groundwater tables in the peat bogs are stabilised and closer to the bog surface. Water storage capacity within the site will therefore improve and reducing the risk of flooding within the vicinity and downstream of the proposed site. Elsewhere, where rewetting is not suitable the drainage regimes will remain relatively unchanged.

In addition to the standard rehabilitation required by the IPC licence, enhanced rehabilitation measures will be implemented in certain areas of the Ballivor Bog Group (Carranstown East and Bracklin West). The enhanced decommissioning, rehabilitation and restoration measures, referred to as the Peatlands Climate Action Scheme (PCAS), are designed both to exceed/meet the standard requirements as defined by the IPC licence and to enhance ecosystem services by optimising climate action benefits. We note that work associated with PCAS has been completed in Carranstown East. The enhanced restoration, which will include more intensive drain blocking and ground re-profiling, will optimise hydrological conditions and will have benefits for water quality and storage attenuation as well as increased carbon storage and reduced emissions.

With the implementation of the rehabilitation plans and PCAS activities, surface water runoff from the Ballivor Bog Group will be reduced, thereby decreasing the downstream flood risk.

Furthermore the Proposed Development will be constructed with its own drainage system which will provide additional surface water attenuation.

The cumulative effect of the Proposed Development and the Decommissioning and Rehabilitation Plans is that there will be a reduced risk of fluvial flooding downstream of the proposed site.

Table K: Types of Rehabilitation Measures at the Ballivor Bog Group

Bog	Type	Description	Area (Ha)
Lisclogher	Deep Peat Cutover Bog	Regular drain blocking (3 per100 m) and blocking outfalls and managing water levels with overflow pipes	305.7
	Dry Cutaway	Blocking outfalls and managing water levels with overflow pipes	148.7
	Marginal Land	No Work Required	65.5
	Other	Silt Ponds	0.36
Carranstown	Deep peat	More intensive drain blocking (max 7 per 100m), blocking outfalls and Sphagnum inoculation. Berms and field re-profiling (45x60m cell), blocking outfalls and managing overflows & drainage channels for excess water & Sphagnum Inoculation	207.91
	Dry Cutaway 2	Regular drain blocking (3 per 100m) + blocking outfalls and managing water levels with overflow pipes + targeted fertiliser treatment	26.62
	Wetland	Turn off or reduce pumping to re-wet cutaway + blocking outfalls and managing water levels with overflow pipes + Targeted blocking of outfalls within a proposed site + constructing larger berms to re-wet cutaway + transplanting Reeds and other rhizomes. More intensive drain blocking (max 7 per 100m), + blocking outfalls and managing overflows + transplanting Reeds and other rhizomes	9.57
	Marginal Land	No Work Required	45.46
	Other	Silt Ponds, Other Constraints (ROW)	16.1
Lisclogher West	Deep peat	More intensive drain blocking (max 7 per 100m), modifying outfalls	132.6
	Additional Works	Targeted Drain Blocking, where possible	22.2
	Marginal Land	No Work Required	58.1
	Other	Silt ponds, constrained areas	25.4
Ballivor	Deep Peat Cutover Bog	Regular drain blocking (3 per100m) and blocking outfalls and managing water levels with overflow pipes	537.9
	Dry Cutaway	Blocking outfalls and managing water levels with overflow pipes	19.1
	Marginal Land	No Work Required	82.4
	Other	Silt ponds	5.79
Bracklin	Deep Peat Cutover Bog	Regular drain blocking (3 per 100m) and blocking outfalls and managing water levels with overflow pipes	362.4
	Dry Cutaway	Modifying outfalls and managing water levels with overflow pipes	169.9
	Wetland	Modifying outfalls and managing water levels with overflow pipes	12.3
	Marginal Land	No Work Required	221.2
	Other	Silt pond	2.07

5. PLANNING POLICY AND JUSTIFICATION TEST

5.1 PLANNING POLICY AND CDP

The following policies are defined in the Westmeath County Council Development Plan (2021-2027) (**Table L**) and the Meath County Council Development Plan 2021-2027 (**Table M**) in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the Proposed Development design:

Table L: Westmeath CDP Policy on flooding and reference to relevant sections of this FRA report

No.	Policy	Development Design Response
CPO-10.105	Have regard to the "Guidelines for Planning Authorities on the Planning System and Flood Risk Management" (DoEHLG/OPW 2009) and Circular PL2/2014, through the use of the sequential approach and application of the Justification Tests in Development Management.	As outlined in this FRA, and **Section 4.5**
CPO 10.106	Ensure that a flood risk assessment is carried out for any development proposal within 200m of a watercourse and at risk of flooding, in accordance with the "Guidelines for Planning Authorities on the Planning System and Flood Risk Management" (DoEHLG/OPW 2009). This assessment shall be appropriate to the scale and nature of risk to the potential development.	As outlined in this FRA.
CPO 10.118	Ensure new development is adequately serviced with surface water drainage infrastructure which meets the requirements of the Water Framework Directive, associated River Basin Management Plans and CFRAM Management Plans.	As outlined in this FRA.
CPO 10.119	Require that planning applications are accompanied by a comprehensive SUDs assessment that addresses run-off quantity, run-off quality and its impact on the existing habitat and water quality.	The WF drainage proposals incorporate numerous SuDS elements that reflect the requirements of this policy.

Table M: Meath CDP Policy on flooding and reference to relevant sections of this FRA report

No.	Policy	Development Design Response
INF POL-18	To implement the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoEHLG/OPW, 2009) through the use of the sequential approach and application of the Justification Tests for Development Management and Development Plans, during the period of this Plan.	As outlined in this FRA, and **Section 4.5**
INF POL 30	To implement the findings and recommendations of the Strategic Flood risk Assessment prepared in conjunction with the County Development Plan review, ensuring that climate change is taken into account.	SFRA mapping described in **Section 4.3.7**. Flooding associated with climate change described in **Section 4.3.9.**
INF POL 20	To require that a flood risk assessment is carried out for any development proposal, where flood risk may be an issue in accordance with the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoECLG/OPW, 2009). This assessment shall be appropriate to the scale and nature of risk to the potential development.	As outlined within this FRA. Flood zone types defined within **Section 4.3**.

5.2 JUSTIFICATION TEST

Box 5.1 (**Table N** below) of "The Planning System and Flood Risk Management Guidelines" (PSFRM Guidelines) outlines the criteria required to complete the "Justification Test".

Table N: Format of Justification Test for Development Management

Box 5.1 Justification Test for Development Management (to be submitted by the applicant)
When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied: 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: i. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; ii. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes. The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

***Note:** this table has been adapted from Box 5.1 of "The Planning System and Flood Risk Management Guidelines", (2009).*

Referring to Point 1 and Points 2 (i) to (iv) inclusive in Figure 20 [of PSFRMG guideline document]:

1. The Proposed Development is currently in the planning process and has been deemed suitable for development by the applicant.
2. The proposal for 26 no. turbine wind farm and associated access tracks, construction compounds, sub-station, cable trench route, grid connection, amenity pathways, carpark and other ancillary works have been the subject of Stage II and Stage III flood risk assessment (this report) and this assessment has shown that:
   i. The Proposed Development has been assessed to have no impact on flood risk elsewhere in the locality.
   ii. The Proposed Development will not impede the flow of surface water during extreme flood events. Drainage designs for the Proposed Development follow SuDS principles and will restrict discharge rates. It is therefore estimated that the development presents minimal risk to people, property, the economy and the environment. In addition, volumetric modelling has demonstrated that the proposed substation site is above the 1000-yr flood level (proposed floor level >74.9mOD). There will be no increase in flood risk on lands upstream or downstream of the proposed site;
   iii. The assessment has shown that there will be no residual risks to the Proposed Development or local area; and,
   iv. With respect to the above (flood risk management proposals), the Proposed Development is therefore compatible with the wider planning objectives of the area. It does not alter the flood risk upstream or downstream of the proposed site.

With regards to the proposed site, it will for the large part remain flood free, but on very rare occasions there is a risk of shallow inundation from pluvial flooding. Surface water discharges from the proposed site are attenuated and will be slowed down below greenfield runoff rates. All drainage from the 4 no. bogs comprising the proposed site is by gravity. There are no operational pumping stations at the site.

Surface water will be held on-site, behind access tracks, in shallow wet areas (as described in **Section 3.4.2**), in low lying areas, in silt traps, in settlement ponds.

Given the large area of the Ballivor Bog Group, the bogs have an enormous capacity to store water following rainfall events, even if storage is only a couple of centimetres in depth, the volume of stored water will be very large.

Overall, during the wind farm operation phase of Proposed Development, water is more likely to be held on-site, and this will have a positive impact on downstream flooding events.

No part of the proposed wind farm infrastructure will flood, and all access roads and turbine bases will be designed to be above known pluvial flood levels.

The proposed substation will be raised to be above the 1 in 1000-year flood level as outlined above (i.e. >74.9mOD).

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed Ballivor wind farm development in Co. Meath and Co. Westmeath. From this study:
  - No instances of historical flooding were identified in historic OS maps;
  - No instances of recurring flooding were identified on OPW maps within the proposed site;
  - The GSI Historical 2015/2016 flood map does not record any areas of surface water flooding within the proposed site;
  - The GSI Groundwater flood mapping does not record any flood zones within the proposed site;
  - CFRAM maps, for Ballivor village and the surrounding areas, do not show any flood zones within the proposed site; and,
  - Areas of the proposed site were identified within Local Authority SFRA flood zones as described below.
- The Local Authority Strategic Flood Risk Assessment (SFRA) mapping indicates that there are areas of the proposed site are located in Fluvial Flood Zone A. The remainder of the proposed site is mapped in Flood Zone C (Low Risk);
  - However, site surveys reveal that the EPA incorrectly mapped a watercourse (the Cartenstown stream) to cross Lisclogher Bog from the west (refer to Section 9.3.3 of the EIAR) and this indicates that the SFRA mapping in this area is inaccurate;
  - We conclude, based on site observation, lack of flooding in winter 2015/2016, and the high drainage density within the bog at this location, that the actual flood risk in this area is the same for the entire Lisclogher bog, and it should be mapped in Flood Zone C;
- CFRAM mapping includes modelled flood levels for the 10-year and 100-year flood events. These levels, modelled near Ballivor village, range from 64.19 – 65.34m OD and are well above the current outfall pipe elevations of the proposed site (67.97 – 79.13m OD). Therefore, the risk of fluvial flooding along the Ballivor River, located to the east of the proposed site, backing up into the site drainage network is very low;
- The main risk of flooding across much of the proposed site is via pluvial flooding due to the low permeability of peat soils and subsoils;
- Site walkover indicates the surface of the cutover bog contains an extensive network of peat drains with surface water outflows from the bogs. This existing drainage network has been reduced the risk of pluvial flooding across much of the site. However, following periods of intense and prolonged rainfall events localised surface water ponding is still likely to occur in places across each of the bogs. Therefore, a freeboard (~0.3m) will be included in the design of each turbine base and along access roads;
- The proposed substation is particularly sensitive to flooding. Conservative volumetric analysis has determined the peak flood levels at the proposed substation site for 100-yr and 1000-yr rainfall events to be 74.3 and 74.6m OD respectively. The primary control in the analysis is the expanse of the bog in Carranstown West which needs to fill with pluvial flood water before the substation site can flood. It is therefore recommended to give the substation a minimum floor level of >74.9mOD (74.6mOD + 0.3m freeboard). At this elevation the risk of flooding at the substation site is negligible;

- It may be considered that the proposed wind farm can be categorised as "Highly Vulnerable Development". A justification test has been completed in Section 5.2 and concludes that the Proposed Development is designed and laid out in a manner that reduces flood risk, and that there is negligible potential for an increase in flood risk downstream of the Proposed Development;
- In addition, the risk of the wind farm contributing to downstream flooding is also very low, as the long-term plan is to implement Bord na Móna's decommissioning and rehabilitation plans at the proposed site. These plans aim to stabilise and rehabilitate the peat bogs by placing the existing peatland environments on a path towards naturally functioning peatlands. With the implementation of the rehabilitation plans, surface water runoff from the Ballivor Bog Group will be reduced, thereby decreasing the downstream flood risk. Furthermore the proposed wind farm development will be constructed with its own drainage system which will provide additional surface water attenuation. The cumulative effect of the Proposed Development and the Decommissioning and Rehabilitation Plans is that there will be a reduced risk of fluvial flooding downstream of the proposed site; and,
- The overall risk of flooding posed at the proposed site is assessed to be low, and all proposed infrastructure will be located at or above Flood Zone C elevations.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
Natural Environment Research Council	1975	Flood Studies Report (& maps).
Cunnane & Lynn	1975	Flood Estimated Following the Flood Studies Report
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Institute of Hydrology	1994	Flood Estimation in Small Catchments (IH 124).
Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Meath County Council	2021	Meath County Development Plan 2021-2027
Westmeath County Council	2021	Westmeath County Development Plan 2021-2027

APPENDIX 9-2

ORIGINAL LABORATORY RESULTS

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: HYDR-246020421
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 02/04/2021
Date Reported 07/04/2021
Order Number N/A

For the Attention of: Hydro Environmental Services

Sample Reception 18 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

Conditions:
1. *Results in this report relate only to the items tested*
2. *Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd*
3. *All queries regarding this report should be addressed to the Technical Manager at the above address*
4. *A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method*
5. *Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed*
6. *SUBCON* indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test*
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8. *Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation*
9. *Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing*

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CERTIFICATE OF ANALYSIS

Date Received 02/04/2021
Date Reported 07/04/2021
Order Number N/A

Sample Type Surface Water
Client ID Ballivor SW 1 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420452

Test	Result	Unit	Method
Suspended Solids	40	mg / l	P202
Phosphorus	0.11	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	12.9	mg/l Cl	P281
Nitrate	7.0	mg/l NO3	P281
Nitrite	0.08	mg/l NO2	P281
Ammonia	0.20	mg/l NH3-N	P281
Nitrogen (Total)	2.3	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 2 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420453

Test	Result	Unit	Method
Suspended Solids	9	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	14.0	mg/l Cl	P281
Nitrate	17.8	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.20	mg/l NH3-N	P281
Nitrogen (Total)	5.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Order Number N/A

Sample Type Surface Water
Client ID Ballivor SW 3 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420454

Test	Result	Unit	Method
Suspended Solids	8	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	15.2	mg/l Cl	P281
Nitrate	23.8	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	6.3	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 4 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420455

Test	Result	Unit	Method
Suspended Solids	80	mg / l	P202
Phosphorus	0.42	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.33	mg/l P	P281
Chloride	18.4	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	1.8	mg/L N	P285

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Order Number N/A

Sample Type Surface Water
Client ID Ballivor SW 5 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420456

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	15.6	mg/l Cl	P281
Nitrate	24.6	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	7.0	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 6 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420457

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	17.6	mg/l Cl	P281
Nitrate	32.9	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.11	mg/l NH3-N	P281
Nitrogen (Total)	8.2	mg/L N	P285

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Order Number N/A

Sample Type Surface Water
Client ID Ballivor SW 7 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420458

Test	Result	Unit	Method
Suspended Solids	8	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	13.6	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.23	mg/l NH3-N	P281
Nitrogen (Total)	1.6	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 8 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420459

Test	Result	Unit	Method
Suspended Solids	32	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	10.5	mg/l Cl	P281
Nitrate	6.3	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.51	mg/l NH3-N	P281
Nitrogen (Total)	2.4	mg/L N	P285

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Date Received 02/04/2021
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Order Number N/A

Sample Type Surface Water
Client ID Ballivor SW 9 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420460

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	12.3	mg/l Cl	P281
Nitrate	5.5	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.08	mg/l NH3-N	P281
Nitrogen (Total)	1.4	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 10 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420461

Test	Result	Unit	Method
Suspended Solids	14	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	26.4	mg/l Cl	P281
Nitrate	6.1	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.39	mg/l NH3-N	P281
Nitrogen (Total)	4.0	mg/L N	P285

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Sample Type Surface Water
Client ID Ballivor SW 11 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420462

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	13.6	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	1.4	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 12 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420463

Test	Result	Unit	Method
Suspended Solids	11	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	23.2	mg/l Cl	P281
Nitrate	11.9	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.05	mg/l NH3-N	P281
Nitrogen (Total)	3.6	mg/L N	P285

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Date Received 02/04/2021
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Order Number N/A

Sample Type Surface Water
Client ID Ballivor SW 13 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420464

Test	Result	Unit	Method
Suspended Solids	7	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	17.2	mg/l Cl	P281
Nitrate	7.8	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	1.9	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 14 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420465

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	0.33	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.30	mg/l P	P281
Chloride	13.0	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.56	mg/l NH3-N	P281
Nitrogen (Total)	2.5	mg/L N	P285

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CERTIFICATE OF ANALYSIS

Date Received	02/04/2021
Date Reported	07/04/2021
Order Number	N/A

Sample Type	Surface Water
Client ID	Ballivor SW 15 Date sampled: 01.04.2021
Date Tested	02/04/2021
ALS ID	4420466

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	15.6	mg/l Cl	P281
Nitrate	11.4	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.06	mg/l NH3-N	P281
Nitrogen (Total)	2.8	mg/L N	P285

Sample Type	Surface Water
Client ID	Ballivor SW 16 Date sampled: 01.04.2021
Date Tested	02/04/2021
ALS ID	4420467

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	14.3	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.37	mg/l NH3-N	P281
Nitrogen (Total)	1.8	mg/L N	P285

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Order Number N/A

Sample Type Surface Water
Client ID Ballivor SW 17 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420468

Test	Result	Unit	Method
Suspended Solids	8	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	15.5	mg/l Cl	P281
Nitrate	9.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.05	mg/l NH3-N	P281
Nitrogen (Total)	2.2	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW 18 Date sampled: 01.04.2021
Date Tested 02/04/2021
ALS ID 4420469

Test	Result	Unit	Method
Suspended Solids	9	mg / l	P202
Phosphorus	0.13	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	10.4	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	1.4	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No:	HYDR-712190122
Document No:	EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received	19/01/2022
Date Reported	27/01/2022
Order Number	N/A

For the Attention of:	Hydro Environmental Services
Sample Reception	16 sample(s) received in good condition.
Comments	N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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*4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method*
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test*
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
8. Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation
9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing

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CERTIFICATE OF ANALYSIS

Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 1
Date Tested 20/01/2022
ALS ID 4849635

Test	Result	Unit	Method
Suspended Solids	13	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.09	mg/l P	P281
Chloride	22.0	mg/l Cl	P281
Nitrate	13.2	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.25	mg/l NH3-N	P281
Nitrogen (Total)	3.0	mg/L N	P285

Sample Type Surface Water
Client ID SW 2
Date Tested 20/01/2022
ALS ID 4849636

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.09	mg/l P	P281
Chloride	15.2	mg/l Cl	P281
Nitrate	21.5	mg/l NO3	P281
Nitrite	0.11	mg/l NO2	P281
Ammonia	0.25	mg/l NH3-N	P281
Nitrogen (Total)	6.1	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 3
Date Tested 20/01/2022
ALS ID 4849637

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	15.8	mg/l Cl	P281
Nitrate	27.9	mg/l NO3	P281
Nitrite	0.09	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	7.8	mg/L N	P285

Sample Type Surface Water
Client ID SW 5
Date Tested 20/01/2022
ALS ID 4849639

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	15.9	mg/l Cl	P281
Nitrate	28.4	mg/l NO3	P281
Nitrite	0.09	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	9.4	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 6
Date Tested 20/01/2022
ALS ID 4849640

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	17.6	mg/l Cl	P281
Nitrate	35.4	mg/l NO3	P281
Nitrite	0.06	mg/l NO2	P281
Ammonia	0.13	mg/l NH3-N	P281
Nitrogen (Total)	8.0	mg/L N	P285

Sample Type Surface Water
Client ID SW 7
Date Tested 20/01/2022
ALS ID 4849641

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	12.9	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.46	mg/l NH3-N	P281
Nitrogen (Total)	2.1	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 8
Date Tested 20/01/2022
ALS ID 4849642

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	10.8	mg/l Cl	P281
Nitrate	7.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.74	mg/l NH3-N	P281
Nitrogen (Total)	3.6	mg/L N	P285

Sample Type Surface Water
Client ID SW 9
Date Tested 20/01/2022
ALS ID 4849643

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	13.1	mg/l Cl	P281
Nitrate	7.3	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	1.8	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 10
Date Tested 20/01/2022
ALS ID 4849644

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	22.8	mg/l Cl	P281
Nitrate	21.8	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.04	mg/l NH3-N	P281
Nitrogen (Total)	7.0	mg/L N	P285

Sample Type Surface Water
Client ID SW 11
Date Tested 20/01/2022
ALS ID 4849645

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.11	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	12.6	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.22	mg/l NH3-N	P281
Nitrogen (Total)	1.9	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 12
Date Tested 20/01/2022
ALS ID 4849646

Test	Result	Unit	Method
Suspended Solids	28	mg / l	P202
Phosphorus	0.15	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	23.9	mg/l Cl	P281
Nitrate	14.9	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.07	mg/l NH3-N	P281
Nitrogen (Total)	5.2	mg/L N	P285

Sample Type Surface Water
Client ID SW 13
Date Tested 20/01/2022
ALS ID 4849647

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	20.9	mg/l Cl	P281
Nitrate	11.8	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.06	mg/l NH3-N	P281
Nitrogen (Total)	3.1	mg/L N	P285

Report Authorised by: Rosemary Thomas

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CERTIFICATE OF ANALYSIS

Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 15
Date Tested 20/01/2022
ALS ID 4849649

Test	Result	Unit	Method
Suspended Solids	15	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	16.6	mg/l Cl	P281
Nitrate	13.2	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.07	mg/l NH3-N	P281
Nitrogen (Total)	3.8	mg/L N	P285

Sample Type Surface Water
Client ID SW 16
Date Tested 20/01/2022
ALS ID 4849650

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<1	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	18.3	mg/l Cl	P281
Nitrate	9.8	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.25	mg/l NH3-N	P281
Nitrogen (Total)	7.1	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
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Report No: HYDR-712190122

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 19/01/2022
Date Reported 27/01/2022
Order Number N/A

Sample Type Surface Water
Client ID SW 17
Date Tested 20/01/2022
ALS ID 4849651

Test	Result	Unit	Method
Suspended Solids	5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	15.1	mg/l Cl	P281
Nitrate	14.3	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.04	mg/l NH3-N	P281
Nitrogen (Total)	3.3	mg/L N	P285

Sample Type Surface Water
Client ID SW 18
Date Tested 20/01/2022
ALS ID 4849652

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	12.3	mg/l Cl	P281
Nitrate	6.2	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.09	mg/l NH3-N	P281
Nitrogen (Total)	2.4	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Report No:	HYDR-759281021
Document No:	EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received	28/10/2021
Date Reported	18/11/2021
Order Number	P1510

For the Attention of: Hydro Environmental Services

Sample Reception 18 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing

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Report No: HYDR-759281021

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 28/10/2021
Date Reported 18/11/2021
Order Number P1510

Sample Type Surface Water
Client ID Ballivor SW1
Date Tested 29/10/2021
ALS ID 4733798

Test	Result	Unit	Method
Suspended Solids	20	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.06	mg/l P	P281
Chloride	14.1	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	0.15	mg/l NO2	P281
Ammonia	0.60	mg/l NH3-N	P281
Nitrogen (Total)	1.8	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW2
Date Tested 29/10/2021
ALS ID 4733799

Test	Result	Unit	Method
Suspended Solids	19	mg / l	P202
Phosphorus	0.16	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	11.0	mg/l Cl	P281
Nitrate	11.8	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.13	mg/l NH3-N	P281
Nitrogen (Total)	4.3	mg/L N	P285

Report Authorised by: Rosemary Thomas

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CERTIFICATE OF ANALYSIS

Date Received 28/10/2021
Date Reported 18/11/2021
Order Number P1510

Sample Type Surface Water
Client ID Ballivor SW3
Date Tested 29/10/2021
ALS ID 4733800

Test	Result	Unit	Method
Suspended Solids	10	mg / l	P202
Phosphorus	0.18	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	12.5	mg/l Cl	P281
Nitrate	14.8	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.09	mg/l NH3-N	P281
Nitrogen (Total)	5.4	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW4
Date Tested 29/10/2021
ALS ID 4733801

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	0.26	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	0.11	mg/l P	P281
Chloride	10.0	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.05	mg/l NH3-N	P281
Nitrogen (Total)	1.7	mg/L N	P285

Report Authorised by: Rosemary Thomas

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CERTIFICATE OF ANALYSIS

Date Received 28/10/2021
Date Reported 18/11/2021
Order Number P1510

Sample Type Surface Water
Client ID Ballivor SW5
Date Tested 29/10/2021
ALS ID 4733802

Test	Result	Unit	Method
Suspended Solids	5	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	11.0	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.20	mg/l NH3-N	P281
Nitrogen (Total)	1.7	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW6
Date Tested 29/10/2021
ALS ID 4733803

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	0.26	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	17.3	mg/l Cl	P281
Nitrate	19.7	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	8.7	mg/L N	P285

Report Authorised by: Rosemary Thomas

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Date Received 28/10/2021
Date Reported 18/11/2021
Order Number P1510

Sample Type Surface Water
Client ID Ballivor SW7
Date Tested 29/10/2021
ALS ID 4733804

Test	Result	Unit	Method
Suspended Solids	14	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	4.6	mg/l Cl	P281
Nitrate	5.2	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.24	mg/l NH3-N	P281
Nitrogen (Total)	2.3	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW8
Date Tested 29/10/2021
ALS ID 4733805

Test	Result	Unit	Method
Suspended Solids	29	mg / l	P202
Phosphorus	0.12	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	8.1	mg/l Cl	P281
Nitrate	8.5	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.14	mg/l NH3-N	P281
Nitrogen (Total)	4.4	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
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Date Received 28/10/2021
Date Reported 18/11/2021
Order Number P1510

Sample Type Surface Water
Client ID Ballivor SW9
Date Tested 29/10/2021
ALS ID 4733806

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	8.0	mg/l Cl	P281
Nitrate	10.2	mg/l NO3	P281
Nitrite	0.06	mg/l NO2	P281
Ammonia	0.08	mg/l NH3-N	P281
Nitrogen (Total)	3.4	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW10
Date Tested 29/10/2021
ALS ID 4733807

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.14	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.05	mg/l P	P281
Chloride	28.5	mg/l Cl	P281
Nitrate	14.4	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.10	mg/l NH3-N	P281
Nitrogen (Total)	4.5	mg/L N	P285

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Report No: HYDR-759281021

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CERTIFICATE OF ANALYSIS

Date Received 28/10/2021
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Sample Type Surface Water
Client ID Ballivor SW11
Date Tested 29/10/2021
ALS ID 4733808

Test	Result	Unit	Method
Suspended Solids	8	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	6.5	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.16	mg/l NH3-N	P281
Nitrogen (Total)	1.0	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW12
Date Tested 29/10/2021
ALS ID 4733809

Test	Result	Unit	Method
Suspended Solids	29	mg / l	P202
Phosphorus	0.12	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	16.9	mg/l Cl	P281
Nitrate	9.2	mg/l NO3	P281
Nitrite	0.11	mg/l NO2	P281
Ammonia	0.11	mg/l NH3-N	P281
Nitrogen (Total)	3.4	mg/L N	P285

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Date Received	28/10/2021
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Order Number	P1510

Sample Type	Surface Water
Client ID	Ballivor SW13
Date Tested	29/10/2021
ALS ID	4733810

Test	Result	Unit	Method
Suspended Solids	13	mg / l	P202
Phosphorus	0.13	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	13.7	mg/l Cl	P281
Nitrate	7.0	mg/l NO3	P281
Nitrite	0.08	mg/l NO2	P281
Ammonia	0.18	mg/l NH3-N	P281
Nitrogen (Total)	3.0	mg/L N	P285

Sample Type	Surface Water
Client ID	Ballivor SW14
Date Tested	29/10/2021
ALS ID	4733811

Test	Result	Unit	Method
Suspended Solids	9	mg / l	P202
Phosphorus	0.16	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.06	mg/l P	P281
Chloride	9.7	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.14	mg/l NH3-N	P281
Nitrogen (Total)	2.2	mg/L N	P285

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Date Received 28/10/2021
Date Reported 18/11/2021
Order Number P1510

Sample Type Surface Water
Client ID Ballivor SW15
Date Tested 29/10/2021
ALS ID 4733812

Test	Result	Unit	Method
Suspended Solids	31	mg / l	P202
Phosphorus	0.16	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	18.3	mg/l Cl	P281
Nitrate	20.3	mg/l NO3	P281
Nitrite	0.15	mg/l NO2	P281
Ammonia	0.11	mg/l NH3-N	P281
Nitrogen (Total)	6.0	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW16
Date Tested 29/10/2021
ALS ID 4733813

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	10.7	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.20	mg/l NH3-N	P281
Nitrogen (Total)	1.7	mg/L N	P285

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Report No: HYDR-759281021

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 28/10/2021
Date Reported 18/11/2021
Order Number P1510

Sample Type Surface Water
Client ID Ballivor SW17
Date Tested 29/10/2021
ALS ID 4733814

Test	Result	Unit	Method
Suspended Solids	12	mg / l	P202
Phosphorus	0.18	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	12.0	mg/l Cl	P281
Nitrate	15.3	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.09	mg/l NH3-N	P281
Nitrogen (Total)	5.8	mg/L N	P285

Sample Type Surface Water
Client ID Ballivor SW18
Date Tested 29/10/2021
ALS ID 4733815

Test	Result	Unit	Method
Suspended Solids	51	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	8.3	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.12	mg/l NH3-N	P281
Nitrogen (Total)	1.8	mg/L N	P285

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APPENDIX 9-3

WATERFRAMEWORK DIRECTIVE ASSESSMENT

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WATER FRAMEWORK DIRECTIVE ASSESSMENT
BALLIVOR WIND FARM, CO. MEATH\WESTMEATH

FINAL REPORT

Prepared for:

BORD NA MONA POWERGEN

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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current revision no:	**FINAL_REV F0**
Author:	**MICHAEL GILL** **CONOR MCGETTIGAN**
Signed:	 **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO, on behalf of Bord na Móna Powergen Ltd, to complete a Water Framework Directive (WFD) Compliance Assessment for a planning application for the proposed Ballivor wind farm, Co. Meath and Co. Westmeath. The Proposed Development comprises a 26 no. turbine windfarm and all associated site development works.

The purpose of this WFD assessment is to determine whether any specific components or activities associated with the proposed wind farm development (i.e. the Proposed Development) will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures and determine if the project is in compliance with the objectives of the WFD.

This WFD Assessment is intended to supplement the EIAR submitted as part of the wind farm planning application.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including wind farms.

This WFD assessment was prepared by Michael Gill, Conor McGettigan and Jennifer Law.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Slievecallan WF, Cahermurphy (Phase I & II) WF, Carrownagowan WF, and Croagh WF and over 100 other wind farm related projects across the country.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 3 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science and a B.Sc. in Geology from University College Dublin. Conor routinely completes WFD compliance assessments for a variety of proposed developments including developments on peatlands.

Jenny Law (BSc) is a master's student in Applied Environmental Geoscience. Jenny holds a BSc in Earth and Ocean Science. In recent times Jenny has assisted in the preparation of hydrological and hydrogeological impact assessments for a variety of developments.

1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("**WFD**"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021.

The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the Proposed Development, include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Furthermore, the 3rd Cycle Draft River Basin Management Plan (2022 - 2027) is currently being prepared by the Department of Housing, Local Government and Heritage following completion of a 6-month public consultation process in March 2022.

Our understanding of these objectives is that water bodies, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed.

2. WATERBODY IDENTIFICATION CLASSIFICATION

This section identifies those surface water, groundwater bodies and protected areas with potential to be affected by the Proposed Development and reviews any available WFD information.

2.1 SURFACE WATERBODY IDENTIFICATION

Regionally the proposed site is located in the River Boyne surface water catchment within Hydrometric Area 7 of the Eastern River Basin District (www.epa.ie).

On a more local scale, the majority of the proposed site is located in the River Boyne sub-catchment (Boyne_SC_050) with much of Ballivor Bog and a small section towards the southwest of Bracklin Bog located in the Boyne_040 sub-catchment. Additionally, a small area in the northwest of Bracklin Bog (*i.e.* Bracklin West) is located in the Deel[Raharney]_010 sub-catchment (we note that this area of Bracklin Bog does not form part of the proposed site).

Within the Deel[Raharney]_010 sub-catchment, the Deel River flows to the southeast approximately 1km west of Bracklin West. This area (*i.e.* Bracklin West) drains towards the Deel(Raharney)_030 and Deel(Raharney)_040 river waterbodies. The River Deel flows to the southeast entering the Boyne_040 sub-catchment to the south of Raharney village. The River Deel reaches its confluence with the River Boyne approximately 4.5km south of Ballivor village.

Within the Boyne_040 sub-catchment, the Deel River flows to the southeast approximately 1.25km southwest of Ballivor Bog. This area of the proposed site (*i.e.* the southwest of Bracklin Bog and the west of Ballivor Bog) is drained by the Deel(Raharney)_060 river waterbody which discharges into the Boyne_060 river waterbody approximately 3.5km southeast of Ballivor Bog.

As stated above, the majority of the proposed site is located in the Boyne_050 sub-catchment. The Stonyford River flows to the southeast, approximately 700m east of Lisclogher Bog before eventually discharging into the Boyne River approximately 7km east of Ballivor Bog. The north of Lisclogher Bog is drained by the Stonyford_020 and Stonyford_030 river waterbodies (refer to Section 9.3.3 of the EIAR for a description of drainage within Lisclogher Bog) with the remainder of Lisclogher Bog and the majority of Bracklin and Carranstown bogs drained by the Stonyford_040 river waterbody. Meanwhile the south of Carranstown Bog and the east of Ballivor Bog are drained by the Boyne_060 river waterbody.

The Stonyford River discharges into the Boyne_070 river waterbody approximately 5km southeast of Ballivor village. The River Boyne then flows to the northeast through the towns of Trim and Navan after which it continues eastwards before becoming tidal to the west of my M1 motorway. The Boyne flows through the Boyne Estuary transitional waterbody and discharges into the Boyne Estuary Plume Zone costal waterbody between Haven and Mornington Point.

Figure A below is a local hydrology map of the local area.

Table A presents the catchment area of each waterbody downstream of the proposed site as per WFD mapping. The Deel(Raharney)_030 river waterbody in the vicinity of the Ballivor Bog Group has the smallest catchment area of 68.54km^2. The catchment area increases progressively downstream as more tributaries discharge into the Boyne River, with the final river waterbody *i.e*. Boyne_180, having a total catchment area of 2,524km^2. In addition, **Table A** presents the area of the Ballivor Bog Group draining to each waterbody as a percentage of the total catchment area for that waterbody. The percentage decreases progressively downstream of the proposed site. For example, the proposed site is 7.09% of the total catchment area of the Stonyford_040 river waterbody but only 0.66% of the total catchment draining to the Boyne_180 river waterbody. Therefore, those waterbodies which are located in close proximity to the proposed site are more susceptible to water quality impacts as a result of activities associated with the Proposed Development.

Table A: Downstream Catchment Size (as per WFD Mapping)

WFD River Sub-Basin	Total Catchment Area (km²)	Area of Proposed Site Draining to Waterbody (km²)	Proposed Site as % Area of Catchment
Deel(Raharney)_030	68.54	0	0
Deel(Raharney)_040	103.81	0	0
Deel(Raharney)_050	118.71	0	0
Deel(Raharney)_060	153.96	4.81	3.12
Boyne_050	741.64	4.81	0.64
Boyne_060	947.67	6.73	0.71
Stonyford_030	102.83	0.31	0.3
Stonyford_040	154.67	10.97	7.09
Boyne_070	1,147.95	17.7	1.54
Boyne_080	1,343.76	17.7	1.31
Boyne_090	1,354.41	17.7	1.3
Boyne_100	1,471.87	17.7	1.2
Boyne_110	1,563.22	17.7	1.13
Boyne_120	1,666.65	17.7	1.1
Boyne_130	1,680.85	17.7	1.05
Boyne_140	2,397.15	17.7	0.74
Boyne_150	2,411.06	17.7	0.73
Boyne_160	2,468.03	17.7	0.72
Boyne_170	2,477.50	17.7	0.71
Boyne_180	2,524.54	17.7	0.7

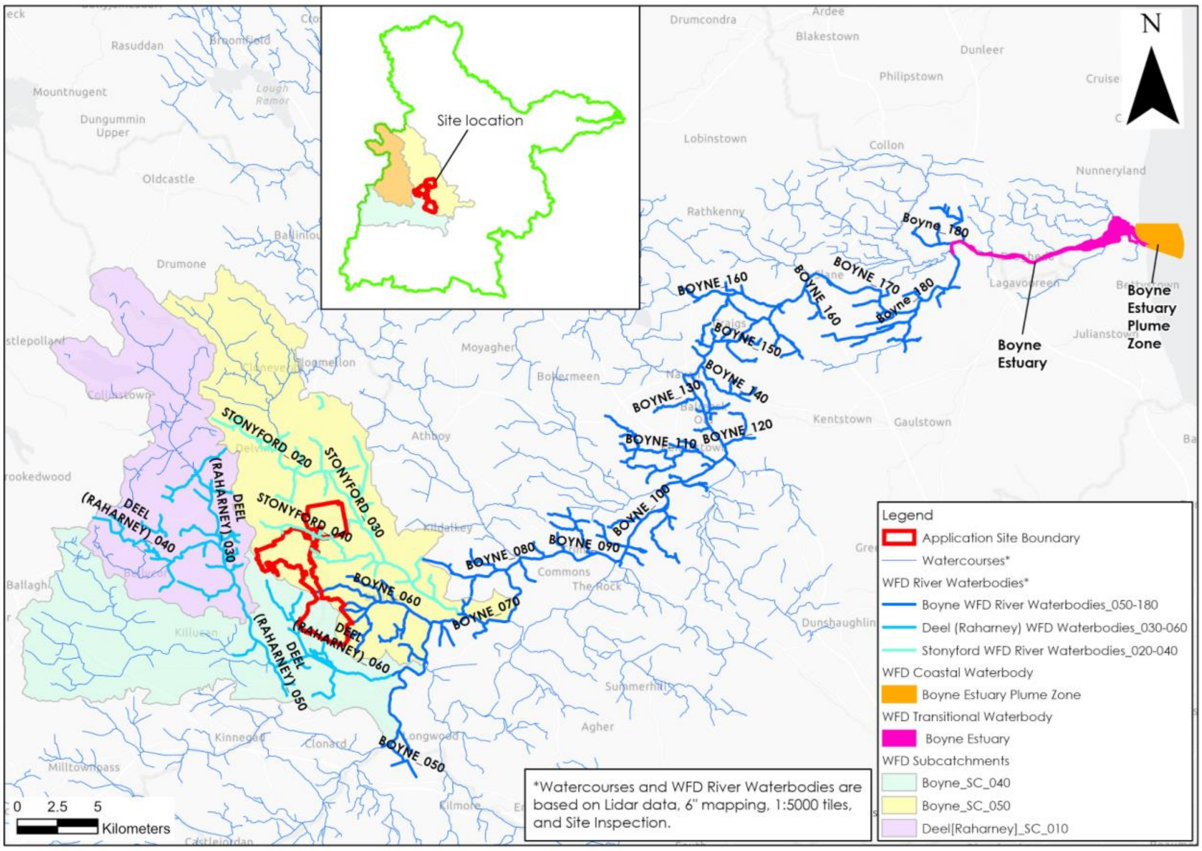

Figure A: Local Hydrology Map

2.2 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the Ballivor Bog Group are shown in **Table B**. The overall status is based on the ecological, chemical and quantitative status of each SWB.

Local Groundwater Body (GWB) and Surface water Body (SWB) status information is available from (www.catchments.ie).

Bracklin West is drained by the Deel(Raharney)_030 SWB. The status of this SWB has improved from "Moderate" in the 2nd WFD cycle (2013-2018) to "Good" in the latest 3rd WFD cycle (2016-2021). Further downstream the Deel(Raharney)_040 SWB achieved "Good" status in all 3 no. WFD cycles while the Deel(Raharney)_050 SWB was assigned "Moderate" status in all 3 no. WFD cycles. The Deel(Raharney)_060 SWB, which drains the western section of Ballivor Bog, has increased from "Moderate" status in the 1st WFD cycle (2010-2015) to "Good" in the 2nd WFD cycle (2013-2018) and has remained at "Good" status in the latest WFD cycle (2016-2021). Further downstream, the Boyne_050 achieved "Good" status in all 3 no. WFD cycles.

The Boyne_060 SWB drains the eastern section of Ballivor and Carranstown Bogs. This SWB has experienced an improved status from "Moderate" in 2010-2015 to "Good" in 2013-2018 and 2016-2021. The Stonyford River drains Lisclogher and Bracklin bogs. The Stonyford_020 and 030 SWBs have consistently deteriorated in status throughout each of the WFD cycles, having "Good" status in 2010-2015, to "Moderate" in 2013-2018, to "Poor" in 2016-2021. The Stonyford_040 also experienced a deterioration in status from "Good" in 2010-2015 to "Moderate" in 2013-2018 and remained at "Moderate" status in 2016-2021. Further downstream the Boyne_070 and Boyne_080 both achieved "Moderate" status in the latest WFD round.

Further downstream the River Boyne (Boyne_090 to Boyne_180) is mostly of "Moderate" status with only 2 no. waterbodies located in it's lower reaches (Boyne_170 and _180) achieving "Good" status in the latest WFD cycle. A greater proportion of waterbodies proximal to the proposed site have achieved "Good" status in comparison to those further downstream.

The majority of the SWBs draining the proposed site or directly downstream have been deemed to be "At risk" of not meeting their WFD objectives. The significant pressures impacting on these SWBs are listed in **Table B** below.

The 3rd cycle Draft Boyne Catchment Report (EPA, 2021) states that agriculture is the most significant pressure in the Boyne Catchment. Agriculture has been identified as a significant pressure on 8 no. SWBs downstream of the proposed site. The primary issues relating to agricultural activities are phosphorus loss to surface waters, organic pollution associated with run-off from farmyards and the entrainment of sediment in surface waters due to land drainage works and bank erosion.

Hydromorphological (or physical) is also listed as a significant pressure in the Boyne Catchment, impacting 9 no. surface waterbodies downstream of the proposed site. Hydromorphological conditions including the input of excessive fine sediment and poor habitat quality are major issues for several SWBs in the vicinity of the proposed site (i.e. Deel(Raharney)_050, Deel(Raharney)_060 and Boyne_060). The River Basin Management Plan states that these SWBs have been subject to excessive modification due to the presence of drainage schemes. In addition, dams, barriers, locks and weirs were identified as a pressure on the Stonyford_020 SWB.

Meanwhile, the 3rd Cycle Draft Boyne Catchment Report (EPA, 2021) lists peat (peat drainage and extraction) as a significant pressure on 13 no. river waterbodies within the Boyne Catchment. This is a reduction from 18 no. waterbodies from the 2nd WFD Cycle. Downstream of the proposed site the Stonyford_030 SWB is listed as being under significant pressure from peat related activities in 3rd Cycle Draft Report. Meanwhile, peat was listed as a pressure on the Boyne_060 SWB in the 2nd Cycle. This SWB has been deemed to be no longer impacted by peat related activities in the 3rd Cycle. Peat pressures are related to increased sediment loads which alter habitats, morphology and hydrology. Peat extraction activities also result fluctuation in downstream ammonia concentrations.

Domestic wastewater is listed as a significant pressure on the Boyne_150 SWB. Issues arise from unsuitable domestic wastewater treatment systems and results in nutrient enrichment and organic contamination. Meanwhile urban wastewater is a listed as a pressure on the Boyne Estuary which is located downstream of the Drogheda agglomeration.

The SWB status for the 2016-2021 WFD cycle are shown on **Figure B.**

Table B: Summary WFD Information for River Water Bodies

SWB	Overall Status (2010-2015)	2nd Cycle WFD Pressures	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status 3rd Cycle	3rd Cycle WFD Pressures
Deel(Raharney)_030	Good	-	Moderate	Good	At risk	Agriculture
Deel(Raharney)_040	Good	-	Good	Good	Not at risk	-
Deel(Raharney)_050	Moderate	Hydromorphology	Moderate	Moderate	At risk	Hydromorphology
Deel(Raharney)_060	Moderate	Hydromorphology & agriculture	Good	Good	Under review	-
Boyne_050	Good	-	Good	Good	Not at risk	-
Boyne_060	Moderate	Hydromorphology, peat and urban wastewater	Good	Good	At risk	Agriculture & Hydromorphology
Stonyford_020	Good	-	Moderate	Poor	At risk	Agriculture & Hydromorphology
Stonyford_030	Good	-	Moderate	Poor	At risk	Agriculture & Peat
Stonyford_040	Good	-	Moderate	Moderate	At risk	Agriculture
Boyne_070	Good	-	Moderate	Moderate	At risk	Agriculture
Boyne_080	Moderate	Hydromorphology	Moderate	Moderate	At risk	Hydromorphology
Boyne_090	Moderate	Hydromorphology & urban run-off	Moderate	Moderate	At risk	Hydromorphology & urban run-off
Boyne_100	Moderate	Hydromorphology & Agriculture	Moderate	Moderate	At risk	Agriculture & Hydromorphology
Boyne_110	Unassigned	-	Good	Moderate	Under review	-
Boyne_120	Moderate	Agriculture & urban wastewater	Good	Moderate	Under review	-
Boyne_130	Unassigned	-	Good	Moderate	Not at risk	-
Boyne_140	Unassigned	-	Moderate	Moderate	Under review	-
Boyne_150	Moderate	Anthropogenic & domestic wastewater	Moderate	Moderate	At risk	Anthropogenic & domestic wastewater
Boyne_160	Moderate	Hydromorphology, agriculture, urban wastewater & domestic wastewater	Moderate	Moderate	Under review	-
Boyne_170	Good	-	Good	Good	Under review	-
Boyne_180	Good	-	Good	Good	Not at risk	-
Boyne Estuary	Moderate	Agriculture & urban wastewater	Moderate	Moderate	At risk	Agriculture & urban wastewater
Boyne Estuary Plume	Good	Anthropogenic	Moderate	Moderate	At risk	Anthropogenic & urban runoff

2.3 GROUNDWATER BODY IDENTIFICATION

According to data from the GSI database and bedrock geology series (www.gsi.ie), the majority of the proposed site is underlain by a locally Important Aquifer (LI) with a small area in the north underlain by a Poor Aquifer (PI). These bedrock aquifers comprise of Dinantian Pure Unbedded Limestones and Dinantian Upper Impure Limestones.

The proposed site is underlain by the Athboy Groundwater Body (GWB), characterised by poorly productive bedrock.

The GWB status for the 2016-2021 WFD cycle are shown on **Figure B.**

2.4 GROUNDWATER BODY CLASSIFICATION

The Athboy GWB (IE_EA_G_001) underlies the proposed site. This GWB has been assigned 'Good Status' in all 3 no. WFD cycles (2010-2015, 2013-2018 and 2016-2021) (**Table C**). This status is defined based on the quantitative status and chemical status of the GWB. The Athboy GWB is deemed to be "At risk" of not meeting its WFD objectives.

While no significant pressures were identified in Cycle 2, the 3rd Cycle Draft Boyne Catchment Report (EPA, 2021) lists identifies agriculture as a significant pressure impacting this GWB.

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010 - 2015)	2nd Cycle WFD Pressures	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (2013-2018)	3rd Cycle WFD Pressures
Athboy	Good	-	Good	Good	At risk	Agriculture

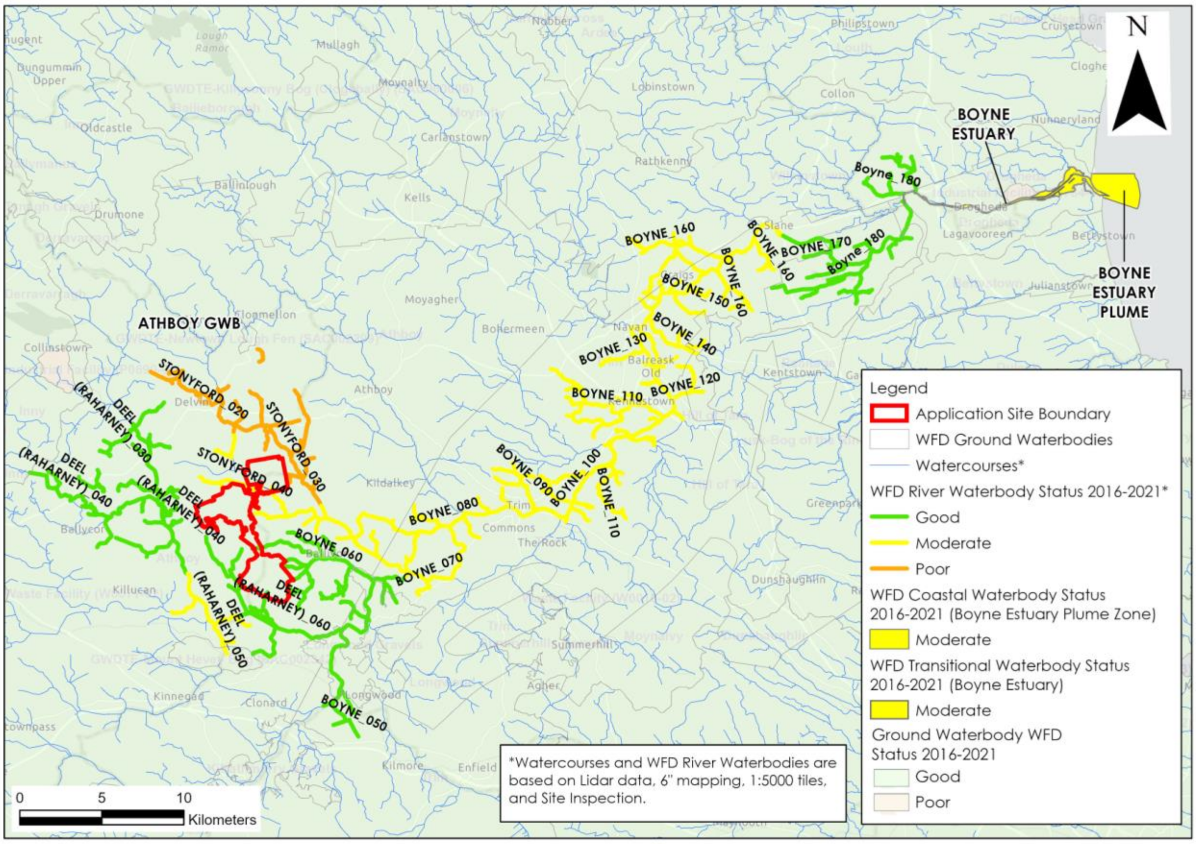

Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021)

2.5 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below.

The potential effect of the Proposed Development on nature conservation designations, bathing waters, nutrient sensitive areas (NSAs), shellfish areas and drinking water protected area's (DWPAs) are also included as part of the WFD Compliance Assessment.

2.5.1 Nature Conservation Designations

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The proposed site is not located within a Ramsar site or a designated site of national (Natural Heritage Area (NHA) / Proposed Natural Heritage Area (pNHA)) or European importance (Special Area of Conservation (SAC) / Special Protection Area (SPA).

However, there are downstream hydrological connections with some Natura 2000 sites within the River Boyne surface water catchment. Designated sites that lie downstream of the proposed site include:

- River Boyne and River Blackwater SAC (Site Code: 002299), is hydrologically linked within the proposed site as the Deel (Raharney), Stonyford and Boyne rivers are included within the SAC;
- River Boyne and River Blackwater SPA (Site Code: 004232), is hydrologically linked within the proposed site as the Deel (Raharney), Stonyford and Boyne rivers are included within the SAC;
- Boyne Woods pNHA (Site Code: 001592), 26km northeast of Lisclogher Bog and to the east of Navan Town along the River Boyne;
- Crewbane March pNHA (Site Code: 000553), 35km northeast of Lisclogher Bog along the River Boyne;
- Dowth Wetland pNHA (Site Code: 001861), 40km northeast of Lisclogher Bog;
- Boyne River Islands pNHA (Site Code: 001862), 42km northeast of Lisclogher Bog and to the west of Drogheda; and,
- Boyne Coast and Estuary SAC and pNHA(Site Code: 001957), 48km northeast of the Lisclogher Bog.

Other protected sites located in the vicinity of the proposed site but are not directly linked via surface water pathways are considered below:

- Mount Hevey Bog SAC and Mount Hevey Bog pNHA is located approximately 3.4km west of the proposed site.
- The Royal Canal pNHA is located approximately 1.3km southwest of the proposed site.

2.5.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

There are no bathing water sites located in the vicinity of the proposed site. The closest protected bathing waters are located at Portrane - Brook Beach (IEEABWC020_0000_0200), ~60km west (as the crow flies) of proposed site.

2.5.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

The Boyne River NSA (IERI_EA_1994_0001) and the Boyne Estuary NSA (IE_EA_010_0100) are mapped downstream of the proposed site. The Boyne River NSA is mapped to begin within the Boyne_100 river sub-basin, approximately 16km downstream of the proposed site. The EPA carried out a review of Nutrient Sensitive Areas (NSAs) downstream of large urban wastewater discharges in 2020. Once the regulations are in place, and nutrient sensitive areas have been identified, additional nutrient removal must be applied (if not already applied) to wastewater treatment plants discharging to the sensitive area. If this treatment was in place the objective was deemed to have been met. According to the 3rd Cycle Draft Boyne Catchment Report (2021, EPA) the NSA objectives are being met for the River Boyne and Boyne Estuary within the catchment.

2.5.4 Shellfish Area

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

There are no Shellfish areas located in the vicinity of the proposed site. The proposed site is ~60km west (as the crow flies) of Balbriggan\Skerries (IE_EA_020_0000), the nearest protected shellfish area.

2.5.5 Drinking Water

According to the 3rd Cycle Draft Boyne Catchment Report (EPA, 2021) there are 12 no. surface waterbodies in the catchment identified as Drinking Water Protected Areas (DWPAs).

The Stoneyford_040 (IE_EA_07S020400) SWB mapped within the proposed site is identified as a DWPA. Further downstream the Boyne_100 SWB (IE_EA_07B041500), the Boyne_120 SWB (IE_EA_07B041700) and the Boyne_180 SWB (IE_EA_07B042200) are also recognised as DWPA's.

Meanwhile, all GWBs within the catchment, including the Athboy GWB, are listed as DWPAs.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 22 no. surface water bodies that are located in the vicinity or downstream of the proposed site. In addition, 1 no. groundwater body underlies the proposed site. Furthermore there are several protected areas within the vicinity and downstream of the proposed site including a number of nature conservation designated sites, NSA's and DWPA's.

3.1 SURFACE WATER BODIES

As shown in **Figure A** above, there are 20 no. river water bodies, 1 no. transitional waterbody and 1 no. coastal waterbody located downstream of the proposed site.

With consideration for the construction, operational and decommissioning phases of the Proposed Development, it is considered that due to their proximal location to the proposed site and the occurrence of proposed infrastructure within their respective catchments, that the Deel(Raharney)_060 and Stonyford River (Stonyford_020, 030 and _040) are carried through to the WFD Impact Assessment. The Deel(Raharney)_030 _040 and _050 SWBs have been screened out due to the lack of Proposed Development infrastructure in their upstream catchments.

Furthermore all sections of the Boyne River downstream of the proposed site and upstream of Trim (i.e. Boyne_050 to _080) will be carried through to the WFD Impact Assessment. The southern section of the proposed site drains directly to the Boyne_060 SWB. Meanwhile the Boyne_050 and Boyne_070 and _080 SWBs lie downstream and in close proximity (<10km) from the proposed site.

The Boyne River downstream of the town of Trim has been screened out due to its distant location (>10km) from the proposed site and the increasing volumes of water within the Boyne River. In addition the Boyne Estuary transitional waterbody and the Boyne Estuary Plume coastal waterbody have been screened out due to their distant location, the large volumes of water within these surface waterbodies and the saline nature of these waters. The Proposed Development has no potential to cause a deterioration in the status of these surface waterbodies and/or jeopardise the attainment of good surface water status in the future.

Regarding the SWBs which have been screened in the potential for the Proposed Development to impact these waterbodies will vary. This will be dependent on the nature of the activities within the upstream catchment area to a specific waterbody. As shown in **Table A** the waterbodies with the greatest potential to be impacted by the Proposed Development are the Stonyford_040 and Deel(Raharney)_060 SWBs.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Athboy GWB will be carried through to the WFD Impact Assessment due to its proximal location directly underlying the Ballivor Bog Group.

3.3 PROTECTED AREAS

The proposed site is hydrologically connected to the River Boyne and River Blackwater SAC and SPA via several drains and streams which flow from the bog areas into the Deel (Raharney), Stonyford and Boyne rivers. With consideration for the construction, operational and decommissioning phases of the Proposed Development, it is considered that the River

Boyne and River Blackwater SAC and SPA are carried through into the WFD Impact Assessment.

Several other designated sites, listed in **Section 2.5.1**, are located further downstream along the River Boyne and are therefore also hydrologically connected with the proposed site. However, these designated sites are located significant distances (>25km) from the proposed site. Therefore, there is no potential for the Proposed Development to impact any of these designated sites and so have been screened out. Consequently, the River Boyne and River Blackwater SAC/SPA remain the primary sensitive receptors due to their proximity to the proposed site and the direct hydrological linkage.

The Mount Hevey Bog SAC and Mount Hevey Bog pNHA is a raised bog and is located upgradient of any drainage from the proposed site. In addition, the River Deel acts as a hydraulic barrier between the proposed site and Hevey Bog. Therefore no hydrological or hydrogeological impacts will occur on this designated site as a result of the Proposed Development.

The Royal Canal pNHA is located approximately 1.3km southwest of the proposed site. The River Deel acts as a hydraulic barrier between the proposed site and this pNHA. Therefore, no hydrological or hydrogeological impacts will occur on this designated site as a result of the Proposed Development.

The Boyne River NSA downstream of the town of Trim has been screened out due to its distant location (>10km) from the proposed site and the increasing volumes of water within the Boyne River. In addition, the Boyne Estuary NSA has been screened out due to its distant location, the large volumes of water within the surface waterbody and the saline nature of these waters. The Proposed Development has no potential to cause a deterioration in the status of these NSAs.

With consideration for the construction, operational and decommissioning phases of the Proposed Development, it is considered that the Stonyford_040 DWPA is carried through into the WFD Impact Assessment due to its proximal location to the proposed site and the occurrence of proposed infrastructure within the Stonyford_040 sub basin.

The bathing waters at Portrane, the Brook Beach and Shellfish areas at Balbriggan\Skerries, have been screened out due to their distal location from the proposed site. The Proposed Development has no potential to cause a deterioration to these bathing or shellfish protected areas.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table D**.

Table D: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	River	Deel(Raharney)_030	No	While the northwest of Bracklin Bog (i.e. Bracklin West) is located in the Deel(Raharney)_030 river sub-basin, no Proposed Development infrastructure is located in the catchment to this SWB. All works associated with the Proposed Development are located downstream of the Deel(Raharney)_030 SWB. Therefore, the Deel(Raharney)_030 SWB has been screened out as the Proposed Development has no potential to impact the status of this SWB.
	River	Deel(Raharney)_040	No	A small area in the northwest of Bracklin Bog (i.e. Bracklin West) is also mapped in the Deel(Raharney)_040 river sub-basin. However, no Proposed Development infrastructure is located in the catchment to this SWB. All works associated with the Proposed Development are located downstream of the Deel(Raharney)_040 SWB. Therefore, the Deel(Raharney)_040 SWB has been screened out as the Proposed Development has no potential to impact the status of this SWB.
	River	Deel(Raharney)_050	No	The Deel(Raharney)_050 SWB is located directly downstream of the Deel(Raharney)_040 SWB. No works associated with the Proposed Development are located in the upstream catchment to this SWB. Therefore, the Deel(Raharney)_050 SWB has been screened out as the Proposed Development has no potential to impact the status of this SWB.
	River	Deel(Raharney)_060	**Yes**	The southwest of the proposed site (the southwest of Bracklin Bog and the west of Ballivor Bog) is located within the Deel(Raharney)_060 river sub-basin. In terms of proposed infrastructures a total of 9 no. turbines, 1 no. met mast, 1 no. borrow pit and 2 no. construction compounds are located within this sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Boyne_050	**Yes**	The Boyne_050 SWB is located directly downstream of the Deel(Raharney)_060 SWB and in close proximity to the proposed site (~3.5km). An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Stonyford_020	**Yes**	The northwest of Lisclogher Bog drains to the north into the Stonyford_020 SWB (refer to Section 9.3.3 of the EIAR). Therefore, an assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Stonyford_030	**Yes**	The north of Lisclogher Bog is located within the catchment of the Stonyford_030 SWB. In terms of proposed infrastructures, 1 no. turbine is located within this sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Stonyford_040	**Yes**	A large area of the proposed site, including the majority of Lisclogher, Bracklin and Carranstown bogs, is located within the Stonyford_040 river sub-basin. In terms of proposed infrastructure a total of 13 no. turbines, 3 no. construction compounds, 1 no. substation, 1 no. met mast, 2 no. borrow pits and an amenity car park are located in this sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Boyne_060	**Yes**	The south of Carranstown Bog and the east of Ballivor Bog are located within the catchment of the Boyne_060 SWB. In terms of proposed infrastructures a total of 3 no. turbines are located

				within this river sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Boyne_070	**Yes**	The Boyne_070 SWB is located directly downstream of the Stonyford_040 and Boyne_060 SWBs and in close proximity to the proposed site (~6.8km). An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Boyne_080	**Yes**	The Boyne_080 SWB is located directly downstream of the Boyne_070 SWB and in close proximity to the proposed site (~10km). An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Boyne_090	No	The Boyne_090 SWB has been screened out due to its distal location from the proposed site (~13km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_100	No	The Boyne_100 SWB has been screened out due to its distal location from the proposed site (~16km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_110	No	The Boyne_110 has been screened out due to its distal location from the proposed site (~20km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_120	No	The Boyne_120 SWB has been screened out due to its distal location from the proposed site (~23km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_130	No	The Boyne_130 SWB has been screened out due to its distal location from the proposed site (~23km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_140	No	The Boyne_140 SWB has been screened out due to its distal location from the proposed site (~22.5km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_150	No	The Boyne_150 SWB has been screened out due to its distal location from the proposed site (~24km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_160	No	The Boyne_160 SWB has been screened out due to its distal location from the proposed site (~29km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.

	River	Boyne_170	No	The Boyne_170 SWB has been screened out due to its distal location from the proposed site (~33km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	River	Boyne_180	No	The Boyne_180 SWB has been screened out due to its distal location from the proposed site (~36km) and the increasing volumes of water within the River Boyne associated with its increasing upstream catchment area. Therefore the Proposed Development has no potential to impact the status of this SWB.
	Transitional	Boyne Estuary	No	The Boyne Estuary transitional waterbody has been screened out due to its distal location from the proposed site, the large volume of water within the estuary and the saline nature of its water. Therefore the Proposed Development has no potential to impact the status of this SWB.
	Coastal	Boyne Estuary Plume	No	The Boyne Estuary Plume coastal waterbody has been screened out due to its distal location from the proposed site, the large volumes of water within the surface waterbody and the saline nature of its water. Therefore the Proposed Development has no potential to impact the status of this SWB.
Groundwater Body	Groundwater	Athboy	**Yes**	The proposed site and all associated infrastructure immediately overlies the Athboy GWB. An assessment is required to consider the impacts of the Proposed Development on this GWB.
Protected Areas	Nature Conservation Designations	River Boyne and River Blackwater SAC & SPA	**Yes**	The proposed site is hydrologically connected to the River Boyne and River Blackwater SAC and SPA via several drains and streams which flow from the bog areas into the Deel (Raharney), Stonyford and Boyne rivers. An assessment is required to consider the potential impacts of the Proposed Development on this designated site.
		Boyne Woods pNHA	No	The Boyne Woods pNHA has been screened out due to its distal location from the proposed site (>25km). Therefore the Proposed Development has no potential to impact the pNHA.
		Crewbane March pNHA	No	The Crewbane March pNHA has been screened out due to its distal location from the proposed site (>25km). Therefore the Proposed Development has no potential to impact the pNHA.
		Dowth Wetland pNHA	No	The Dowth Wetland pNHA has been screened out due to its distal location from the proposed site (>25km). Therefore the Proposed Development has no potential to impact the pNHA.
		Boyne River Islands pNHA	No	The Boyne River Islands pNHA has been screened out due to its distal location from the proposed site (>25km). Therefore the Proposed Development has no potential to impact the pNHA.
		Boyne Coast and Estuary SAC & pNHA	No	The Boyne Coast and Estuary SAC and pNHA has been screened out due to its distal location from the proposed site (>25km). Therefore the Proposed Development has no potential to impact the designated site.
		Mount Hevey Bog SAC & pNHA	No	Mount Hevey Bog SAC & pNHA is located upgradient of the proposed site. In addition, the River Deel acts as a hydraulic barrier between the proposed site and Hevey Bog. Therefore no hydrological or hydrogeological impacts will occur on this designated site.
		Royal Canal pNHA	No	The Royal Canal pNHA is located approximately 1.3km southwest of the proposed site. The River Deel acts as a hydraulic barrier between the proposed site and the pNHA. Therefore, no hydrological or hydrogeological impacts will occur on this designated site.
	Bathing Waters	Portrane, the Brook Beach	No	Portrane, the Brook Beach bathing waters have been screened out due to its distal location from the proposed site (>60km). The Proposed Development has no potential to

				impact these Bathing Waters
	Nutrient Sensitive Areas	Boyne River NSA	No	The Boyne River NSA has been screened out due to its distal location from the proposed site (~16km) and the increasing volumes of water within the River Boyne. Therefore the Proposed Development has no potential to impact the status of this NSA.
		Boyne Estuary NSA	No	The Boyne Estuary NSA has been screened out due to its distal location from the proposed site, the large volume of water within the estuary and the saline nature of its water. Therefore the Proposed Development has no potential to impact the status of this NSA.
	Shellfish Areas	Balbriggan\Skerries	No	Balbriggan\Skerries shellfish area has been screened out due to its distal location from the proposed site (>60km). The Proposed Development has no potential to impact this Shellfish Area.
	Drinking Water Protected Areas.	Stonyford_040	**Yes**	A large area of the proposed site, including the majority of Lisclogher, Bracklin and Carranstown bogs, is located within the Stonyford_040 river sub-basin. In terms of proposed infrastructure a total of 13 no. turbines, 3 no. construction compounds, 1 no. substation, 1 no. met mast, 2 no. borrow pits and an amenity car park are located in this sub-basin. An assessment is required to consider the potential impacts of the Proposed Development on this DWPA.
		Boyne_100	No	The Boyne_100 DWPA has been screened out due to its distal location from the proposed site (~16km) and the increasing volumes of water within the River Boyne. Therefore the Proposed Development has no potential to impact the status of this DWPA.
		Boyne_120	No	The Boyne_120 DWPA has been screened out due to its distal location from the proposed site (~23km) and the increasing volumes of water within the River Boyne. Therefore the Proposed Development has no potential to impact the status of this DWPA.
		Boyne_180	No	The Boyne_180 DWPA has been screened out due to its distal location from the proposed site (~36km) and the increasing volumes of water within the River Boyne. Therefore the Proposed Development has no potential to impact the status of this DWPA.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

The Proposed Development consists of 26 no. wind turbines and associated infrastructure including hardstands, 2 no. meteorological masts, 4 no. temporary construction compounds, 2 no. borrow pits, a 110kV substation, 3 no. permanent amenity carparks as well as access roads and all associated development and drainage works. Please refer to Chapter 4 of the EIAR for a full description of the Proposed Development.

Due to the nature of wind farm developments being near surface construction activities, impacts on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risks to groundwater at the proposed site will be from cementitious materials, hydrocarbon spillage and leakages, and potential piling works.

The primary risk to surface waters will be entrained suspended sediments (peat and soil particles) in site runoff during earthworks and tree felling along with chemical pollution of surface waters by concrete, oil and or fuels.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects During Earthworks

Construction phase activities including access road construction, turbine base/hardstanding construction, construction compound construction, meteorological mast construction, substation and grid connection construction, internal cable route excavations, amenity paths construction, entrance locations and amenity car parks will require varying degrees of earthworks resulting in excavation of peat and mineral subsoil where present. These activities can result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality in downstream water bodies.

Hydrocarbons and cement-based compounds will also be used during the construction phase. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to surface waters at all construction. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

The release of effluent from on-site temporary staff welfare facilities has the potential to effect downstream surface water quality.

Therefore, construction phase activities could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which could affect the water quality and fish stocks of downstream water bodies such as the Stonyford, Deel(Raharney) and Boyne Rivers.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table E**.

Table E: Surface Water Quality Effects During Construction Phase (Unmitigated)

SWB	WFD Code	WFD Status (2016-2021)	Assessed Potential Status Change
Deel(Raharney)_060	IE_EA_07D010600	Good	Moderate
Boyne_050	IE_EA_07B040800	Good	Good
Boyne_060	IE_EA_07B040900	Good	Moderate
Stonyford_020	IE_EA_07S020075	Poor	Bad
Stonyford_030	IE_EA_07S020100	Poor	Bad
Stonyford_040	IE_EA_07S020400	Moderate	Poor
Boyne_070	IE_EA_07B041000	Moderate	Moderate
Boyne_080	IE_EA_07B041200	Moderate	Moderate

4.2.1.2 Groundwater Quality Effects

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a major pollution risk to groundwater. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Chemicals such as cement-based compounds also pose a threat to the groundwater environment. Runoff from concrete works can impact on groundwater quality.

These sources of contamination have the potential to impact on groundwater quality in the underlying Athboy GWB.

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table F**.

Table F: Groundwater Quality Effects During Construction Phase (Unmitigated)

GWB	WFD Code	WFD Status (2013-2018)	Assessed Potential Status Change
Athboy	IE_EA_G_001	Good	Moderate

4.2.1.3 Groundwater Quantity Effects

Temporary dewatering may be required during the construction phase of the Proposed Development during the excavation of turbine base foundations as well as the excavations to facilitate the construction of the substations and construction compounds. Dewatering will also be required at the proposed borrow pit locations. These dewatering works have the potential to impact local groundwater levels.

No groundwater level impacts are anticipated from the construction of the underground cabling trench between the proposed turbines and the substation due to the shallow nature of the excavation (i.e. ~1.2m).

A summary of potential status change to GWBs arising from potential groundwater quantity impacts during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table G**.

Table G: Groundwater Quantity Effects During Construction Phase (Unmitigated)

GWB	WFD Code	WFD Status (2013-2018)	Assessed Potential Status Change
Athboy	IE_EA_G_001	Good	Moderate

4.2.1.4 Potential Effects on the River Boyne and River Blackwater SAC & SPA

The surface water connections from the proposed site to the Deel, Stoneyford and Boyne rivers could transfer poor quality surface water that may affect the conservation objectives of the designated sites.

The qualifying interests of the SAC, as listed below, have the potential to be affected as these are associated directly with the river system.

- [7230] Alkaline Fens
- [91E0] Alluvial Forests
- [1099] River Lamprey (Lampetra fluviatilis)
- [1106] Atlantic Salmon (Salmo salar)
- [1355] Otter (Lutra lutra)

However, with regards the SPA, it is noted that even if some material was to enter the local watercourses of the Deel, Stoneyford and Boyne rivers, the actual Special Conservation Interests of the SPA, as listed below, would not be affected as the species are not associated with watercourses:

- • A229 Kingfisher

It can be concluded that the Proposed Development may have the potential to affect the qualifying interests of the River Boyne and River Blackwater SAC in an unmitigated scenario throughout the construction phase.

4.2.1.5 Potential Effects on the Stonyford_040 DWPA

Construction phases activities as described above in **Section 4.2.1.1,** could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which could affect the water quality in the Stonyford River, therefore impacting on the Stonyford_040 DWPA.

4.2.2 Operational Phase (Unmitigated)

4.2.2.1 Increased Site Runoff and Hydromorphology Effects on Surface Water Bodies

Progressive replacement of the soil, peat or vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the proposed site and increase flood risk downstream of the development. In reality, the access roads will have a higher permeability than the underlying peat.

During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and causing hydromorphological effects.

A summary of potential status change to SWBs arising from increased runoff during the operation stage of the Proposed Development in the unmitigated scenario are outlined in **Table H**.

Table H: Potential Effect on Surface Water Flows During Operational Phase (Unmitigated)

SWB	WFD Code	WFD Status (2016-2021)	Assessed Potential Status Change
Deel(Raharney)_060	IE_EA_07D010600	Good	Moderate
Boyne_050	IE_EA_07B040800	Good	Good
Boyne_060	IE_EA_07B040900	Good	Moderate
Stonyford_020	IE_EA_07S020075	Poor	Bad
Stonyford_030	IE_EA_07S020100	Poor	Bad
Stonyford_040	IE_EA_07S020400	Moderate	Poor
Boyne_070	IE_EA_07B041000	Moderate	Moderate
Boyne_080	IE_EA_07B041200	Moderate	Moderate

4.2.2.2 Surface Water Quality Effects from Site Maintenance

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads and hardstand areas. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

A summary of potential status change to SWBs arising from surface water quality impacts during the operation stage of the Proposed Development in the unmitigated scenario are outlined in **Table I**.

Table I: Surface Water Quality Effects During Operational Phase (Unmitigated)

SWB	WFD Code	WFD Status (2016-2021)	Assessed Potential Status Change
Deel(Raharney)_050	IE_EA_07D010400	Moderate	Poor
Deel(Raharney)_060	IE_EA_07D010600	Good	Moderate
Boyne_050	IE_EA_07B040800	Good	Good
Boyne_060	IE_EA_07B040900	Good	Moderate

Stonyford_020	IE_EA_07S020075	Poor	Bad
Stonyford_030	IE_EA_07S020100	Poor	Bad
Stonyford_040	IE_EA_07S020400	Moderate	Poor
Boyne_070	IE_EA_07B041000	Moderate	Moderate
Boyne_080	IE_EA_07B041200	Moderate	Moderate

4.2.2.3 Groundwater Quality Effects from Operational Site Maintenance

The risks to groundwater quality are the same as those described in **Section 4.2.1.2** but of a lesser extent than during the construction phase due to the limited activity at the proposed site with only minor maintenance required during the operational phase. There will be no groundwater quality impacts along the proposed Grid Connection route.

A summary of potential status change to GWBs arising from groundwater quality impacts during the operation stage of the Proposed Development in the unmitigated scenario are outlined in **Table J**.

Table J: Groundwater Quality Effects During Operational Phase (Unmitigated)

GWB	WFD Code	WFD Status (2016-2021)	Assessed Potential Status Change
Athboy	IE_EA_G_001	Good	Good

4.2.2.4 Potential River Boyne and River Blackwater SAC & SPA Impacts

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete.

Therefore, the risk of surface water connections from the proposed site to the Deel, Stoneyford and Boyne rivers that could transfer poor quality surface water that may affect the conservation objectives of the designated sites is reduced.

4.2.2.5 Potential Stonyford_040 DWPA Impacts

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete.

Therefore, the risk of surface water connections from the proposed site to the Stoneyford_040 DWPA is reduced.

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the construction and operational phases of the Proposed Development. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Protect Surface Water Quality

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in **Table K** below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls.

During the construction phase of the Proposed Development, excavations will be limited to minimise the generation of spoil. Sediment will be generated where excavations are required (turbine and substation foundations) and dirty water from these work areas will be routed via drains to settlement ponds for treatment and removal of suspended solids prior to release into the existing bog drainage network. There will be no direct or untreated discharge from construction work areas into the existing bog drainage network.

Finally, regular inspection and maintenance for the on-site drainage system will be completed regularly during the construction phase. This will be a particular importance following periods of heavy rainfall to check for blockages in any drains and any excess build-up of silt within settlement ponds which will decrease the effectiveness of the drainage system unless removed.

Table K: Summary of Drainage Mitigation & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	• Application of 50m buffer zones to natural watercourses where possible; • Application of 10m buffer zones to main drains where possible; • Using small working areas; • Working in appropriate weather and suspending certain work activities in advance of forecasted wet weather.	Construction work areas where sediment is being generated.
Source Controls:	• Use of upstream interceptor drains and downstream collector drains, diversion drains and culvert pipes; • Erosion and velocity control measures such as: o sand bags; o oyster bags filled with gravel; o filter fabrics; and o other similar/equivalent or appropriate systems • Using small working areas.	Construction work areas where sediment is being generated.
	• Using small working areas; • Surrounding temporary stockpiles with silt fencing; • Weathering off / sealing peat stockpiles.	Stockpiles areas
In-Line Controls:	• Interceptor drains and/or collector drains/OTE drainage; • Erosion and velocity control measures such as: o sand bags; o oyster bags filled with gravel; o silt fences / filter fabrics; o check dams / weirs or baffles; o and/or other similar/equivalent or appropriate systems; • In stream sedimats; • Collection sumps, temporary sumps, pumping systems; • Attenuation ponds; • Sediment traps, stilling / settlement ponds.	Interceptor and collection drainage systems
Water Treatment Controls:	• Silt fencing; • Temporary sumps / Attenuation ponds;	Surface water treatment locations

	• Sediment traps, Stilling / Settlement ponds; • Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems; • Silt dewatering bags.	
Outfall Controls:	• Levelspreaders; • Buffered outfalls; • Vegetation filters; • Silt dewatering bags; • Flow limiters and weirs.	Drainage run outfalls and overland discharge points

Each element of the wind farm development (*i.e.*, access roads, turbines and borrow pits etc.) will have an array of drainage control measures to ensure protection of downstream watercourses. Surface water quality protection is not reliant on just one element of the proposed drainage management system. Each drainage control element is not stand alone but occurs as part of a treatment train of control systems (i.e., check dams, silt traps, settlement ponds etc).

4.3.1.2 Mitigation Measures to Protect Against the Release of Hydrocarbons

The potential pollution of ground and surface water during the construction phase will be mitigated by the provision of appropriate controls and working methods. These include best practice methods for storage and handling of fuels and chemicals and include:

- All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on site;
- On-site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer or truck will be re-filled off site and will be towed/driven around the proposed site to where machinery is located. The 4x4 jeep/fuel truck will also carry fuel absorbent materials for the event of any accidental spillages. The fuel bowser will be parked in a designated location on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be available during all refuelling operations and used when required;
- Fuel volumes stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume during the construction phase;
- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

4.3.1.3 Mitigation Measures to Prevent Release of Cement-Based Products

Best practice methods for cement-based compounds:

- No batching of wet-concrete products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of concrete contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined concrete washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.4 Mitigation Measures to Prevent the Release of Wastewater

The best practice methods for wastewater management at the 4 no. proposed on-site construction compounds during the construction phase include:

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at each of the site construction compounds, maintained by the providing contractor, and removed from the proposed site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to the proposed site and removed after use from the proposed site to be discharged at a suitable off-site treatment location; and,
- No water or wastewater will be sourced at the proposed site, nor discharged to the proposed site.

4.3.1.5 Mitigation to Prevent the Release of Cement-Based Products

Best practice methods for cement-based compounds:

- No batching of wet-cement products on-site is proposed. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will be the design approach;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of the main body of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the concrete truck chute will be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be isolated in temporary lined wash-out pits located near proposed site compounds. These temporary lined wash-out pits will be removed from the proposed site once their utility is no longer required or at the end of the construction phase;
- Any washing out of concrete pumping plant will also be into the temporary lined wash-out pits.
- Weather forecasts will be used to plan dry days for pouring concrete; and,
- Construction contractors will ensure each concrete pour site is free of standing water and plastic covers will be available in case of a sudden rainfall event.

4.3.1.6 Mitigation Measures to Protect River Boyne and River Blackwater SAC & SPA

The potential for elevated levels on suspended solids and other pollutants such as hydrocarbons to enter the local surface water network is negligible as mitigation controls, described in **Sections 4.3.1** above, will be implemented during the construction phase. These mitigation measures include the use of interceptor drains, collector drains, silt fences, silt traps, check dams and settlement ponds. Mitigation measures will also be implemented to precent the release of hydrocarbons.

With the implementation of these mitigation measures and with adherence to best practice methods during the construction of the Proposed Development, the potential for the project to effect the qualifying interests of the River Boyne and River Blackwater SAC & SPA is not significant.

4.3.1.7 Mitigation Measures to Protect Stonyford_040 DWPA

The potential for elevated levels on suspended solids and other pollutants such as hydrocarbons to enter the local surface water network is negligible as mitigation controls, described in **Sections 4.3.1** above, will be implemented during the construction phase. These mitigation measures include the use of interceptor drains, collector drains, silt fences, silt traps, check dams and settlement ponds. Mitigation measures will also be implemented to precent the release of hydrocarbons.

With the implementation of these mitigation measures and with adherence to best practice methods during the construction of the Proposed Development, the potential for the project to effect the Stonyford_040 DWPA is not significant.

4.3.2 Operational Phase

4.3.2.1 Increased Site Runoff and Hydromorphology Effects

The operational phase drainage system of the Proposed Development will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road-side drains will be used to collect runoff from access roads and turbine hardstanding areas of the proposed site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds have been designed in consideration of the greenfield runoff rate.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Development are the same as those outlines in **Section 4.3.1.1** above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlines in **Section 4.3.1.2** above.

4.3.2.3 Mitigation Measures to Protect Groundwater Quality

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

4.3.2.4 Mitigation Measures to Protect River Boyne and River Blackwater SAC & SPA

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Development are the same as those outlined in **Section 4.3.1.1** above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlines in **Section 4.3.1.2** above.

It can be concluded that with best practice methods adhered to during the operation phase of the Proposed Development, the potential for the project to impact upon the qualifying interests of the River Boyne and River Blackwater SAC & SPA is not significant.

4.3.2.5 Mitigation Measures to Protect Stonyford_040 DWPA

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Development are the same as those outlined in **Section 4.3.1.1** above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlines in **Section 4.3.1.2** above.

It can be concluded that with best practice methods adhered to during the operation phase of the Proposed Development, the potential for the project to impact upon the Stonyford_040 DWPA is not significant.

4.3.3 Decommissioning Phase

The potential impacts associated with decommissioning of the Proposed Development will be similar to those associated with construction but of a reduced magnitude, due to the reduced scale of the proposed decommissioning works in comparison to construction phase works.

During decommissioning, it will be possible to reverse or at least reduce some of the potential effects caused during construction, and to a lesser extent operation, by rehabilitating constructed areas such as turbine bases and hard standing areas. This will be done by covering with vegetation to encourage vegetation growth and reduce run-off and sedimentation.

The proposed site roadways will be kept and maintained following decommissioning of the wind farm infrastructure, as these will be utilised for amenity and recreational purposes.

The electrical cabling connecting the proposed site infrastructure to the on-site substation will be removed, while the ducting itself will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

The turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported off-site along their original delivery route. The disassembly and removal of the turbines will not have an impact on the hydrological/hydrogeological environment at the proposed site.

Other impacts such as possible contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site. Similar mitigation as outlined in Sections 4.3.1.2 and 4.3.1.3 for the construction stage will be implemented during the decommissioning phase to ensure no impacts of receiving waters.

Some of the potential impacts of water bodies will be avoided by leaving elements of the Proposed Development in place where appropriate. The turbine bases will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects.

With the implementation of the mitigation measures outlined above no significant effects on the hydrological and hydrogeological environment will occur during the decommissioning stage of the Proposed Development.

4.3.4 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3** are sufficient to meet the WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table L** below.

Table L: Summary of WFD Status for Unmitigated and Mitigated Scenarios

SWB	WFD Code	WFD Status (2013-2018)	Assessed Status – Unmitigated	Assessed Status – with Mitigation Measures
Deel(Raharney)_050	IE_EA_07D010400	Moderate	Poor	Moderate
Deel(Raharney)_060	IE_EA_07D010600	Good	Moderate	Good
Boyne_050	IE_EA_07B040800	Good	Good	Good
Boyne_060	IE_EA_07B040900	Good	Moderate	Good
Stonyford_020	IE_EA_07S020075	Poor	Bad	Poor
Stonyford_030	IE_EA_07S020100	Poor	Bad	Poor
Stonyford_040	IE_EA_07S020400	Moderate	Poor	Moderate
Boyne_070	IE_EA_07B041000	Moderate	Moderate	Moderate
Boyne_080	IE_EA_07B041200	Moderate	Moderate	Moderate
Athboy	IE_EA_G_001	Good	Moderate	Good

5. SUMMARY AND CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the proposed site are defined in **Section 2** above.

1 no. groundwater body underlies the proposed site *i.e.,* Ardboy GWB. Due to the local hydrogeological regime, characterized by high runoff rates and low rates of groundwater recharge, this GWB is less susceptible to potential effects arising from the Proposed Development than nearby surface waterbodies. Surface watercourses downstream of the proposed site will be susceptible to effects from the Proposed Development due to the presence of surface water pathways between the proposed site and these downstream receptors.

Mitigation proposed for the protection of ground and surface waters during the construction, operation and decommissioning phases of the Proposed Development will ensure the qualitative and quantitative status of the receiving ground and surface waters will not be altered by the Proposed Development.

There will be no change in GWB or SWB status in the underlying GWBs or downstream SWBs resulting from the Proposed Development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWB are protected from any potential deterioration from chemical pollution.

Furthermore, with the implementation of the proposed mitigation measures, there will be no potential effects on any downstream protected areas as a result of the Proposed Development.

As such, the Proposed Development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve ‘Good’ surface water/groundwater status;
- does not jeopardise the attainment of 'Good’ surface water/groundwater chemical status;
- does not jeopardise the attainment of ‘Good’ surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in Section 9.1.4 of EIAR Chapter 9).

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APPENDIX 3

CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

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1. INTRODUCTION

This Construction and Environmental Management Plan (CEMP) has been developed by McCarthy Keville O' Sullivan Ltd. (MKO) on behalf of Bord na Móna Powergen Ltd., who intend to apply to An Bord Pleanála for planning permission to construct a wind energy development and all associated infrastructure at Ballivor and adjacent townlands, on the border of Counties Meath and Westmeath. The Proposed Development will be located on the Ballivor, Carranstown, Bracklin, Lisclogher, and Lisclogher West Bogs which are part of the Ballivor Bog Group. The CEMP has been prepared in conjunction with the Environmental Impact Assessment Report (EIAR) which will accompany the planning application for the Proposed Development to be submitted to the competent authorities.

Should the project secure planning permission, the CEMP will be updated, in line with all conditions and obligations which apply to any grant of permission. The CEMP should be read in conjunction with the EIAR and planning drawings. The CEMP will also require updating by the selected contractor in order to identify, assess and satisfy the contract performance criteria as set out by the various stakeholders. The CEMP due to its structure and nature will also require constant updating and revision throughout the construction period as set out below. Therefore, this is a working document and will be developed further prior to and during the construction phase of the wind farm development.

Triggers for amendments to the CEMP will include:

- When there is a perceived need to improve performance in an area of environmental impact;
- As a result of changes in environmental legislation applicable and relevant to the project;
- Where the outcomes from auditing establish a need for change;
- Where Work Method Statements identify changes to a construction methodology to address high environmental risk; and
- As a result of an incident or complaint occurring that necessitates an amendment.

This CEMP identifies the key planning and environmental considerations that must be adhered to and delivered during site construction and operation. The Contractor, as appointed by the Project Developer, will be required to implement all of the requirements set out in this CEMP. The CEMP may be updated and revised throughout the construction phase of the project, but all future iterations must meet or exceed the standards and requirements set out in this document and the Project Developer must be satisfied that all requirements set out in this document can and will be implemented in full by the appointed contractor.

The CEMP to be prepared by the appointed contractor will be a single, amalgamated document that can be used during the construction phase of the project, as a single consolidated point of reference relating to all construction, environmental and drainage requirements for the Planning Authority, developer and contractors alike. The CEMP may evolve over further iterations as the construction works progress, but at all times must meet or exceed the standards and requirements set out in this document. It will be the contractor's current version of the CEMP, which at any point in time, will guide the construction activities on site and the implementation of which will be audited by an Environmental Clerk of Works (ECoW).

1.1 Scope of Construction and Environmental Management Plan

This report is presented as a guidance document for the construction of the proposed Ballivor Wind Farm including connection to the national grid. Where the term 'site' is used in the CEMP it refers to all works associated with the Proposed Development enabling works. The CEMP outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner.

The report is divided into nine sections, as outlined below.

- Section 1 provides a brief introduction as to the scope of the report.
- Section 2 outlines the Site and Project details, detailing the targets and objectives of this plan along with providing an overview of construction methodologies that will be adopted throughout the project.
- Section 3 sets out details of the environmental controls to be implemented on site. Site drainage measures, peat stability monitoring measures and a waste management plan are also included in this section.
- Section 4 sets out a fully detailed implementation plan for the environmental management of the project outlining the roles and responsibilities of the project team.
- Section 5 outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection.
- Section 6 consists of a summary table of all mitigation proposals to be adhered to during the project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 7 consists of a summary table of all monitoring requirements and proposals to be adhered to during the project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 8 sets out a programme for the timing of the works.
- Section 9 outlines the proposals for reviewing compliance with the provisions of this report.

2. SITE AND PROJECT DETAILS

2.1 Site Location and Description

The site of the Proposed Development is located on four bogs within the Ballivor Bog Group at the Meath-Westmeath border, namely Ballivor, Carranstown, Bracklin and Lisclogher Bogs. The closest settlements to the site are Delvin, located 5km north, Raharney, 4km west and Ballivor, 3.5km east of the site.

The Wind Farm Site Boundary measures approximately 1,170 hectares. The site topography ranges between 86 metres above ordnance datum (mAOD) at its highest point to approximately 69 mAOD at its lowest point. The site measures approximately 9km in length from north to south, and approximately 6 km from east to west, at its widest point. The Grid Reference co-ordinates for the approximate centre of the site are E263560, N257213. The site is accessed via the R156 National Secondary Road which bisects the site and various local roads off the N52, N51, N4 the L4101, the L4106, the R161 which surround the site.

The Wind Farm Site bare cutaway peat, re-vegetation of bare peat, degraded blanket bog, scrub, low woodland, remnants of high bog and a very small area of conifer plantation. Approximately 18.9km of Bord na Móna permanent fixed gauge rail lines can be found in Ballivor, Bracklin and Carranstown Bogs. Existing activities within the site include site management and environmental monitoring as required under IPC Licence P0-501, temporary wind measurement (a single 100m meteorological mast on Lisclogher Bog). Several telecommunication links traverse the site but there is no communication infrastructure e.g. communication towers within the Wind Farm Site Boundary. Please see Chapter 14 Material Assets of the accompanying EIAR for further details on this.

Active peat extraction permitted under IPC Licence No. 501 ceased in June 2020. Under IPC Licence, the applicant is required to commence decommissioning and rehabilitation of the Ballivor Bog Group. Part of the decommissioning involves removing previously harvested and stockpiled peat off the bogs. The removal of stockpiled peat will be completed by 2024.

As part of the IPC licence rehabilitation requirements, the applicant is required to produce peatland rehabilitation plans. These plans have considered the Proposed Development footprint and demonstrate that both peatland rehabilitation and renewable energy can coexist harmoniously onsite. Please see Appendix 4-6 for details on the rehab plans.

The Peatland Climate Action Scheme (PCAS) which comprises enhanced peatland rehabilitation (above and beyond IPC licence requirements), commenced and was completed at Carranstown East, adjacent to the Wind Farm Site Boundary. Bracklin West, also adjacent to the Wind Farm Site Boundary has been selected for PCAS and it is expected to commence in 2023. This accelerated form of peatland rehabilitation has been undertaken at the recently constructed Cloncreen wind farm. The PCAS scheme is supported by Government through the Climate Action Fund and Ireland's National Recovery and Resilience Plan administered by the Department of Environment, Climate and Communications (DECC). Please see https://www.bnmpcas.ie/ for details. The National Parks and Wildlife Service (NPWS) acts as the Scheme regulator and there is ongoing engagement with the EPA. This scheme is in addition to the IPC licence requirements and therefore does not form part of the proposed Ballivor Wind Farm application.

The proposed grid connection forms part of the planning application. It is proposed to construct a 110kV substation within the site at Carranstown Bog in the townland of Grange More and to connect from here via a 110 kV loop-in and loop out connection to the existing Mullingar-Corduff 110 kV Overhead line. The electrical substation will have 2 No. control buildings, associated switchgear room, electrical plant and equipment, and wastewater holding tank and a 36 metre high telecom tower.

The Proposed Development will require the permanent vertical realignment of the R156 in the vicinity of the site entrance to achieve required sight lines. On the R156 in between the proposed component entrances to Ballivor and Carranstown Bogs, existing visibility is currently impacted by a trough and rise in the road. An assessment of the vertical alignment shown indicates that a 44m section of the R156 impedes on required sightlines and as a result, a maximum reduction of approximately 0.47m for 44m along the R156 is required in this area. This proposed work will be undertaken prior to any construction phase works and will be retained for the operational phase and beyond. This proposed lowering of the road section will enhance the road safety for both construction and operational phase users as well as local road users of the R156.

2.2 Description of the Development

The planning application for the proposed wind farm includes connection to the national electricity grid. All elements of the proposed project, including grid connection and any works required on public roads to accommodate turbine delivery, have been considered.

This application seeks a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.

The key components of the Proposed Development include the following:

i. *26 No. wind turbines with a blade tip height of 200m and all associated hard-standing areas.*
ii. *2 No. permanent Meteorological Anemometry Masts with a height of 115 metres and removal of existing meteorological mast.*
iii. *4 No. temporary construction compounds, in the townlands of Bracklin and Grange More.*
iv. *5 No. temporary security cabins at the main construction site entrances as well as at a number of access points around the site, in the townland of Killagh, Grange More and Coolronan.*
v. *2 No. borrow pits located in Carranstown Bog, and in third party land in the townland of Craddanstown; All works associated with the opening, gravel and spoil extraction, and decommissioning of the borrow pits.*
vi. *1 No. 110 kV electrical substation, which will be constructed in the townland of Grange More. The electrical substation will have 2 No. control buildings, a 36 metre high telecom tower, associated electrical plant and equipment, a groundwater well and a wastewater holding tank. All associated underground electrical and communications cabling connecting the turbines and masts to the proposed electrical substation, including road crossings at R156 and local road between Lisclogher and Bracklin Bogs, and all works associated with the connection of the proposed wind farm to the national electricity grid, which will be to the existing Mullingar – Corduff 110 kV overhead line via overhead line.*
vii. *Provision of new internal site access roads with passing bays measuring a total length of 28km and provision/upgrade of existing/new pathways for amenity use measuring a total length of approximately 3.3km and associated drainage.*
viii. *Temporary accommodating works to existing public road infrastructure to facilitate delivery of abnormal loads at locations on the R156 and R161 in the townlands of Doolystown and Moyfeagher;*
ix. *Accommodating works to widen existing site entrances off the R156 into Ballivor and Carranstown Bogs and reopen entrances at Lisclogher and Bracklin Bogs for use as construction site entrances and to facilitate delivery and movement of turbine components and construction materials; Entrances will be used for maintenance and amenity access during the operational period;*
x. *Permanent vertical realignment of the R156 in the vicinity of the site entrance to achieve required sight lines.*

xi. *Construction of permanent site entrances off a local road into Lisclogher and Bracklin Bogs to facilitate a crossing point for turbine components and construction materials and operation/amenity access;*

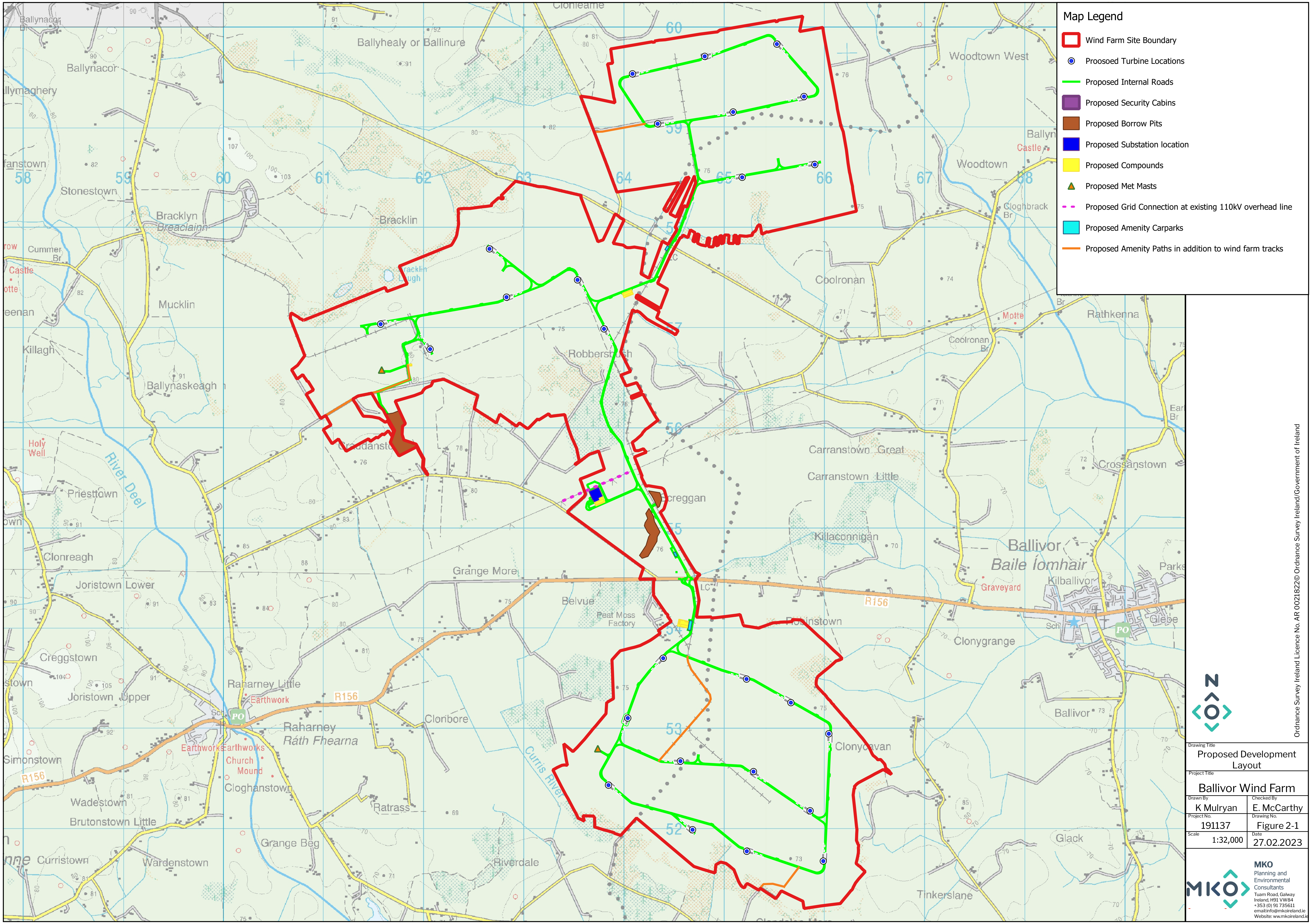
xii. *Provision of amenity access using existing entrances off the R156 and local roads in the townlands of Bracklin, Coolronan, Clondalee More and Craddanstown;*

xiii. *3 No. permanent amenity carparks in Ballivor Bog (50 car parking spaces), Carranstown (15 car parking spaces) and Bracklin Bog (15 car parking spaces) and the provision of bicycle rack facilities at each location.*

xiv. *All associated site works and ancillary development including access roads, amenity pathways, drainage and signage.*

xv. *A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*

The proposed site layout showing individual elements of the development is shown in Figure 2-1 and in the Site Layout Drawings included with the application (Appendix 4-1).


Map Legend
Wind Farm Site Boundary
Prososed Turbine Locations
Proposed Internal Roads
Proposed Security Cabins
Proposed Borrow Pits
Proposed Substation location
Proposed Compounds
Proposed Met Masts
Proposed Grid Connection at existing 110kV overhead line
Proposed Amenity Carparks
Proposed Amenity Paths in addition to wind farm tracks
Ordnance Survey Ireland Licence No. AR 0021822© Ordnance Survey Ireland/Government of Ireland
Drawing Title
Proposed Development Layout
Project Title
Ballivor Wind Farm
Drawn By
K Mulryan
Checked By
E. McCarthy
Project No.
191137
Drawing No.
Figure 2-1
Scale
1:32,000
Date
27.02.2023
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Ballynacor
Stonestown
Bracklyn
Mucklin
Killagh
Ballynaskeagh
Robbersbush
Carranstown Great
Carranstown Little
Killaconnigan
Grange More
Belvue
Peat Moss Factory
Clonycavan
Clonygrange
Coolronan
Woodtown West
Woodtown
Rathkenna
Crossanstown
Priestown
Clonreagh
Joristown Lower
Joristown Upper
Creggstown
Raharney Little
Raharney
Ráth Fhearna
Clonbore
Simonstown
Wadestown
Brutonstown Little
Cloghanstown
Ratrass
Grange Beg
Riverdale
Wardenstown
Curristown
Tinkerslane
Glack
River Deel
Curris River
R156

2.3 Targets and Objectives

The construction phase works are designed to approved standards, which include specified materials, standards, specifications and codes of practice. The design of the project has considered environmental issues and this is enhanced by the works proposals.

The key site targets are as follows;

- Adopt a sustainable approach to construction and, ensure sustainable sources for materials supply where possible;
- Keeping all watercourses free from obstruction and debris;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Correct fuel storage and refuelling procedures to be followed;
- Air and noise pollution prevention to be implemented;
- Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Good waste management and house-keeping to be implemented;
- Using recycled materials if possible, e.g. excavated stone, soil and subsoil material;
- Avoidance of vandalism;
- Monitoring of the works and any adverse effects that it may have on the environment; and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Keep impact of construction to a minimum on the local environment, watercourses, habitats and wildlife;
- Comply with all relevant water quality legislation;
- Ensure construction works and activities are completed in accordance with mitigation and best practice approach presented in the Environmental Impact Assessment Report, NIS and associated planning documentation;
- Ensure construction works and activities are completed in accordance with any planning conditions for the development;
- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community; and
- Ensure construction works and activities have minimal impact on the natural environment.

2.4 Construction Methodologies Overview

2.4.1 Introduction

An experienced main contractor will be appointed for the civil works for the construction phase of the Proposed Development. The appointed contractor for the works will be required to comply with this CEMP and any revisions made to this document in the preparation of method statements for the various elements of the construction phase of the Proposed Development. An overview of the proposed Construction Methodologies is provided below.

2.4.2 Overview of Proposed Construction Methodology

The EIAR includes construction methodologies for various elements of work to be undertaken as part of the project. These construction methodologies are reproduced in the following sub-sections but will be superseded by an appointed contractor's construction method statements, which will form part of the CEMP. The contractor's construction method statements will be prepared to take account of the detailed engineering, geotechnical and detailed drainage design which will be prepared prior to commencement of construction and all requirements of this CEMP.

The proposed anticipated construction methodology is summarised under the following main headings:

- Permanent Road Improvement Works at R156
- Proposed New Site Access Roads;
- Proposed widening of existing site entrances and provision of amenity entrances;
- Temporary Construction Compound;
- Site Drainage System;
- Culvert crossings
- Crane Hardstands;
- Turbine and Anemometry Mast Foundations;
- Anemometry Mast Removal
- Electricity Substation and Control Buildings;
- Cable Trenching;
- Grid Connection – Overhead Lines

Proposed Permanent Road Improvement Works at R156

An assessment of the vertical alignment along the R156 indicates that there is an existing driver visibility impediment in the vicinity of the proposed main wind farm site entrances. It is proposed to remove this existing safety issue permanently by the lowering of a stretch of the road, approximately 44m in length prior to any other construction related activities at the wind farm site. This proposed lowering of the road section will enhance the road safety for both construction and operational phase users as well as local road users of the R156. The works will be undertaken in agreement with the local authority and to TII standards and guidelines.

2.4.2.1 New Site Access Roads

There is approximately 28 km of new onsite access roads to be installed at the site. The new access roads will be constructed as follows using either a floating road or excavated site road methodology both of which are summarised below:

2.4.2.1.1 *Construction of New Floating Roads*

Floating access roads are the predominant road construction type proposed for the site and will be used in areas where the peat depth is in excess of 1m. This road construction type is selected for flat terrain i.e., typically less than 5-degree slope.

The general construction methodology for the construction of floating roads, as presented in FTC's Peat and Spoil Management Plan in Appendix 4-2, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

1. *Prior to commencing floating road construction movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
2. *Floating road construction shall be to the line and level requirements as per design/planning conditions.*
3. *Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.*
4. *Construction of road to be in accordance with appropriate design from the designer.*

5. *The typical make-up of the new floated access road is up to 1,200mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator. This may vary depending on designer requirements.*
6. *Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 5m wide pressure berm (typically 1m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.*
7. *The finished road surface width will be approximately 6m (to be confirmed by the designer).*
8. *Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.*
9. *To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.*
10. *Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.*
11. *Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.*
12. *A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

2.4.2.1.2 Construction of New Excavated Roads

The general construction methodology for the construction of excavated roads, as presented in the Peat and Spoil Management Plan (Appendix 4-2), is summarised below. This methodology includes procedures that are to be included in construction to minimise any adverse impact on peat stability.

1. *Prior to commencing the construction of the excavated roads movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m.*
2. *Interceptor drains should be installed upslope of the access road alignment to divert any surface water away from the construction area.*
3. *Excavation of roads shall be to the line and level given in the design requirements. Excavation should take place to a competent stratum beneath the peat (as agreed with the site designer).*
4. *Road construction should be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill unless otherwise agreed with the site designer or resident engineer on site.*
5. *All excavated peat shall be placed/spread alongside the excavations.*
6. *Side slopes in peat shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations should be carried out as the excavation progresses.*
7. *A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer).*
8. *At transitions between floating and excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.*
9. *Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any*

unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability. It should be noted that slopes greater than 5 degrees are not envisaged on site.

10. *A final surface layer shall be placed over the excavated road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

2.4.2.1.3 Upgrade of Existing Roads

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

1. *For upgrading of existing excavated access tracks, the following guidelines apply:*
    a. *Excavation of the widened section of access road should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.*
    b. *Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.*
    c. *The surface of the existing access track should be overlaid with up to 500mm of selected granular fill.*
    d. *A layer of geogrid/geotextile may be required at the surface of the existing access track and at the base of the widened section of access road (to be confirmed by the designer).*
    e. *For excavations in peat, side slopes shall be not greater than 1 (v): 2 or 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.*
2. *For upgrading of existing access tracks constructed using a floated construction technique the following guidelines apply:*
    a. *The surface of the existing access track should be graded/tidied up prior to the placement any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).*
    b. *Where granular fill has been used in the existing access track make-up, a layer of geogrid should be placed on top of the existing access track.*
    c. *The geogrid may be overlaid with up to 500mm of selected granular fill.*
    d. *Additional geogrid and granular fill may be required in certain sections of the works (to be confirmed by the designer).*
3. *Where the ground is sloping across a section of access road (side long ground) any road widening works required should be done on the upslope side of the existing access road, where possible.*
4. *At transitions between floating and existing excavated roads a length of road of about 10m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.*
5. *A final surface layer shall be placed over the existing access track, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.*

2.4.3 Site Entrance Management

Construction Site Entrances

The existing entrances off the R156 into Ballivor and Carranstown Bogs will be widened to facilitate turbine component delivery. Adjacent to the component entrance into Ballivor Bog will be a non-component entrance. This non-component entrance is required in order to provide a staggered crossroads junction as required by TII specifications. Therefore, non-component vehicles will utilise this entrance into Ballivor Bog while all vehicles will utilise the widened component entrance into Carranstown.

Former railway entrance/egress points at the northeast of Bracklin Bog and southwest of Lisclogher Bogs will be reopened and widened for the construction phase. This will facilitate the movement of construction vehicles straight across the local road from Bracklin Bog into Lisclogher Bog in the morning and again in the evening, thus minimising traffic impacts by avoiding the need to travel long distances along the roads. The crossing point at Bracklin will be retained for the operational phase and an amenity carpark will be provided inside this entrance. The entrance into Lisclogher will be retained for the occasional maintenance staff and pedestrians only. There will be no carparking facilities in this bog for amenity users.

There are two proposed borrow pits as part of the Proposed Development. Borrow pit 1a and 1b are located within Carranstown Bog. Borrow pit 2 is located in a field in third party lands. It is proposed to initially access to the borrow pit field via the landowners farm access track off the local road 800m south of Bracklin Bog. This existing farm access track will be upgraded prior to any borrow pit excavation works. Following the upgrading of the existing farm entrance, a new access road connecting the borrow pit field to Bracklin Bog will be constructed; approximately 50m will be constructed through pastureland via the excavated road method and approximately 120m will be floated (over an existing drain). Once complete, machinery access to and from the borrow pit area during its construction, use and reinstatement will be via internal roads only, i.e. no local road use will be required by heavy goods vehicles for the purpose of transporting stone. There may be occasional use of the local roads by employee vehicles or empty trucks from the borrow pit area. Post-construction phase, the offsite borrow pit area and any construction access works will be permanently graded over and allowed to reseed.

Turbine Component Entrances

The widened entrances into Ballivor and Carranstown Bogs will used to facilitate turbine component delivery. The delivery of the components will enter the main site entrances via a manned traffic stop/go system under supervision by a Traffic Management Coordinator and with a Garda escort. The transportation of the turbine components will be carried out at night when traffic is at its lightest and in consultation with the relevant Roads Authority and An Garda Síochána. The delivery programme and management requirements will be detailed in a Traffic Management Plan and agreed with the local authority and An Garda Síochána. Please see Chapter 14 Material Assets and Appendix 14-1 Outline Traffic Management Plan for details.

In addition to the main component entrances off the R156, there will be a requirement for turbine components to cross the local road in the northeast of the Wind Farm Site in order to facilitate component delivery from Bracklin Bog into Lisclogher Bog. The crossing of this local road with components will also be detailed in the Traffic Management Plan and agreed with the Local Authority and An Garda Siochana. It will be carried out under stop/go system at night when traffic is at its lightest.

2.4.3.2 Drainage System

The early establishment of temporary drainage facilities will manage the risk of impacts on watercourses on and adjacent to the site during construction. In addition, construction operations will adopt best working practices. The development of the site will need to be phased accordingly. The construction of the drainage will start from the downstream sections and progress upstream, connecting wind farm drainage elements together as each development phase progresses. They will therefore need to be designed with sufficient flexibility to respond to an early phase incoming flow during the construction phase.

Surface drainage design and management is summarised with in Section 3.2 below.

2.4.3.3 Temporary Construction Compound

Four temporary construction compounds are proposed as part of the development and are located off the R156 in Ballivor Bog, off the L5507 at the proposed substation area in Carranstown Bog and in the northeast of Bracklin Bog. The construction compounds will be constructed as follows:

- The areas to be used as the compound will be marked out at the corners using ranging rods or timber posts.
- All drainage measures prescribed in the detailed drainage design for the project will be implemented around the works area
- The compound platform will be established using a similar technique as the construction of the substation platform discussed in section 2.4.2.8 below.;
- A layer of geo-grid will be installed and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc.;
- The compound will be fenced and secured with locked gates if necessary;
- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor as required and will be removed from the site on completion of the construction phase;
- The water supply to the site will be from a temporary water storage tank which will be filled using a mobile water tank which will source water locally as required, and;
- Upon completion of the Proposed Development construction, the temporary construction compound at the substation and in Bracklin Bog will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required. The compound at Ballivor will be converted into an amenity carpark, as will a component set down area in Carranstown Bog. A third amenity carpark will be added to the northeast of Bracklin off a local road entrance.

2.4.3.4 Culvert Crossings on the Wind Farm Site

Culverts will be required where site roads, crane pads and turbine pads cross main bog drainage networks. Locations of the culverts are shown on the drawings in Appendix 4-1 of the EIAR.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow as necessary. All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

All new crossings and upgrades to existing crossings will be completed as follows:

- The access road on the approach watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- The installation of the culvert will take place in low flow conditions.

- Where a flow exists, the water running through the watercourse channel will be pumped around the water crossing location and back into the watercourse channel downstream of the works area.
- Where over pumping is required, measures will be taken to ensure that the pumped water discharge does not disturb the channel bed with the force of water from the discharge. A steel plate to reduce the force of the flow will be used where appropriate.
- The project engineer will determine the required gradient of the culvert. The culvert must be laid at a gradient that will ensure water is contained within the culvert at all times. Where necessary a rock armour dam will be installed within the channel to reduce flow and ensure an acceptable depth of water remains within the culvert. Where a gradient of 1 –1.5% is identified, the use of a baffle has been recommended.
- The embedded section will be allowed to fill naturally with existing material within the base of the drain or with suitable drainage material such as gravel or round shingle where deemed applicable.
- The culvert will be lowered into place using an excavator with a lifting mechanism.
- Large stone boulders (13 approx. 400mm), sourced from the on-site borrow pits, will be placed over the culvert to create a headwall for the culvert and a suitable sub-base for road construction.
- Smaller 50mm stone sourced on site will be placed upon the sub-base to construct the road over the water crossing.

The works will be undertaken in line with NRA Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.

For crossings at Bord na Móna bog drains the bed of the watercourse channel will be excavated, if necessary, to achieve the correct line and to allow the culvert to be embedded 300mm into the base of the existing drain.

Proposed Mitigation Measures for watercourse crossings are detailed below as detailed in Section 9.5 of the EIAR and are summarised as follows:

- All proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing location;
- Where the proposed underground cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road;
- All guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland is incorporated into the design of the proposed crossings;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", i.e., May to September inclusive. This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI);
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas; and,

All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent. All of the above works will be supervised by the Environmental Clerk of Works and the project hydrologist.

2.4.3.5 Crane Hardstands

All crane pads will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads and will be sized to the turbine manufacturer's requirements. Where an excavated crane hardstand cannot be used due to the depth of peat, the hardstand will be supported by using reinforced concrete piles as per the methodology outlined for piled foundations summarised below. The position of the crane pads varies between turbine locations depending on topography, position of the site access road, and the turbine position.

2.4.3.6 Turbine and Anemometry Mast Foundations

The wind turbines and anemometry mast foundations will be a reinforced concrete base designed to Eurocode 2/BS8110. Foundation loads will be provided by the wind turbine and mast supplier and these will be assessed in accordance with European design regulations. The turbine will be anchored to the foundation using a bolt assembly which shall be cast into the concrete. The anemometry mast is a structure which is also anchored to the reinforced concrete foundation. It is anticipated that the foundations for both the turbines and the anemometry mast will be either gravity or piled type and that the formation level of the turbine foundations will be on the lower mineral subsoil or bedrock.

Gravity foundation bases will measure approximately 25 metres in diameter. They will likely be founded one metre below the base of the peat layer on stiff subsoil material or bedrock, or at a suitable level directed by the Geotechnical Engineer/Designer. The foundations will be constructed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter;
- the peat will be stripped over the area of the excavation, the unsuitable subsoil will be excavated and either side cast or landscaped around the finished turbine;
- No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practices;
- All groundwater and surface water arising from turbine base excavation will be pumped to the dirty water system prior to discharge from the works area;
- Soil excavation shall be observed by a qualified archaeologist in accordance with a scheme of archaeological monitoring to identify any significant remains as they come to light and,
- The foundations excavation will be raised to formation level by compacted layers of well graded granular material will be spread and compacted to provide a hard area for the turbine foundation.

Reinforced concrete piled foundations will be completed as follows:

- The extent of the excavation will be marked out
- No material will be removed from site and placement areas will be stripped of vegetation prior to placement in line with best working practices;
- A piling platform for the piling rig will be constructed. This can be done in two ways depending on the bearing capacity of the underlying soil.
    - The first method is to lay geo-textile on the existing surface and a stone layer will then be placed on top of the geo-textile by an excavator and compacted in order to give the platform sufficient bearing capacity for the piling rig.
    - The second method is to excavate the soils to a suitable subsoil and backfill to the piling, platform level.
- The piling rig, fitted with an auger, will then bore through the soft material with a sleeve fitted around the auger to prevent the sidewalls of the peat from collapsing. The borehole is then extended to a suitable depth into the subsoil/bedrock.

- When the auger and the sleeve are removed high tensile steel cages will be lowered into the boreholes. These steel cages will extrude above the level of the top of the concrete pile.
- As the auger is removed concrete is pumped into the borehole.
- Reinforcing steel on the top of the pile will tie to the foundation base steel.

2.4.3.7 Anemometry Mast Removal

There is an existing 100m high meteorological mast (Pl. Ref. 16/6259) on Lisclogher which will be decommissioned, disassembled and removed from site as it will no longer be required due to the presence of the 2 No. new masts. The disassembly process will generally follow the sequencing shown below:

- Removal of Equipment: Equipment and monitors on the mast will be removed;
- Removal of hazardous materials: Electrical cabling, solar panels and other remaining electrical equipment;
- Disassembly and removal of Mast Structure;
- Removal of Groundworks: Ground anchors will either be dug up and removed or remain in situ;
- Source segregation of material fractions for construction and demolition waste collection by an appropriately authorised waste contractor, and;
- Transport of the construction and demolition waste materials to an appropriately authorised waste facility.

2.4.3.8 **Electricity Substation and Control Buildings**

The electricity substation and control buildings will be constructed within the site, as shown in Figure 2.1. The dimensions of the substation area will be set to meet the requirements and specifications of Eirgrid/ESB Networks and the necessary equipment to safely and efficiently operate the Proposed Development.

The substation will be constructed by the following methodology:

- The area of the onsite substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to nearby storage area
- All drainage measures prescribed in the detailed drainage design for the project will be implemented around the works area.
- Excavation of the substation footprint should take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.
- The dimensions of the onsite substation area will be set to meet the requirements of Eirgrid/ESB Networks and the necessary equipment to safely and efficiently operate the permitted wind farms;
- Two control buildings will also be built within the onsite substation compound;
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix;
- The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables and internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.

- The electrical equipment will be installed and commissioned.
- Perimeter fencing will be erected.

It is proposed to install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, *Guide for Drilling Wells for Private Water Supplies* (IGI, 2007). The well will be flush to the ground and covered with a standard manhole. A pump house is not currently envisaged as an in-well pump will direct water to a water tank within the roof space of the control building (subject to final design). Bottled water will be supplied for drinking, if required.

The construction and components of the substation will be to Eirgrid/ESB Networks specifications.

2.4.3.9 Cable Trenching

The transformer in each turbine is connected to the substation through a network of buried electrical cables. The ground is trenched typically using a mechanical excavator. The top layer of soil is removed and saved so that it is replaced on completion. The electrical cables from wind turbines to the substation will be run in ducts approximately 1.2m below the ground surface. On completion, the ground will be reinstated as previously described above.

A method statement for all internal cabling works will be prepared by the appointed contractor prior to the commencement of any construction.

2.4.3.10 Grid Connection

The proposed wind farm will connect to the existing national grid via a 110kV substation in the north-western part of the Carranstown bog from where a loop-in loop-out connection to the existing Mullingar – Corduff 110 kV overhead line with be constructed.

2.4.3.10.1 *Overhead Lines*

A connection between the Proposed Development and the national electricity grid will be necessary to export electricity on to the national grid. This connection from the proposed onsite substation to the national grid will occur within the vicinity of the proposed substation, via an overhead line which will connect into the existing Mullingar-Corduff 110 kV transmission line located approximately 35m north of the proposed substation within the development site boundary. Two lattice loop in/loop out masts and approximately 35m of overhead line from each mast will be required to connect from the proposed substation to the existing overhead line. The proposed lattice masts will be located within the Proposed Development site. Each mast will have a footprint of approximately 140m2 and an overall height of 12–15m. They will be lattice steel structures with cross-arms which can extend over the base footprint and internal bracing. The exact final detail and specifications of the grid connection method for the Proposed Development will ultimately be decided by ESB/EirGrid

The following section outlines the methodology to be followed during construction works of the new Loop In tower structures which will be constructed underneath the existing 110 kV overhead line;

- The Steel lattice tower sites are scanned for underground services such as cables etc. Consultation with the landowner will help to identify services / constraints and ensure there are no unidentified services in the area.
- For the 2 No. towers a foundation c.3m x 3.6m x 3.6m is excavated and the formation levels (depths) will be checked by the onsite foreman. The excavated material will be temporarily stored close to the excavation and excess material will be used as berms along the site access roads.
- To aid construction, a concrete pipe is placed into each excavation to allow operatives level the mast at the bottom of the excavation. The frame of the reinforcing bars will

be prepared and strapped to a concrete pipe with spacers as required. The reinforcing bars will be lifted into each excavated foundation using the excavator and chains/slings. The base and body section of each tower will then be assembled next to excavation.

- Concrete trucks will pour concrete directly into each excavation in distinct stages.
- A third pour for the leg of the tower 1m x 1m and will be 300mm over ground level.
- Once the main concrete foundation pour is cured after circa five days, metal shuttering is installed to accommodate the placement of concrete around the tower legs. During each pour, the concrete will be vibrated thoroughly using a vibrating poker.
- Once the concrete is set after the five days the shuttering is removed.
- The tower foundations will be backfilled one leg at a time with the material already excavated at the location. The backfill will be placed and compacted in layers. All dimensions will be checked following the backfilling process. All surplus excavated material and removed from the tower locations and stored in berms adjacent to the Substation Compound or distributed on site in accordance with approved environmental procedures.
- The existing overhead line will be de-energised by Eirgrid/ESB Networks, so work can commence on the construction of the towers.
- An earth mat consisting of copper or aluminium wire will be laid circa 400mm below ground around the tower. This earth mat is a requirement for the electrical connection of the equipment on the tower structure.
- Once the base section of each tower is completed and the concrete sufficiently cured, it is ready to receive the tower body. Temporary hardstands may be removed and disposed of off site where necessary.
- A hardstand area for the crane will be created by laying geogrid material on the ground surface and overlaying this geogrid with a suitable grade of aggregate.
- A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close to the OHL.
- The towers will be constructed lying flat on the ground beside the recently installed tower base.
- The conductor will be moved off centre using a stay wire and weights to anchor the stay wire to ground.
- The tower section will be lifted into place using the crane and guide ropes.
- The body sections will be bolted into position.
- The conductor will be centred over the towers and held in place. Once the conductor is secured at both ends it is then cut and attached onto each tower. The section of conductor in between the two towers will be removed and utilised as connector wire for the new towers.

Stringing of Conductors

Stringing of overhead lines on the supporting lattice structures will be kept clear of all obstacles applying sufficient tension. This method requires the pulling of a light pilot line (nylon rope) which is normally carried by hand into the stringing wheels. This in turn is used to pull a heavier pilot line (Steel rope) which is subsequently used to pull the conductors from the drum stands using specifically designed "puller – tensioner" machines. The main advantages with this method are:

- The line is protected from surface damage
- Major obstacles can be completed without any significant disruption.

Once the conductors have been pulled into position, one end of the straight is terminated on the appropriate tension fittings and insulator assemblies. The free end of the straight is then placed in temporary clamps which take the conductor tension. The conductor is then cut from the puller-tensioner and the conductor is sagged using a chain hoist. Bird flight diverters or warning spheres can be added following the sagging procedure if required.

2.4.4 Decommissioning

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully. The onsite substation will remain in place as it will be under the ownership of the ESB/EirGrid. The road improvement works at the R156 will also remain in place.

Upon decommissioning of the Proposed Development, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration. Site roadways will be in use as amenity and recreational pathways, and therefore will not be removed during decommissioning. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required. Underground cables, including grid connection, will be removed and the ducting left in place. A decommissioning plan will be agreed with Meath and Westmeath County Council three months prior to decommissioning the Proposed Development. An outline decommissioning plan is included as Appendix 4-5 of this EIAR.

However, as noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013)[1] reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*

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[1] *Welstead, J., Hirst, R., Keogh, D., Robb G. and Bainsfair, R. 2013. Research and guidance on restoration and decommissioning of onshore wind farms. Scottish Natural Heritage Commissioned Report No. 591. Available at: https://www.nature.scot/sites/default/files/2017-07/Publication%202013%20-%20SNH%20Commissioned%20Report%20591%20-%20Research%20and%20guidance%20on%20restoration%20and%20decommissioning%20of%20onshore%20wind%20farms.pdf*

3. ENVIRONMENTAL MANAGEMENT

3.1 Introduction

This CEMP has been prepared and presented as a standalone document and includes all best practice measures required to construct the wind farm. The drainage proposals will be developed further prior to the commencement of construction however, any such improvements will be in line with the principles set out here and will also be in full compliance with the planning consent and mitigation measures as presented in the EIAR, NIS and all other relevant planning documents. The following sections give an overview of the drainage design principles, dust and noise control measures and a waste management plan for the site.

3.2 Protecting Water Quality

3.2.1 Environmental Management in the Construction Phase

Timing of works can strongly influence the potential for damaging the freshwater environment. Operations during wetter periods of the year pose a significantly greater risk of causing erosion and siltation, which can be particularly severe following major rainfall or snowmelt events. Traditionally, wind farm construction undertaken during the drier summer months would result in significantly less erosion and siltation. Construction activities in the hydrological buffer zones shall be avoided during or after prolonged rainfall or an intense rainfall event and work will cease entirely near watercourses when it is evident that water quality is being impacted. Given that this site has an established drainage network and existing watercourse crossing points, there will be minimal impacts on watercourses.

3.2.2 Site Drainage Principles

The site drainage features have been outlined in Chapter 4 of the EIAR and Appendix 4-1 in addition to the drainage design and management for the Proposed Development. The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. There is an existing drainage system and surface water discharges from the site which is regulated by the Environmental Protection Agency (Licence Ref. P0501). The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems.

No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development.

3.2.3 Best Practice Guidance

The drainage design has been prepared based on experience of the project team of other renewable energy sites in peat-dominated environments, and the number of best practice guidance documents.

There is no one guidance document that deals with drainage management and water quality controls for wind farm and other renewable energy developments. However, a selection of good practice approaches have been adopted in preparation of this CEMP, and these are taken from the various best practice guidance documents listed below.

- National Roads Authority (2005): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Department of the Environment, Heritage and Local Government (2006): Wind Farm Development Guidelines for Planning Authorities;
- Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works Adjacent to Waters;
- Scottish Natural Heritage (2010): Good Practice During Wind Farm Construction;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- Control of water pollution from construction sites - Guidance for consultants and contractors. CIRIA C532. London, 2001; and,
- Control of water pollution from linear construction projects -Technical guidance. CIRIA C648 London, 2006.

3.2.4 Site Drainage Design and Management

The proposed site drainage features for this site are outlined in Chapter 4 of the EIAR. As this CEMP is a working document and is presented as an Appendix to the EIAR, the detailed drainage measures are not included in this document. When the final CEMP report is prepared, and presented as a standalone document, all drainage measures will be included in that document. The drainage proposals will be developed further prior to the commencement of construction. The following sections give an outline of drainage management arrangements in terms of pre-construction, construction and operational phases of the Proposed Development.

3.2.4.1 Pre-Construction Drainage

The surface of the cutover bog is drained by a network of parallel field drains that are typically spaced every 15 - 20m. The field drains are approximately 0.5 - 1.5m deep and in most areas, they intercept the mineral subsoil underlying the peat. These field drains mostly feed into larger surface water drains which drain the main catchments across the site. This existing drainage system will continue to function as it is during the pre-construction phase.

However, prior to commencement of works in sub-catchments across the site, main drain inspections will be completed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment-by-catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.

3.2.4.2 Construction Phase Drainage

The Project Hydrologist/Design Engineer will complete a site drainage and maintenance plan before construction commences and will attend the site to set out and assist with micro-siting of proposed drainage controls as outlined in Chapter 4 of the EIAR. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site.

Best practice and practical experience on other similar projects suggest that in addition to the drainage plans that are included in the EIAR, there are additional site based decisions and plans that can only be made in the field through interaction between the Site Construction Manager, the Project Hydrologist and the Project Geotechnical Engineers. The mechanisms for interaction between these are outlined within Section 4 of this CEMP.

Drainage infrastructure will include:

- Interceptor drains will convey clean runoff water around works areas to the existing downstream drainage system (field drains and main drains). Where required, interceptor drains will be installed in advance of any construction works commencing. This will ensure that clean water is kept clear by diverting surface water flow around excavations, construction areas and temporary storage areas. Where possible (depending on orientation), existing field drains can be used as interceptors drains;
- Collector drains will be used to intercept and collect runoff from construction areas (from turbine base/hardstand areas, construction compounds, and the substation). During the construction phase temporary settlement ponds will be used to attenuate and treat runoff from the construction areas (from turbine base/hardstand areas, construction compounds, and the substation) and treated water will then discharge into existing field drains and main drains. Temporary settlement ponds will be removed at the end of the construction phase (end of high risk period), and wind farm runoff will discharge into existing field drains and main drains;
- During the construction phase, temporary silt traps (silt fences) will be used as an additional water protection measures around the existing bog drainage network, particularly where works are proposed within 50m of a natural watercourse. The silt fences will be placed in the existing drains downstream of construction works, and the associated construction area run-off water will be diverted into proposed interceptor drains, or culverted under/across the works area;
- During the construction phase, dewatering silt bags will also be used as required. They can be used downgradient of turbine bases, where temporary pumping is required. Discharge from dewatering silt bags will flow into settlement ponds and treated water from settlement ponds will outfall to existing field drains and main drains;
- Within the proposed site layout there are section of proposed floating road between turbine infrastructure. In these sections, and depending on intermediate topography, a collector drain (dirty water system as described above) may be used during construction stage, or over the edge (OTE) drainage will occur. Over the edge drainage allows runoff from access tracks to flow into local field drains and be managed via the existing site drainage system. OTE drainage will only occur where topography allows, and it is only proposed in areas of low risk and remote from outfall locations (at least 150m from bog outfall locations. Silt traps and check dams will be installed in field drains downstream of OTE drainage areas, and these will provide attenuation and treatment of dirty water; and,
- Culverts will be required where site roads and proposed hardstands cross the main bog drainage networks. These will be installed with a minimum gradient to reduce the entrainment of suspended solids. All culverts will be inspected regularly and maintained where appropriate. Culverts will remain in-situ during the Operational Phase of the Proposed Development.

In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures outlined in Section 6 below, and to ensure protection of all watercourses.

3.2.4.3 Operational Phase Drainage

The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will be maintained up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader.
- Swales/road side drains will be installed to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling;
- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds will be ongoing through the construction period.

3.2.4.4 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above will be brought on-site in phases as they are required during the construction phase.

A sufficient number of straw bales, clean drainage stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

3.2.4.5 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the project will take account of weather forecasts and predicted rainfall. Large excavations, large movements of overburden or large-scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

3.2.4.6 Reactive Site Drainage Management

The final drainage design prepared for the site has provided for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored by the Environmental Clerk of Works (ECoW) on-site.

The contractor is solely responsible for the implementation of the detailed drainage design on-site. The ECoW is responsible for monitoring the effectiveness of the drainage design as it is implemented om-site.

The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground at a particular time.

In the event that works are giving rise to siltation of watercourses, the ECoW or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

3.2.4.7 Rainfall Forecasting and Monitoring

Accurate forecasting and monitoring of rainfall is critical to the successful pre-emptive and reactive site drainage management as outlined in the subsections above.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the threshold rainfall values, listed below, will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures shall be completed:

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall (listed above) and for up to 24 hours after heavy events to ensure drainage systems are not overloaded

Construction personnel will be required to check the forecasted rainfall for the days ahead and plan for or suspend planned works accordingly. The forecasted rainfall should be recorded for reference and comparison with the rainfall levels to be recorded on-site. Actual rainfall will be monitored on site, ideally via an automated rain gauge with regular recording intervals recommended by the Project Hydrologist and a means of alerting the construction personnel of rainfall trigger levels. The recorded rainfall data should be available on site at all times for review by the ECoW, Project Hydrologist or any regulatory authorities. The appointed contractor will be required to outline their proposed means of recording rainfall on site to the satisfaction of the ECoW and the Project Hydrologist prior to commencement of works.

3.2.5 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation, and in the case of the Proposed Development, would be used for landscaping and reinstatements of other areas elsewhere on site.

3.2.6 Refuelling, Fuel and Hazardous Materials Storage

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling should occur at a controlled fuelling station;
- On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser will be re-filled off site, and will be towed by a 4x4 jeep to machinery is located. The 4x4 jeep will also carry fuel spill kits in the event of any spillages. The fuel bowser will be parked on a designated level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
- Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical substation compound fuel storage area will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be developed (refer to Section 5). Spill kits will be available to deal with any spillage in and outside the refuelling area.

3.2.7 Cement Based Products Control Measures

The following mitigation measures are proposed to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site;
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.
- Use weather forecasting to plan dry days for pouring concrete;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;
- The small volume of water that will be generated from washing of the concrete lorry’s chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow

much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

3.2.8 Peat Stability Management

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

3.2.8.1 General Recommendations for Good Construction Practice

Based on the recommendations and control measures given in the FTC **Peat Stability Assessment** (**Appendix 8-1** of the EIAR) report being strictly adhered to during construction and the detailed stability assessment carried out for the peat slopes which showed that there is a low risk of peat instability at the Ballivor Wind Farm site.

The following mitigation measures are recommended and should be taken into account when preparing Construction Method Statements for the development:

- Appointment of experienced and competent contractors;
- The site should be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Set up, maintain and report readings from peat stability monitoring systems;
- Ensure construction method statements are followed;
- Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction;
- Maintain hydrology of area as far as possible by maintaining existing drains to
- water pressures in the peat to avoid peat becoming buoyant;
- Use of experienced geotechnical staff for site investigations ;
- Use of experienced contractors and trained operators to carry out the work;
- Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties;
- Potential requirement for small buttress on upslope side of access road to retain peat should any instability be noted.

3.2.9 Dust Control

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, peat, etc. and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- The public roads outside the wind farm site boundary including the two access locations off the R156 will be regularly inspected by the ECoW for cleanliness, and cleaned as necessary;
- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind;
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary;
- All construction related traffic will have speed restrictions on un-surfaced roads to 20 kph;
- Daily inspection by the ECoW of construction sites to examine dust measures and their effectiveness.
- When necessary, sections of the haul route immediately outside the site entrances will be swept using a truck mounted vacuum sweeper; and,
- All vehicles leaving the construction areas of the site will pass through a wheel washing area prior to entering the local road network.

3.2.10 Noise Control

The operation of plant and machinery, including construction vehicles, is a source of potential impact that will require mitigation at all locations within the site. Proposed measures to control noise include:

- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern.
- Ensure that any extraordinary site work continuing throughout 24 hours of a day occurring outside of the core working hours (for example, crane operations lifting components onto the tower) will be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid anticipated periods of high traffic flows.
- Select inherently quiet plant where appropriate - all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use.
- All ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers.
- Instruct that machines will be shut down between work periods (or when not in use) or throttled down to a minimum.
- Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation.

- Diesel generators will be enclosed in sound proofed containers to minimise the potential for noise impacts;
- Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All construction plant and equipment to be used on-site will be modern equipment and will comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations;
- Regular maintenance of plant will be carried out in order to minimise noise emissions. Particular attention will be paid to the lubrication of bearings and the integrity of silencers;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works;
- Compressors will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machines, which are used intermittently, will be shut down during those periods when they are not in use;
- Training will be provided by the ECoW to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.

3.3 Invasive Species Management

A baseline invasive species survey will be carried out at the site to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) by a suitably qualified ecologist. If the presence of such species is found at or adjacent to the site, particularly in areas where its excavation may be required, an invasive species management plan will be prepared for the site to prevent the introduction or spread of any invasive species within the footprint of the works. An invasive species management plan, if required, will set out best practice control methods as summarised in the following sections.

3.3.1 Site Management

Careful preparation of the site and planning of the works is crucial to successful treatment of invasive species. The following list of guidelines, which is not exhaustive, shall be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas. Should any risk of contaminated material escaping be observed by the site supervisor, the management plan for the site must be amended by an appropriately qualified person to mitigate against the risk.

3.3.2 Establishing Good Site Hygiene

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected.
- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.
- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.

- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.
- An ECoW/suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

Plant and equipment which is operated within an area for the management of materials in contaminated areas should be decontaminated prior to relocating to a different works area. The decontamination procedures should take account of the following:

- Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it.
- Decontamination will only occur within designated wash-down areas.
- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches.
- All run-off will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.

3.4 Waste Management

This section of the CEMP provides a waste management plan (WMP) which outlines the best practice procedures during the excavation and construction phases of the project. The WMP will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the Proposed Development. Disposal of waste will be seen as a last resort.

3.4.1 Legislation

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Department of the Environment provides a document entitled, 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects' (2006). It is important to emphasise that no demolition will take place at this site, however, this document was referred to throughout the process of completing this WMP.

3.4.2 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing in the following order:

Prevention and Minimisation:

The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste:

Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste:

There are a number of established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

3.4.3 Construction Phase Waste Management

3.4.3.1 Description of the Works

The construction of the development will involve the construction of 26 no. turbines, new and upgraded site access roads, internal cabling and grid connection, substation and control buildings and all associated infrastructure.

The turbines will be manufactured off site and delivered to site where on site erection will occur.

The turbine foundations will consist of stone from the local quarries and a concrete base which will contain reinforcing steel. These concrete foundations will be shuttered with steel formwork specifically designed for the works and re-usable off site on similar projects.

The construction of the substation will comprise of a concrete foundation with concrete masonry blocks and a timber roof structure with roof tile or slate covering. The roof structure will be made up of prefabricated roof trusses manufactured off site to minimise timber cutting on site.

The site roads will be constructed with rock won from local quarries

The waste types arising from the construction phase of the development are outlined in Table 3.1 below.

Table 3-1 Expected waste types arising during the Construction Phase

Material Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Cardboard	Boxes, cartons	15 01 01
Composite packaging	Containers	15 01 05
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert materials	Sand, stones, plaster, rock, blocks	17 01 07
Mixed municipal waste	Daily canteen waste from construction workers, miscellaneous	20 03 01
Plastic	PVC frames, electrical fittings	17 02 03
Plastic packaging	Packaging with new materials	15 01 02

Material Type	Example	EWC Code
Tiles and ceramics	Slates and tiles	17 01 03
Wooden packaging	Boxes, pallets	15 01 03

Hazardous wastes that may occur on site during the construction phase of the development may include oil, diesel fuel, chemicals, paints, preservatives etc. All hazardous wastes will be stored in bunded containers/areas before being collected by an authorised waste contractor and brought to an EPA licensed waste facility. As mentioned above, hazardous wastes will be kept separate from non-hazardous wastes that contamination does not occur.

3.4.3.2 Waste Arisings and Proposals for Minimisation, Reuse and Recycling of Construction Waste

Construction waste will arise on the project mainly from excavation and unavoidable construction waste including material surpluses and damaged materials and packaging waste.

Appropriate measures should be taken to ensure excess waste is not generated during construction, including;

- Ordering of materials should be on an 'as needed' basis to prevent over supply to site. Co-ordination is required with suppliers enabling them to take/buy back surplus stock.
- Purchase of materials pre-cut to length to avoid excess scrap waste generated on site.
- Request that suppliers use least amount of packaging possible on materials delivered to the site.
- Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal
- Ensuring correct sequencing of operations.
- Use reclaimed materials in the construction works.

Hazardous waste will be kept separate from all other construction waste to prevent contamination and removed appropriately.

3.4.3.3 Waste Arising from Construction Activities

All waste generated on site will be contained in waste skips at a waste storage area on site. This waste storage area will be kept tidy with skips clearly labelled to indicate the allowable material to be disposed of therein.

The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation at the wind farm site. Therefore, all waste streams generated on site will be deposited into a single waste skip. This waste material will be transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.

The waste generated from the turbine erection will be limited to the associated protective covers which are generally reusable. Considering the specialist nature of this packaging material the majority will be taken back by suppliers for their own reuse. Any other packaging waste generated from the turbine supply will be deposited into the on-site skips and subsequently transferred to the MRF.

It is not envisaged that there will be any waste material arising from the materials used to construct the site roads as only the quantity of stone necessary will be sourced from local quarries and brought on site on an 'as needed' basis.

Site personnel will be instructed at induction that under no circumstances can waste be brought to site for disposal in the on-site waste skip. It will also be made clear that the burning of waste material on site is forbidden.

3.4.4 Waste Arising from Decommissioning

The design life of the wind farm is 30 years after which time a decision will be made to determine whether or not the turbines will be replaced by new turbines or if decommissioning will occur. The lengthy time frame between the completion of the construction phase and decommissioning will result in the only materials remaining on site at that time will be infrastructural material such as the turbine foundations, turbines and the granular material used to construct roads. If the site is decommissioned, cranes will disassemble each turbine tower and all equipment. The associated components will be removed from site for re-use, recycling or waste disposal. Any structural elements that are not suitable for recycling will be disposed of in an appropriate manner. All lubrication fluids will be drained down and put aside for appropriate collection, storage, transport and disposal. Any materials which cannot be re-used or recycled will be disposed of by an appropriately licenced contractor.

The waste types arising from the decommissioning of the development are outlined in Table 3.2 below.

Table 3-2 Expected waste types arising during the Decommissioning Phase

Material Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminium, lead, iron and rebar	17 04 07
Inert materials	Crushed stone, concrete	17 01 07

3.4.4.1 Reuse

Many construction materials can be reused a number of times before they have to be disposed of:

- Concrete can be reused as aggregate for roads cable trench backfilling material.
- Plastic packaging etc. can be used to cover materials on site or reused for the delivery of other materials.
- Excavated peat can be reused for reinstatement of the areas around turbine foundations and adjacent to site roads.

3.4.4.2 Recycling

If a certain type of construction material cannot be reused onsite, then recycling is the most suitable option. The opportunity for recycling on site will be restricted to the associated packaging from the wind turbines.

All waste that is produced during the construction phase including dry recyclables will be deposited in the on-site skip initially and sent for subsequent segregation at a remote facility. The anticipated volume of all waste material to be generated at the development is low which provides the justification for adopting this method of waste management.

3.4.4.3 Implementation

3.4.4.3.1 *Roles and Responsibilities for Waste Management*

Prior to the commencement of the development a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the development adheres to the management plan.

3.4.4.3.2 Training

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the waste management plan. All employees working on site during the construction phase of the project will be trained in materials management and thereby, should be able to:

- Distinguish reusable materials from those suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on the best locations for stockpiling reusable materials;
- Separate materials for recovery; and
- Identify and liaise with waste contractors and waste facility operators.

3.4.4.3.3 Record Keeping

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and EWC Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material
- Signature of Confirmation of Dispatch detail
- Date and Time of Waste Arrival at Destination
- Site Address of Destination Facility

3.4.4.4 Waste Management Plan Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy should always be employed when designing the plan to ensure that the least possible amount of waste is produced during the construction phase. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

This preliminary WMP has been prepared to outline the main objectives that are to be adhered to for the preparation of a more detailed WMP to be completed after the planning phase of the Proposed Development.

4. SURFACE WATER QUALITY MONITORING

This section of the SWMP sets out the programme for water quality monitoring during the pre-construction, construction, commissioning and operational phases of the wind farm development.

The surface water quality monitoring programme combines the use of laboratory analysis, water quality monitoring instrumentation and visual inspection to develop a comprehensive schedule of monitoring of all watercourses that exist both at the site and the surrounding area. The information collected by this schedule of water monitoring, particularly the continuous turbidity monitoring will inform the pre-commencement triggers in the SOWOR before works commence in an area. The turbidity monitors both upstream and downstream of the site will provide instant data on the quality of water in which they are deployed and will be equipped with an alarm system to alert site management if a peak in turbidity occurs as set out in the SOWOR.

The water monitoring programme was prepared in accordance with the following legislation:

- Planning and Development Acts 2000-2017;
- Planning and Development Regulations, 2001 (as amended);
- S.I. No. 94 of 1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293 of 1988: Quality of Salmon Water Regulations, resulting from EU Directive 78/659/EEC on the Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive (2000/60/EC) and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC). Since 2000 water management in the EU has been directed by the Water Framework Directive (WFD). The key objectives of the WFD are that all water bodies in member states achieve (or retain) at least 'good' status by 2015. Water bodies comprise both surface and groundwater bodies, and the achievement of 'Good' status for these depends also on the achievement of 'good' status by dependent ecosystems. Phases of characterisation, risk assessment, monitoring and the design of programmes of measures to achieve the objectives of the WFD have either been completed or are ongoing. In 2015 it replaced a number of existing water related directives, which were successively being repealed, while implementation of other Directives (such as the Habitats Directive 92/43/EEC) form part of the achievement of implementation of the objectives of the WFD;
- S.I. No. 41 of 1999: Protection of Groundwater Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 249 of 1989: Quality of Surface Water Intended for Abstraction (Drinking Water), resulting from EU Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (repealed by 2000/60/EC in 2007);
- S.I. No. 439 of 2000: Quality of Water intended for Human Consumption Regulations and S.I. No. 278 of 2007 European Communities (Drinking Water No. 2) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009;
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010; and,

- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.

This water monitoring programme will be the subject of independent review by the supervising hydrologist who will provide the necessary guidance on the monitoring requirements. The water monitoring programme is outlined in the following sections.

4.1.1 Pre-Construction Baseline Monitoring

Water quality field testing and laboratory analysis will be undertaken prior to commencement of construction at the site. The monitoring programme will be subject to agreement with the local authorises but will be based on the planning stage programme already outlined in the EIAR and CEMP and presented in this document.

Analysis will be for a range of parameters with relevant regulatory limits along with Environmental Quality Standard's (EQSs) and sampling will be undertaken for each stream that drains from the construction site.

Baseline sampling will be completed on at least two occasions, and these will coincide with low flow and high flow stream conditions. The high flow sampling event will be undertaken after a period of sustained rainfall, and the low flow event will be undertaken after a dry spell.

The existing drainage system will continue to function as it is during the pre-construction phase.

However, prior to commencement of works in sub-catchments across the site, main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. These inspections will be done on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.

4.1.2 Construction Phase Monitoring

4.1.2.1 Daily Visual Inspections

Daily visual inspections of the installed drains and outfalls will be performed during the construction period to ensure suspended solids are not entering streams and rivers on site, to identify any obstructions to channels and to allow appropriate maintenance of the drainage regime. Should the suspended solids levels measured during construction be higher than the baseline levels, the source will be identified, and additional mitigation measures implemented.

Inspection sheets and photographic records will be kept on site. Inspection points will include the in-situ field monitoring point locations, the laboratory analysis sampling points and continuous monitoring locations. Inspection points will depend on works being completed within the catchment upstream of the identified monitoring locations. Visual inspections will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period and data including photographs will be collected by visual inspections and independently assessed by the supervising hydrologist who will monitor and advise on the records being received.

Daily Visual Inspections are subject to change upon commencement of construction activity and works in progress within the catchment areas.

The following periodic inspection regime will be implemented:

- Daily general visual inspections of site operations and inspections of all watercourses within the site and in the surrounding area by the ECoW or a suitably qualified and competent person as delegated by the ECoW;

- Inspections to include all elements of drainage infrastructure to ensure the system is operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter shall be noted and corrective action shall be implemented. High risk locations such as settlement ponds will be inspected daily. Daily inspections checks will be completed on plant and equipment, and whether materials such as straw bales or oil absorbent materials need replacement;
- Event based inspections by the Environmental Clerk of Works as follows:
  - >10 mm/hr (i.e. high intensity localised rainfall event);
  - >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
  - Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week).
- Monthly site inspections by the Project Hydrologist/ Environmental Clerk of Works of the drainage measures during construction phase;
- Quarterly site inspections by the Project Hydrologist/ Environmental Clerk of Works of the drainage measures after construction for a period of one year following the construction phase; and,
- A written record will be maintained or available on-site within this Construction Environmental Management Plan (CEMP) which will be maintained on-site during the construction phase.

4.1.2.2 Continuous Monitoring

Continuous, in-situ, monitoring equipment will be installed where required at locations surrounding the wind farm site. The monitoring equipment will provide continuous readings for turbidity levels, flow rate and water depth in the watercourse. This equipment will be supplemented by daily visual monitoring.

4.1.2.3 Monthly Laboratory Analysis

Baseline laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken as per water monitoring programme for the overall windfarm development and each primary watercourse along the route. This will not be restricted to just these locations around the immediate wind farm site with further sampling points added as deemed necessary by the ECoW, in consultation with the Project Hydrologist and Site Manager, as the construction phase progresses.

4.1.2.4 Field Monitoring

Field chemistry measurements of unstable parameters, (pH, conductivity, temperature) will be taken at the surface water monitoring locations, as per water monitoring programme for the overall wind farm development and each primary watercourse along the route and also at all installed sonde locations. These analyses will be carried out by either the ECoW or the Project Hydrologist. In-situ field monitoring will be completed on a weekly basis. In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The Project Hydrologist will monitor and advise on the readings collected by in-situ field monitoring.

4.1.2.5 Monitoring Parameters

The analytical determinants of the monitoring programme (including limits of detection and frequency of analysis) will be as per S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations and European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. The likely suite of determinants will include:

- pH (field measured)
- Electrical Conductivity (field measured)
- Temperature (field measured)

- Dissolved Oxygen (field measured)
- Total Phosphorus
- Chloride
- Nitrate
- Nitrite
- Total Nitrogen
- Ortho-Phosphate
- Ammonia N
- Biochemical Oxygen Demand
- Total Suspended Solids

4.1.3 Surface Water Monitoring Reporting

Visual inspection and monthly laboratory analysis results of water quality monitoring shall assist in determining requirements for any necessary improvements in drainage controls and pollution prevention measures implemented on site.

It will be the responsibility of the Environmental Clerk of Works to present the ongoing results of water quality and weather monitoring at or in advance of regular site meetings.

Reports on water quality will consider all field monitoring and visual inspections, and results of laboratory analysis completed for that period. Reports will describe how the results compare with baseline data as well as previous reports on water quality. The reports will also describe whether any deterioration or improvement in water quality has been observed, whether any effects are attributable to construction activities and what remedial measures or corrective actions have been implemented. Any proposed alteration to sampling frequency will be agreed with local authorities in advance.

4.1.4 Post Construction Monitoring

4.1.4.1 Monthly Laboratory Analysis Sampling

Monthly sampling for laboratory analysis for the range of parameters adopted during pre-commencement and construction phases will continue after construction is complete. The project hydrologist will monitor and advise on the readings received from the testing laboratory and monitoring will only cease once the hydrologist is satisfied that the chemical and biological monitoring results show that there is no adverse impact on the quality of surface water within the natural watercourses draining the site.

5. ENVIRONMENTAL MANAGEMENT IMPLEMENTATION

5.1 Roles and Responsibilities

The Site Supervisor/Construction Manager and/or Environmental Clerk of Works are the project focal point relating to construction-related environmental issues.

In general, the Environmental Clerk of Works will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The Environmental Clerk of Works will act as the regulatory interface on environmental matters by reporting to and liaising with Meath and Westmeath County Councils and other statutory bodies as required.

The Environmental Clerk of Works will report directly to the Site Supervisor/Construction Manager. An Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Archaeologist and Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure provides a "triple lock" review/interaction by external specialists. An organogram structure for the construction stage is as follows:

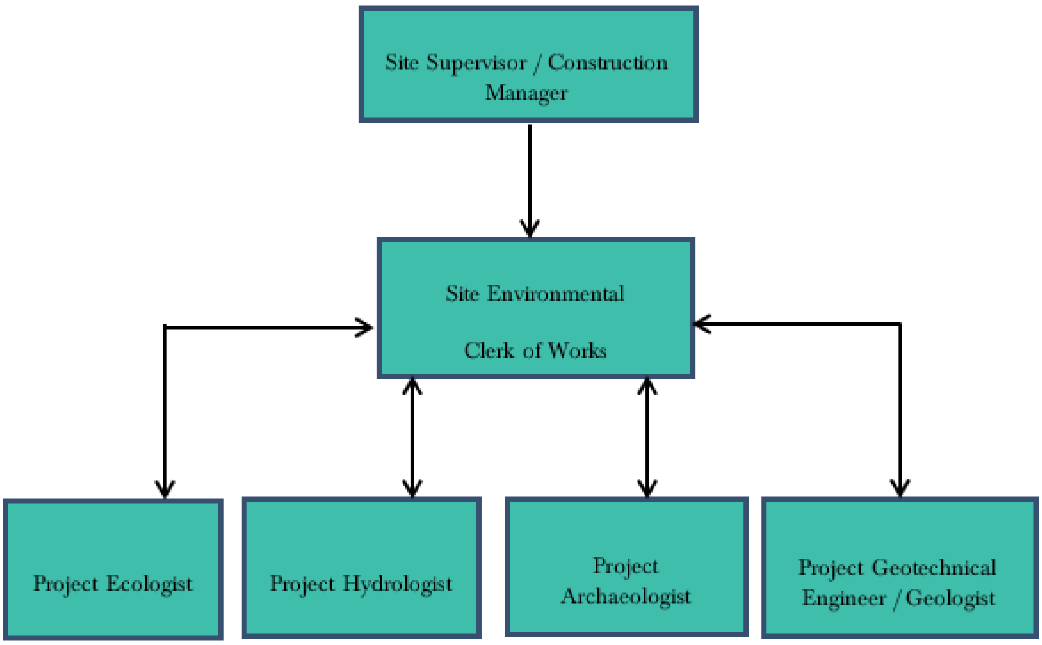

Figure 5-1 Site Management Chain of Command

Any requirement of the granted permission, for the works to be supervised by an engineer with professional indemnity insurance, who upon completion of the works, including site stability, shall certify the said works, will be adhered to. Such an engineer will be appointed to oversee and supervise the construction phase of the project.

5.1.1 Wind Farm Construction Manager/Site Supervisor

The Site Supervisor/Construction Manager will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The duties and responsibilities of the Site Supervisor/Construction Manager will include:

- Ensure that all works are completed safely and with minimal environmental risk;
- Approve and implement the Project CEMP and supporting environmental documentation, and ensure that all environmental standards are achieved during the construction phase of the project;
- Take advice from the Environmental Clerk of Works on legislation, codes of practice, guidance notes and good environmental working practice relevant to their work;
- Ensure compliance through audits and management site visits;
- Ensure timely notification of environmental incidents; and,
- Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

5.1.2 Environmental Clerk of Works

The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in wind farm construction to fulfil the role of Environmental Clerk of Works, and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.

The Environmental Clerk of Works will report to the Site Supervisor/Construction Manager. The responsibilities and duties of the Environmental Clerk of Works will include the following:

- Preparation and update of the CEMP as required, and supporting environmental documentation and review/approval of contractor method statements;
- Undertake inspections and reviews to ensure the works are carried out in compliance with the CEMP;
- Monitor the implementation of the CEMP, particularly all proposed/required Environmental Monitoring;
- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period;
- Advise site management/contractor/sub-contractors on:
    - Prevention of environmental pollution and improvement to existing working methods;
    - Changes in legislation and legal requirements affecting the environment;
    - Suitability and use of plant, equipment and materials to prevent pollution;
    - Environmentally sound methods of working and systems to identify environmental hazards;
- Ensure the specified mitigation measures are initiated and adhered to during the construction phase;
- Liaise with Project Ecologist, Project Hydrologist and Project Geotechnical Engineer to ensure regular site visits and audits/inspections are completed;
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents;
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by e-mail;
- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties; and,

- Identify environmental training requirements and arrange relevant training for all levels of site based staff/workers.

The level, detail and frequency of reporting expected from the Environmental Clerk of Works for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.

5.1.3 Project Ecologist

The Project Ecologist will report to the Environmental Clerk of Works and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the wind farm. The Project Ecologist will not be full time on site but will visit the site at least once a month during construction.

The responsibilities and duties of the Project Ecologist will include the following:

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with Environmental Clerk of Works, oversee and provide advice on all relevant ecology mitigation measures set out in the EIAR and planning permission conditions;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Carry out ecological monitoring and survey work as may be required by the planning authority.

5.1.4 Project Hydrologist

The Project Hydrologist will report to the Environmental Clerk of Works and is responsible for inspection and review of drainage and water quality aspects associated with construction of the wind farm. The Project Hydrologist will not be full time on site but will visit the site at least once a month during construction and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Project Hydrologist will include the following:

- Assist in compiling a detailed drainage design before construction commences and attend the site to set out and assist with micro siting of drainage controls. This will be completed over several site visits at the start of the construction phase;
- Review and input to the final construction phase CEMP in respect of drainage and water quality management;
- Following the initial stage of drainage construction regular site visits will be required, at least once a month, to complete hydrological and water quality audits and reviews and report any issues noted to the Site Supervisor/Construction Manager; and,
- Complete ongoing inspection and monitoring of the development, particularly in areas of drainage control, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, and in relevant planning conditions.

5.1.5 Project Geotechnical Engineer / Geologist

The Geotechnical Engineer or Project Geologist will report to the Environmental Clerk of Works and is responsible for monitoring of all soil excavation works associated with construction of the wind farm. The

Geotechnical Engineer will not be full time on site but will visit site at least once a month during the construction phase and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Geotechnical Engineer or Geologist will include the following:

- Visit site regularly, or at least once a month during the construction phase, to complete geotechnical audits and reviews and report any issues to the Site Supervisor/Construction Manager;
- Ensuring that identified hazards are listed in the Construction Risk Register and that these are subject to ongoing monitoring; and,
- Ongoing inspection and monitoring of the development, particularly in areas of peatland and the peat repository areas, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, and in relevant planning conditions.

5.1.6 Project Archaeologist

The Project Archaeologist report to the Environmental Clerk of Works and is responsible monitoring of all soil excavation groundworks associated with construction of the wind farm.

The responsibilities and duties of the Archaeologist will include the following:

- Archaeological monitoring (under licence from the National Monuments Service) of any further geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. This will include all excavation works within the EIAR site boundary as well as any topsoil removal along the haul route. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance).
- Once the project is completed, a report on the results of the monitoring will be compiled and submitted to the relevant authorities. The National Monuments Service will be informed of such findings to discuss how best to proceed.

5.2 Environmental Awareness and Training

5.2.1 Environmental Induction

The Environmental Induction will be integrated into the general site induction on a case-by-case basis for each member of staff employed on-site depending on their assigned roles and responsibilities on site. Where necessary, the Environmental Induction will as a minimum include:

- A copy of the Environmental Management Site Plans and discussion of the key environmental risks and constraints;
- An outline of the CEMP structure;
- A discussion of the applicable Works Method Statement;
- The roles and responsibilities of staff, including contractors, in relation to environmental management; and,
- An outline of the Environmental Incident Management Procedure.

5.2.2 Toolbox Talks

Toolbox talks would be held by the ECoW or Site Supervisor/Construction Manager at the commencement of each day, or at the commencement of new activities. The aims of the toolbox talks are to identify the specific work activities that are scheduled for that day or phase of work. In addition, the necessary work method statements and sub plans would be identified and discussed prior to the commencement of the day's activities.

Site meetings would be held on a regular basis involving all site personnel. The objectives of site meetings are to discuss the coming week's activities and identify the relevant work method statements and sub plans that will be relevant to that week's activities. Additionally, any non-compliance identified during the previous week would also be discussed with the aim to reduce the potential of the same non-compliance reoccurring.

6. EMERGENCY RESPONSE PLAN

6.1 Overview

The Emergency Response Plan (ERP) is presented in this section of the CEMP. It provides details of procedures to be adopted in the event of an emergency. The site ERP includes details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP will require updating and submissions from the contractor/PSCS and suppliers as the project progresses. Where sub-contractors that are contracted on site are governed by their own emergency response procedure a bridging arrangement will be adopted to allow for inclusion of the sub-contractor's ERP within this within this document.

This is a working document that requires updating throughout the various stages of the project.

6.1.1 Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Site Supervisor/Construction Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 5-1. In a situation where the Site Supervisor/ Construction Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command outlined in Figure 5-1. This will be updated throughout the various stages of the project.

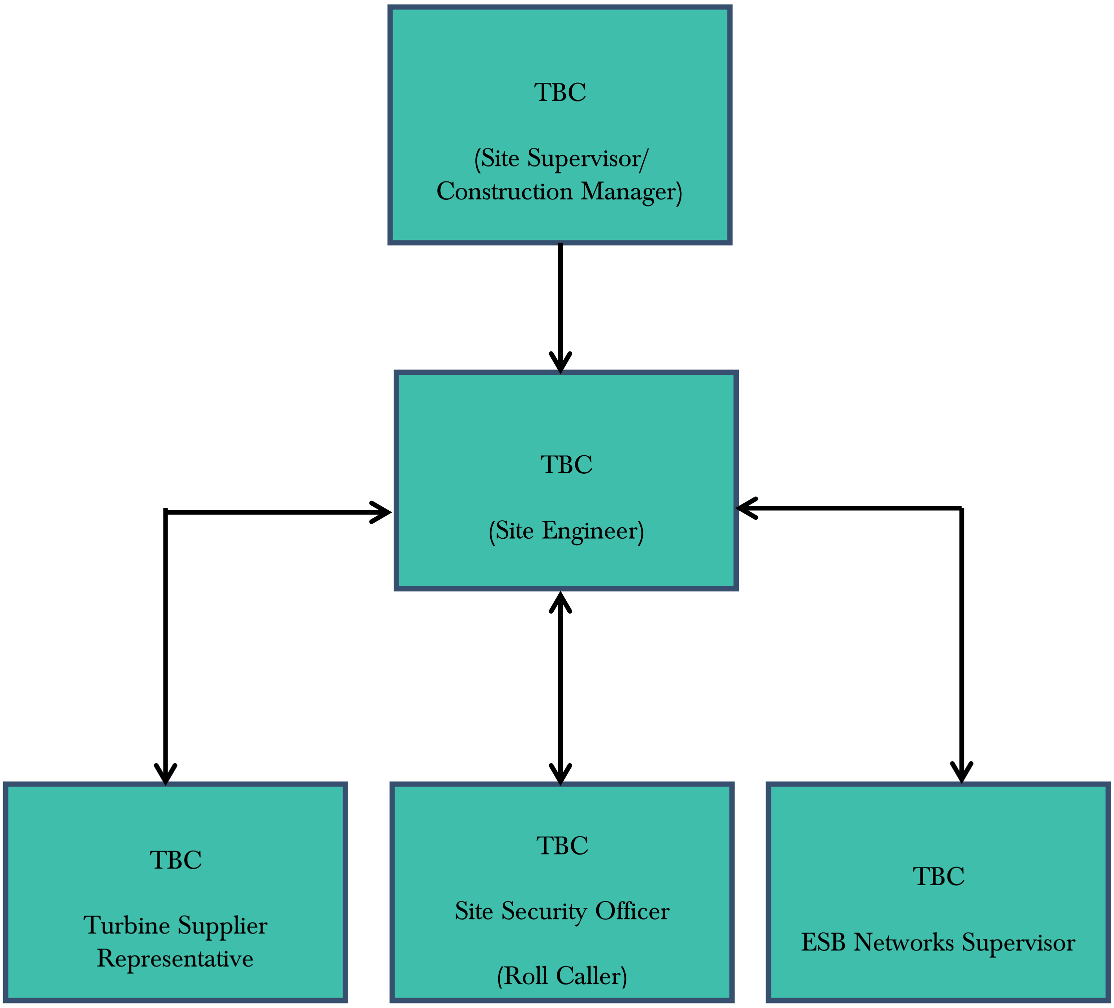

Figure 6-1 Emergency Response Procedure Chain of Command

6.1.2 Hazard Identification

In order to establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 6-1 Hazards associated with potential emergency situations.

Hazard	Emergency Situation
Construction Vehicles: Dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services
Fire	Injury to operative through exposure to fire

Hazard	Emergency Situation
Falls from heights including falls from scaffold towers, scissor lifts, ladders, roofs and turbines	Injury to operative after a fall from a height
Sickness	Illness unrelated to site activities of an operative e.g., heart attack, loss of consciousness, seizure
Turbine Specific Incident	This will be included when the upon agreement and section of the final turbine type

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in Table 5-1 the Site Supervisor/Construction Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/fog horn that activates an emergency evacuation on the site. The Site Supervisor/Construction Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare and if there are no injured personnel at the scene that require assistance. The Site Supervisor/Construction Manager will be required to use their own discretion at that point. In the case of fire, the emergency evacuation of the site should proceed, without exception. The site evacuation procedure is outlined in Section 5.1.3.
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g., if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone. If delegating the task, ensure that the procedures for contacting the emergency services as set out in Section 5.3 is followed.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g., cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g., ESB Networks the numbers for which as provided in Section 5.4.
- Contact the next of kin of any injured personnel where appropriate.

6.1.3 Site Evacuation/Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or fog horn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Supervisor/Construction Manager when all personnel have been accounted for. The Site Supervisor/Construction Manager will decide the next course of action, which be determined by the situation that exists at that time, and will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills.

6.2 Environmental Emergency Response Procedure

6.2.1 Excessive Peat Movement

Where there is excessive peat movement or continuing peat movement recorded at a monitoring location, or identified at any location within the site, but no apparent signs of distress to the peat (e.g., cracking, surface rippling) then the following shall be carried out.

1. *All construction activities shall cease within the affected area.*
2. *Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.*
3. *Re-commencement of limited construction activity shall only start following a cessation of movement and the completion of a geotechnical risk assessment by a geotechnical engineer.*

6.2.2 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g., cracking, surface rippling) then the following shall be carried out.

4. *On alert of a peat slide incident, all construction activities will cease, and all available resources will be diverted to assist in the required mitigation procedures.*
5. *Where considered possible, action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.*
6. *For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.*

6.2.3 Spill Control Measures

Every effort will be made to prevent an environmental incident during the construction and operational phase of the project. However, in the event of an oil / fuel spill occurring the following steps will be followed:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident.
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the Environmental Clerk of Works immediately giving information on the location, type and extent of the spill so that they can take appropriate action.

- The Environmental Clerk of Works will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The Environmental Clerk of Works will notify the appropriate regulatory body such as Meath and Westmeath County Councils, and the Environmental Protection Agency (EPA), if deemed necessary.

The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The Environmental Clerk of Works must be immediately notified.
- If necessary, the Environmental Clerk of Works will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on an ecologically sensitive receptor, such as a sensitive habitat, protected species or designated conservation site (pSPA or cSAC), the Environmental Clerk of Works will liaise with the Project Ecologist.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the Environmental Clerk of Works will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the Environmental Clerk of Works and the Main Contractor. These records will be made available to the relevant authorities such as Meath and Westmeath County Councils, and the EPA if required.

The Environmental Clerk of Works will be responsible for any corrective actions required as a result of the incident e.g., an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate.

6.3 Contact the Emergency Services

6.3.1 Emergency Communications Procedure

In the event of requiring the assistance of the emergency services the following steps should be taken:

Stay calm. It's important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.

Know the location of the emergency and the number you are calling from. This may be asked and answered a couple of times but don't get frustrated. Even though many emergency call centres have enhanced capabilities meaning they are able to see your location on the computer screen they are still required to confirm the information. If for some reason you are disconnected, at least emergency crews will know where to go and how to call you back.

Wait for the call-taker to ask questions, then answer clearly and calmly. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.

If you reach a recording, listen to what it says. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When the next call-taker or dispatcher is available to take the call, it will transfer you.

Let the call-taker guide the conversation. He or she is typing the information into a computer and may seem to be taking forever. There's a good chance, however, that emergency services are already being sent while you are still on the line.

Follow all directions. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly, and ask for clarification if you don't understand.

Keep your eyes open. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.

Do not hang up the call until directed to do so by the call taker.

Due to the remoteness of the site, it may be necessary to liaise with the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.

6.4 Contact Details

A list of emergency contacts is presented in Table 5-2. A copy of these contacts will be included in the Site Safety Manual and in the site offices and the various site welfare facilities.

Table 5.6-2 Emergency Contacts

Contact	Telephone no.
Emergency Services – Ambulance, Fire, Gardaí	999/112
Doctor – Longwood Health Centre	046 9555006
Hospital – Midlands Regional Hospital Mullingar	044 9340221
ESB Emergency Services	1850 372 999
Gas Networks Ireland Emergency	1850 20 50 50
Gardaí – Ballivor Garda Station	046 9546002
Health and Safety Co-ordinator - Health & Safety Services	TBC
Health and Safety Authority	1890 289 389
Inland Fisheries Ireland (IFI)	1890 347 424
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDS): MKO	091 735611
Client: Bord na Móna Powergen Ltd.	045 439000

6.4.1 Procedure for Personnel Tracking

All operatives on site without any exception will have to undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.

In the event of a site operative becoming in an emergency situation where serious injury has occurred and hospitalisation has taken place, it will be the responsibility of the Site Manager or next in command if unavailable to contact the next of kin to inform them of the situation that exists.

6.5 Induction Checklist

Table 5-3 provides a list of items highlighted in this ERP which must be included or obtained during the mandatory site induction of all personnel that will work on the site. This will be updated throughout the various stages of the project.

Table 5-6-3 Emergency Response Plan Items Applicable to the Site Induction Process

ERP Items to be included in Site Induction	Status
All personnel will be made aware of the evacuation procedure during site induction	
Due to the remoteness of the site, it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.	
All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

7. MITIGATION PROPOSALS

All mitigation measures relating to the pre-commencement, construction and operational phases of the Proposed Development were set out in the various sections of the Environmental Impact Assessment Report (EIAR) prepared as part of the planning permission application to An Bord Pleanála.

This section of the CEMP groups together all of the mitigation measures presented in the EIAR. The Mitigation Measures are presented in the following pages.

By presenting the mitigation proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits.

Table 7-1 Mitigation Measures for pre commencement, construction, operation and decommissioning phases of the proposed Ballivor Wind Farm

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
EIAR Chapter 4 – Description of the Proposed Development					
Pre-Commencement Phase					
MM1	Environmental Management	EIAR Chapter 4	All proposed activities on the site of the Proposed Development will be provided for in a Construction and Environmental Management Plan (CEMP), prepared prior to the commencement of any operations onsite. The CEMP will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in the EIAR and will set out the monitoring and inspections procedures and frequencies.		
		EIAR Chapter			
MM2	Environmental Management	CEMP Section 3	A Site ECoW will oversee the site works and implementation of the Construction Environmental Management Plan (CEMP) and provide on-site advice on the mitigation measures necessary as necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the ECoW for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by parties where required prior to commencement of construction, and may be further adjusted as required during the course of the project.		
MM3	Surface Water Quality	CEMP Section 4	Baseline water quality field testing and laboratory analysis will be undertaken where required prior to commencement construction at the site. The baseline monitoring programme will be subject to agreement with Meath and Westmeath County Council. Baseline laboratory analysis of a range of parameters with relevant regulatory limits and Environmental Quality Standards (EQSs) will also be undertaken as per water		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			monitoring programme for the Proposed Development and each primary watercourse along the route.		
MM4	Concrete Deliveries	EIAR Chapter 4 CEMP Section 3	The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures. Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching.		
MM5	Site Drainage Plan	CEMP Section 4	The Project Hydrologist will prepare detailed drainage design before construction commences.		
MM6	Preparative Site Drainage Management	EIAR Chapter 4 CEMP Section 4	The detailed drainage design will specify all materials and equipment necessary to implement the drainage measures effectively, which will be brought on site in advance of any works commencing. An adequate quantity of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the detailed drainage design measures as necessary. The detailed drainage measures will be installed prior to, or at the same time as the works they are intended to drain.		
MM7	Drainage Inspection	CEMP Section 3	Prior to commencement of works in sub-catchments across the site, main drain inspections will be completed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment-by-catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM8	Drainage Maintenance	EIAR Chapter 4 CEMP Section 4	An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. Regular inspections of installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water within the system where it is not intended. The inspection of the drainage system will be the responsibility of the environmental clerk of works or the supervising hydrologist		
MM9	Earthworks	CEMP Section 3	Drainage and associated pollution control measures will be implemented onsite before the main construction works commence. Where possible, drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.		
MM10	Peat Management	EIAR Chapter 4 CEMP Section 4	Prior to commencing floating and excavated road construction movement monitoring posts should be installed in areas where the peat depth is greater than 2.0m in locations recommended by the geotechnical engineer		
Construction Phase					
MM11	Wastewater Management	EIAR Chapter 4	The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. Full details of the proposed tank alarm system can be submitted to the Planning Authority in advance of any works commencing on-site. The wastewater storage tank alarm will be part of a continuous stream of data from the site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007(as amended), will be employed to transport wastewater away from the site.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM12	Environmental Management	EIAR Chapter 4 CEMP Section 3	The Environmental Clerk of Works will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. In addition, an Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office.		
MM13	Environmental Management	CEMP Section 3	A Site ECoW will oversee the site works and implementation of the Construction Environmental Management Plan (CEMP) and provide on-site advice on the mitigation measures necessary as necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the ECoW for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by parties where required prior to commencement of construction, and may be further adjusted as required during the course of the project.		
MM14	Refuelling	EIAR Chapter 4 CEMP Section 3	- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling should occur at a controlled fuelling station; - On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser will be re-filled off site and will be towed by a 4x4 jeep to machinery is located. The 4x4 jeep will also carry fuel spill kits in the event of any spillages. The fuel bowser will be parked on a designated level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations. - Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor; › The electrical substation compound fuel storage area will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor; › The plant used will be regularly inspected for leaks and fitness for purpose; and, › An emergency plan for the construction phase to deal with accidental spillages will be developed Spill kits will be available to deal with any spillage in and outside the refuelling area.		
MM15	Concrete Deliveries and Management	EIAR Chapter 4 CEMP Section 3	The following mitigation measures are proposed to avoid release of cement leachate from the site: › No batching of wet-cement products will occur on site; › Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used; › No washing out of any plant used in concrete transport or concreting operations will be allowed on-site; › Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. › Use weather forecasting to plan dry days for pouring concrete; › Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.		
MM16	Road Cleanliness	EIAR Chapter 4. CEMP Section 3	When necessary, sections of the haul route immediately outside the site entrances will be swept using a truck mounted vacuum sweeper.		
MM17	Water Discharge	EIAR Chapter 4	All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development		
MM18	Wastewater Management	EIAR Chapter 4. CEMP Section 3	Temporary toilets will be used during the construction phase as part of the welfare facilities for site staff and visitors. Wastewater from toilets will be directed to a sealed storage tank, with all wastewater tankered off site by an appropriately consented waste collector to wastewater treatment plants.		
MM19	Collector Drains	EIAR Chapter 4.	Swales will be used to intercept and collect run off from construction areas of the site during the construction phase, and channel it to settlement ponds for sediment attenuation as per the drainage design.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		EIAR Chapter 9			
MM20	Interceptor Drains	CEMP Section 3 EIAR Chapter 9	Interceptor drains will be installed up-gradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site. It will then be directed to areas where it can be re-distributed over the ground as sheet flow as per the drainage design.		
MM21	Check Dams	EIAR Chapter 4. EIAR Chapter 9	Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the site, downstream of where drainage swales connect in. Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be installed at regular intervals along interceptor drains to restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam as per the drainage design.		
MM22	Level Spreaders,	CEMP Section 3 EIAR Chapter	A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.		
MM23	Stilling Ponds	EIAR Chapter 4. EIAR Chapter 9	Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from but will be		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds will be ongoing through the construction period.		
MM24	Dewatering Silt Bag	CEMP Section 3 EIAR Chapter 9	Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.		
MM25	Siltbuster	EIAR Chapter 4. EIAR Chapter 9	Siltbuster type concrete was unit. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids will be removed off-site by an appropriately authorised waste collector for disposal at an authorised waste facility.		
MM26	Culvert Upgrades	EIAR Chapter 4. EIAR Chapter 9	- All proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing location;		
MM27	Silt Fences	CEMP Section 3 EIAR Chapter 9	- Silt fences will be placed within drains down-gradient of all construction areas. - They will remain in place throughout the entire construction phase. - Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. - The silt fence designs follow the technical guidance document 'Control of Water Pollution from Linear Construction Projects' published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- All silt fencing will be formed using Terrastop Premium or equivalent silt fence product. - Silt fences will be inspected regularly to ensure water is continuing to flow through the fabric, and the fence is not coming under strain from water backing up behind it		
MM28	Peat Management	EIAR Chapter 4 CEMP Section 3	- All excavated peat and non-peat will be placed/spread alongside the proposed infrastructure elements on site, where possible. - The peat and spoil placed adjacent to the proposed infrastructure elements should be restricted to a maximum height of 1m over a 10m wide corridor on both sides of the proposed infrastructure elements. It should be noted that the designer should define/confirm the maximum restricted height for the placed peat and spoil within the indicated parameters. - The placement of excavated peat and spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the placement areas may require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works. - Where there is any doubt as to the stability of the peat surface then no excavated spoil shall be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface. - Where practical, it should be ensured that the surface of the placed peat and spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the peat and spoil should be carried out as placement of peat and spoil within the placement area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat and spoil. - Finished/shaped side slopes in the placed peat and spoil shall be not greater than 1 (v): 2 (h) or 3 (h). This slope inclination will be		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			reviewed during construction, as appropriate. Where areas of weaker peat and spoil are encountered then slacker slopes will be required. › All placed spoil will be allowed to revegetate naturally from the extensive seed source of the plants that have already colonised in the area. Alternatively, if significant areas of bare spoil are still evident after a 3 year period and possibly in addition, seeding of the placed spoil could be carried out which would aid in stabilising the placed spoil in the long term. › Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified by the designer on site if required. › An interceptor drain should be installed upslope of the designated spoil placement areas to divert any surface water away from these areas. This will help ensure stability of the placed spoil and reduce the likelihood of debris run-off. All the above-mentioned general guidelines and requirements will be confirmed by the designer prior to construction.		
Operational Phase					
MM29	Wastewater Management	EIAR Chapter 4 EIAR Chapter 14	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM30	Electrical Substation	CEMP Section 3	The electrical substation compound fuel storage area will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;		
MM31	Drainage Inspection	EIAR Chapter 4 4	The frequency of drainage system inspections will be reduced following completion of the construction phase of the project. Inspections will be reduced to monthly, twice monthly and eventually quarterly during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.		
			Decommissioning Phase		
MM32	Decommissioning	EIAR Chapter 4	Prior to the end of the operational period the Decommissioning Plan (Appendix 4-5 of the EIAR) will be updated in line with decommissioning methodologies that may exist at the time and will agree with the competent authority at that time.		
MM33	Decommissioning	DP Section 2	On removal of turbines, turbine and mast foundations would remain underground and would be covered with earth and allowed to revegetate		
MM34	Decommissioning	DP Section 3	The following mitigation measures are proposed to avoid release of hydrocarbons at the site: › Road-going vehicles will be refuelled off site wherever possible; › On-site refuelling will be carried out at designated refuelling areas at various locations throughout the site. Machinery will be refuelled directly by a fuel truck that will come to site as required › Only designated trained and competent operatives will be authorised to refuel plant on site. › Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately;		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- The plant used will be regularly inspected for leaks and fitness for purpose; and, - An emergency plan for the decommissioning phase to deal with accidental spillages will be developed (refer to EIAR Chapter 4). Spill kits will be available to deal with and accidental spillage in and outside the refuelling area. A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the decommissioning phase.		
MM35	Decommissioning	DP Section 3	- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions. - The designated public roads outside the site and along the main transport routes to the site will be regularly inspected by the Site Manager for cleanliness and cleaned as necessary. - Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind. - Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods. - The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary. - All site related traffic will have speed restrictions on un-surfaced roads to 15 kph. - Daily inspection of the site to examine dust measures and their effectiveness. - When necessary, local sections of the public roads being used will be swept using a truck mounted vacuum sweeper.		
MM36	Decommissioning	DP Section 3	- Diesel generators will be enclosed in sound proofed containers to minimise the potential for noise impacts.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			• Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All plant and equipment to be used on-site will be modern equipment and will comply with the S.I. No. 359/1996 - European Communities (Construction Plant and Equipment) (Permissible Noise Levels) (Amendment) Regulations. • Regular maintenance of plant will be carried out in order to minimise noise emissions. Particular attention will be paid to the lubrication of bearings and the integrity of silencers. • All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works. • Compressors will be of the “sound reduced” models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. • Machines, which are used intermittently, will be shut down during those periods when they are not in use. • Training will be provided by the Site Manager to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation; and, • Local areas of the public road networking being used will be condition monitored and maintained, if necessary.		
MM37	Decommissioning	EIAR Chapter 4	Site roadways will be in use as amenity and recreational pathways, and therefore will not be removed during decommissioning. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required.		
Chapter 5: Population and Human Health					
Pre-Construction Phase					

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM38	Traffic and Transport	EIAR Chapter 5	Prior to commencement of any ground works, the occupants of dwellings in the vicinity of the proposed works will be contacted and the scheduling of works will be made known. Local access to properties will also be maintained throughout any construction works and local residents will be supplied with the number of the works supervisor in order to ensure that disruption will be kept to a minimum.		
Construction Phase					
MM39	(Human Health) Health and Safety	EIAR Chapter 5	The Proposed Development will be constructed, operated and decommissioned in accordance with all relevant Health and Safety Legislation, including: - Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005); - Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2016 (S.I. No. 36 of 2016); - S.I. No. 528/2021 - Safety, Health and Welfare at Work (Construction) (Amendment) Regulations 2021 and - Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006). A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared on a preliminary basis at the procurement stage and developed further at construction stage.		
MM40	Human Health (Noise)	EIAR Chapter 5	- No plant used on site will be permitted to cause an on-going public nuisance due to noise. - The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract. - Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. - Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use. - Any plant, such as generators or pumps, which is required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen. - During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Chapter 11 using methods outlined in British Standard BS 5228-1:2014+A1:2019 Code of practice for noise and vibration control on construction and open sites – Noise. - The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs Monday to Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e., concrete pours, large turbine component delivery, rotor/blade lifting) it could occasionally be necessary to work out of these hours.		
Operational Phase					
MM41	(Human Health) Health and Safety	EIAR Chapter 5	Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits. The doors will only be unlocked as required for entry by authorised personnel and will be locked again following their exit.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			Signs will be erected at suitable locations such as, amenity access points and carparks, setting out the conditions of public access under the relevant legislation and providing normal hours (and out of hours) contact details. Staff associated with the project will conduct frequent visits, which will include inspections to establish whether any signs have been defaced, removed, faded, or are becoming hidden by vegetation or foliage, with prompt action taken as necessary. Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include: › Buried cable route markers at 50m (maximum) intervals and change of cable route direction; › Directions to relevant turbines at junctions; › "No access to Unauthorised Personnel" at appropriate locations; › Speed limits signs at site entrance and junctions; › "Warning these Premises are alarmed" at appropriate locations; › "Danger HV" at appropriate locations; › "Warning – Keep clear of structures during electrical storms, high winds or ice conditions" at site entrance; › "No unauthorised vehicles beyond this point" at specific site entrances; and › Other operational signage required as per site-specific hazards. An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site. Access for emergency services will be available at all times.		
MM42	Shadow Flicker	EIAR Chapter 5	Where daily shadow flicker exceedances have been predicted at buildings by the modelling software, a site visit will be undertaken firstly to determine the level of occurrence, existing screening and window orientation. **Screening Measures**		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			In the event of an occurrence of shadow flicker exceeding guideline threshold values of 30 minutes per day at a residential receptor, mitigation options will be discussed with the affected homeowner, including: › Installation of appropriate window blinds in the affected rooms of the residence; › Planting of screening vegetation; › Other site-specific measures which might be agreeable to the affected party and may lead to the desired mitigation. If agreement can be reached with the homeowner, then it would be arranged for the required mitigation to be implemented in cooperation with the affected party as soon as practically possible and for the full costs to be borne by the wind farm operator. **Wind Turbine Control Measures** If it is not possible to mitigate any identified shadow flicker limit exceedance locally using the measures detailed above, wind turbine control measures will be implemented. The wind farm's SCADA control system can be programmed to shut down any particular turbine at any particular time on any given day to ensure that shadow flickers occurrences at properties which are not naturally screened or cannot be screened with measures outlined above		
Chapter 6: Biodiversity					
Pre-Construction Phase					

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM43	Invasive Species Management	EIAR Chapter 6 CEMP Section 3	A baseline invasive species survey will be carried out at the site to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) by a suitably qualified ecologist. If the presence of such species is found at or adjacent to the site, particularly in areas where its excavation may be required, an invasive species management plan will be prepared for the site to prevent the introduction or spread of any invasive species within the footprint of the works.		
MM44	Fauna	EIAR Chapter 6	- A pre-construction badger survey will be undertaken at the location of the identified setts at Carranstown Bog by a qualified ecologist prior to the commencement of any works to determine if the setts are in use and to identify any additional sett entrances that may have been excavated in the intervening period. - The outlier sett within the footprint of the proposed substation will be monitored for 2 weeks prior to construction using a camera trap to determine if it is in use. - If the outlier sett in the construction footprint is found to be in use exclusion measures will be put in place prior to construction in line with NRA Guidelines to ensure that the sett is evacuated. - As per NRA guidelines exclusion from an active sett will only be carried out during the period of July to November inclusive in order to avoid the badger breeding season. - During the breeding season (December to June inclusive) no works will be undertaken within 50m of active setts or pile driving within 150m of active setts. - Exclusion zone fencing and appropriate signage will be put in place around the main sett to the south of the substation which lies outside the construction footprint. This will ensure that there will be no vehicles tracking in the area and no temporary storage of construction materials that could impact the sett.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM45	Bats	EIAR Chapter 6 Appendix 6-2	In accordance with NatureScot (2021) and the Northern Ireland Environment Agency (NIEA) Guidance (2021), a minimum 50m buffer to all habitat features used by bats should be applied to the siting of all wind turbines. This 50m buffer will be implemented from the outset and monitored as per the post construction monitoring		
Construction Phase					
MM46	Flora & Fauna	EIAR Chapter 6 Appendix 6-2	<u>Noise Restriction</u> › During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (S.I. No. 632 of 2001). <u>Lighting Restriction</u> Exterior lighting, during construction and post construction, shall be designed to minimize light spillage, thus reducing the effect on areas outside the proposed development, and consequently on bats i.e. Lighting will be directed away from mature trees/treelines around the periphery of the site boundary to minimize disturbance to bats. Directional accessories can be used to direct light away from these features, e.g. through the use of light shields (Stone, 2013). The luminaries will be of the type that prevent upward spillage of light and minimize horizontal spillage away from the intended lands. The proposed lighting around the site shall be designed in accordance with the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			In addition, the applicant commits to the use of lights during construction (such that they are necessary) in line with the following guidance that is provided in the Dark Sky Ireland Lighting Recommendations: - Every light needs to be justifiable, - Limit the use of light to when it is needed, - Direct the light to where it is needed, - Reduce the light intensity to the minimum needed, - Use light spectra adapted to the environment, When using white light, use sources with a "warm" colour temperature (less than 3000K).		
MM47	Aquatic Faunal Species	EIAR Chapter 6	While there will be no requirement for instream works, all works adjacent to watercourses, will adhere to Inland Fisheries Ireland (IFI) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016).		
MM48	Flora & Fauna	EIAR Chapter 6	While no significant effects are anticipated as a result of the loss of these habitats these linear features will be fully re-instated by replanting of the same lengths of hedgerow and treeline at the locations where they were lost following the completion of works. Planting will comprise native species.		
MM49	Invasive Species	EIAR Chapter 6 CEMP Section 3	The following measures are proposed to establish good site hygiene to ensure the control of any potential spread of invasive species during construction works, if they are identified prior to the commencement of the construction phase: - A risk assessment and method statement must be provided by the Contractor prior to commencing works. - Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected. - A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			disposed of with other contaminated material. This area will contain a washable membrane or hard surface. - Stockpile areas will be chosen to minimise movement of contaminated soil. - Stockpiles will be marked and isolated. - Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore. - The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material. - An ECoW/suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans. Plant and equipment which is operated within an area for the management of materials in contaminated areas should be decontaminated prior to relocating to a different works area. The decontamination procedures should take account of the following: - Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it. - Decontamination will only occur within designated wash-down areas. - Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches. - All run-off will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM50	Flora and Fauna	EIAR Chapter 6	The Proposed Development has the potential to result in enhancement of the surrounding areas through habitat rehabilitation management (as described in the Biodiversity and Enhancement Management Plan) that will be implemented during the construction phase of the Proposed Development and maintained during the operational phase. Details of the management that will be undertaken are provided in the Biodiversity and Enhancement Management Plan in Appendix 6-5 of the EIAR. These include: › Drain Blocking › Vegetation Monitoring › Planting of Native Woodland › Hydrological Monitoring In addition to the above, during construction activities on this habitat, the works area will be fenced off to prevent encroachment onto areas of habitat outside the development footprint.		
Operational Phase					

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM51	Bats	EIAR Chapter 6 Appendix 6-2	As per the bat survey report in Appendix 6-2, in accordance with NatureScot (2021) and the Northern Ireland Environment Agency (NIEA) Guidance (2021), a minimum 50m buffer to all habitat features used by bats should be applied to the siting of all wind turbines. Eurobats No. 6 guidance and NIEA (2021) recommends increased buffers around woodland/forestry areas. All habitat suitable for foraging and commuting bats has been identified as linear scrub features which developed along cutover bog drains. NatureScot recommends that a distance of 50m between turbine blade tip and nearest scrub habitat is adequate mitigation. This 50m buffer will be implemented from the outset and monitored as per the post construction monitoring. Where possible, the proposed location of turbines has accounted for the least possible loss of scrub and woodland habitat as it provides suitable habitat for other species. Where linear scrub features are located at the edge of the felling buffers, the option to maintain the features has been considered. All buffer zones will be maintained vegetation-free for the duration of the project. The success of the buffer mitigation will be assessed as part of post construction monitoring and updated where necessary. Blade feathering NIEA Guidelines also recommend that, in addition to buffers applied to habitat features, all wind turbines are subject to 'feathering' of turbine blades when wind speeds are below the cut-in speed of the proposed turbine. This means that the turbine blades are pitched at 90 degrees or parallel to the wind to reduce their rotation speed to below two revolutions per minute while idling. This measure has been shown to significantly reduce bat fatalities (by up to 50%) in some studies (NIEA, 2021).		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			In accordance with NIEA Guidelines, blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine (i.e. 3.5 m/s).		
Decommissioning Phase					
MM52	Decommissioning	EIAR Chapter 6	The same mitigation to prevent significant impacts on water quality and associated aquatic fauna and other terrestrial fauna during construction will be applicable to the decommissioning phase. An outline decommissioning plan is contained in the CEMP, Appendix 4-3 of the EIAR. The CEMP for the project provides the details of the mitigation and best practice that will be employed to avoid any potential for significant residual effects on biodiversity during decommissioning of the proposed wind farm.		
Chapter 7 Birds (Appendix 7-1)					
Pre- Construction Phase					
MM53	Birds	EIAR Chapter 7	The project design has followed the basic principles outlined below to eliminate the potential for significant effects on avian receptors: › The Proposed Development avoids wildlife refuge sites (e.g. waterbodies)		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Hard standing areas have been designed to the minimum size necessary to minimise habitat loss.		
MM54	Birds	EIAR Chapter 7	- A Construction and Environmental Management Plan (CEMP, Appendix 4-3) has been prepared. The CEMP will be in effect prior to the start of the construction phase. Best practice measures which form part of the design of the project are included in Chapter 4 of the EIAR. The CEMP is included as an Appendix to Chapter 4. - Construction works will begin outside the bird nesting season as defined by the Wildlife Act 1976 as amended (1st of March to the 31st of August). - All removal of woody vegetation will be undertaken in accordance with Section 40 of the Wildlife Act 1976 as amended.		
Construction Phase					
MM55	Birds	EIAR Chapter 7	During the construction phase, noise limits, noise control measures, hours of operation (i.e. dusk and dawn is high faunal activity time) and selection of plant items will be considered in relation to disturbance of birds. Plant machinery will be turned off when not in use.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			All plant and equipment for use will comply with the European Communities (Noise Emission by Equipment For Use Outdoors) Regulations, 2001 (S.I. No. 632/2001) and other relevant legislation. An Ecological Clerk of Works (ECoW) will be appointed. Duties will include: - Oversee a pre-construction transect/walkover bird survey is undertaken, to avoid significant effects on breeding birds will be avoided. - Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Application Site. - Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise. - Provide guidance to contractors to ensure legal compliance with respect to protected species onsite. - Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.		
MM56	Removal of Vegetation	EIAR Chapter 4	The commencement of works where the removal of vegetation is required, or where works take place in sensitive breeding habitats (such as birch scrub and emergent wetland vegetation), will be scheduled to occur outside the bird breeding season (1st of March to 31st of August) to avoid any potentially significant effects on nesting birds.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Operational Phase					
MM57	Birds	EIAR Chapter 7	No operational phase impacts requiring mitigation were identified. However, monitoring in line with best practice is proposed. Refer to MX19		
Decommissioning Phase					
MM58	Birds	EIAR Chapter 7	During the decommissioning phase, disturbance limitation measures will be as per the construction phase described.		
EIAR Chapter 8 Land Soils & Geology					
Pre- Construction Phase					
MM59	Peat & Subsoil Excavation	EIAR Chapter 8	› The Proposed Development has been designed to avoid sensitive habitats within the application area; ○ Placement of turbines and associated infrastructure in areas with shallower peat where constraints allow; ○ Use of floating roads, where appropriate, to reduce peat excavation volumes.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Construction Phase					
MM60	Excavation of Borrow Pits	EIAR Chapter 8	Upon the removal of the required volumes of granular material (for the construction of the infrastructure elements at the wind farm) from the borrow pits it is proposed to reinstate the pits using excavated peat and spoil. The borrow pits are designed and will be constructed in a way which will allow the excavated peat and spoil to be placed safely, with areas within the borrow pits designated for the storage of excavated peat. Other mitigation measures included in the design of the borrow pits are as follows: › Borrow pits will be developed with stable ground inclinations; › Exposed slopes will be left with irregular faces to promote re-vegetation; › Where possible segments of granular material will be left in places to help retain placed peat and spoil. Where this is not possible buttresses of permeable fill may be constructed to provide sufficient stability to the placed peat; and, › Infilling of peat should commence at the back of the borrow pit and progress towards the pit entrance.		
MM61	Peat & Subsoil Excavation	EIAR Chapter 8	› A minimal volume of peat and subsoil will be removed to allow for infrastructural work to take place in comparison to the total volume present on the site due to optimisation of the layout by mitigation by design; › The peat and subsoil which will be removed during the construction phase will be localised to the wind farm infrastructure turbine location, substation and temporary compounds and access roads; › Excavated peat that is not used locally for landscaping will be stored in the 3 no. borrow pits; and		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			• Construction of settlement ponds will be volume neutral, and all excess material will be used locally to form pond bunds and surrounding landscaping. • In general, excavated peat will be moved short distances from the point of excavation and used locally for landscaping;		
MM62	Contamination of Soil	EIAR Chapter 8	• On-site re-fuelling will be undertaken using a double skinned bowser with spill kits kept on site for accidental leakages or spillages; • Only designated trained operatives will be authorised to refuel plant on-site; • Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system; • Fuels volumes stored on-site will be minimised. All storage areas will be bunded appropriately for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area; • Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage; • The plant used during construction will be regularly inspected for leaks and fitness for purpose; and • An emergency response plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (which is contained in Appendix 4-3)		
MM63	Erosion	EIAR Chapter 8	• All works will be completed in accordance with the Peat and Spoil Management Plan (FTC, 2023)		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- All excavated peat and spoil shall be transported immediately on excavation to designated peat storage areas along the access roads and will be used on site for landscaping close to the extraction area; - Where peat/spoil is not used to landscaping it will be transported immediately to one of the proposed borrow pits; - Peat and spoil will not be transported significant distances upon excavation; - Upon excavation, the upper vegetative layer (where still present) will be stored with the vegetation part of the sod facing the right way up to keep the plants and vegetation alive to aid construction reinstatement of disturbed ground; - Re-seeding and spreading/planting will also be carried out in areas where ground will be disturbed; and, - A full Peat and Spoil Management Plan for the development is shown as Appendix 4-2.		
MM64	Peat Instability	EIAR Chapter 8	The following mitigation measures will be adhered to during the construction phase to minimise the risks of peat instability and failure: - Appointment of experienced and competent contractors; - The site will be supervised by experienced and qualified personnel; - Allocate sufficient time for the project (decreasing the construction time has the potential to increase the risk of initiating a localised peat movement); - Prevent undercutting of slopes and unsupported excavations; - Maintain a managed robust drainage system; - Prevent placement of loads/overburden on marginal ground; - Set up, maintain and report findings from monitoring systems (as detailed in the Geotechnical and Peat Stability Assessment); - Ensure construction method statements are finalised and implemented prior to the commencement of construction (these construction method		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			statements will align with the mitigation measures outlined in this EIAR and the CEMP); and, › Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction.		
MM65	Pilling Works	EIAR Chapter 8	Other than surface level and minor excavation works, any driven piles will not produce significant volumes of spoil, these will displace soil/subsoil within the ground. The bored pile option could produce between 320 to 580m^3 of spoil material per turbine base. Excess spoil will be removed for permanent storage in the on-site borrow pits. Bored pile spoil volumes only amount to between ~1 to 2% of the overall peat and spoil volumes for the Proposed Development.		
Operational Phase					
MM66	Site Road Maintenance	EIAR Chapter 8	Use of aggregate from authorised quarries for use in road and hardstand maintenance		
MM67	Site Vehicle/Plant use	EIAR Chapter 8	› Vehicles used during the operational phase will be refuelled off site before entering the proposed site; › No fuels will be stored on-site during the operational phase; and		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Spill kits will be available in all site vehicles to deal with an accidental spillage and breakdowns; and, - An emergency plan for the operational phase to deal with accidental spillages and breakdowns will be contained in the finalised Environmental Management Plan.		
MM68	Oils in Substation and Turbine Transformers	EIAR Chapter 8	- The electrical control building (at the substation) will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor; - All transformer areas at the turbines will be bunded to 110% of the volume of oil used in each transformer; - An emergency plan for the operational phase to deal with accidental spillages will be contained in the Environmental Management Plan		
Decommissioning Phase					
MM69	Decommissioning Phase	EIAR Chapter 8	Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
EIAR Chapter 9 Hydrology					
Pre- Construction Phase					
MM70	Earthworks	EIAR Chapter 9	Mitigation by Avoidance: The key mitigation measure during the construction phase is the avoidance of sensitive hydrological features where possible, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). All of the key Proposed Development areas (turbines, hardstands, substation, construction compounds etc.) are located significantly away from the delineated 50m watercourse buffer zones except for the upgrading of the existing watercourse crossings, new drain crossings and upgrades to the existing site access tracks. The Proposed Development includes upgrades to existing watercourse crossings and site access roads and a new proposed amenity path which cross EPA mapped watercourses at 3 no. locations within the proposed site: › Upgrades to the existing crossing over the Killanconnigan stream between Ballivor and Carranstown bogs; › Upgrades to the existing crossing over the Cartenstown stream between Bracklin and Lisclogher bogs; › Proposed amenity path over the Cartenstown stream in the centre of Lisclogher bog. However as stated above in Section **Error! Reference source not found.**, walkover surveys have confirmed that there is no watercourse in this area of the proposed site). The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be installed and operate effectively. The proposed buffer zone will: › Minimise physical damage (river/stream banks and river/stream beds) to watercourses (where possible, this cannot be avoided at the		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			watercourse crossing discussed above) and the associated release of sediment; › Minimise excavations within close proximity to surface watercourses; › Minimise the entry of suspended sediment from earthworks into watercourses; and, › Minimise the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone. Mitigation by Design: There is an extensive network of drains already existing at the 4 no. bogs comprising the proposed site. The existing drainage infrastructure is operating in accordance with IPC licence requirements, with environmental monitoring and silt control measures being implemented at these bogs. The existing drainage system at the proposed site will be maintained and expanded locally as required for use within the Proposed Development drainage system. The key elements are the upgrading and improvements to water treatment elements, such as in-line controls and treatment systems, including wind farm related silt traps and settlement ponds. The elements of interaction with existing drains will be as follows: › Interceptor drains will convey clean runoff water around works areas to the existing downstream drainage system (field drains and main drains). Where required, interceptor drains will be installed in advance of any construction works commencing. This will ensure that clean water is kept clear by diverting surface water flow around excavations, construction areas and temporary storage areas. Where possible (depending on orientation), existing field drains can be used as interceptors drains;		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Collector drains will be used to intercept and collect runoff from construction areas (from turbine base/hardstand areas, construction compounds, and the substation). During the construction phase temporary settlement ponds will be used to attenuate and treat runoff from the construction areas (from turbine base/hardstand areas, construction compounds, and the substation) and treated water will then discharge into existing field drains and main drains. Temporary settlement ponds will be removed at the end of the construction phase (end of high risk period), and wind farm runoff will discharge into existing field drains and main drains; - During the construction phase, temporary silt traps (silt fences) will be used as an additional water protection measures around the existing bog drainage network, particularly where works are proposed within 50m of a natural watercourse. The silt fences will be placed in the existing drains downstream of construction works, and the associated construction area run-off water will be diverted into proposed interceptor drains, or culverted under/across the works area; - During the construction phase, dewatering silt bags will also be used as required. They can be used downgradient of turbine bases, where temporary pumping is required. Discharge from dewatering silt bags will flow into settlement ponds and treated water from settlement ponds will outfall to existing field drains and main drains; - Within the proposed site layout there are section of proposed floating road between turbine infrastructure. In these sections, and depending on intermediate topography, a collector drain (dirty water system as described above) may be used during construction stage, or over the edge (OTE) drainage will occur. Over the edge drainage allows runoff from access tracks to flow into local field drains and be managed via the existing site drainage system. OTE drainage will only occur where topography allows, and it is only proposed in areas of low risk and remote from outfall locations (at least 150m from bog outfall locations.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			Silt traps and check dams will be installed in field drains downstream of OTE drainage areas, and these will provide attenuation and treatment of dirty water; and, › Culverts will be required where site roads and proposed hardstands cross the main bog drainage networks. These will be installed with a minimum gradient to reduce the entrainment of suspended solids. All culverts will be inspected regularly and maintained where appropriate. Culverts will remain in-situ during the Operational Phase of the Proposed Development.		
MM71	Drainage & Water Quality	EIAR Chapter 9	An inspection and maintenance plan for the on-site drainage system will be prepared in advance of the commencement of any works and will be included in the CEMP. Regular inspections of all installed drainage systems will be undertaken, especially before and after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.		
Construction Phase					
MM72	Water Treatment Train	EIAR Chapter 9	If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'siltbuster' or similar equivalent treatment system) will be used to filter and treat all required surface discharge water collected in the dirty water drainage system. This will apply to all of the construction phase.		
MM73	Silt Fences	EIAR Chapter 9	Silt fences will be located within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to the existing drainage network of sand and gravel-sized sediment, released from the excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Regular inspection and maintenance of silt fences during the construction phase are critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM74	Silt Bags	EIAR Chapter 9	Silt bags will be used where small to medium volumes of water need to be pumped from excavations (e.g. the proposed underpass locations). As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through.		
MM75	Weather Management	EIAR Chapter 9	The works programme for the construction stage of the development will also take account of weather forecasts and predicted heavy rainfall events in particular. Large excavations and movements of peat/subsoil or peat stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast. The following forecasting systems are available and will be used on a daily/weekly basis, as required, to allow site staff to manage construction activities: › General Forecasts: Available on a national, regional and county level from the Met Éireann website (www.met.ie/forecasts). These provide general information on weather forecasts including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates; › MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale; › 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events; › Rainfall Radar Images: Images covering the entire country are freely available from the Met Éireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Consultancy Service: Met Éireann provide a 24-hour telephone consultancy service. The forecaster will provide an interpretation of weather data and give the best available forecast for the area of interest. Using the safe threshold of rainfall values given below will allow planned works to be safely executed (from a water quality perspective) or works to be postponed if a high rainfall intensity event is forecast. Earthworks will be suspended if forecasting predicts any of the following is likely to occur: - >10 mm/hr (i.e. high intensity local rainfall events); - >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or, - >half monthly average rainfall in any 7 days. Prior to earthworks being suspended the following further control measures will be completed: - All open peat/spoil excavations will be secured and sealed; - Temporary or emergency drainage will be created to prevent back-up of surface runoff; and, - Working during heavy rainfall and for up to 24 hours after heavy events will not be allowed to ensure drainage systems are not overloaded.		
MM76	Runoff	EIAR Chapter 9	It is proposed that excavated peat will be used for landscaping close to its original extraction point. During the initial placement of peat and subsoil, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from the storage areas as required. Interceptor and collector drains will be used at storage areas. 'Siltbuster' treatment trains will be employed if previous treatment is not of a high quality.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM77	Timing of Construction Works	EIAR Chapter 9	Construction of the site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during low rainfall periods will also ensure that attenuation features associated with the drainage system will be in place and operational for all subsequent construction works.		
MM78	Surface Water Management	EIAR Chapter 9 CEMP Section 4	During the construction phase field testing (visual, supplemented with pH, electrical conductivity, temperature, dissolved oxygen and turbidity monitoring), sampling and laboratory analysis of a range of parameters[2] with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly and event-based). The data will be processed and analysed and works will cease if elevated turbidity concentrations are recorded. In this event, all upstream silt traps and drainage routes will be inspected to identify the cause of the elevated turbidity levels. Works will not recommence until any issues have been resolved and the turbidity concentrations have returned to background concentrations		
MM79	Drainage Maintenance & Water Quality	EIAR Chapter 9	Any excess build-up of silt sediment levels at dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. During the construction phase field testing (visual, supplemented with pH, electrical conductivity, temperature, dissolved oxygen and turbidity monitoring), sampling and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy		

[2] example suite: pH (field measured), Electrical Conductivity (field measured), temperature (field measured), Dissolved Oxygen (field measured), Turbidity (NTU) (sonde measured), Flow (m/s), Total Suspended Solids (mg/l), Ammonia, Nitrite (NO_2) (mg/l), Ortho-Phosphate (P) (mg/l), Nitrate (NO_3) (mg/l), Phosphorus (unfiltered) (mg/l), Chloride (mg/l), and BOD (mg/l).

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			rainfall events (i.e. weekly, monthly and event-based). The data will be processed and analysed and works will cease if elevated turbidity concentrations are recorded. In this event, all upstream silt traps and drainage routes will be inspected to identify the cause of the elevated turbidity levels. Works will not recommence until any issues have been resolved and the turbidity concentrations have returned to background concentrations.		
MM80	Excavation Dewatering	EIAR Chapter 9	Management of excavation seepages and subsequent treatment prior to discharge into the drainage network will be undertaken as follows: › Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place; › If required, pumping of excavation inflows will prevent the build-up of groundwater in the excavation; › The interceptor drainage will be discharged to the existing drainage system or onto the bog surface within the overall bog drainage and treatment system; › The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a "Siltbuster" unit; › There will be no direct discharge to the existing bog drainage network and therefore no risk of hydraulic loading or contamination will occur; and, › Daily monitoring of excavations and the water treatment system by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped, and a geotechnical assessment will be undertaken.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM81	Piling Works	EIAR Chapter 9	Proposed mitigation measures relative to piling works will comprise: - Where driven piles are used, they will have a cross section without re-entrant angles; - Strict QA/QC procedures for piling works will be followed; - Piles will be kept vertical during piling works; - Good workmanship will be employed during all piling works; and, - Where required use bentonite seal to prevent upward/downward movement of surface water/groundwater.		
MM82	Hydrocarbons	EIAR Chapter 9	- All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on site; - On-site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer or truck will be re-filled off site and will be towed/driven around the proposed site to where machinery is located. The 4x4 jeep/fuel truck will also carry fuel absorbent materials for the event of any accidental spillages. The fuel bowser will be parked in a designated location on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be available during all refuelling operations and used when required; - Fuel volumes stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume during the construction phase; - An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (Appendix 4-3). Spill kits will be available to deal with accidental spillages.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM83	Release of Cement Based Products	EIAR Chapter 9	Mitigation by Avoidance: - No batching of wet-cement products on-site is proposed. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will be the design approach; - Where possible pre-cast elements for culverts and concrete works will be used; - No washing out of the main body of any plant used in concrete transport or concreting operations will be allowed on-site; - Where concrete is delivered on site, only the concrete truck chute will be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be isolated in temporary lined wash-out pits located near proposed site compounds. These temporary lined wash-out pits will be removed from the site their utility is no longer required or at the end of the construction phase; - Any washing out of concrete pumping plant will also be into the temporary lined wash-out pits. - Weather forecasts will be used to plan dry days for pouring concrete; and, - Construction contractors will ensure each concrete pour site is free of standing water and plastic covers will be available in case of a sudden rainfall event.		
MM84	Groundwater and Surface Water Contamination	EIAR Chapter 9	- There are a total of 4 no. proposed construction compounds associated with the Proposed Development; - During the construction phase, self-contained port-a-loo with an integrated waste holding tank will be used at each of the site		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
	from Wastewater Disposal		compounds, maintained by the providing contractor, and removed from the site on completion of the construction works; › Water supply for the site office and other sanitation will be brought to site and removed after use by a licensed contractor to be discharged at a suitable off-site treatment location; and, › No water or wastewater will be sourced on the site, nor discharged to the site.		
MM85	Transport Delivery Route	EIAR Chapter 9	Mitigation by Avoidance: A constraint/buffer zone will be maintained for all upgrade works locations where possible. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse. The purpose of the constraint zone is to: › Avoid physical damage to surface water channels; › Provide a buffer against hydraulic loading by additional surface water run-off; › Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks; › Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and, › Provide a buffer against construction plant and materials entering any watercourse. General Best Practice Pollution Prevention Measures will also include:		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- No stock-piling of construction materials will take place within environmental buffer zones. No refuelling of machinery or overnight parking of machinery is permitted in this area; - No concrete truck chute cleaning is permitted in this area; - Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast; - Plant will travel slowly across bare ground at a maximum of 5km/hr. - Machinery deliveries shall be arranged using existing structures along the public road; - All machinery operations shall take place away from the stream and ditch banks, although no instream works are proposed or will occur; - Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility or the on-site spoil management areas; - No stockpiling of materials will be permitted in the constraint zones; - Spill kits shall be available in each item of plant required; and, - Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required. Mitigation Measures relating to the use and storage of fuels and chemicals in terms of groundwater protection: - Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser, as described in Section **Error! Reference source not found.**. No maintenance of construction vehicles or plant will take place along the temporary junction works areas; - The plant used will be regularly inspected for leaks and fitness for purpose; and, - Spill kits will be available to deal with accidental spillage.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Operational Phase					
MM86	Replacement of Natural Surface with Lower Permeability Surfaces	EIAR Chapter 9	As part of the Proposed Developments drainage design, it is proposed that runoff from the proposed infrastructure will be collected locally in new proposed silt traps, settlement ponds and vegetated buffer areas prior to release into the existing bog drainage network. The new proposed drainage measures will then create significant additional attenuation to what is already present. The operational phase drainage system will be installed and constructed in conjunction with the existing bog drainage network and will include the following mitigation measures: - Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed into downstream field drains; - Collector drains will be used to gather runoff from access roads and turbine hardstanding areas of the site likely to have entrained suspended sediment, and channel it to new local settlement ponds for sediment settling; - On sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/roadside drains; - Check dams will be used along sections of access road drains to intercept silt at source. Check dams will be constructed from a 4/40mm non-friable crushed rock; - Settlement ponds, emplaced downstream of access road sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to existing drains;		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Settlement ponds will be designed in consideration of the greenfield runoff rate, existing bog settlement ponds will also buffer discharges from the bogs; and, - Finally, all surface water runoff from the development will pass through the existing settlement ponds at the existing bog outfall locations.		
MM87	Wastewater	EIAR Chapter 9	It is proposed to install a sealed underground holding tank for effluent (wastewater) from the substation building. The tank shall be routinely emptied by a licensed contractor. A level sensor will be installed in the tank which shall be linked to the on-site SCADA system. If the level of the tank contents rise to a predetermined 'high' level a warning shall appear on the overall SCADA system for the site and automatic notification shall be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on site.		
Decommissioning Phase					
MM88	Decommissioning	EIAR Chapter 9	During decommissioning, it will be possible to reverse or at least reduce some of the potential effects caused during construction, and to a lesser extent operation, by rehabilitating constructed areas such as turbine bases and hardstanding areas. This will be done by re-establishing vegetation, thereby reducing runoff and sediment loads. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.		
Chapter 10 Air & Climate					
Construction Phase					
MM89	Exhaust Emissions Greenhouse Gas Emissions	EIAR Chapter 10	Exhaust Emissions during construction of turbine and other infrastructure: - Construction staff will be trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise. The Site Supervisor/Construction Manager produce and follow a site		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			inspection and machinery checklist which will be followed and updated if/when required. - Machinery will be switched off when not in use. - Turbines and construction materials will be transported to the site on specified routes only, unless otherwise agreed with the Planning Authority. Please see Chapter 14 Material Assets for details. - Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions. - A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures. Borrow Pits: - Measures pertaining to exhaust emissions from turbine and other infrastructure construction will be implemented for the construction of the borrow pits. - Sporadic wetting of loose stone surface in the borrow pits will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff. - All plant and materials vehicles shall be stored in dedicated areas (on site). - Wheel wash bays will be located at both the main site entrances into Ballivor Bog and Carranstown Bog off the R156. All vehicles		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			will go through the wheel wash prior to exiting the site to ensure no materials are carried onto the local road network. › Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. › The transport of construction materials from the borrow pits around the site will be undertaken in tarpaulin or similar covered vehicles, where necessary. Transportation of Materials to site: › Measures listed in the section above pertaining to exhaust emissions from turbine, other infrastructure and borrow pit construction will be implemented for the transportation of vehicles to and from the Wind Farm Site. › Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions. › Turbines and construction materials will be transported to the site on specified haul routes only. › The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.		
MM90	Dust Emissions Greenhouse Gas Emissions	EIAR Chapter 10	› Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- All plant and materials vehicles shall be stored in dedicated areas (on site). - Wheel wash bays will be located at both the main site entrances into Ballivor Bog and Carranstown Bog off the R156. All vehicles will go through the wheel wash prior to exiting the site to ensure no materials are carried onto the local road network. - Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. - Turbines and construction materials will be transported to the site on specified haul routes only. - The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary. - The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary. - A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures. - Construction staff will be trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise. The Site Supervisor/Construction Manager produce and follow a site inspection and machinery checklist which will be followed and updated if/when required. - The transport of construction materials from the borrow pits around the site will be undertaken in tarpaulin or similar covered vehicles, where necessary. - Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced or onsite where possible, which will further reduce potential emissions.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Operational Phase					
MM91	Exhaust, Dust and Greenhouse Gas Emissions	EIAR Chapter 10	• Maintenance vehicles brought onsite during the operational phase will be maintained in good operational order, thereby minimising any emissions that arise. • Amenity carparks are spread out throughout the Wind Farm Site thus minimising the potential for traffic delays due to congestion building up at site entrance points and consequently further exhaust emissions		
Decommissioning Phase					
MM92	Decommissioning Phase	EIAR Chapter 10	The mitigation measures prescribed for the construction phase of the Proposed Development will be implemented during the decommissioning phase thereby minimising any potential impacts.		
EIAR Chapter 11 Noise					
Pre- Construction Phase					
MM93	Construction Noise	EIAR Chapter 11	Local residents will be kept informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;		
Construction Phase					
MM94	Construction Noise	EIAR Chapter 11	Good site practices will be implemented to minimise the likely effects. Section 8 of BS5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that will be employed onsite: • Local residents will be kept informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern; • No plant used on site will be permitted to cause an on-going public nuisance due to noise.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			• The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. • All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract. • Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. • Machinery that is used intermittently will be shut down during periods when not in use. • Any plant, such as generators or pumps, which is required to operate close to NSL's outside of general construction hours will be surrounded by an acoustic enclosure or portable screen. • During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Section 11.3.2 using methods outlined in British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise.* • The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs Monday to Friday and 7:00hrs to 1400hrs Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, rotor/tower deliveries) it will be necessary on occasion to work outside of these hours.		
Operational Phase					

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM95	Operational Phase Noise	EIAR Chapter 11	An assessment of the operational noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Section **Error! Reference source not found.** of this Chapter. The findings of the assessment, presented in Section **Error! Reference source not found.** confirms that the predicted operational noise levels will be within the relevant best practice noise criteria curves for wind farms at all locations. In the unlikely event that an issue with low frequency noise is associated with the Proposed Development, an appropriate detailed investigation will be undertaken. Due consideration will be given to guidance on conducting such an investigation which is outlined in Appendix VI of the EPA document entitled *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (NG4) (EPA, 2016). This guidance is based on the threshold values outlined in the Salford University document *Procedure for the assessment of low frequency noise complaints, Revision 1, December 2011*. If an exceedance of the threshold values is confirmed, measures to mitigate low frequency noise at noise-sensitive locations will be implemented through operational controls for the relevant turbine type, which may include turbine curtailment and/or stopping turbines under specific operational conditions. In the event that a confirmed complaint is received which indicates potential amplitude modulation (AM) associated with turbine operation, the operator will employ an independent acoustic consultant to assess the level of AM in accordance with the methods outlined in the Institute of Acoustics (IoA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) namely, *A Method for Rating Amplitude Modulation in Wind Turbine Noise* (August 2016) or subsequent revisions. These mitigation measures, if required, will consist of the implementation of operational controls for the relevant turbine type, which will include turbine curtailment and/or stopping turbines under specific operational conditions.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
EIAR Chapter 12 Cultural Heritage					
Pre-construction Phase					
MM96	Archaeological Monitoring Licence	EIAR Chapter 12	Application request to national Monuments Service in advance of ground works during the construction phase. Archaeological monitoring (under licence from the National Monuments Service) to monitor any pre-construction geotechnical engineering investigations prior to construction, if required.		
Construction Phase					
MM97	Sub Surface Archaeological Potential	EIAR Chapter 12	• Archaeological monitoring (under licence from the National Monuments Service) of any further geotechnical / engineering trial pits or investigations and a report detailing the results of same. • Archaeological monitoring of ground works during construction. This will include all excavation works within the EIAR site boundary as well as any topsoil removal along the haul route. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance).Once the project is completed, a report on the results of the monitoring will be compiled and submitted to the relevant authorities. The National Monuments Service will be informed of such findings and either preservation in situ (avoidance) or preservation by record (archaeological excavation) will be required.		
Chapter 14 Material Assets - Traffic					
Chapter 14 – Traffic					

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Pre- Construction					
MM98	Traffic		Prior to the commencement of the construction phase of the Proposed Development a detailed Traffic Management Plan will be prepared by the Contractor for agreement with the relevant local authorities and An Garda Síochána . The TMP includes recommendations, which will include the measures below as a minimum requirement, for the following: - **Traffic Management Coordinator** – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management. - **Delivery Programme** – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site. - **Information to locals** – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided. - **A Pre and Post Construction Condition Survey** – Where required by the local authority, a pre-condition survey of roads associated		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			with the Proposed Development will be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers. › **Liaison with the relevant local authority** - Liaison with the County Councils and An Garda Síochána I, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, (in compliance with the provisions of the CEMP), the Roads section will be informed of the relevant names and contact numbers for the Project Developer/Contractor Site Manager as well as the Site Environmental Manager. › **Implementation of temporary alterations to road network at critical locations** – at locations highlighted in section 14.1.8. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable. › **Identification of delivery routes** – These routes will be agreed with the County Councils and adhered to by all contractors. › **Delivery times of large turbine components** - The management plan includes the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage. › **Travel plan for construction workers** – While the assessment above has assumed the worst case in that construction workers will drive		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site. - **Additional measures** - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required. These are set out in the CEMP which is contained in Appendix 4.3. - **Re-instatement works** - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.		
Construction Phase					
MM99	Traffic		The construction of this development will require significant coordination and the following comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the proposed wind farm. **Delivery of abnormal sized loads** The following are the main points to note for these deliveries. These will take place after peak evening traffic: - The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised. - The deliveries will be made in consultation with the Local Authority and An Garda Síochána. - The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised.		

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- The turbine component deliveries will be made in consultation with the Local Authority and An Garda Síochána. - It is estimated that 234 abnormal sized loads will be delivered to the site, comprising 47 convoys of 5 abnormal vehicles and loads, undertaken over 47 separate nights. - These nights will be spread out over an approximate period of 24 weeks and will be agreed in advance with the relevant authorities. - In order to manage each of the travelling convoys, for each convoy there will be two police escort vehicles that will stop traffic at the front and rear of the convoy of 5 vehicles. - There will also be two escort vehicles provided by the haulage company for each convoy.		
Decommissioning Phase					
MM100	Decommissioning	EIAR Chapter 14	When the Proposed Development is decommissioned, a decommissioning plan will be prepared for agreement with the local authority, as described in Chapter 4. This plan will include a traffic management plan and other similar mitigation measures to those implemented during the construction phase. In terms of traffic effects the decommissioning stage will generally mirror the constructions stage although the effects will be significantly reduced as the volumes of materials removed from the site will be less.		
Chapter 14 Other Material Assets					
Pre- Construction					
Construction Phase					

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM101	Overhead Lines	EIAR Chapter 14	- Goal posts will be established under the overhead line for the entirety of the construction phase. They will not exceed a height of 4.2 metres, unless specifically agreed with ESB Networks - The suitability of machinery and equipment for use near power lines will be risk assessed. - All staff will be trained on operating voltages of overhead electricity lines running the site. All staff will be trained to be aware of the risks associated with overhead lines. All contractors that may visit the sites are made aware of the location of lines before they come on to site. - Barriers will run parallel to the overhead line at a minimum horizontal distance of 6 metres on plan from the nearest overhead line conductor wire. - When activities must be carried out beneath overhead lines, e.g. component delivery or substation construction, a site-specific risk assessment will be undertaken prior to any works. The risk assessment must take into account the maximum potential height that can be reached by the plant or equipment that will be used prior to any works. Overhead line proximity detection equipment will be fitted to machinery when such works are required. - Information on safe clearances will be provided to all staff and visitors. - Signage indicating locations and health and safety measures regarding overhead lines will be erected in canteens and on site. - All staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) (Amendment) Regulations 2021'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.	MM91	Overhead Lines

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			All health and safety measures as detailed in the Construction Environment Management Plan and Chapter 5 Population and Human Health will be adhered to during the construction, operation and decommissioning phases.		
MM102	Waste Management	EIAR Chapter 14	• All waste generated on site will be contained in waste skips at a waste storage area on site. This waste storage area will be kept tidy with skips clearly labelled to indicate the allowable material to be disposed of therein. • The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation at the wind farm site. Therefore, all waste streams generated on site will be deposited into a single waste skip. This waste material will be transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal. • The waste generated from the turbine erection will be limited to the associated protective covers which are generally reusable. Considering the specialist nature of this packaging material the majority will be taken back by suppliers for their own reuse. Any other packaging waste generated from the turbine supply will be deposited into the on-site skips and subsequently transferred to the MRF. • It is not envisaged that there will be any waste material arising from the materials used to construct the site roads as only the quantity of stone necessary will be sourced from local quarries and brought on site on an 'as needed' basis. • Site personnel will be instructed at induction that under no circumstances can waste be brought to site for disposal in the on-site waste skip. It will also be made clear that the burning of waste material on site is forbidden.	MM92	Waste Management

Ref. MM no.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Operational Phase					
MM103	Tele-communications	EIAR Chapter 14	In the event of interference occurring to telecommunications, the Department of the Environment, Heritage and Local Government Wind Farm Planning Guidelines (2006) state that these effects can be dealt with by the use of divertor relay links out of line with the proposed wind turbines.		
MM104	Aviation	EIAR Chapter 14	- Turbines will be illuminated by high intensity obstacle lights that will allow the hazard to be identified and avoided by aircraft in flight (and in liaison with IAA requirement No.1 below) - Obstruction lights will be incandescent or of a type visible to Night Vision Equipment. - Obstruction lighting fitted to obstacles must emit light at the near Infra-Red (IR) range of the electromagnetic spectrum specifically at or near 850 nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light - Provide as-constructed coordinates in WGS84 format together with ground and tip height elevations at each wind turbine location and Notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.		
Decommissioning					
MM105	Decommissioning	EIAR Chapter 14	The measures outlined for the construction phase are considered the same for the decommissioning phase.		

8. MONITORING PROPOSALS

All monitoring proposals relating to the pre-commencement, construction and operational phases of the Proposed Development were set out in various sections of the EIAR prepared as part of the planning permission application to An Bord Pleanála.

This section of the Construction and Environment Management Plan groups together all of the monitoring proposals presented in the EIAR. The monitoring proposals are presented in the following pages.

By presenting the monitoring proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits.

Table 8-1 Monitoring Measures for pre commencement, construction, operation and decommissioning phases of the proposed Ballivor Wind Farm

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
Pre-Construction Phase						
MX1	Drainage Maintenance	EIAR Chapter 4	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site ECoW or the Project Hydrologist.	On going	Monthly	Project Hydrologist
MX2	Drainage Inspection		Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.	As Required	Monthly	Project Hydrologist
MX3	Surface Water Monitoring	CEMP Section 4	Baseline sampling will be completed on at least two occasions and these will coincide with low flow and high flow stream conditions. The high flow sampling event will be undertaken after a period of sustained rainfall, and the low flow event will be undertaken after a dry spell.	Twice (Minimum)	As Required	Project Hydrologist
MX4	Invasive Species	EIAR Chapter 6	A pre-commencement invasive species survey shall be completed for the site.	Once	As required	Project Ecologist
MX5	Badger-Disturbance/Displacement	EIAR Chapter 6	A pre-construction badger survey will be undertaken at the location of the identified setts at Carranstown Bog by a qualified ecologist prior to the commencement of any works to determine if the setts are in use and to identify any additional sett entrances that may have been excavated in the intervening period.	Once	Post Survey	Project Ecologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			The outlier sett within the footprint of the proposed substation will be monitored for 2 weeks prior to construction using a camera trap to determine if it is in use. If the outlier sett in the construction footprint is found to be in use exclusion measures will be put in place prior to construction in line with NRA Guidelines[3] to ensure that the sett is evacuated. As per NRA guidelines exclusion from an active sett will only be carried out during the period of July to November inclusive in order to avoid the badger breeding season.			
MX6	Bats	EIAR Chapter 6	3-year post-construction monitoring for bats will include: • Static surveys • Transect surveys • Carcass searches	Seasonal	Seasonal	Project Ecologist
MX7	Birds	EIAR Chapter 7	Taking a precautionary approach, it is proposed that construction works will commence outside the bird nesting season (1st of March to 31st of August inclusive). Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm. Any requirement for construction works to run into the subsequent breeding season following commencement will be subject to a repeat of the pre-commencement bird surveys to confirm the absence of	Once	As required	Project Ornithologist

[3] *National Roads Authority (2006) Guidelines for the treatment of badgers prior to the construction of National Road Schemes.*

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			breeding birds of conservation concern. The survey will aim to identify sensitive sites e.g. nests or roosts depending on the season in question. Monitoring will be undertaken by a suitably qualified ornithologist. The survey will include a thorough walkover survey to a 500m radius of the development footprint and/or all works areas, where access allows. If winter roosts or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the construction phase. If the roost/nest is found to be active during the construction phase survey no works shall be undertaken within a species-specific buffer (as per Goodship, N.M. and Furness, R.W. 2022) in line with best practice. No works within the buffer zone shall be permitted until it can be demonstrated that that birds of conservation concern are no longer reliant on the roost/nest site.			
			Construction Phase			
MX8	Archaeological Monitoring	EIAR Chapter 12	Archaeological monitoring (under licence from the National Monuments Service) of any further geotechnical / engineering trial pits or investigations and a report detailing the results of same. Archaeological monitoring of ground works during construction. This will include all excavation works within the EIAR site boundary as well as any topsoil removal along the haul route. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or	As Required	As Required	Project Archaeologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			preservation in situ (avoidance).Once the project is completed, a report on the results of the monitoring will be compiled and submitted to the relevant authorities. The National Monuments Service will be informed of such findings and either preservation in situ (avoidance) or preservation by record (archaeological excavation) will be required.			
MX9	Water Quality and Monitoring	CEMP Section 3	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the ECoW on-site. The ECoW or Project Hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible.	Daily	As Necessary	ECoW
MX10	Water Quality and Monitoring	EIAR Chapter 9	Daily surface water monitoring forms will be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection.	Daily	As Necessary	ECoW
MX11	Surface Water Quality	CEMP Section 4	Baseline laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken as per water monitoring programme for the Proposed Development and each primary watercourse along the route. This will not be restricted to just these locations around the proposed renewable energy development site with further sampling points added as deemed necessary by the ECoW in consultation with the Project Hydrologist and Site Manager. In-situ field monitoring will be completed on a weekly basis. In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The Project Hydrologist will monitor and advise on the readings collected by in-situ field monitoring.	As Required	Monthly	ECoW

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
MX12	Surface water Quality Monitoring	CEMP Section 4	During the construction phase, a field monitoring campaign will be undertaken in local streams where construction activity takes place which can affect water quality. This involves a) visual checks of drainage and streams, and b) daily measurements of field parameters temperature, pH, specific electrical conductivity (SEC), alkalinity and turbidity. Field measurements will be taken once a day, upstream and downstream of the construction activity. The field campaign will begin one week prior to activity and cease one week after activity is completed, unless observations dictate that measurements should continue. If visible impact occurs, works will be suspended at the discretion of the supervising engineer, in which case the problem will be identified and corrective action taken before recommencing works. Refer to Section 9.3.13 of the EIAR.	Daily	As Necessary	EcOW
MX13	Plant and Equipment Inspections	EIAR Chapter 5, Section 9 CEMP Section 4	The plant used should be regularly inspected for fuel leaks, unnecessary noise generation and general fitness for purpose.	As Required	Monthly	ECoW
MX14	Plant and Equipment Inspections	EIAR Chapter 5, Section 9 CEMP Section 4	Local areas of the haul route will be condition monitored and maintained, if necessary.	Daily	Monthly	ECoW
MX15	Flora and Fauna	CEMP Section 4	A Project Ecologist will be appointed. The responsibilities and duties of the Project Ecologist will include the following:	As required	As required	Project Ecologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			› Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Proposed Development area. › Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise. › Provide guidance to contractors to ensure legal compliance with respect to protected species onsite. › Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.			
MX16	Noise and Vibration	Section 11 CEMP	Monitoring typical levels of noise and vibration during critical periods and at sensitive locations will be carried out.	Daily	Monthly	ECoW
Operational Phase						
MX17	Surface Water Quality	CEMP Section 4	Monthly sampling for laboratory analysis for a range of parameters adopted during pre-commencement and construction phases will continue for six months during the operational phase. The Project Hydrologist will monitor and advise on the readings being received from the testing laboratory.	Monthly	Monthly	ECoW
MX18	Drainage Inspections	CEMP Section 3	The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.	Monthly	Monthly	ECoW
MX19	Ornithology	EIAR Chapter 7	The programme of works will monitor parameters associated with a collision, displacement/barrier effects and habituation during the lifetime of the project. Surveys will be scheduled to coincide with Years 1, 2, 3, 5, 10 & 15 of the life-time of the wind farm. Monitoring measures are broadly based on	Years 1, 2, 3, 5, 10, 15	Monthly	Project Ornithologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			guidelines issued by the Scottish Natural Heritage (SNH, 2009). The following individual components are proposed: - Monthly flight activity surveys: vantage point surveys. - Breeding Bird surveys: Adapted Brown & Shepard - Annual kestrel nest box monitoring - Targeted bird collision surveys (corpse searches) will be undertaken with trained dogs. The surveys will include detection and scavenger trials, to correct for these two biases and ensure the resulting data is robust. The proposed programme of monitoring was not proposed in response to any identified significant effect but rather as a best practice measure (SNH, 2009). The monitoring is comprehensive and considered entirely adequate in this regard. The results of this monitoring will be reported to the Planning Authority following each monitoring year and will include recommendations that may inform additional mitigation or adaptation if required.			
MX20	Bats	EIAR Chapter 6 Appendix 6-2	Bat Monitoring Plan includes for 3 years of post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity i.e. the 50 metre separation between the proposed turbine blade tips and the nearest landscape feature, or the influence of aviation lighting. Post construction monitoring will include static detector surveys, walked survey	Years 1, 2, 3	Annually	Project Ecologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			transects and corpse searching to record any bat fatalities resulting from collision. The results of post construction monitoring shall be utilised to assess changes in bat activity patterns post construction and to monitor the implementation of the mitigation strategy. At the end of Year 1, and if a curtailment requirement is identified (i.e. significant bat fatalities encountered), a curtailment programme shall be devised around key activity periods and weather parameters in accordance with NIEA Guidance. The performance of any curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed would be analysed to confirm the efficacy of the curtailment during different periods of bat activity. At the end of each subsequent year of monitoring, the efficacy of the curtailment programme will be reviewed, and any identified efficiencies incorporated into the curtailment programme. This approach allows for an evidence-based review of the potential or bat fatalities at the site, post construction, to ensure that the necessary measures, based on a new baseline post-construction, are implemented for the protection of bat species locally.			
MX21	Flora and Fauna	EIAR Chapter 6 Appendix 6-5	The Proposed Development has the potential to result in enhancement of the surrounding areas through habitat rehabilitation management (as described in the Biodiversity Management and Enhancement Plan) that will be implemented during the construction phase of the Proposed Development and maintained during the operational phase. Details of the management that will be undertaken are provided in the Biodiversity Management and Enhancement Plan in Appendix 6-4 of the EIAR. These include:	See Appendix 6-5 for schedule	As required	Project Ecologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			- Drain blocking within degraded peatlands - Surface Peat Assessments - Vegetation Sampling - Hydrological Monitoring			
Decommissioning Phase						
MX22	Decommissioning	DP Section 3	The Site Manager in consultation with the ECoW will be responsible for employing the services of a suitably qualified ecologist and any other suitably qualified professionals as required throughout the decommissioning works.	As required	As required	Site Manager
MX23	Decommissioning	DP Section 3	Prior to decommissioning, a suitably qualified ecologist will complete an invasive species survey of any material proposed for use as part of foundation backfilling. The invasive species survey will also be undertaken along the cable route to identify invasive species at joint bay locations where excavation to expose the cabling for removal will be required.	As required	As required	Project Ecologist
MX24	Birds	EIAR Chapter 7	Taking a precautionary approach, it is proposed that works will commence outside the bird nesting season (1st of March to 31st of August inclusive). Decommissioning monitoring surveys will be undertaken prior to works associated with decommissioning at the wind farm. The surveys will include a thorough walkover survey to a 500m radius of the development footprint and all works areas, where access allows. Any requirement for decommissioning works to run into the subsequent breeding season following commencement will be subject to a repeat of the decommissioning bird surveys to confirm the absence of breeding birds of conservation concern. If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the decommissioning phase. If it is found to be active	As required	As required	Project Ornithologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			during the decommissioning phase survey, no works shall be undertaken within a species-specific buffer (as per Goodship, N.M. and Furness, R.W. 2022), in line with industry best practise. No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied			

9. PROGRAMME OF WORKS

9.1 Construction Schedule

The construction phase will take approximately 30 months to complete from starting on site to the commissioning of the electrical system and export of electricity from site.

The EIAR stipulated that in the interest of breeding birds, construction would not commence during the breeding bird season, which runs from April to July. The EIAR stipulated that construction may commence between August to the end of March, so that construction activities are ongoing by the time the next breeding bird season comes around and can continue throughout the next breeding season.

Construction activities will be carried out during normal daytime working hours (i.e. weekdays 0700 – 1900hrs and Saturdays 0700 – 1400hrs). However, to ensure that optimal use is made of good weather period or at critical periods within the programme (i.e. concrete pours) or to accommodate delivery of large turbine component along public routes it could be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with the Local Authorities.

The phasing and scheduling main construction task items are outlined in Figure 9.1 below.

Figure 9-1 Indicative Construction Schedule

ID	Task Name	Task Description	Month 1-3	Month 3-6	Month 6-9	Month 9-12	Month 12-15	Month 15-18	Month 18-24	Month 24-30
1	Site Health and Safty		■	■	■	■	■	■	■	■
2	Vertial Realignment of R156		■							
3	Site Compounds	Site Compounds, site access, fencing, gates	■							
4	Borrow pits	Access/site roads to borrow pits, borrow pit excavation, landscaping, fencing	■	■						
5	Site Roads	Construction/upgrade of roads, install drainage measures, install water protection measures	■	■	■	■	■			
6	Turbine Hardstands	Excavate/pile for turbine bases where required		■	■	■	■	■		
6	Turbine Foundations	Fix reinforcing steel and anchorage system, erect shuttering, concrete pour				■	■	■		
7	Substation Construction and Electrical Works	Construct substation, underground cabling, grid connection		■	■	■	■	■	■	■
8	Backfilling and Landscaping						■	■	■	■
9	Turbine Delivery and Erection						■	■	■	■
10	Substation Commissioning							■	■	■
11	Turbine Commissioning							■	■	■

10. COMPLIANCE AND REVIEW

10.1 Site Inspections and Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the ECoW and the Site Supervisor/Construction Manager to ensure all controls to prevent environmental impact, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this CEMP and all other planning application documents. Only suitably trained staff will undertake environmental site inspections.

10.2 Auditing

The Contractor will be responsible for implementing the mitigation and monitoring measures specified throughout the EIAR and compiled in Sections 6 and 7 of this CEMP. The Contractor will also be responsible for ensuring that all construction staff understand the importance of implementing the mitigation measures. The implementation of the mitigation measures will be overseen by the environmental clerk of works or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation.

Environmental audits will be carried out during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to shed light on the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by contractor staff or alternatively by external personnel acting on their behalf. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the CEMP is being properly implemented and maintained. The results of environmental audits will be provided to project management personnel.

10.3 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the wind farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the EMP.

10.4 Corrective Action Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Site Supervisor/Construction Manager, as advised by the Site Environmental Clerk of Works. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention, direct communications between the Site supervisor/Construction Manager and the Site Environmental Clerk of Works will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

10.5 Construction Phase Plan Review

This CEMP will be updated and reviewed prior to commencement of construction, and also every six months thereafter during the construction phase of the project.

APPENDIX 4

AQUATIC SURVEY REPORT

Aquatic baseline report for Ballivor wind farm, Co. Meath/Westmeath

Prepared by Triturus Environmental Ltd. for McCarthy Keville O'Sullivan Ltd.

October 2021

Please cite as:

Triturus (2021). Aquatic baseline report for Ballivor wind farm, Co. Meath. Report prepared by Triturus Environmental Ltd. for McCarthy Keville O'Sullivan Ltd. October. October 2021.

Table of contents

1. Introduction

1.1 Background

The following report provides a baseline assessment of the aquatic ecology including fisheries and biological water quality as well as protected aquatic species and habitats in the vicinity of the proposed Ballivor wind farm, located near Ballivor, Co. Meath.

Undertaken on a catchment-wide scale, the baseline surveys focused on aquatic habitats in relation to fisheries potential for species of high conservation value (i.e., salmonids, eel and lamprey), white-clawed crayfish (*Austropotamobious pallipes*) and other aquatic invertebrates. It also considered macrophytes and aquatic bryophytes, aquatic invasive species, and otter (*Lutra lutra*) which may use the watercourses in the vicinity of the proposed project. Aquatic surveys were undertaken in May and July 2021.

The *n*=20 aquatic survey sites were located within the Deel (Raharney) and Stoneyford River sub-basins, in the wider River Boyne catchment (Boyne_SC_040 and Boyne_SC_050). Whilst not located within a European site, the proposed wind farm site (via several watercourses) shared downstream hydrological connectivity with the River Boyne and River Blackwater SAC (002299).

1.2 Project description

The proposed Bord na Móna Ballivor wind farm is located on the Ballivor, Bracklin, Carranstown, Lisclogher and Lisclogher West bogs located in Counties Meath and Westmeath. The closest large settlements to the site are Ballivor which is located approximately 2km to the east, Delvin which is located approximately 2.5km to the northwest and Raharney which is located 3km to the west.

A full description of the proposed project is provided in Chapter 2 of the EIAR.

2. Methodology

2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed wind farm project were considered as part of the current assessment. A total of *n*=20 sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1** below). The nomenclature for the watercourses surveyed is as per the Environmental Protection Agency's (EPA) online map viewer.

Aquatic survey sites were present on the Cartenstown Stream (EPA code: 07C60), Stonestown River (07S11), Ballinn Stream (07B47), Bolandstown River (07B45), Woodtown West Stream (07W06), Stonyford River (07S02), Carranstown Little River (07C87), Killaconnigan Stream (07K34), Kilballivor Stream (07B35), Ballivor River (07B52) and two unnamed tributaries, Graffanstown Stream (07G10), Ballynaskeagh Stream (07B24), Mucklin Stream (07M13), River Deel (07D01), Craddanstown Stream (07C550), Clondalee More Stream (07C77) and River Boyne (07B04) (**Table 2.1**). The survey sites on the Stonyford River, River Deel and River Boyne were located within the River Boyne and River Blackwater SAC (002299).

Surveys at each of these sites included a fisheries assessment (electro-fishing, habitat appraisal), and (where suitable) biological water quality sampling (Q-sampling) (**Figure 2.1**). White-clawed crayfish (sweep netting & hand searching) surveys were also undertaken at each site, in addition to macrophyte & aquatic bryophyte and otter surveys. This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed wind farm project.

Please note this aquatic report should be read in conjunction with the final Environmental Impact Assessment Report (EIAR) prepared for the proposed project. More specific aquatic methodology is outlined below and in the appendices of this report.

2.2 Aquatic site surveys

Surveys of the watercourses within the vicinity of the proposed wind farm project were conducted in July 2021. Survey effort focused on both instream and riparian habitats in the vicinity of each sampling point (see **Figure 2.1** above). The watercourses at each survey site were described in terms of the important aquatic habitats and species. This helped to evaluate species and habitats of ecological value in the vicinity of each site. The aquatic baseline prepared would inform mitigation for the wind farm project.

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

- Physical watercourse/waterbody characteristics (i.e., width, depth etc.)
- Substrate type, listing substrate fractions in order of dominance (i.e., bedrock, boulder, cobble, gravel, sand, silt etc.)

- River profile in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 2.1 Location of *n*=20 aquatic survey sites in the vicinity of Ballivor wind farm near Ballivor, Co. Meath.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Cartenstown Stream	07C60	Ballyhealy	661703	759056
A2	Stonestown River	07S11	Cartenstown Stream confluence	663011	759233
A3	Ballinn Stream	07B47	Local road crossing, Lisclogher Great	664937	760833
A4	Bolandstown River	07B45	Local road crossing, Bracklin	662455	758674
A5	Cartenstown Stream	07C60	Local road crossing, Coolronan	666077	756898
A6	Woodtown West Stream	07W06	Lisclogher Great	666459	758978
A7	Stonyford River	07S02	Cloghbrack Bridge	667624	758158
A8	Carranstown Little River	07C87	Coolronan	664558	756649
B1	Killaconnigan Stream	07K34	Grange More	664652	754555
B2	Kilballivor Stream	07K35	Killconnigan	667115	755088
B3	Unnamed stream	n/a	Clonycavan	667308	753476
B4	Unnamed stream	n/a	Local road crossing, Clonycavan	666871	752716
B5	Ballivor River	07B52	Local road crossing, Clonycavan	667266	751725
C1	Graffanstown Stream	07G10	Local road crossing, Bracklin	659139	757974
C2	Ballynaskeagh Stream	07B24	Local road crossing, Ballynaskeagh	659022	756531
C3	Mucklin Stream	07M13	Local road crossing, Craddanstown	659139	755895
C4	River Deel	07D01	Raharney Bridge, R156 road crossing	660041	753049
C5	Craddanstown Stream	07C55	Local road crossing, Riverdale	663341	751542
C6	Clondalee More Stream	07C77	Local road crossing, Clondalee More	664753	750982
D1	River Boyne	07B04	Scarriff Bridge, R156 road crossing	673349	752700

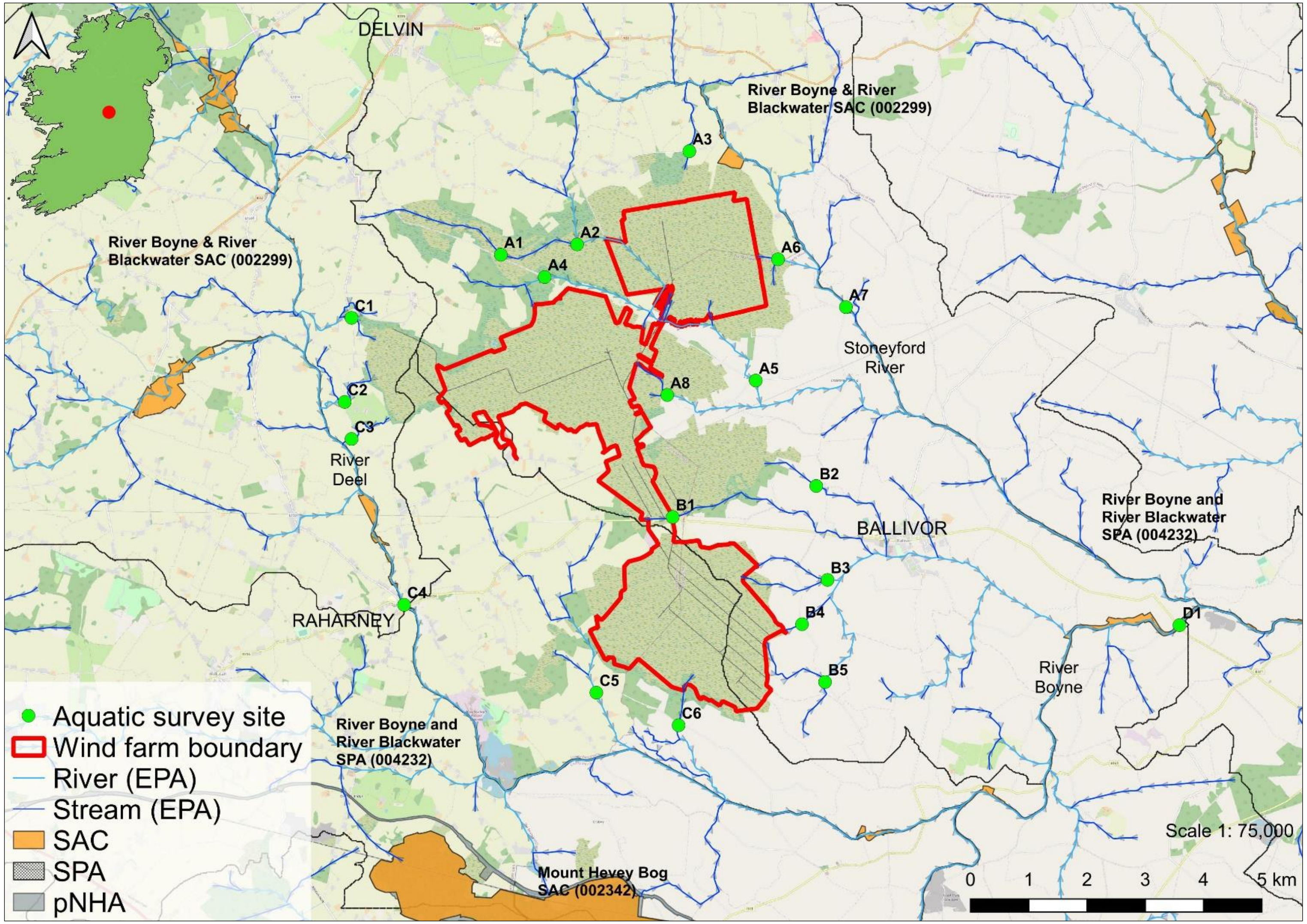

Figure 2.1 Overview of the *n*=20 aquatic survey site locations for the proposed Ballivor wind farm project, Co. Meath

2.3 Catchment-wide electro-fishing

A catchment-wide electro-fishing (CWEF) survey of the watercourses within the vicinity of the proposed wind farm (*n*=20 sites, **Figure 2.1**) was conducted on the 14-16th July 2021, under the conditions of a Department of Communications, Climate Action & Environment (DCCAE) license. The survey was undertaken in accordance with best practice and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of the watercourses in the vicinity of the proposed wind farm project (**Figure 2.1**) was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites.

For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix A.**

2.4 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in July 2021 under a National Parks and Wildlife (NPWS) open licence (no. C145/2021), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 6 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish license sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). Trapping of crayfish was not feasible given the small nature of most aquatic survey sites sampled. An appraisal of white-clawed crayfish habitat at each site was conducted based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider Ballivor wind farm survey area was completed.

2.5 Biological water quality (Q-sampling)

The aquatic survey sites were assessed for biological water quality through Q-sampling in May 2021. Some sites were unsuitable for Q-sampling during the survey period given low water levels/flows and the non-perennial nature of some watercourses (see section 4). Sites A2 (Stonestown River), B1 (Killaconnigan Stream), B2 (Kilballivor Stream), B4 (Ballivor River) and C3 (Mucklin Stream) were dry or semi-dry during the sampling period (i.e., non-perennial channels) and, thus, it was not possible to take biological water quality (Q) samples at these sites. A total of *n*=15 sites were sampled (i.e., sites A1, A3, A4, A6, A7, A8, A9, B3, B5, C1, C2, C4, C5, C6 & D1; **Figure 2.2**).

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

Table 2.2 Reference categories for EPA Q-ratings (Q1 to Q5)

Q Value	WFD Status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.6 Otter signs

The presence of otter (*Lutra lutra*) was determined through the recording of otter signs within 150m of the aquatic survey sites. This also helped to determine the presence of white-clawed crayfish, whose remains may be found in otter spraint. The location of signs was recorded via handheld GPS.

2.7 Aquatic ecological evaluation

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

2.8 Biosecurity

A strict biosecurity protocol including the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Particular cognisance was given towards preventing the spread or introduction of crayfish plague (*Aphanomyces astaci*) given the known distribution of white-clawed crayfish (*Austropotamobius pallipes*) in the wider survey area. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced.

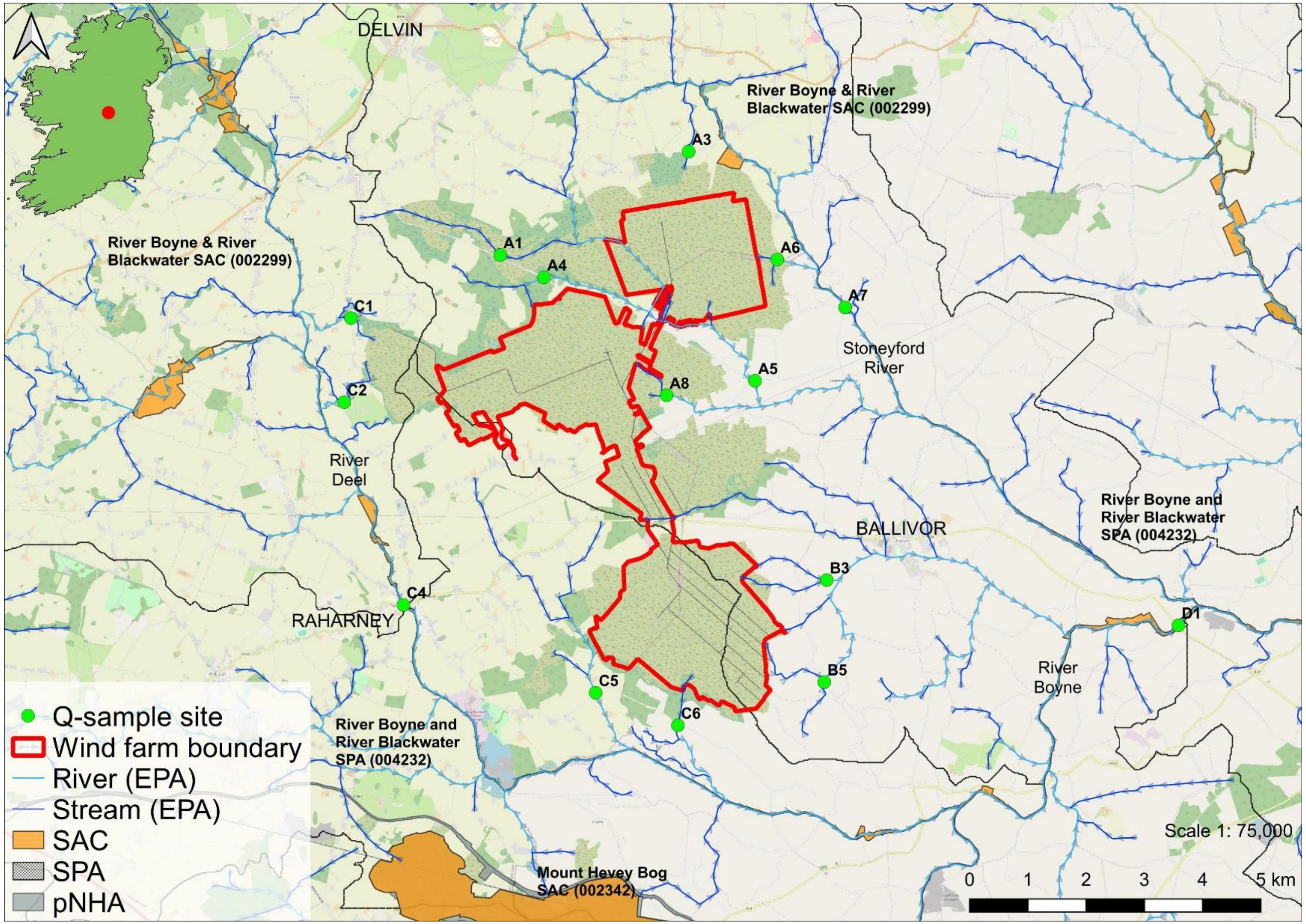

Figure 2.2 Overview of the biological water quality (Q-sampling) survey locations for the proposed Ballivor wind farm project, Co. Meath

3. Receiving environment

3.1 Sites designated for aquatic interests

There was a single European site with downstream hydrological connectivity to the proposed Ballivor wind farm project, namely the River Boyne and River Blackwater SAC (site code: 002299) (**Figure 2.1**).

3.1.1 River Boyne and River Blackwater SAC (002299)

This site comprises the freshwater element of the River Boyne as far as the Boyne Aqueduct, the Blackwater as far as Lough Ramor and the Boyne tributaries including the Deel, Stoneyford and Tremblestown Rivers. These riverine stretches drain a considerable area of Meath and Westmeath, and smaller areas of Cavan and Louth. The Boyne and its tributaries form one of Ireland's premier game fisheries and the area offers a wide range of angling, from fishing for spring salmon and grilse to seatrout fishing and extensive brown trout fishing. Atlantic Salmon (*Salmo salar*) use the tributaries and headwaters as spawning grounds. The River Blackwater is a medium sized limestone river which is still recovering from the effects of the arterial drainage scheme of the 1970s. Salmon stocks have not recovered to the numbers that existed pre drainage. The Deel, Riverstown, Stoneyford and Tremblestown Rivers are all spring-fed, with a continuous high volume of water. They are difficult to fish because some areas are overgrown, while others have been affected by drainage with resultant high banks due to deepening. This River Boyne & Blackwater SAC (002299) is also important for the populations of two other species listed on Annex II of the E.U. Habitats Directive which it supports, namely river lamprey (*Lampetra fluviatilis*), which is present in the lower reaches of the Boyne River, and otter (*Lutra lutra*), which can be found throughout the site (NPWS, 2014).

Potential downstream hydrological connectivity exists between the proposed wind farm site and River Boyne and River Blackwater SAC via all 19 no. survey watercourses (20 no. survey sites within), namely the Cartenstown Stream, Stonestown River, Ballinn Stream, Bolandstown River, Woodtown West Stream, Stonyford River, Carranstown Little River, Killaconnigan Stream, Kilballivor Stream, Ballivor River and two unnamed tributaries, Graffanstown Stream, Ballynaskeagh Stream, Mucklin Stream, River Deel, Craddanstown Stream, Clondalee More Stream and River Boyne (**Figure 2.1**).

The survey sites on the Stonyford River (A7), River Deel (C4) and River Boyne (D1) were located within the River Boyne and River Blackwater SAC (002299) (**Figure 2.2**). The River Boyne and River Blackwater SAC is designated for the following qualifying interests (NPWS, 2021), namely;

- [1106] *Salmo salar* (Atlantic salmon)
- [1355] *Lutra Rivertown* (otter)
- [1099] *Lampetra fluviatilis* (river lamprey)
- [91E0] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)
- [7230] Alkaline fens

3.2 Sensitive species data request

A sensitive species data request was submitted (13/07/21) to the National Parks and Wildlife Service for the 10km grid squares containing and adjoining the proposed wind farm project (i.e., N55, N65, N66, N75) and was received on the 23rd July 2021. Records for a number of rare or protected species were available although most did not overlap directly with the survey area (**Figure 3.1**).

Records for white-clawed crayfish (*Austropotamobius pallipes*) widespread within the survey area, on the Deel, Stonyford and Boyne rivers (**Figure 3.1**). However, the bulk of these records were historical only (i.e., 1971-1985). A low number of contemporary records (2006-2009) were available for the upper reaches of the Stonyford River, although a single record was available for Stonyford Bridge near the River Boyne confluence (downstream of survey area) in 2009.

Otter (*lutra lutra*) records were also widespread throughout the relevant grid squares, with records available for the River Deel, Stonyford River and River Boyne. Historical records (1980) were available for the Cartenstown Stream and Bolandstown River within the vicinity of the proposed wind farm planning boundary.

Numerous kingfisher (*Alcedo atthis*) records were available for the survey area, including along the Deel, Stonyford and Boyne Rivers (all from 2010). Historical records were also available for these watercourses from data held by the National Biodiversity Data Centre (NBDC). There were no kingfisher records available for the watercourses within the proposed site boundary.

Common frog (*Rana temporaria*) were widespread throughout 10km grid squares S22, S23, S24, S33 and S34, with a low number of records available for Culronan Bog, located within the proposed site boundary.

3.3 Ballivor wind farm catchment and survey area description

The proposed Ballivor wind farm is located on the Ballivor, Bracklin, Carranstown, Lisclogher and Lisclogher West bogs located in Counties Meath and Westmeath. The closest large settlements to the site are Ballivor which is located approximately 2km to the east, Delvin which is located approximately 2.5km to the northwest and Raharney which is located 3km to the west. The proposed wind farm site is within the Eastern River Basin District and within hydrometric area 7 (Boyne). This catchment includes the area drained by the River Boyne and by all streams entering tidal water between The Haven and Mornington Point, Co. Meath, draining a total area of 2,694km^2. The aquatic survey sites were located within the Deel (Raharney) and Stoneyford River sub-basins, in the wider River Boyne catchment (Boyne_SC_040 and Boyne_SC_050) (**Figure 2.1**).

The following watercourses drained the proposed wind farm site: Cartenstown Stream (07C60), Stonestown River (07S11), Ballinn Stream (07B47), Bolandstown River (07B45), Woodtown West Stream (07W06), Stoneyford River (07S02), Carranstown Little River (07C87), Killaconnigan Stream (07K34), Kilballivor Stream (07K35), Ballivor River (07B52), Graffanstown Stream (07G10), Ballynaskeagh Stream (07B24), Mucklin Stream (07M13), River Deel (07D01), Craddanstown

Stream (07C55), Clondalee More Stream (07C77), River Boyle (07B04) and an unnamed stream near the townland of Clonycavan.

The watercourses and aquatic surveys sites in the vicinity of Ballivor wind farm were typically small, lowland depositing channels (FW2; Fossitt, 2000) and drainage ditches (FW4) (see **section 4** for more details). The three major watercourses with hydrological connectivity to the site were the River Deel, Stoneyford River and River Boyne. Land use practices in the wider survey area were primarily peat bogs (CORINE 412) bordered by agricultural pasture (231) and non-irrigated arable land (211).

Predominantly, the watercourses flowed over areas of Visean or Tournaisian limestone and calcareous shale limestone (Geological Survey of Ireland data).

3.4 EPA water quality data (existing data)

The following outlines the available water quality data for the watercourses in context of the proposed wind farm project. Only recent water quality (i.e., since 2015) is summarised below. There were no existing EPA biological monitoring data available for the smaller watercourses surveyed, namely the Cartenstown Stream (07C60), Stonestown River (07S11), Ballinn Stream (07B47), Bolandstown River (07B45), Woodtown West Stream (07W06), Carranstown Little River (07C87), Killaconnigan Stream (07K34), Kilballivor Stream (07K35), Ballivor River (07B52), Graffanstown Stream (07G10), Ballynaskeagh Stream (07B24), Mucklin Stream (07M13), Craddanstown Stream (07C55) or Clondalee More Stream (07C77).

Please note that biological water quality analysis was undertaken as part of this study, with the results presented in the **section 4** and **Appendix B** of this report.

3.4.1 Stoneyford River

The Stoneyford River (EPA code: 07S02) flowed parallel to the proposed eastern site boundary. There were a number of EPA biological monitoring stations which have been recently monitored on the river (since 2015). In the vicinity of the wind farm site, the uppermost of these (station code RS07S020075) was located at Stonestown Bridge upstream of the proposed site boundary, and achieved Q3 (poor status) water quality in 2020. Station RS07S020100, located at Rathkenna Bridge, downstream of the site boundary and downstream of aquatic survey site A7, achieved Q4 (good status) water quality in 2015. At Stonyford Bridge (station RS07S020400) near the River Boyne confluence, the river achieved Q3-4 (moderate status) in 2020.

At the time of report drafting, there was no WFD status (2013-2018) or River Waterbodies Risk score available for the Stoneyford River.

3.4.2 River Deel

The River Deel (07D01) ran parallel (loosely north to south) to the western site boundary, draining several small watercourses to the west and south of the proposed site. At both Cummer Bridge (station RS07D010200) and Raharney Bridge (RS07D010300, survey site C4) the Deel achieved Q4 (good status) in 2020 and 2018, respectively. At Inan Bridge (RS07D010400), located south of the wind farm site, the river achieved Q3-4 (moderate status) in 2020. The lowermost monitoring station on the river, at the R161 road bridge (RS07D010600), the river achieved Q4 (good status) in 2020.

Upstream of the wind farm, the Deel (Raharney)_030 sub-catchment was of moderate WFD status. Downstream, the Deel (Raharney)_040 and Deel (Raharney)_060 sub-catchments were of good WFD status (2013-2018). Downstream of Raharney, the Deel (Raharney)_050 sub-catchment was of moderate WFD status. At the time of report drafting, there was no River Waterbodies Risk score available for the River Deel.

3.4.3 River Boyne

The River Deel and Stoneyford River both joined the River Boyne (07B04) to the south of the proposed site (i.e., downstream connectivity). At Inchamore Bridge (RS07B040800), downstream of the Deel confluence, the Boyne achieved QQ4-5 (high status) in 2015. However, at Scarriff Bridge (RS07B040900, aquatic survey site D1), the river achieved Q3-4 (moderate status) in 2015. Downstream of the Stoneyford confluence, the Boyne typically achieved Q3-4 (moderate status) for the length of its course (EPA data 2015-2020).

Whilst the WFD status of the Boyne was good upstream of Scarriff Bridge, downstream it fell to moderate status and was generally considered ‘at risk’ in terms of the Waterbodies Risk score.

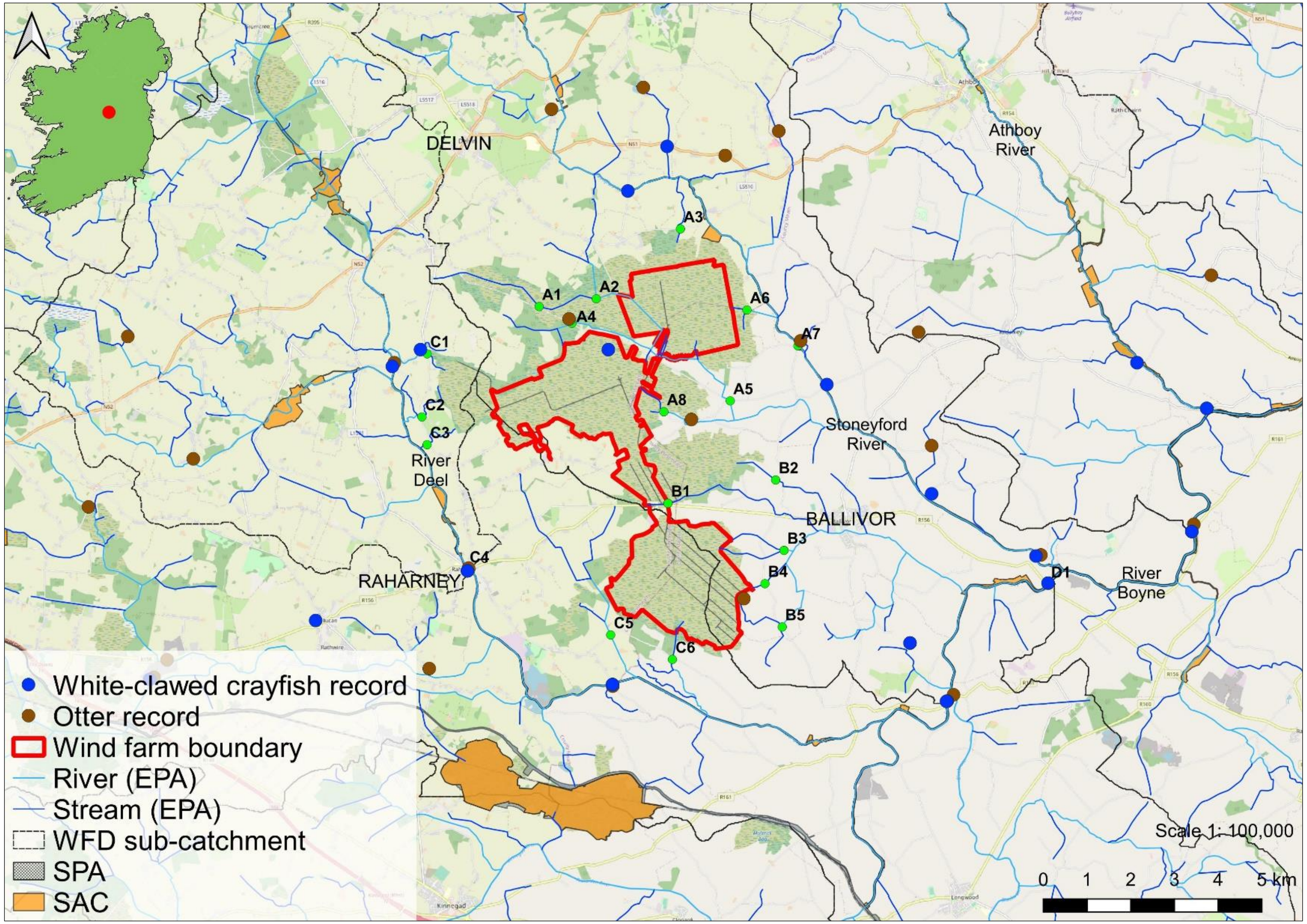

Figure 3.1 Distribution of white-clawed crayfish and otter records in the vicinity of the proposed Ballivor wind farm (source: NPWS data)

4. Results of aquatic surveys

The following section summarises each of the *n*=20 survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, white-clawed crayfish and macrophyte/aquatic bryophyte communities. The aquatic sites were surveyed in July 2021. Please refer to **Appendix A** (fisheries assessment report) for detailed fisheries results. Biological water quality (Q-sample) results are also summarised for each sampling site (*n*=15) in Appendix B. Habitat codes are listed according to Fossitt (2000). Scientific names are provided at first mention only. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.1**.

4.1 Aquatic survey site results

4.1.1 Site A1 – Cartenstown Stream, Ballyhealy

Site A1 was located on the upper reaches of the Cartenstown Stream in area of cutover bog (PB4). The stream was a very narrow (<0.5m wide) modified drainage channel that had been straightened and deepened historically with bankfull heights of 1.5-2m. The channel was deeply cut into peat and, resultingly, the channel bed comprised 100% soft peat with no hard substrata. The site featured 100% slow-flowing glide habitat and was considered likely non-perennial (i.e., dries up seasonally), being 0.05-0.1m deep with a slight flow. Instream encroachment by downy birch (*Betula pubescens*), purple moor grass (*Molinia caerulea*), heather (*Calluna vulgaris*), grey willow (*Salix cinerea*) and other terrestrial grasses obstructed the flow considerably. Shading was also high given the steep (often vertical) cut banks. The channel was bordered by cutover bog dominated by heather with cottongrass (*Eriophorum angustifolium*), occasional tormentil (*Potentilla erecta*) and scattered downy birch and Scots pine (*Pinus sylvestris*). Macrophytes and aquatic bryophytes were absent due to the peat-stained water, likely non-perennial nature and shading.

Three-spined stickleback was the only fish species recorded via electro-fishing (**Appendix A**). With the exception of low densities of this species, the heavily silted channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. The site offered no suitability for white-clawed crayfish or otter with no evidence of either species recorded during the survey.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). However, it should be noted that, given the poor flows and heavily silted nature, this is a tentative Q-rating. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site A1 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.1 Representative image of site A1 on the Cartenstown Stream, May 2021

4.1.2 Site A2 – Stonestown River, Cartenstown Stream confluence

Site A2 was located on the Stonestown River (07S11) at the Cartenstown Stream confluence. The channel had been modified historically (straightened and deepened) and was 100% dry at the time of survey, with no pools of standing water remaining. The non-perennial channel drained cutover peat bog (PB4) and averaged 1.5-2m wide in a shallow U-shaped channel. The river featured a 100% peat base and was evidently dry for much of the year. The channel was heavily scrubbed with willow (*Salix* sp.) and bramble (*Rubus fruticosus* agg.) vegetation.

The river had no aquatic or fisheries value given the lack of water. However, the downstream-connecting Cartenstown Stream featured low flows at the time of survey and had some low fisheries and aquatic value.

Site A2 was not suitable for Q-sampling during the survey period due to its dry nature and lack of flow. Thus, it was not possible to assess biological water quality at this site.

The aquatic ecological evaluation of site A2 was of **local importance (lower value) (Table 4.1).**

Plate 4.2 Representative image of site A2 on the Stonestown River, May 2021 (channel 100% dry)

4.1.3 Site A3 – Ballinn Stream, Lisclogher Great

Site A3 was located on the upper reaches of the Ballinn Stream (07B47) at a local road crossing north of the wind farm site boundary. The stream represented a 1.5-2m-wide peat drainage channel (FW4) that had been straightened and deepened historically, with bankfull heights of 2m-2.5m in a steep U-shaped channel. The channel had been excavated to a uniform depth of 0.6-0.7m and was heavily silted (peat deposition). Some fine to medium gravels were present underfoot but these were heavily bedded in silt. Peat staining was high. The stream adjoined another channel along the adjacent local road which featured greater depths to 0.8m in a 2m wide channel. The site was heavily covered with terrestrial and aquatic vegetation. Macrophytes recorded included occasional watercress (*Nasturtium officinale*) and common duckweed (*Lemna minuta*) with >90% cover of bentgrass (*Agrostis* sp.) instream, creating extensive floating mats. Reed canary grass (*Phalaris arundinacea*) was also present along the banks and instream. There was no open water present. Flow was very slow at the time of survey (even following rainfall). Upstream of the confluence, the Ballinn Stream was heavily shaded by riparian scrub with frequent downy birch and grey willow treelines. To the west, cutover bog (PB4) with high birch cover was present, with GA1 (sheep grazing) to the west and downstream of the road crossing (pipe culvert).

Three-spined stickleback was the only fish species recorded via electro-fishing (**Appendix A**). With the exception of low densities of this species, the heavily silted channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Some low potential for European eel was present but none were recorded. The site offered no suitability for white-clawed crayfish or otter.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). However, it should be noted that, given the poor flows and absence of faster flowing riffle and glide habitat heavily, this is a **tentative** Q-rating. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site A3 was of **Local importance (lower value)** (**Table 4.1**).

Plate 4.3 Representative image of site A3 on the Ballinn Stream, May 2021 (stream is in background, with adjoining drainage channel in foreground)

4.1.4 Site A4 – Bolandstown River, Bracklin

Site A4 was located on the upper Bolandstown River (07B45) at a local road crossing. The river was a small lowland depositing watercourse (FW2) which had been historically straightened and deepened. Recent maintenance (bank clearance and excavation) was evident upstream of the bridge. The river averaged 2m wide and 0.1-0.2m deep in a deep V-shaped channel with 2-3m bankfull heights. The site predominantly featured shallow moderate flowing glide habitat with occasional riffle areas and even more occasional pools (max depth 0.4m). The water was heavily peat-stained at the time of survey (following recent rain) and the substrata were moderately to heavily silted with flocculent peat. The bed was dominated by soft sand (low compaction) with frequent silt deposits (some >15cm deep). Exposed gravels were rare but present (tailings of pools etc.) but these were compacted/bedded. Boulder and cobble were absent. Instream macrophytes were limited to emergent species given the high peat-staining with occasional watercress, brooklime (*Veronica beccabunga*) and water speedwell (*Veronica* sp.) along channel margins. Downstream of the bridge, the river was adjoined by improved pasture (GA1) and scrubby woodland dominated by willow, birch and occasional ash (*Fraxinus excelsior*) along the channel with frequent cherry laurel (*Prunus laurocerasus*). An area of clear-fell (WS5) was located adjacent to the channel upstream of the bridge (south bank).

Three-spined stickleback and *Lampetra* sp. were the only species recorded via electro-fishing (**Appendix A**). Site A4 had low nursery, spawning and holding value for salmonids given the poor thalweg and very high levels of siltation and none were recorded during electro-fishing. The channel was not considered of value to European eel given the absence of refugia such as cobble and boulder. The channel was however of some value to lamprey given pockets of fine silt with a high organic content up to 20cm deep adjoining areas with finer gravels (albeit degraded by silt). Low to moderate densities of lamprey were recorded at 2.8 per m^2 ($5m^2$ of habitat targeted and 14 ammocoetes captured). The site offered no suitability for white-clawed crayfish, given heavy siltation. Although no otter signs were recorded, there was some low foraging potential for the species.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site A3 was of **Local importance (higher value)** (**Table 4.1**).

Plate 4.4 Representative image of site A4 on the Bolandstown River, May 2021

4.1.5 Site A5 – Cartenstown Stream, Coolronan

Site A5 was located on the Cartenstown Stream (07C60) at a local road crossing, approx. 1.6km downstream of the wind farm boundary. The stream was a small, swift-flowing lowland depositing watercourse (FW2) that had been straightened and deepened historically, both upstream and downstream of the bridge. The channel averaged 2.5-3m wide in a deep steep U-shaped channel with bankfull heights often exceeding 2.5m. Channel depths were between 0.1m and 0.5m deep. The site was dominated by glide and pool habitat with occasional riffles upstream and downstream in association with instream large woody debris (LWD). The water was very heavily peat-stained at the time of survey. Instream substrata were dominated by bedded mixed gravels and cobble with frequent boulder. Sand was frequent and sand/silt accumulations were present in channel margins and slacks. The bridge featured a concrete apron with harder substrata atop. Overall, siltation (peat derived) was moderate. Given high peat staining, there were no visible macrophytes or aquatic bryophytes. The stream flowed through improved pasture (GA1) with associated riparian treelines (WL2) and hedgerows of hawthorn (*Crataegus monoygna*), elder (*Sambucus nigra*), willow, privet (*Ligustrum vulgare*) and scrubby bramble understories.

Brown trout (*Salmo trutta*) and *Lampetra* sp. were the only species recorded via electro-fishing (**Appendix A**). The site had low nursery, spawning and holding value for salmonids given the poor thalweg and very high levels of siltation. These were exacerbated by historical channelization and sedimentation pressures from the adjoining improved grassland. Only small numbers of 0+ brown trout were recorded, exemplifying the poor value of the site for salmonids. The channel was considered of only moderate value to European eel (none recorded). The channel was however of some value to lamprey given pockets of fine silt with a high organic content up to 15cm deep adjoining areas with finer gravels (albeit degraded by silt). Very low densities of lamprey were recorded at 0.4 per m^2 ($10m^2$ of habitat targeted and 4 ammocoetes captured) despite targeted electro-fishing of soft sediment areas being undertaken. The site offered no suitability for white-clawed crayfish, given heavy siltation. Although no signs were recorded, there was some low potential for foraging otter.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site A5 was of **Local importance (higher value)** (**Table 4.1**).

Plate 4.5 Representative image of site A5 on the Cartenstown Stream, May 2021 (facing downstream from underneath road bridge)

4.1.6 Site A6 – Woodtown West Stream, Lisclogher Great

Site A6 was located on the on the Woodtown West Stream (07W06) was located in cutover bog (PB4) downstream of the wind farm site boundary. The stream was a heavily-modified bog drainage channel (FW4) which averaged 1-1.5m in width and 0.2-0.3m deep. The channel had been historically straightened and deepened adjacent to a working area of cutover bog. The stream had an imperceptible flow with numerous instream blockages (100% standing water/ponding). The channel was considered non-perennial at this location. The drainage channel was grossly silted (several silt dams present). The channel and banks comprised 100% soft peat. No macrophytes were present in the heavily peat-stained water. However, *Sphagnum* sp. moss was abundant within the channel and filamentous algae was also present (10% cover). Encroachment of terrestrial grasses (e.g., *Juncus* sp.) was high and often coverage exceeded 80%. The channel adjoined an area of cutover bog with birch-dominated woodland/scrub present along the south bank, with frequent heather, soft rush (*Juncus effusus*) and occasional willow. Improved pasture (GA1) was present to the south.

No fish species were recorded via electro-fishing (**Appendix A**) and the heavily silted channel was of no fisheries value, given the lack of flow and heavily-silted (peat) nature. The site offered no suitability for white-clawed crayfish or otter and the species were not recorded during the survey. However, both common frog (*Rana temporaria*) and smooth newt (*Lissotriton vulgaris*) were recorded via sweep netting.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that, given the poor flows and absence of faster flowing riffle and glide habitat heavily, this is a tentative Q-rating. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of both smooth newt and common frog, the aquatic ecological evaluation of site A6 was of **local importance (higher value)** (**Table 4.1**).

Plate 4.6 Representative image of site A6 on the Woodtown West Stream, May 2021

4.1.7 Site A7 – Stonyford River, Cloghbrack Bridge

Site A7 was located on the Stoneyford River (07S02) at Cloghbrack Bridge. The river at this location was a high energy lowland depositing watercourse (FW2). The had been historically straightened and over-deepened, with bankfull heights of 3-4m. The channel was 7-8m in width in a steep V-shaped channel that had been excavated down to clay. Thus, the substrata were very compacted/bedded, with calcified deposits present also further reducing availability of the bed to aquatic biota. The site was typified by fast glide averaging 0.4-0.8m in depth. Small pools to 1m+ were present but rare with deep glide predominating upstream and downstream of the bridge structure. Riffles were present locally upstream of the bridge. A small drain adjoined the south bank of the river which carried a significantly higher peat loading (stained water). Peat staining of the main river was low. The heavily compacted bed featured mostly cobble and boulder with interstitial bedded coarse gravels and some sand. Soft sediment deposits were not present. Instream macrophytes were not recorded owing to high flow rates, relatively high riparian shading and compacted substrata although the cover of Kneiff's feather moss (*Leptodictyum riparium*) was relatively high (20%), with submerged *Pellia* sp. liverwort being occasional on boulders. Filamentous algae was also present at low coverage (<2%). The riparian zone supported mature treelines of ash, alder (*Alnus glutinosa*), willow and hazel (*Corylus avellana*) with occasional sycamore (*Acer psuedoplatanus*). The understorey was dominated by bramble scrub (WS1). The site was adjoined by improved pasture (GA1) on all sides.

Brown trout, Atlantic salmon (*Salmo salar*) and *Lampetra* sp. ammocoetes were recorded via electro-fishing (**Appendix A**). The channel featured moderate quality nursery and spawning habitat, given that both were compromised by historical dredging. This had resulted in a channel with limited riffle habitat and localised patches of gravel between paths of argillaceous clay. The holding value for salmonids was good due to the presence of deep glide and pool with overhanging trees, undercut banks etc. The site was not considered of good quality for European eel given the limited presence of accessible refugia such as cobble and boulder. The site was of only moderate value for lamprey, with both sub-optimal adult (spawning) and ammocoete burial habitat present. Low densities of larval lamprey were recorded at 1.75 per m^2 ($4m^2$ of habitat targeted and n=7 ammocoetes captured). The site offered poor suitability for white-clawed crayfish given a paucity of suitable refugia and no crayfish were recorded during targeted surveys. Although no signs were recorded, there was some good potential for foraging otter given the presence of salmonids.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the location of the Stoneyford River within the River Boyne and River Blackwater SAC (002299), the aquatic ecological evaluation of site A7 was of **international importance.**

Plate 4.7 Representative image of site A7 on the Stonyford River, May 2021 (facing downstream towards bridge)

4.1.8 Site A8 – Carranstown Little River, Coolronan

Site A8 was located on the upper reaches of the Carranstown Little River (07C87), downstream of the wind farm site boundary. Situated at a drainage channel confluence, site A8 was a 2m-wide historically modified, swift-flowing lowland depositing watercourse with some eroding characteristics. The river averaged 0.2-0.3m deep with occasional pools >0.5m. The river had been straightened and deepened with bank heights exceeding 2.5m in a steep U-shaped channel. The substrata were dominated by bedded/compacted mixed gravels and small cobble with occasional boulder in faster flowing areas near the bridge culvert, with sand heavily intermixed with peat dominating in slower flowing glide. The river drained an area of adjacent cutover bog (PB4) and peat staining was very high at the time of survey. Silt accumulations were present and, despite having high fractions of sand, were invariably soft (uncompacted). Glide habitat dominated with only occasional pool and even more occasional riffle areas. Instream macrophytes were absent given the peat-staining but the semi-aquatic moss *Brachythecium rivulare* was present on the lip of the bridge apron (2ft fall, barrier to fish at low flows) and on larger boulders. The site adjoined cutover bog and improved grassland (GA1), with scattered treelines of willow, elder and downy birch and scrubby understories adjoining the channel.

No fish were recorded via electro-fishing at site A8 (**Appendix A**). Suitability was limited to three-spined stickleback, although none were recorded present. The channel featured poor quality salmonid nursery and spawning habitat, given high levels of peat-derived siltation. The site was not considered of good quality for European eel given the limited presence of accessible refugia such as cobble and boulder. Despite the presence of soft sediment accumulations, these were humic in nature (i.e., peat-dominated) and not suitable for larval lamprey. The site offered no suitability for white-clawed crayfish given high levels of siltation. Potential for otter was low given the evidently poor fish prey resource.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of fish species and poor status water quality, the aquatic ecological evaluation of site A8 was of **local importance (lower value).**

Plate 4.8 Representative image of site A8 on the Carranstown Little River, May 2021

4.1.9 Site B1 – Killaconnigan Stream, Grange More

Site B1 was located on the uppermost reaches of the Killaconnigan Stream (07K34), adjacent to the R156 near the Ballivor Bord na Móna factory. The stream represented a semi-dry bog drainage channel (FW4), that averaged 2m wide and <0.1m deep. The channel had been straightened and over-deepened historically, with poor recovery evident. The stream was located in a deeply excavated, steep U-shaped channel with bankfull heights of 2-2.5m. There was no flow at the time of survey with stagnant water (ponding) present. The site drained an extensive area of cutover bog (PB4) to the north and was heavily silted, with no harder substrata present (i.e., 100% soft peat). The banks were heavily scrubbed with downy birch, willow and bramble. As such, riparian shading was high and no instream macrophytes were present.

No fish were recorded via electro-fishing of stagnant pools (**Appendix A**). Other than very low suitability for three-spined stickleback in the wider area, site B1 was not of fisheries value given its heavily-silted nature with limited water. There was some suitability for common frog (although none were recorded via sweep netting). The site had no suitability or white-clawed crayfish or otter and the species was not recorded.

Site B1 was not suitable for Q-sampling during the survey period due to its semi-dry nature and lack of flow. Thus, it was not possible to assess biological water quality at this site.

Given the non-perennial nature of the stream at this location, the aquatic ecological evaluation of site B1 was of **local importance (lower value).**

Plate 4.9 Representative image of site B1 on the Killaconnigan Stream, May 2020 (semi-dry channel)

4.1.10 Site B2 – Kilballivor Stream, Killconnigan

Site B2 was located on the upper reaches of the Kilballivor Stream, approx. 1km downstream of an extensive area of cutover bog. The site was 100% dry at the time of survey and, evidently, had not conveyed water for a considerable period. The 2-2.5m wide, U-shaped drainage channel (FW4) had been historically straightened and realigned through improved agricultural grassland. Bankfull heights were 1-1.5m. The channel base was dry mud (i.e., no evidence of recent flows or standing water) and was colonised by ruderal species such as nettle. The non-perennial site was heavily shaded by a mature treeline/hedgerow of ash, elder and hawthorn with bramble scrub. The site was adjoined by improved grassland on both banks.

The stream had no aquatic or fisheries value given the lack of water at the time of survey and would appear to offer no aquatic value for much of the year. No signs of otter were recorded.

Site B4 was not suitable for Q-sampling during the survey period due to its dry nature and lack of flow. Thus, it was not possible to assess biological water quality at this site.

The aquatic ecological evaluation of site B2 was of **local importance (lower value) (Table 4.1).**

Plate 4.10 Representative image of site B2 on the Kilballivor Stream, May 2020 (100% dry channel)

4.1.11 Site B3 – Unnamed stream, Clonycavan

Site B3 was located at the confluence of two unnamed tributaries (no EPA code) of the Ballivor River, approx. 1.4km downstream of the site boundary. Bordered by intensive pasture (GA1), both channels had been extensively straightened and deepened in the recent past with poor recovery evident. Downstream and upstream of the confluence, the channel averaged 2m in width and 0.1-0.2m deep. The steep V-shaped profile featured bankfull heights of 2.5m throughout. Slow-flowing glide dominated with an absence of pool habitat apart from the confluence. The northern channel featured a greater flow than the southern channel, which was more representative of a drainage ditch habitat (near stagnant and very heavily silted apart from near road crossing, where dredging had not been undertaken). As a result of dredging, the substrata were very heavily silted with very limited harder substrata present. These were restricted to localised medium-coarse gravels and small cobble in areas of faster flow (riffle zones) and partially bedded in peat/silt. Sand was frequent but overwhelmingly the bed was composed of silt (often >15cm in depth). The southern channel was heavily peat-stained whilst the northern channel was much less turbid. Instream macrophytes were limited to occasional watercress, fool's watercress (*Apium nodiflorum*) and brooklime in channel margins, with very occasional water starwort (*Callitriche stagnalis*) present in slacker areas. Aquatic bryophytes were not present given recent channel modifications. The riparian zone (which had been flailed and recently cut) supported treelines and hedgerows of hawthorn, willow, elder, holly (*Ilex aquifolium*) and ash with scrubby understories of mostly bramble. The southern bank had been cleared to the banktop.

Three-spined stickleback was the only fish species recorded via electro-fishing (**Appendix A**). With the exception of low densities of this species, the heavily-silted channel was of very poor fisheries value, i.e., not of value to salmonids given the lack of flow and heavily-silted (peat) nature. Some low potential for European eel and *Lampetra* sp. was present but none were recorded. The site offered no suitability for white-clawed crayfish and none were recorded. No signs of otter were recorded.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site B3 was of **local importance (lower value).**

Plate 4.11 Representative image of site B3, May 2021

4.1.12 Site B4 – Unnamed stream, Clonycavan

Site B3 was located in the upper reaches of an unnamed Ballivor River tributary (no EPA code) at a local road crossing, approx. 0.3km downstream of the site boundary. The historically straightened and deepened channel averaged 1-1.5m wide with bankfull heights of up to 2m. The channel was 100% dry at the time of survey, with no ponding or stagnant water present (i.e., non-perennial channel). The base comprised 100% mud (i.e., no hard substrata). The site was bordered by improved agricultural grassland (GA1) and a mature treeline of sycamore, hawthorn and ash.

The river had no aquatic or fisheries value given the lack of water at the time of survey and no otter signs were recorded. The channel was considered likely to convey water intermittently during the year given a damp, muddy base. The downstream-connecting Ballivor River (0.7km downstream) was of some moderate fisheries and aquatic value.

Site B4 was not suitable for Q-sampling during the survey period due to its dry nature and lack of flow. Thus, it was not possible to assess biological water quality at this site.

The aquatic ecological evaluation of site A2 was of **local importance (lower value) (Table 4.1).**

Plate 4.12 Representative image of site B4 on unnamed Ballivor River tributary, May 2021 (dry channel)

4.1.13 Site B5 – Ballivor River, Clonycavan

Site B5 was located on the upper reaches of the Ballivor River (07B52) at a local road crossing, approx. 1.5km downstream of the site boundary. The lowland depositing watercourse (FW2/FW4) had been straightened and deepened historically, with more recent maintenance evident downstream of the bridge. The channelised river was 3m wide and 0.2-0.3m deep on average. The water was peat-stained and had a moderate flow rate, but no broken riffle or glide habitat was present. The river was very heavily silted with extremely localised superficial patches of fine to medium gravels atop deep silt deposits in vicinity of the bridge. The bed comprised 99% silt, often deeper than 0.5m. The river had been extensively straightened and deepened upstream of the bridge (to the north) and suffered from imperceptible flows and gross siltation. The profile was of shallow glide with an absence of pooling areas and no riffle zones (typical of a dredged channel section). The river was contained in an excavated deep U-shaped channel with 2-2.5m bankfull heights. Instream macrophytes were limited to occasional unbranched bur reed (*Sparganium erectum*) with very occasional water starwort. The site adjoined agricultural pasture (GA1) with a mature scrubby treeline of ash, sycamore, elder, Scots pine and abundant hawthorn and bramble along the north bank. The south bank had been cleared historically (to banktop) with the steeply sloping bank colonised by grasses and nitrophilous species like nettle (*Urtica dioica*) and hogweed (*Heracleum sphondylium*).

Three-spined stickleback was the only fish species recorded via electro-fishing (**Appendix A**). With the exception of low densities of this species, the heavily silted channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Some low potential for European eel was present but none were recorded. The site offered no suitability for white-clawed crayfish and the species was not recorded. A regular otter spraint site was recorded on a ledge underneath the bridge (ITM 667172, 751822) (invertebrate remains only, no fish or crayfish).

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). However, it should be noted that, given the absence of faster flowing riffle and glide habitat heavily, this is a **tentative** Q-rating. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of otter, the aquatic ecological evaluation of site B5 was of **Local importance (higher value).**

Plate 4.13 Representative image of site B5 on the Ballivor River, May 2021 (facing downstream from bridge)

4.1.14 Site C1 – Graffanstown Stream, Bracklin

Site C1 was located on the Graffanstown Stream (07G10) at a local road crossing, approx. 1.2km upstream of the River Deel confluence and River Boyne and River Blackwater SAC (002299). The lowland depositing watercourse (FW2) emanated from cutover bog and had been extensively straightened and over-deepened, historically. Upstream of the single pipe culvert at the road crossing, the stream was contained within a 3m-wide, deep U-shaped channel with bankfull heights of >2.5m. The stream averaged 2.5m wide and <0.15m deep. The site comprised 95% shallow, slow-flowing glide with very limited pool. The flow was slow at the time of survey. Gravels were present underfoot but these were underneath 0.2-0.3m of silt deposits. The stream bed was very heavily silted (peat derived) with deep deposits (to 0.25m) present. Whilst some limited sands and fine gravels were present on top of the flocculent sediment in places (e.g., near meander 40m upstream of culvert), these were also heavily silted. Peat staining was low at the time of survey. However, instream macrophytes were limited to only occasional lesser water parsnip (*Berula erecta*) along channel margins. No aquatic bryophytes were recorded (no suitable substrata or flow for such species). The site was bordered by improved pasture (GA1) to the south and an area of mixed broadleaved woodland (WD1) to the north. The banks of the channel were heavily scrubbed with willow and bramble along the north bank, with the adjoining pasture extending to the banktop on the south.

Three-spined stickleback was the only fish species recorded via electro-fishing (**Appendix A**). With the exception of very low densities of this species, the heavily silted channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Despite an abundance of soft sediment accumulations, these were not of value for larval lamprey given the flocculent and or high humic content, in addition to poor flows.

The site offered no suitability for white-clawed crayfish and none were recorded. No otter signs were recorded.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). However, it should be noted that, given the absence of faster flowing riffle and glide habitat heavily, this is a **tentative** Q-rating. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site C1 was of **local importance (lower value).**

Plate 4.14 Representative image of site C1 on the Graffanstown Stream, May 2021 (facing upstream from road culvert)

4.1.15 Site C2 – Ballynaskeagh Stream, Ballynaskeagh

Site C2 was located on the Ballynaskeagh Stream (07B24) at a local road crossing, approx. 0.6km upstream of the River Deel confluence and River Boyne and River Blackwater SAC (002299). The stream was a small, shallow, moderate-energy lowland depositing watercourse (FW2), with low flows at the time of survey. The stream was considered likely to be non-perennial at this location. The channel had been straightened and deepened historically, with bankfull heights of >2m. The stream averaged 1-1.5m wide and <0.05m deep at the time of survey (July 2021). Shallow glide and riffle dominated with only very localised shallow pool to 0.1m depth. The bed featured fine, medium and coarse gravels with low sand fractions. However, these were often heavily silted and bound in peat. Cobble and small boulder were occasional. Peat agglomerations were present on top of the substrata in some areas (the stream drained cutover bog upstream). The site was bordered by residential properties (GA2) and scrub, with a mature treeline of sycamore, hawthorn and elder. The channel was very heavily shaded upstream and downstream of the road bridge by riparian scrub, with tunnelling present in most areas. This precluded the presence of instream macrophytes although very limited *Leptodictyum riparium* present.

No fish were recorded via electro-fishing (**Appendix A**). Despite some low physical habitat suitability for salmonids and lamprey, these species were absent. This was considered a result of very low water levels at the time of survey (average depth <0.05m) and the stream's likely non-perennial nature. Nevertheless, even during higher water levels (e.g., winter), the site would only provide (at best) moderate suitability, given high rates of siltation and compacted substrata. There was some low suitability for European eel, albeit none were recorded. The site offered no suitability for white-clawed crayfish or otter and neither species was recorded.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site C2 was of **local importance (lower value).**

Plate 4.15 Representative image of site C2 on the Ballynaskeagh Stream, July 2021

4.1.16 Site C3 – Mucklin Stream, Craddanstown

Site C3 was located on the lowermost reaches of the Mucklin Stream (07M13), approx. 0.2km upstream of the River Deel confluence and River Boyne and River Blackwater SAC (002299). The channel was 100% dry at the time of survey, with no ponding or stagnant water present (i.e., non-perennial channel). The historically straightened and deepened channel averaged <1m wide with bankfull heights of 0.5-1m. The base comprised 100% mud (i.e., no hard substrata). The site was bordered by improved agricultural grassland (GA1) and a mature hawthorn hedgerow.

The stream had no aquatic or fisheries value given the lack of water at the time of survey. The channel was considered likely to convey water intermittently during the year (but mostly dry). The fisheries and aquatic value was superior in the nearby downstream-connecting River Deel, located <200m downstream. The lowermost reaches of the channel were likely of some low fisheries and aquatic value during high water levels (i.e., refuge from flood water on the River Deel).

Site B4 was not suitable for Q-sampling during the survey period due to its dry nature and lack of flow. Thus, it was not possible to assess biological water quality at this site.

The aquatic ecological evaluation of site C3was of **local importance (lower value) (Table 4.1).**

Plate 4.16 Representative image of site C3 on the Mucklin Stream, July 2021 (100% dry channel)

4.1.17 Site C4 – River Deel, Raharney Bridge

Site C4 on the River Deel (07D01) was located at Raharney Bridge on the R156 in Raharney village. The River Deel was a medium-sized high-energy lowland river (FW2) which averaged 6-7m wide and 0.2-0.5m deep. Fast glide dominated with localised pools to 0.8m and very occasional riffle areas. The river had been historically straightened and deepened (embankments still present) but good natural recovery had occurred both in the riparian zone and instream. Small cobble and boulder dominated the substrata with localised areas of medium to very coarse gravels present, intestinally. Given the fast flow, the substrata were clean from siltation with little or no silt accumulations present (apart from those associated with macrophytes). Water turbidity was very low and, coupled with only moderate shading and evidently good water quality, the site featured a relatively high coverage of macrophytes. Water crowfoot (*Ranunculus* sect. *Batrachium*) dominated (25% cover) with frequent submerged form of lesser water parsnip plus fool's watercress and frequent fine-leaved dropwort (*Oenanthe aquatica*) along channel margins. *Callitriche* sp. was rare but present. Pellia sp. liverwort was submerged on cobble. The aquatic smaller lattice moss (*Cinclidotus fontinaloides*) was also frequent on larger cobble and boulder. The presence of more than three indicator species meant the site's aquatic plant community was considered representative of the Annex I habitat 'Water courses of plain to montane levels with

Triturus

the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]'. Filamentous algae was present, indicating some enrichment, but coverage was low (<2%). The fast-flowing site was contained in a deep U-shaped channel with mature riparian treelines along the west bank supporting sycamore, ash, elder and willow. Butterbur (*Petasites hybridus*) was frequent along the west bank downstream of the bridge. The eastern bank was an ornamental/biodiversity garden (BC4) with associated flood walls. Herbaceous vegetation recorded downstream of the bridge supported watercress, great willowherb (*Epilobium hirsutum*), water mint (*Mentha aquatica*), fool's watercress, bindweed (*Calystegia* sp.) and meadowsweet (*Filipendula ulmaria*), thus indicating linkages with the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' (see EC, 2013; Devaney et al., 2013).

Brown trout and Atlantic salmon were the only two fish species recorded via electro-fishing (**Appendix A**). Both were present in several cohorts and in relatively high densities. The site provided excellent-quality salmonid nursery habitat with well-oxygenated broken glide and riffle sequences and cover in macrophyte vegetation. The cobble substrata also provided good cover for juvenile salmonids. Good-quality spawning habitat was also present given unbedded, well-sorted mixed gravels between cobble areas. These had light siltation only. Holding habitat was also very good in deep glide and localised pool with overhanging tree cover and good shading. The site was also considered good for European eel, with ample boulder and cobble refugia, albeit none were recorded. No soft sediment lamprey habitat was identified present but the quality of spawning habitat was considered good. Lamprey species likely occur downstream of the survey area in suitable depositing areas. Despite some good suitability, no white-clawed crayfish were recorded and no contemporary records were available for the river (1980s only: see section 3.1). Otter foraging potential was high although no otter signs were recorded during the survey.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the location of the site within the River Boyne and River Blackwater SAC (002299), in addition to the presence of two Annex I aquatic habitats and qualifying interest Atlantic salmon, the aquatic ecological evaluation of site C4 was of **international importance.**

Plate 4.17 Representative image of site C4 on the River Deel at Raharney Bridge, May 2021

4.1.18 Site C5 – Craddanstown Stream, Riverdale

Site C5 was located on the Craddanstown Stream (07C55) at a local road crossing, south of the proposed wind farm site boundary. The stream represented a small lowland depositing watercourse (FW2) that had been straightened and deepened historically. The stream was contained in a deep U-shaped channel with bankfull heights varying between 1.8-3m. The canalised stream averaged 2.5m in width and 0.2-0.4m in depth, with occasional pools to 0.75m. Moderate-flowing glide dominated the site with a lack of riffle areas and only localised pool. The stream bed was composed almost entirely of soft silt (peat-derived) although some compacted sands were present on top of the silt locally. The sediment was a mixture of clay and peat and often exceeded 0.2m in depth. Instream macrophytes were limited to very sparse growth of unbranched bur reed (more present upstream of the bridge). No aquatic bryophytes were recorded. The site adjoined improved pasture (GA1) with narrow riparian treelines supporting mature ash, hawthorn, elder, grey willow and alder.

Low numbers of brown trout, *Lampetra* sp. and three-spined stickleback were recorded via electro-fishing (**Appendix A**). The channel had negligible nursery, spawning and holding value for salmonids given the absence of riffle, glide and pool sequences and extreme levels of siltation. These were exacerbated by historical channelisation and sedimentation pressures from the adjoining improved grassland. Only a single 0+ brown trout was recorded, exemplifying the poor value of the site for salmonids. The channel was not considered of value to European eel given the absence of refugia such as cobble and boulder and the shallow nature. The channel was, however, of some value to *Lampetra* sp. given pockets of fine silt with a high organic content up to 15cm deep. These adjoined degraded areas of fine gravel that provided some local spawning habitat for the species. Low densities of larval lamprey were recorded at 0.8 per m^2 ($10m^2$ of habitat targeted and *n*=8 ammocoetes captured). Despite some physical suitability (i.e., soft loamy banks in which to burrow) the extensive channel modifications and high siltation created conditions inimical to white-clawed crayfish. A regular otter spraint site with associated prints was recorded on a muddy paludal area underneath the bridge (ITM 663341, 751542).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of brown trout, *Lampetra* sp. and otter, the aquatic ecological evaluation of site C5 was of **local importance (higher value).**

Plate 4.18 Representative image of site C5 on the Craddanstown Stream, May 2021 (facing downstream from bridge)

4.1.19 Site C6 – Clondalee More Stream, Clondalee More

Site C6 was located on the Clondalee More Stream (07C77) at a local road crossing, approx. 0.6km south of the site boundary. The stream represented a small lowland depositing watercourse (FW2) that had been extensively straightened and deepened. Whilst some recovery of the banks had occurred, instream recovery was poor. The stream averaged 1.5-2m wide with bankfull heights of up to 2.5m in a deep U-shaped channel. Shallow glide predominated with only very localised riffle and pool areas. The stream bed comprised 100% soft silt, with peat agglomerations (sods) on top of the bed. The soft (largely peat) sediment was up to 0.3m deep locally. Slumping of the peat banks due to floods and widespread livestock poaching (sheep) was evident. Peat-staining was moderate at the time of survey. No instream macrophytes were recorded growing on the soft (often flocculent) bed. The site adjoined improved pasture (GA1) with a small area of mixed broadleaved woodland (WD1) upstream (supporting mostly beech and sycamore). A disjunct riparian treeline was present downstream of the road culvert (1m pipe) supporting hawthorn, alder and willow with occasional bramble understorey (all grazed). The south bank was farmed to the edge with no riparian buffer.

Three-spined stickleback was the only fish species recorded via electro-fishing (**Appendix A**). With the exception of low densities of this species, the heavily silted channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Despite an abundance of soft sediment accumulations, these were not of value for larval lamprey given the flocculent and or high humic content, in addition to high clay fractions, locally, resulting in compaction. Suitability or European eel was low given the open, shallow nature of the site and paucity of suitable refugia. The site offered no suitability for white-clawed crayfish and none were recorded. No otter signs were recorded.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

The aquatic ecological evaluation of site C6 was of **local importance (lower value).**

Plate 4.19 Representative image of site C6 on the Clondalee More Stream, May 2021

4.1.20 Site D1 – River Boyne, Scarriff Bridge

Site D1 was located on the River Boyne (07B04) at Scarriff Bridge, approx. 7km downstream of the site boundary (shortest hydrological distance). The Boyne at this location was a large lowland depositing watercourses (FW2) that averaged 20m in width and 0.4-0.7m deep. Fast glide dominated with occasional pools to >1m. Localised shallower riffle areas were resent downstream of the bridge. Given high flow rates, the substrata were compacted with cobble and coarse gravels dominating between argillaceous clay banks. Boulder was frequent but scattered. There were no sediment accumulations recorded outside of the margins. The river had been historically straightened (possibly deepened) with embankments present. The channel showed good recovery, however. Instream macrophytes were limited although the cover of aquatic bryophytes such *Pellia* sp. were frequent on more stable substrata. Unbranched bur reed was present in channel margins and here some soft sediment accumulations suitable for larval lamprey were present (albeit very shallow). The riparian zone supported typical species such as hogweed, bramble, willowherb, nettle and frequent willow. The north bank upstream of the bridge featured a mature riparian treeline of alder/willow and had been cleared to the edge downstream (agricultural grassland).

Atlantic salmon, brown trout, stone loach (*Barbatula barbatula*) and minnow (*Phoxinus phoxinus*) were recorded via electro-fishing (**Appendix A**). Historical alterations had reduced the salmonid nursery value of the site. The spawning value was moderate as spawning gravels were restricted to isolated pockets between banks of argillaceous clay given historical deepening works. Holding habitat was very good. While no large salmonids were captured, larger fish were observed in deep pool adjoining the glide habitat surveyed - these areas were outside of wadable reach electro-fishing. Lamprey burial habitat was rare but present in association with marginal bur reed beds (however, no ammocoetes were recorded). European eel habitat was moderate with refugia largely limited to overhanging trees and scattered boulders. Some crayfish habitat was present but the bedded nature of the substrata and sparse macrophyte growth, in addition to the compacted banks, reduced the value overall in the vicinity of the bridge. The River Boyne also has a history of crayfish plague (*Aphanomyces astaci*) outbreaks which have periodically eradicated the species. Otter potential was high although no signs were recorded (few marking opportunities given the removal of boulder outcrops during historical dredging).

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the location of the site within the River Boyne and River Blackwater SAC (002299), in addition to the presence of qualifying interest Atlantic salmon, the aquatic ecological evaluation of site D1 was of **international importance.**

Plate 4.20 Representative image of site D1 on the River Boyne, May 2021 (facing downstream)

4.2 Biological water quality (macro-invertebrates)

Sites A7 (Stonyford River), C4 (River Deel) and D1 (River Boyne) achieved **Q4** (good status) and thus met the good status (**≥Q4**) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**, **Appendix B**). These sites supported low numbers of Group A species such as the mayfly *Ecdyonurus dispar*, *Heptagenia sulphurea* and or *Rhithrogena semicolorata,* as well as the stonefly species *Isoperla grammatica* and *Nemurella picteti.* The presence of these species at sites C4 and D1 elevated the water quality status to **Q4** (good status).

Water samples from sites A1, A3, A4, A5, A6, A8, B3, B5, C1, C2, C5 and C6 achieved **Q2-3** or **Q3** (poor status) water quality and, therefore, failed to meet the good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC). Whilst some of these sites supported group B species such as cased caddis *Limnephilus* spp., the dominance of group C species such as *Gammarus duebeni,* the mayfly species *Baetis rhodani* and Simuliidae larvae, as well as the presence of group D *Asellus aquaticus,* reduced the Q-rating to that of poor status (i.e., **Q2-3** or **Q3**).

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from *n*=15 sites (**Figure 4.1, Appendix B**).

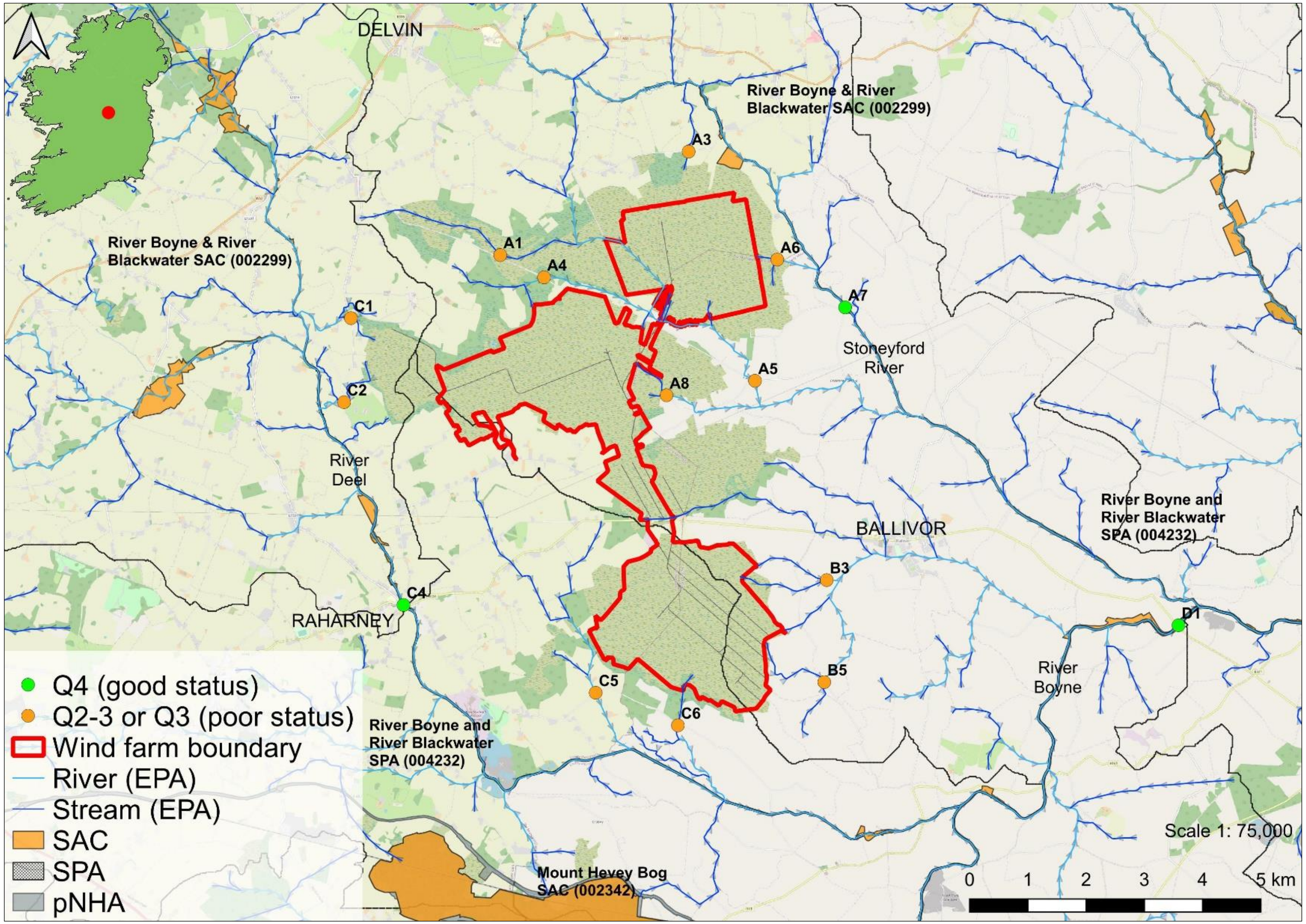

Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed Ballivor wind farm project, Co. Meath

4.3 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of electro-fishing (i.e., presence of fish of conservation value), the presence of protected or rare invertebrates (i.e., white-clawed crayfish), the presence of rare macrophytes and aquatic bryophytes and or associated representations of Annex I habitats. Furthermore, biological water quality status, the presence of otter and or situation within a protected site also informed the evaluation (**Table 4.1**).

Sites A7 (Stonyford River), C4 (River Deel) and D1 (River Boyne) were evaluated as **international importance** given their location within the River Boyne and River Blackwater SAC (002299).

None of the other aquatic survey sites were evaluated as greater than **local importance (higher value)**. The **local importance (higher value)** sites were present on the Bolandstown River (A4), Cartenstown Stream (A5), Woodtown West Stream (A6), Ballivor River (B5), Craddanstown Stream (C5), given the presence of salmonids, *Lampetra* sp., otter and or other aquatic species of conservation value (e.g., smooth newt recorded at site A6).

The remaining sites (i.e., A1, A2, A3, A8, B1, B2, B3, B4, C1, C2, C3 & C6) were evaluated as **local importance (lower value)**.

Table 4.1 Aquatic ecological evaluation summary of the survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
A1	Cartenstown Stream	07C60	Local importance (lower value)	Very low fisheries value overall; three-spined stickleback recorded at low densities via electro-fishing; Q2-3 (poor status) water quality; no aquatic species or habitats of high conservation value recorded present
A2	Stonestown River	07S11	Local importance (lower value)	No aquatic value due to non-perennial nature of channel; not possible to assess biological water quality due to lack of water; no aquatic species or habitats of high conservation value recorded present
A3	Ballinn Stream	07B47	Local importance (lower value)	Very low fisheries value overall; three-spined stickleback recorded at low densities via electro-fishing; Q2-3 (poor status) water quality; no aquatic species or habitats of high conservation value recorded present
A4	Bolandstown River	07B45	**Local importance (higher value)**	Moderate fisheries value overall; *Lampetra* sp. ammocoetes & three-spined stickleback recorded at low densities via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value recorded present
A5	Cartenstown Stream	07C60	**Local importance (higher value)**	Poor-quality salmonid, lamprey & European eel habitat present but only brown trout and *Lampetra* sp. ammocoetes recorded in low densities via electro-fishing; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value recorded present
A6	Woodtown West Stream	07W06	**Local importance (higher value)**	Very low fisheries value overall; no fish recorded via electro-fishing; Q3 (poor status) water quality; smooth newt[1] and common frog[1] present; no other aquatic species or habitats of high conservation value recorded present
A7	Stonyford River	07S02	**International importance**	Located within River Boyne and River Blackwater SAC (002299); moderate-quality salmonid & lamprey habitat; Atlantic salmon, brown trout & *Lampetra* sp. ammocoetes recorded via electro-fishing; Q4 (good status) water quality
A8	Carranstown Little River	07C87	Local importance (lower value)	Poor-quality salmonid, lamprey and European eel habitat present; no fish recorded via electro-fishing; Q2-3 (poor status) water quality; no aquatic species or habitats of high conservation value recorded present
B1	Killaconnigan Stream	07K34	Local importance (lower value)	Very low fisheries value overall; no fish recorded via electro-fishing; non-perennial channel; not possible to assess biological water quality

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
				due to lack of water; no aquatic species or habitats of high conservation value recorded present
B2	Kilballivor Stream	07K35	Local importance (lower value)	No aquatic value due to dry and non-perennial nature of channel; not possible to assess biological water quality due to lack of water; no aquatic species or habitats of high conservation value recorded present
B3	Unnamed stream	n/a	Local importance (lower value)	Low fisheries value overall; three-spined stickleback recorded at low densities via electro-fishing; Q3 (poor status) water quality; no aquatic species or habitats of high conservation value recorded present
B4	Unnamed stream	n/a	Local importance (lower value)	No aquatic value due to non-perennial nature of channel; not possible to assess biological water quality due to lack of water; no aquatic species or habitats of high conservation value recorded present
B5	Ballivor River	07B52	**Local importance (higher value)**	Some poor-quality salmonid, lamprey & European eel habitat present but none recorded; three-spined stickleback recorded via electro-fishing; Q2-3 (poor status) water quality; otter spraint recorded (no crayfish remains); no other aquatic species or habitats of high conservation value recorded present
C1	Graffanstown Stream	07G10	Local importance (lower value)	Some poor-quality salmonid, lamprey & European eel habitat present but none recorded; three-spined stickleback recorded via electro-fishing; Q2-3 (poor status) water quality); no aquatic species or habitats of high conservation value recorded present
C2	Ballynaskeagh Stream	07B24	Local importance (lower value)	Poor-quality salmonid, lamprey & European eel habitat present; no fish recorded via electro-fishing; Q3 (poor status) water quality; likely non-perennial site; no aquatic species or habitats of high conservation value recorded present
C3	Mucklin Stream	07M13	Local importance (lower value)	No aquatic value due to non-perennial nature of channel; not possible to assess biological water quality due to lack of water; no aquatic species or habitats of high conservation value recorded present
C4	River Deel	07D01	**International importance**	Located within River Boyne and River Blackwater SAC (002299); excellent-quality salmonid habitat & moderate lamprey & European eel habitat present; Atlantic salmon & brown trout recorded via electro-fishing; Annex I 'floating river vegetation' and 'Hydrophilous tall herb' habitats present[2]; Q4 (good status) water quality); no other aquatic species or habitats of high conservation value recorded present

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
C5	Craddanstown Stream	07C55	**Local importance (higher value)**	Poor-quality salmonid, lamprey & European eel habitat present; brown trout, *Lampetra* sp. & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality; otter present (spraint); no other aquatic species or habitats of high conservation value recorded present
C6	Clondalee More Stream	07C77	Local importance (lower value)	Poor-quality salmonid, lamprey & European eel habitat present but these species were not recorded; three-spined stickleback recorded via electro-fishing; Q2-3 (poor status) water quality); no aquatic species or habitats of high conservation value recorded present
D1	River Boyne	07B04	**International importance**	Located within River Boyne and River Blackwater SAC (002299); moderate-quality salmonid, lamprey & European eel habitat; Atlantic salmon, brown trout, stone loach & minnow recorded via electro-fishing; Q4 (good status) water quality; no other aquatic species or habitats of high conservation value recorded present

[1] Both smooth newt (*Lissotriton vulgaris*) and common frog (*Rana temporaria*) are protected under the Wildlife Act (1976-2021). Furthermore, common frogs are protected under Annex V of the Habitats Directive [92/42/EEC].

[2] Both Annex I habitats 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]'. And 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' recorded at site C4

*** Conservation value:** Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (La*mpetra planeri*), river lamprey (*Lampetra fluviatilis*), white-clawed crayfish (*Austropotamobius pallipes*) and otter (*Lutra lutra*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon, river lamprey, white-clawed crayfish and otter are also listed under Annex V of the Habitats Directive [92/42/EEC]. Otters, along with their breeding and resting places, are also protected under provisions of the Irish Wildlife Acts 1976 to 2021. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Fisheries Acts 1959 to 2019, brown trout have no legal protection in Ireland.

5. Discussion

5.1 Most valuable areas for aquatic ecology

Sites A7 (Stonyford River), C4 (River Deel) and D1 (River Boyne) were evaluated as **international importance** given their location within the River Boyne and River Blackwater SAC (002299). These sites also supported qualifying interest Atlantic salmon and Q4 (good status) water quality. None of the other aquatic survey sites were evaluated as greater than **local importance (higher value)**. The higher value sites were present on the Bolandstown River (A4), Cartenstown Stream (A5), Woodtown West Stream (A6), Ballivor River (B5), Craddanstown Stream (C5), given the presence of salmonids, *Lampetra* sp., otter and or other aquatic species of conservation value (e.g., smooth newt). The remaining sites (i.e., A1, A2, A3, A8, B1, B2, B3, B4, C1, C2, C3 & C6) were evaluated as **local importance (lower value)**, primarily due to poor flows and poor quality of aquatic habitats.

Atlantic salmon were recorded (via electro-fishing) from a total of three sites on Stonyford River (A7), River Deel (C4) and River Boyne (D1), with brown trout recorded from a total of five sites on the Cartenstown Stream (A5), Stonyford River (A7), River Deel (C4), Craddanstown Stream (C5) and River Boyne (D1). *Lampetra* sp. ammocoetes were recorded from a total of four sites on the Bolandstown River (A4), Cartenstown Stream (A5), Stonyford River (A7) and Craddanstown Stream (C5). Despite some low to moderate suitability across numerous survey sites, no European eel were recorded during the survey. The fisheries value of these watercourses is addressed in further detail in **Appendix A**.

Otter signs (spraint and or prints) were recorded at sites B5 (Ballivor River) and C5 (Craddanstown Stream). Smaller, narrower, modified channels with limited vegetation (such as those in the vicinity of the proposed wind farm) are known to be negative determinants of otter presence (Bailey & Rochford, 2006; Reid et al., 2013). Therefore, wider, less-modified watercourses with improved fisheries habitat, such as the Craddanstown Stream, Stoneyford River and River Deel, have higher inherent value for otter. This would also reflect the distribution of otter records in the vicinity of the proposed project, presented in **Figure 3.1** (sensitive species data request), i.e., primarily located in the middle to lower reaches of larger watercourses.

A single adult smooth newt (*Lissotriton vulgaris*), protected under the Wildlife Act (1976-2021), was recorded during sweep sampling at site A6 on the Woodtown Stream. Although records for white-clawed crayfish widespread within the wider survey area (Deel, Stonyford and Boyne rivers), the bulk of these records were historical only (i.e., 1971-1985). No white-clawed crayfish were recorded during the aquatic surveys. No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from *n*=15 sites.

Good status (Q4) water quality was only recorded from sites A7 (Stonyford River), C4 (River Deel) and D1 (River Boyne). Primarily due to peat harvesting pressures, all remaining survey sites achieved Q2-3 or Q3 (poor status) water quality and, thus, failed to meet the good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC).

Examples of the Annex I habitats 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]' and 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' were present at site C4 on the River Deel (Raharney Bridge). No other survey sites supported examples these Annex I habitats.

In summary, the majority of watercourses in the vicinity of the proposed Ballivor wind farm were of **local importance (higher value)** in terms of their aquatic ecology. However, historical drainage pressures and ongoing peat escapement (siltation) had significantly reduced the quality and or presence of aquatic habitats on the Cartenstown Stream (EPA code: 07C60), Stonestown River (07S11), Ballinn Stream (07B47), Bolandstown River (07B45), Woodtown West Stream (07W06), Carranstown Little River (07C87), Killaconnigan Stream (07K34), Kilballivor Stream (07B35), Ballivor River (07B52) and two unnamed tributaries, Graffanstown Stream (07G10), Ballynaskeagh Stream (07B24), Mucklin Stream (07M13), Craddanstown Stream (07C550) and Clondalee More Stream (07C77). Typically, larger watercourses with higher flow rates are better able to buffer against such impacts and these proved the better-quality aquatic habitat (i.e., Stonyford River, River Deel, River Boyne). With the exception of survey sites on these three watercourses, biological water quality was of ≤Q3 (poor status) across all survey sites sampled and this contributed to the reduction in habitat quality for salmonids, macro-invertebrates (including white-clawed crayfish) and other aquatic species and habitats of conservation value.

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Appendix A:
Fisheries assessment of Ballivor wind farm, Co. Meath/Westmeath

Prepared by Triturus Environmental Ltd. for McCarthy Keville O' Sullivan Ltd.

October 2021

Please cite as:

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Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were contracted by McCarthy Keville O' Sullivan to undertake a baseline fisheries assessment of numerous watercourses in the vicinity of the proposed Ballivor wind farm, located near Ballivor, Co. Meath (**Figure 2.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed project (**Figure 2.1**). In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the vicinity of the proposed project, a catchment-wide electro-fishing survey across *n*=20 sites was undertaken (**Table 2.1; Figure 2.1**). Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, lamprey and European eel (*Anguilla anguilla*), as well as other species, and helped to further inform impact assessment and any subsequent mitigation for the project.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the proposed Ballivor wind farm. Permission was granted on Friday 25th June 2021 and the survey was undertaken on Wednesday 14th to Friday 16th July 2021.

1.2 Fisheries asset of the survey area

The aquatic survey sites were located within the Deel (Raharney) and Stoneyford River sub-basins, in the wider River Boyne catchment (Boyne_SC_040 and Boyne_SC_050). Whilst not located within a European site, the proposed wind farm site (via several watercourses) shared downstream hydrological connectivity with the River Boyne and River Blackwater SAC (002299).

Fisheries survey sites were present on the Cartenstown Stream (EPA code: 07C60), Stonestown River (07S11), Ballinn Stream (07B47), Bolandstown River (07B45), Woodtown West Stream (07W06), Stonyford River (07S02), Carranstown Little River (07C87), KIllaconnigan Stream (07K34), Kilballivor Stream (07B35), Ballivor River (07B52) and two unnamed tributaries, Graffanstown Stream (07G10), Ballynaskeagh Stream (07B24), Mucklin Stream (07M13), River Deel (07D01), Craddanstown Stream (07C550, Clondalee More Stream (07C77) and River Boyne (07B04) (**Table 2.1**). The survey sites on the Stonyford River, River Deel and River Boyne were located within the River Boyne and River Blackwater SAC (002299).

The Stoneyford River rises south of Oldcastle, at the base of Slieve na Caillaigh, Co. Meath. It then flows south easterly for 25km through counties Meath and Westmeath. It enters the River Boyne half a mile downstream of Scarriff Bridge. Recreational brown trout fishing is popular along this river (O'Reilly, 2009). In terms of genetic stock, the Stonyford is known to be a significant contributor of brown trout to the main Boyne channel (one of the three most important spawning tributaries in the middle-Boyne; Mariani & Massa-Gallucci, 2012). Whilst

The River Deel emanates from Lough Lene, Lough Bane and the Ben Loughs (Westmeath) and then flows for 35km in a south easterly direction through Raharney, Co. Westmeath before joining with the River Boyne 2km upstream of Inchamore Bridge. The River Deel is a limestone river with high water clarity, renowned as a wild brown trout fishery (O'Reilly, 2009). *Lampetra* sp. ammocoetes (likely brook lamprey *Lampetra planeri*) are widespread throughout both the Stonyford and Dee rivers. Densities of lamprey have been recorded as low (O'Connor, 2006) and the species is known to suffer from the impacts of continued arterial drainage that have been undertaken in the catchment (IFI, 2013).

The River Boyne rises in Co. Kildare and flows for over 110km in a north easterly direction through counties Offaly, Meath and Louth before entering the Irish Sea at Drogheda. The Boyne is a designated salmonid watercourse under the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293/1988) and is a renowned wild brown trout, Atlantic salmon and (in its lower reaches) sea trout fishery (O'Reilly, 2009). As well as salmonids, the river is known to support *Lampetra* sp., European eel (*Anguilla anguilla*), stone loach (*Barbatula barbatula*), minnow (*Phoxinus phoxinus*) and three-spined stickleback (*Gasterosteus aculeatus*) (Kelly et al., 2011a, 2011b). A number of other cyprinid species are also known from the river, including roach (*Rutilus rutilus*) and bream (*Abramis brama*), primarily in the middle to lower reaches (pers. obs.).

Whilst *Lampetra* sp. ammocoetes (likely brook lamprey *Lampetra planeri*) are widespread throughout both the Boyne, Stonyford and Deel rivers, densities have been recorded as low (O'Connor, 2006) and the species is known to suffer from the impacts of continued arterial drainage throughout the catchment (IFI, 2013).

Fisheries data for the other watercourses within the survey area was not available at the time of survey.

2. Methodology

2.1 Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the proposed Ballivor wind farm on the Wednesday 14th to Friday the 16th July 2021, following notification to Inland Fisheries Ireland and under the conditions of a Department of Communications, Climate Action & Environment (DCCAE) licence. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank.

Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel can be surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

The catchment-wide electro-fishing (CWEF) survey was undertaken across *n*=20 sites (see **Table 2.1, Figure 2.1**).

Table 2.1 *n*=20 electro-fishing survey site locations in the vicinity of the proposed Ballivor wind farm project, Co. Meath

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Cartenstown Stream	07C60	Ballyhealy	661703	759056
A2	Stonestown River	07S11	Cartenstown Stream confluence	663011	759233
A3	Ballinn Stream	07B47	Local road crossing, Lisclogher Great	664937	760833
A4	Bolandstown River	07B45	Local road crossing, Bracklin	662455	758674
A5	Cartenstown Stream	07C60	Local road crossing, Coolronan	666077	756898
A6	Woodtown West Stream	07W06	Lisclogher Great	666459	758978
A7	Stonyford River	07S02	Cloghbrack Bridge	667624	758158
A8	Carranstown Little River	07C87	Coolronan	664558	756649
B1	Killaconnigan Stream	07K34	Grange More	664652	754555
B2	Kilballivor Stream	07K35	Killconnigan	667115	755088
B3	Unnamed stream	n/a	Clonycavan	667308	753476

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
B4	Unnamed stream	n/a	Local road crossing, Clonycavan	666871	752716
B5	Ballivor River	07B52	Local road crossing, Clonycavan	667266	751725
C1	Graffanstown Stream	07G10	Local road crossing, Bracklin	659139	757974
C2	Ballynaskeagh Stream	07B24	Local road crossing, Ballynaskeagh	659022	756531
C3	Mucklin Stream	07M13	Local road crossing, Craddanstown	659139	755895
C4	River Deel	07D01	Raharney Bridge, R156 road crossing	660041	753049
C5	Craddanstown Stream	07C55	Local road crossing, Riverdale	663341	751542
C6	Clondalee More Stream	07C77	Local road crossing, Clondalee More	664753	750982
D1	River Boyne	07B04	Scarriff Bridge, R156 road crossing	673349	752700

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 40-100m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages. At certain, more minor watercourse sites or sites with limited access, it was more feasible to undertake electro-fishing for a 5-minute CPUE. Discrepancies in fishing effort (CPUE) between sites are accounted for in the subsequent results section (**Table 3.1**).

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate conductivity waters of the sites (most draining calcareous geologies) a voltage of 200-230v, frequency of 35-45Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted box quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, approx. 10–15 cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

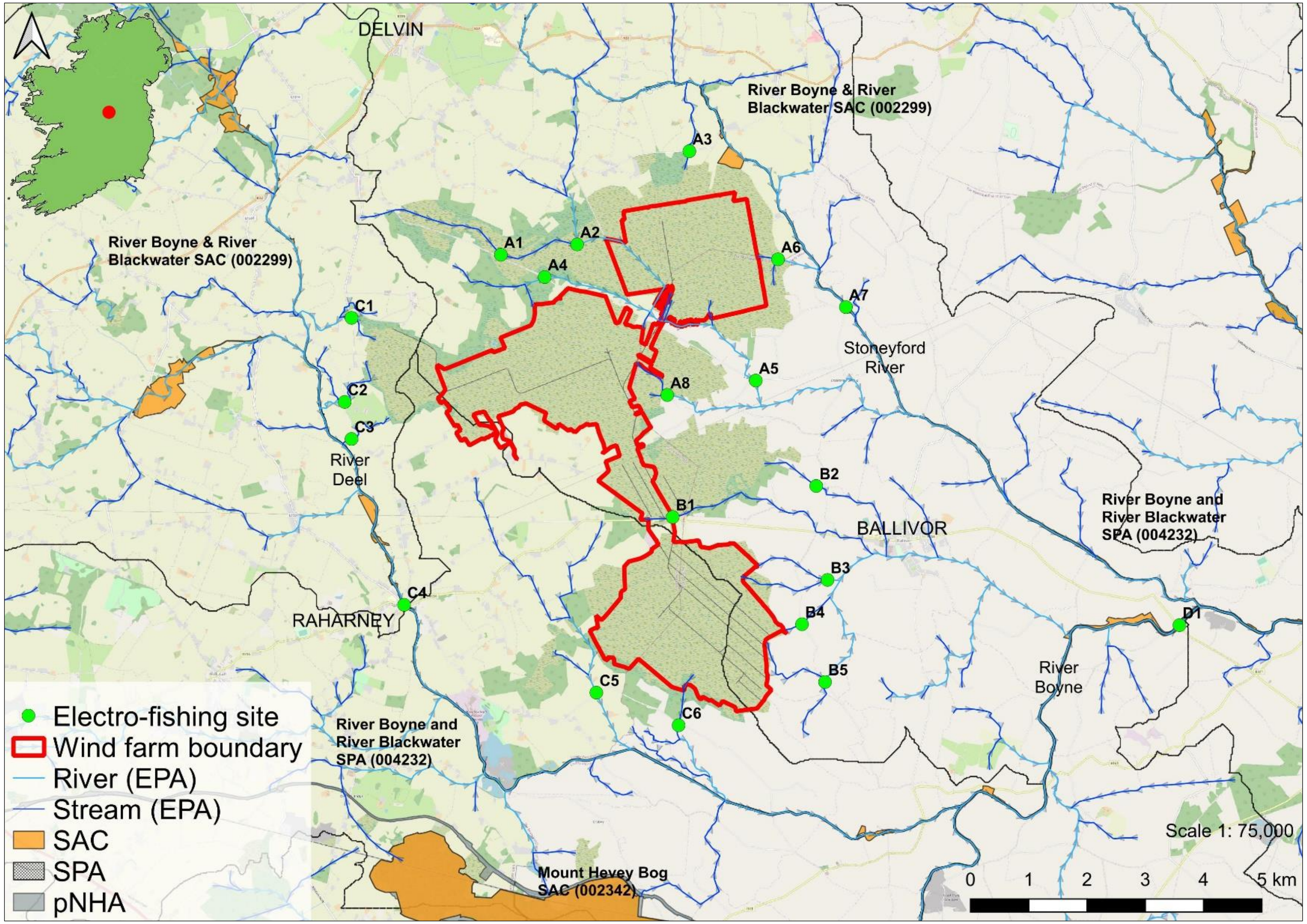

Figure 2.1 Location overview of the *n*=20 electro-fishing sites in vicinity of the proposed Ballivor wind farm, Co. Meath.

2.2 Fisheries habitat

2.2.1 General fisheries habitat

A broad appraisal / overview of the upstream and downstream habitat at each site was also undertaken to evaluate the wider contribution to salmonid and lamprey spawning and general fisheries habitat. River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.).

2.3 Biosecurity

A strict biosecurity protocol following the Check-Clean-Dry approach was employed during the survey. Equipment and PPE used was disinfected with Virkon® between survey sites to prevent the transfer of pathogens and/or invasive species between survey areas. Particular cognisance was given to preventing the introduction or spread of crayfish plague (*Aphanomyces astaci*) given the known presence of white-clawed crayfish in the wider Boyne catchment. As per best practice, surveys were undertaken at sites in a downstream order (i.e., uppermost site surveyed first etc.) to prevent the upstream mobilisation of invasive propagules and pathogens.

3. Results

A catchment-wide electro-fishing survey of *n*=20 sites in the vicinity of the proposed Ballivor wind farm was conducted on Wednesday 14th to Friday 16th July 2021 following notification to Inland Fisheries Ireland. The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery and spawning habitat for salmonids, European eel and lamprey species. Scientific names are provided at first mention only.

3.1 Fish stock assessment (electro-fishing)

3.1.1 Site A1 – Cartenstown Stream, Ballyhealy

Three-spined stickleback was the only fish species recorded via electro-fishing (**Figure 3.1**). With the exception of low densities of this species, the narrow, historically straightened and deepened channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. The site featured 100% slow-flowing glide habitat and was considered likely non-perennial (i.e., dries up seasonally). Fisheries value improved further downstream where the channel became wider, deeper and more supportive of perennial aquatic habitats.

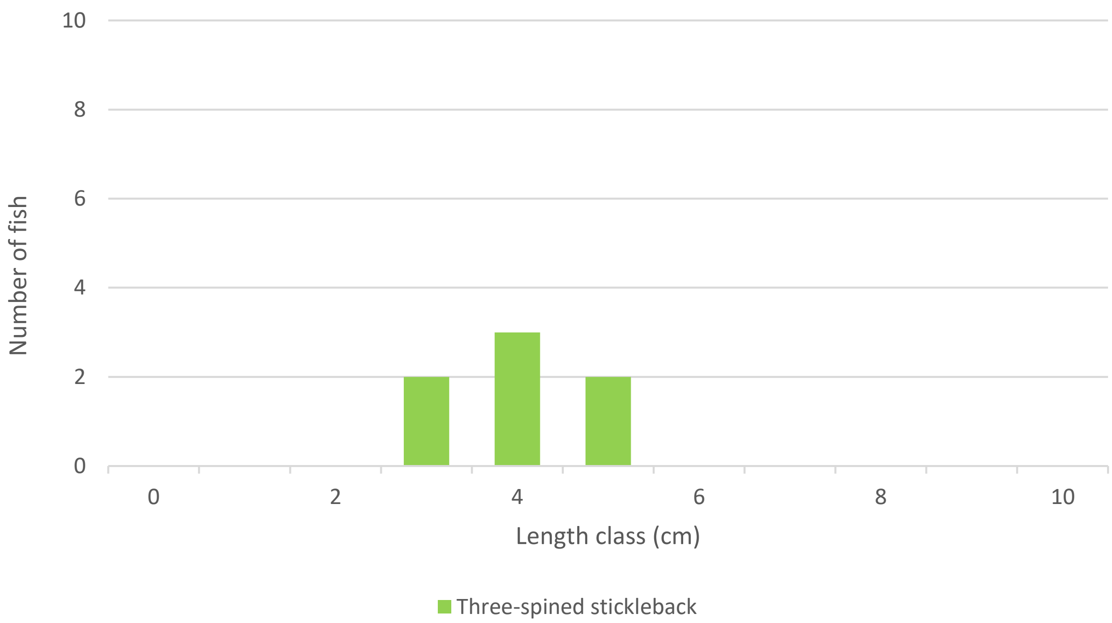

Figure 3.1 Length frequency distribution recorded via electro-fishing at site A1 on the Cartenstown Stream, July 2021

Plate 3.1 Representative image of site A1 on the Cartenstown Stream, May 2021

3.1.2 Site A2 – Stonestown River, Cartenstown Stream confluence

No fish were recorded from site A2 on the Stonestown River. The channel had been modified historically (straightened and deepened) and was 100% dry at the time of survey, with no pools of standing water remaining. Thus, the site had no fisheries value. The non-perennial channel drained cutover peat bog (PB4) and was evidently dry for much of the year.

Plate 3.2 Representative image of site A2 on the Stonestown River, May 2021

3.1.3 Site A3 – Ballinn Stream, Lisclogher Great

Three-spined stickleback was the only fish species recorded via electro-fishing from site A3 on the Ballinn Stream (**Figure 3.2**). All mature male sticklebacks recorded (*n*=10) were an uncommon melanic form (**Plate 3.3**). Melanic male three-spined stickleback are associated with waterbodies that are red-shifted due to the presence of tannins (e.g., peat-stained), where the ambient light environment is dominated by long wavelengths, and is hypothesised to have either a sexual selection or dietary basis (Smith et al., 2020; Flamarique et al., 2011; Reimchen, 1989). With the exception of low densities of this species, the heavily-silted peat drainage channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Some low potential for European eel was present but none were recorded.

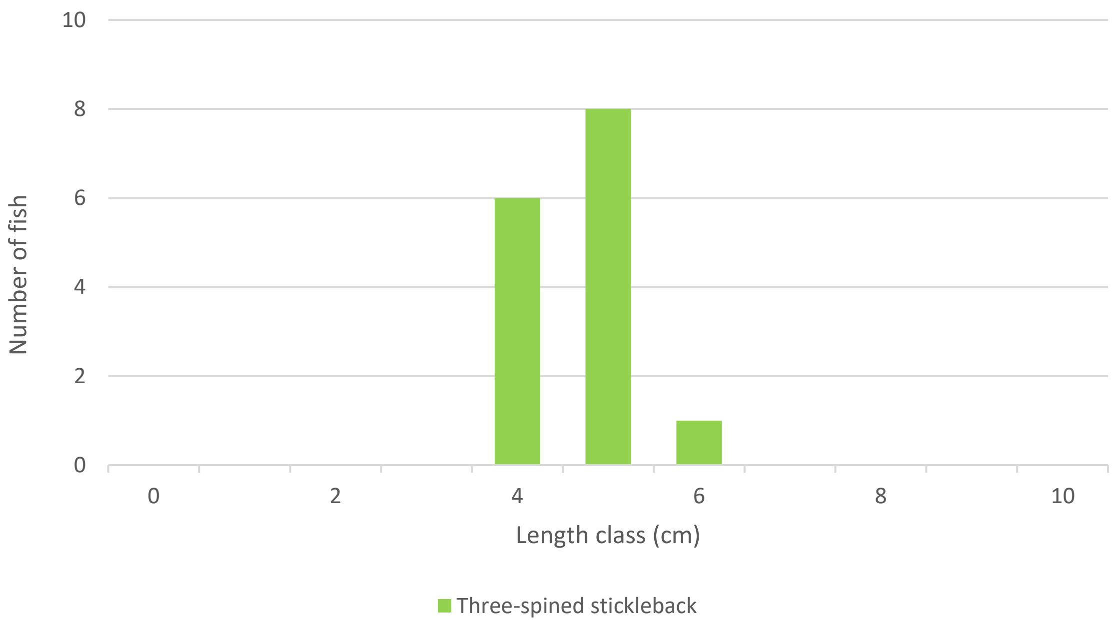

Figure 3.2 Length frequency distribution recorded via electro-fishing at site A3 on the Ballinn Stream, July 2021

Plate 3.3 Rare melanic (pigmented) male three-spined stickleback recorded from the Ballinn Stream, July 2021

3.1.4 Site A4 – Bolandstown River, Bracklin

A total of two fish species were recorded via electro-fishing from site A4 on the Bolandstown River (**Figure 3.3**). Low densities of three-spined stickleback (*n*=5) and *Lampetra* sp. ammocoetes (*n*=14) were captured. Low to moderate densities of ammocoetes (likely brook lamprey) were recorded at 2.8 per m^2 (5m^2 of habitat targeted and 14 ammocoetes captured), with two distinct size classes present.

Site A4 had low nursery, spawning and holding value for salmonids given the poor thalweg and very high levels of siltation and none were recorded during electro-fishing. The channel was not considered of value to European eel given the absence of refugia such as cobble and boulder. The channel was however of some value to lamprey given pockets of fine silt with a high organic content up to 20cm deep adjoining areas with finer gravels (albeit degraded by silt).

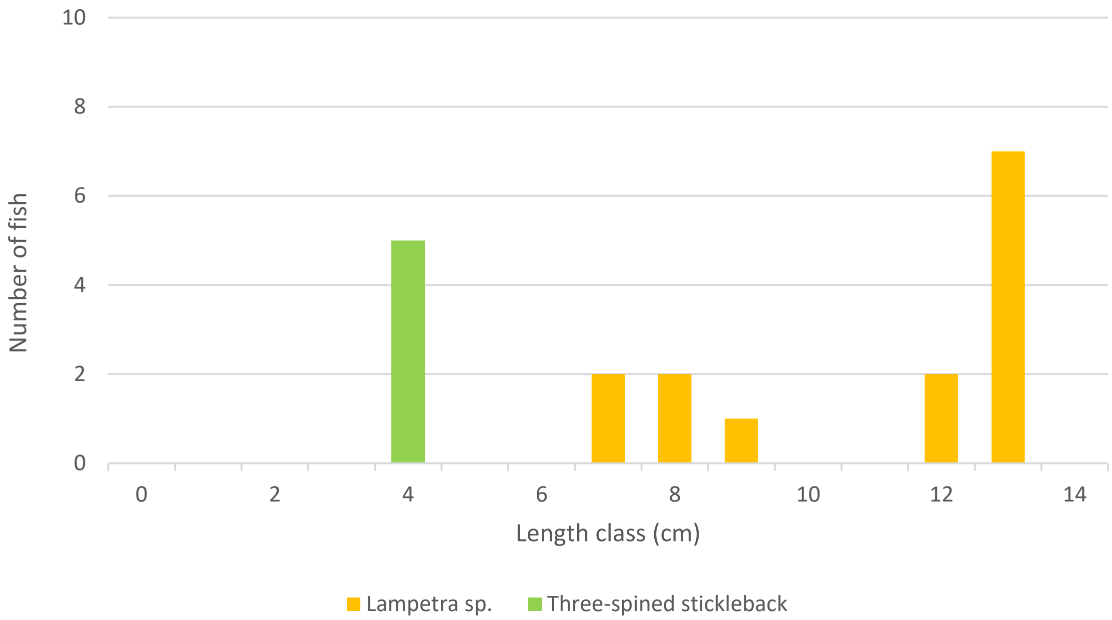

Figure 3.3 Length frequency distribution recorded via electro-fishing at site A4 on the Bolandstown River, July 2021

Plate 3.4 Representative image of site A4 on the Bolandstown River, May 2021

3.1.5 Site A5 – Cartenstown Stream, Coolronan

Brown trout (*Salmo trutta*) and *Lampetra* sp. were the only species recorded via electro-fishing from site A5 on the Cartenstown Stream (**Figure 3.5**). Both were present in low densities and represented single age cohorts, respectively. Only small numbers of 0+ brown trout were recorded, exemplifying the poor value of the site for salmonids Very low densities of lamprey were recorded at 0.4 per m^2 ($10m^2$ of habitat targeted and 4 ammocoetes captured) despite targeted electro-fishing of soft sediment areas being undertaken.

The site had low nursery, spawning and holding value for salmonids given the poor thalweg and very high levels of siltation. These were exacerbated by historical channelization and sedimentation pressures from the adjoining improved grassland. The channel was considered of only moderate value to European eel (none recorded). The channel was however of some value to lamprey given pockets of fine silt with a high organic content up to 15cm deep adjoining areas with finer gravels (albeit degraded by silt).

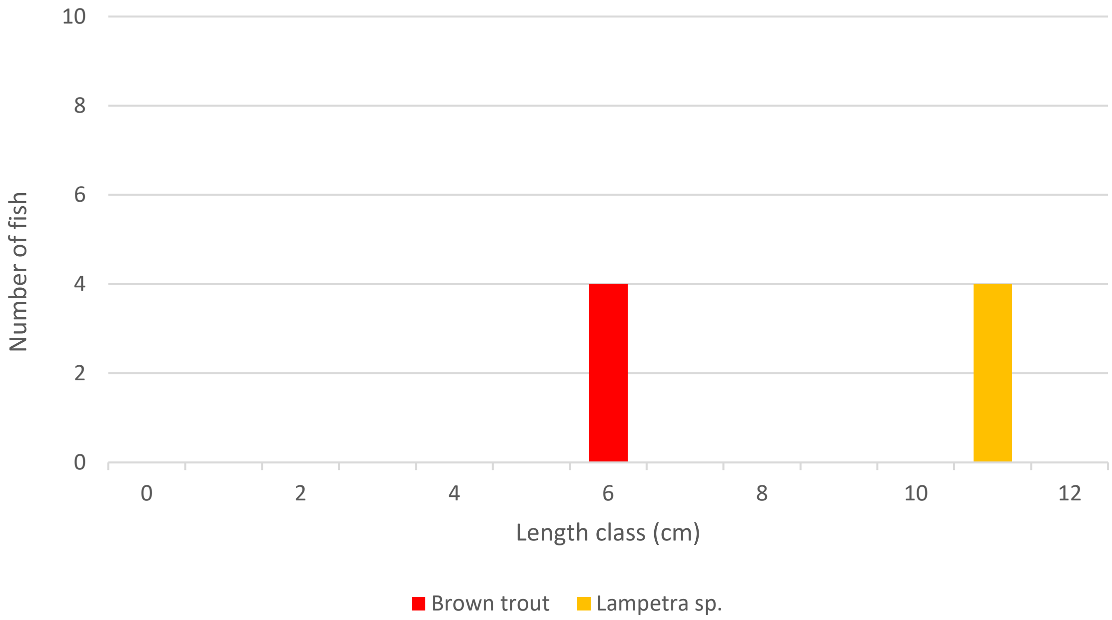

Figure 3.4 Length frequency distribution recorded via electro-fishing at site A5 on the Cartenstown Stream, July 2021

Plate 3.5 *Lampetra* sp. ammocoetes recorded from site A5 on the Cartenstown Stream, July 2021

3.1.6 Site A6 – Woodtown West Stream, Lisclogher Great

No fish species were recorded via electro-fishing at site A6 on the Woodtown West Stream. The peat drainage channel was of no fisheries value, given the lack of flow and heavily-silted (peat) nature. The stream had an imperceptible flow with numerous instream blockages (100% standing water/ponding). The drainage channel was grossly silted (several silt dams present). Deeper pool areas downstream of the survey site may have supported low densities of three-spined stickleback, although the intermittent/non-perennial nature of the stream likely precluded fish presence in the upper reaches. Both common frog (*Rana temporaria*) and smooth newt (*Lissotriton vulgaris*) were recorded via sweep netting during the site visit.

Plate 3.6 Representative image of site A6 on the Woodtown West Stream, May 2021

3.1.7 Site A7 – Stonyford River, Cloghbrack Bridge

A total of three fish species were recorded via electro-fishing at site A7 on the Stonyford River (**Figure 3.5**). Brown trout dominated the site, with a range of juvenile and adult cohorts present (*n*=19 total). Two Atlantic salmon (*Salmo salar*) parr were also recorded (likely 1+ cohort). A low density of *Lampetra* sp. ammocoetes were recorded from sub-optimal marginal silt accumulations (1.75 per m^2, $4m^2$ of habitat targeted and *n*=7 ammocoetes captured).

The site featured moderate-quality salmonid nursery and spawning habitat, given that both were compromised by historical dredging. This had resulted in a channel with limited riffle habitat and localised patches of gravel between paths of argillaceous clay. The holding value for salmonids was good due to the presence of deep glide and pool with overhanging trees, undercut banks etc. The site was of only moderate value for lamprey, with both sub-optimal adult (spawning) and ammocoete burial habitat present. The site was not considered of good quality for European eel given the limited presence of accessible refugia such as cobble and boulder (compacted substrata) and none were recorded.

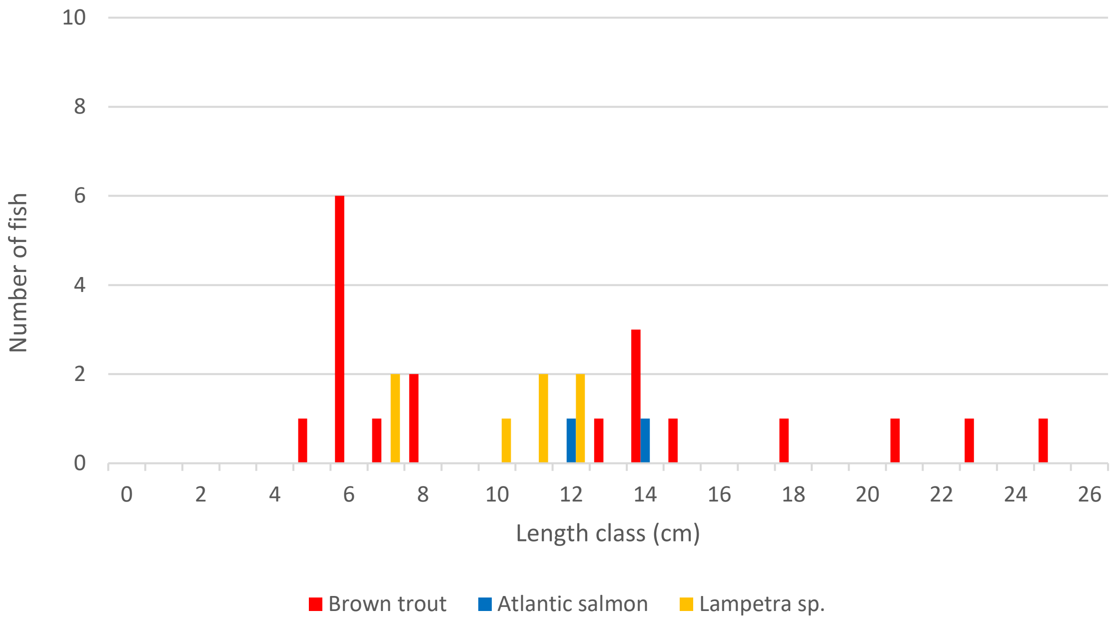

Figure 3.5 Length frequency distribution recorded via electro-fishing at site A7 on the Stonyford River, July 2021

Plate 3.7 Atlantic salmon parr recorded from site A7 on the Stonyford River, July 2021

3.1.8 Site A8 – Carranstown Little River, Coolronan

No fish were recorded via electro-fishing at site A8 on the Carranstown Little River. Suitability was limited to three-spined stickleback, although none were recorded present. The channel featured poor-quality salmonid nursery and spawning habitat, given high levels of peat-derived siltation (site drained an area of cutover bog). The site was not considered of good quality for European eel given the limited presence of accessible refugia such as cobble and boulder. Despite the presence of soft sediment accumulations, these were humic in nature (i.e., peat dominated) and not suitable for larval lamprey.

Plate 3.8 Representative image of site A8 on the Carranstown Little River, May 2021

3.1.9 Site B1 – Killaconnigan Stream, Grange More

No fish were recorded via electro-fishing at site B1 on the Killaconnigan Stream, located adjacent to the R156 near the Ballivor Bord na Móna factory. The stream represented a semi-dry bog drainage channel (FW4) at the time of survey, with only pools of stagnant (standing) water present, i.e., no flow. The stream was evidently non-perennial at this location. Other than very low suitability for three-spined stickleback in the wider area (i.e., downstream of survey site), site B1 was not of fisheries value given its non-perennial and heavily-silted nature.

Plate 3.9 Representative image of site B1 on the Killaconnigan Stream, May 2020

3.1.10 Site B2 – Kilballivor Stream, Killconnigan

No fish were recorded from site B2 on the Kilballivor Stream. The channel had been modified historically (straightened and deepened) and was 100% dry at the time of survey, with no pools of standing water remaining. Thus, the site had no fisheries value. The non-perennial channel drained cutover peat bog (PB4) and was evidently dry for much of the year.

Plate 3.10 Representative image of site B2 on the Kilballivor Stream, May 2020 (100% dry)

3.1.11 Site B3 – Unnamed stream, Clonycavan

Three-spined stickleback was the only fish species recorded via electro-fishing at site B3 on an unnamed Ballivor River tributary (**Figure 3.6**). With the exception of low densities of this species, the heavily silted channel was of very poor fisheries value, i.e., not of value to salmonids given the lack of flow and heavily-silted (peat) nature. Some low potential for European eel and *Lampetra* sp. was present but none were recorded. The site had been extensively straightened and deepened in the recent past with poor instream recovery evident.

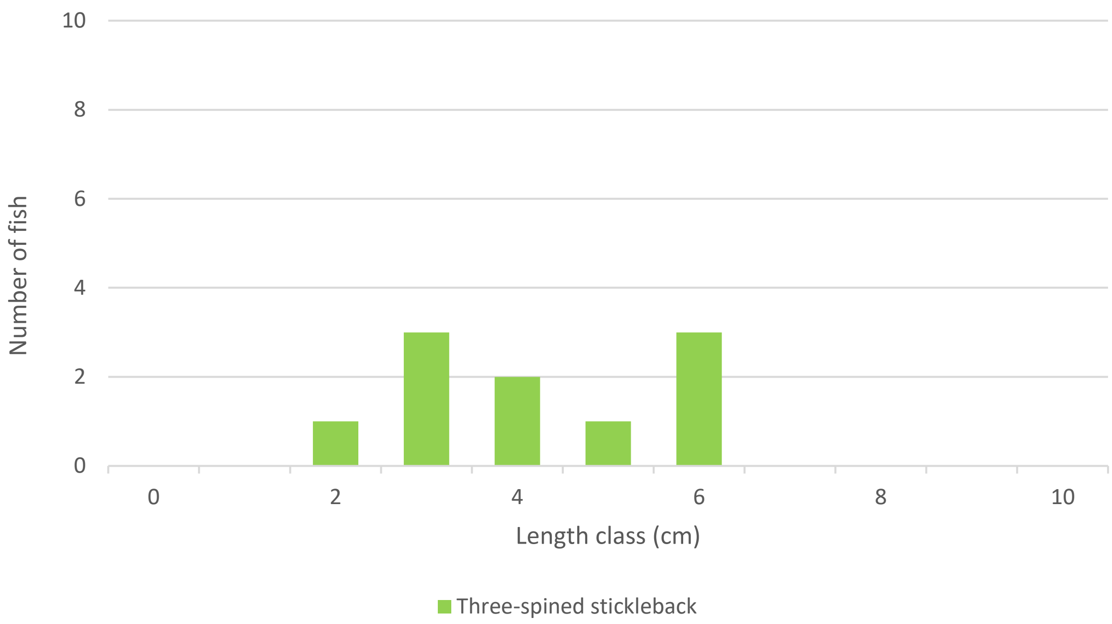

Figure 3.6 Length frequency distribution recorded via electro-fishing at site B3 on an unnamed Ballivor River tributary, July 2021

Plate 3.11 Representative image of site B3 at the confluence of two unnamed streams, May 2021

3.1.12 Site B4 – Unnamed stream, Clonycavan

No fish were recorded via electro-fishing at site B4 on an unnamed Ballivor River tributary. The channel was 100% dry at the time of survey, with no ponding or stagnant water present (i.e., non-perennial channel). The river had no aquatic or fisheries value given the lack of water at the time of survey. The channel was considered likely to convey water intermittently during the year (i.e., mostly dry) and thus may have some very low value as a stickleback habitat. The downstream-connecting Ballivor River (0.7km downstream) was of some moderate fisheries and aquatic value.

Plate 3.12 Representative image of site B4 on unnamed Ballivor River tributary, May 2021 (dry channel)

3.1.13 Site B5 – Ballivor River, Clonycavan

Three-spined stickleback was the only fish species recorded via electro-fishing at site B5 on the Ballivor River (**Figure 3.7**). The lowland depositing watercourse (FW2/FW4) had been straightened and deepened historically, with more recent maintenance evident downstream of the bridge. With the exception of low densities of stickleback, the heavily silted channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Some low potential for European eel was present but none were recorded.

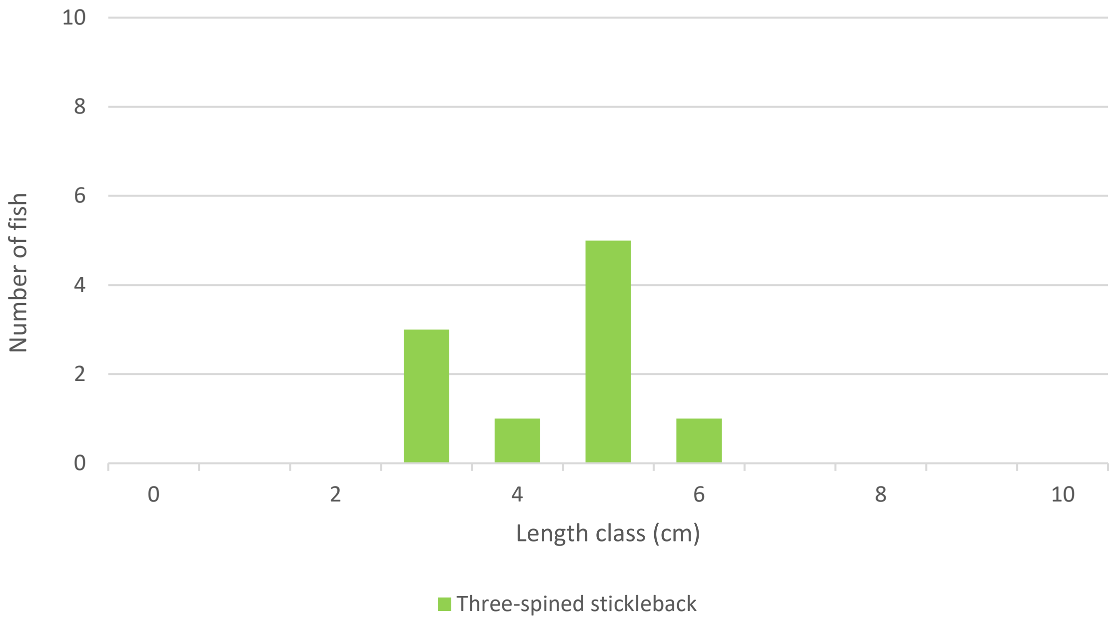

Figure 3.7 Length frequency distribution recorded via electro-fishing at site B5 on the Ballivor River, July 2021

Plate 3.13 Representative image of site B5 on the Ballivor River, May 2021 (facing downstream from bridge)

3.1.14 Site C1 – Graffanstown Stream, Bracklin

Three-spined stickleback was the only fish species recorded via electro-fishing at site C1 on the Graffanstown Stream (**Figure 3.8**). With the exception of very low densities of this species, the heavily silted and enriched drainage channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Whilst some limited sands and fine gravels were present on top of the flocculent sediment in places (e.g., near meander 40m upstream of culvert), these were also heavily silted. Despite an abundance of soft sediment accumulations, these were not of value for larval lamprey given the flocculent and or high humic content, in addition to poor flows.

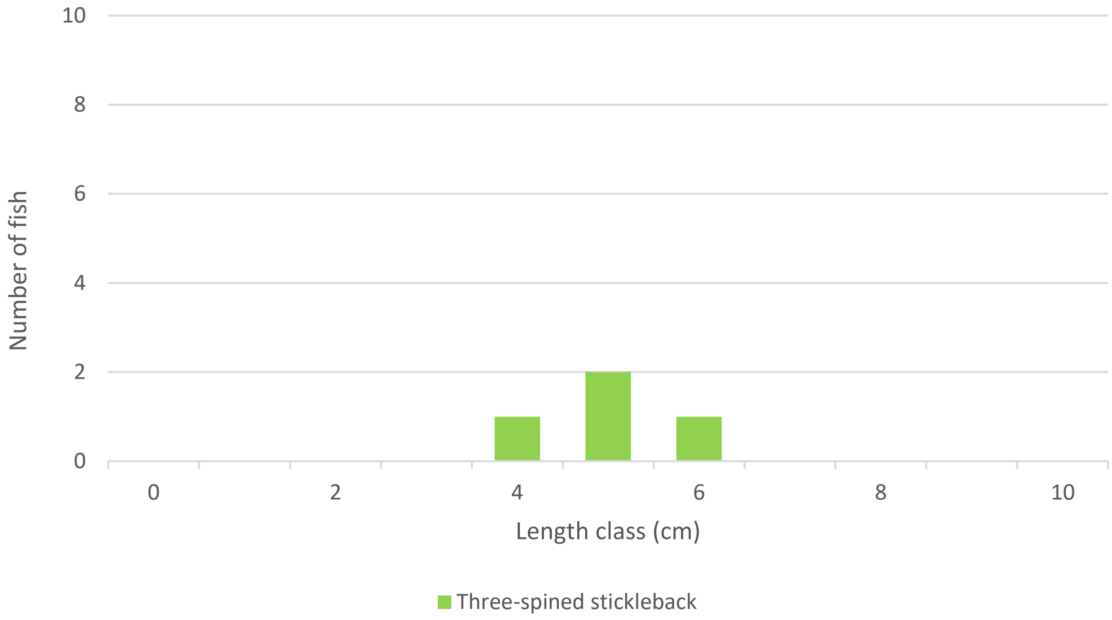

Figure 3.8 Length frequency distribution recorded via electro-fishing at site C1 on the Graffanstown Stream July 2021

Plate 3.14 Representative image of site C1 on the Graffanstown Stream, May 2021 (facing upstream from road culvert)

3.1.15 Site C2 – Ballynaskeagh Stream, Ballynaskeagh

No fish were recorded via electro-fishing at site C2 on the Ballynaskeagh Stream. Despite some moderate physical habitat suitability for salmonids and lamprey, these species were absent. This was considered a result of very low water levels at the time of survey (average depth <0.05m) and the stream's likely non-perennial nature. Nevertheless, even during higher water levels (e.g., winter), the site would only provide (at best) moderate suitability, given high rates of siltation and compacted substrata. There was some low suitability for European eel, albeit none were recorded. Improved fisheries habitat was present in the lowermost reaches at the River Deel confluence and River Boyne and River Blackwater SAC (002299) site boundary.

Plate 3.15 Representative image of site C2 on the Ballynaskeagh Stream, July 2021

3.1.16 Site C3 – Mucklin Stream, Craddanstown

No fish were recorded via electro-fishing at site C2 on the Mucklin Stream. The channel was 100% dry at the time of survey, with no ponding or stagnant water present (i.e., non-perennial channel). Thus, the stream had no aquatic or fisheries value given the lack of water at the time of survey. The channel was considered likely to convey water intermittently during the year (but mostly dry). Fisheries and aquatic value was high in the downstream-connecting River Deel, located <200m downstream. The lowermost reaches of the channel were likely of some low fisheries and aquatic value during high water levels (i.e., refuge from flood water on the River Deel).

Plate 3.16 Representative image of site C3 on the Mucklin Stream, July 2021 (100% dry channel)

3.1.17 Site C4 – River Deel, Raharney Bridge

A total of two fish species were recorded via electro-fishing at site C4 on the River Deel (**Figure 3.9**). Brown trout dominated the site (*n*=40), with a range of cohorts present. Adults were more numerous than juveniles. Two distinct cohorts of Atlantic salmon parr (likely 0+ and 1+) were also recorded (*n*=21 in total).

The site provided excellent-quality salmonid nursery habitat with well-oxygenated broken glide and riffle sequences and cover in macrophyte vegetation. The cobble substrata also provided good cover for juvenile salmonids. Good-quality spawning habitat was also present given unbedded, well-sorted mixed gravels between cobble areas. These had light siltation only. Holding habitat was also very good in deep glide and localised pool with overhanging tree cover and good shading. The site was also considered good for European eel, with ample boulder and cobble refugia, albeit none were recorded. No soft sediment lamprey habitat was identified present but the quality of spawning habitat was considered good. The species likely occur downstream of the survey area in suitable depositing areas.

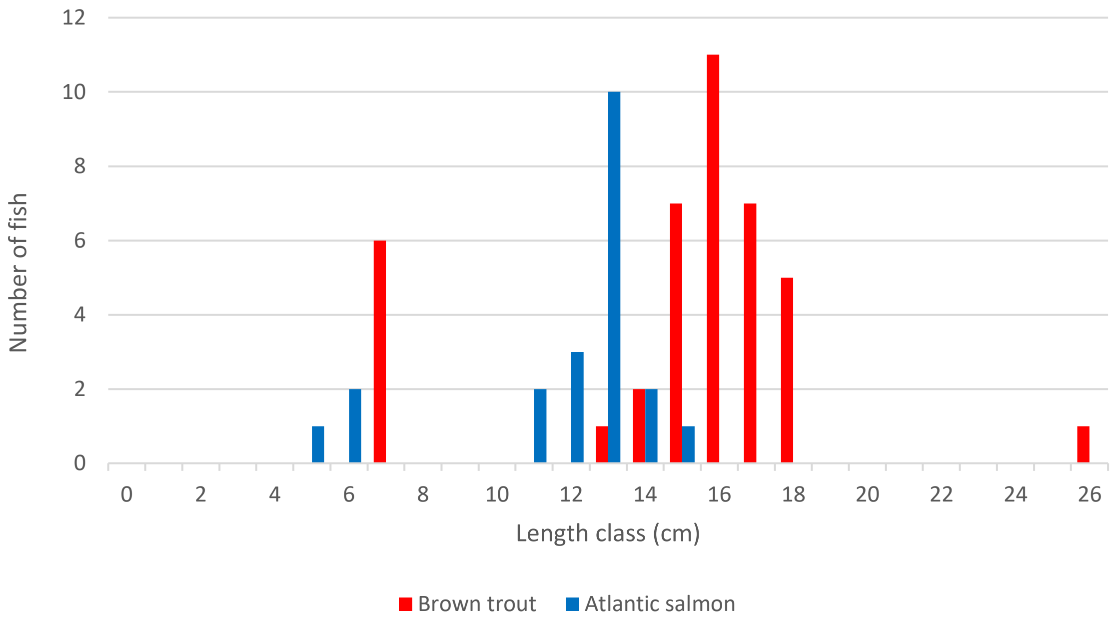

Figure 3.9 Length frequency distribution recorded via electro-fishing at site C4 on the River Deel, July 2021

Plate 3.17 Atlantic salmon (top) and brown trout (bottom) recorded from site C4 on the River Deel at Raharney Bridge, July 2021

3.1.18 Site C5 – Craddanstown Stream, Riverdale

A total of three fish species were recorded via electro-fishing at site C5 on the Craddanstown Stream (**Figure 3.10**). Low densities of three-spined stickleback (*n*=3) and *Lampetra* sp. (*n*=8) were recorded, in addition to a single juvenile (0+) brown trout. Low densities of larval lamprey were recorded at 0.8 per m^2 ($10m^2$ of habitat targeted and *n*=8 ammocoetes captured).

The historically straightened site had negligible nursery, spawning and holding value for salmonids given the absence of riffle, glide and pool sequences and extreme levels of siltation. These were exacerbated by historical channelisation and sedimentation pressures from the adjoining improved grassland. The channel was not considered of value to European eel given the absence of refugia such as cobble and boulder and the shallow nature. The channel was, however, of some value to *Lampetra* sp. given pockets of fine silt with a high organic content up to 15cm deep. These adjoined degraded areas of fine gravel that provided some local spawning habitat for the species.

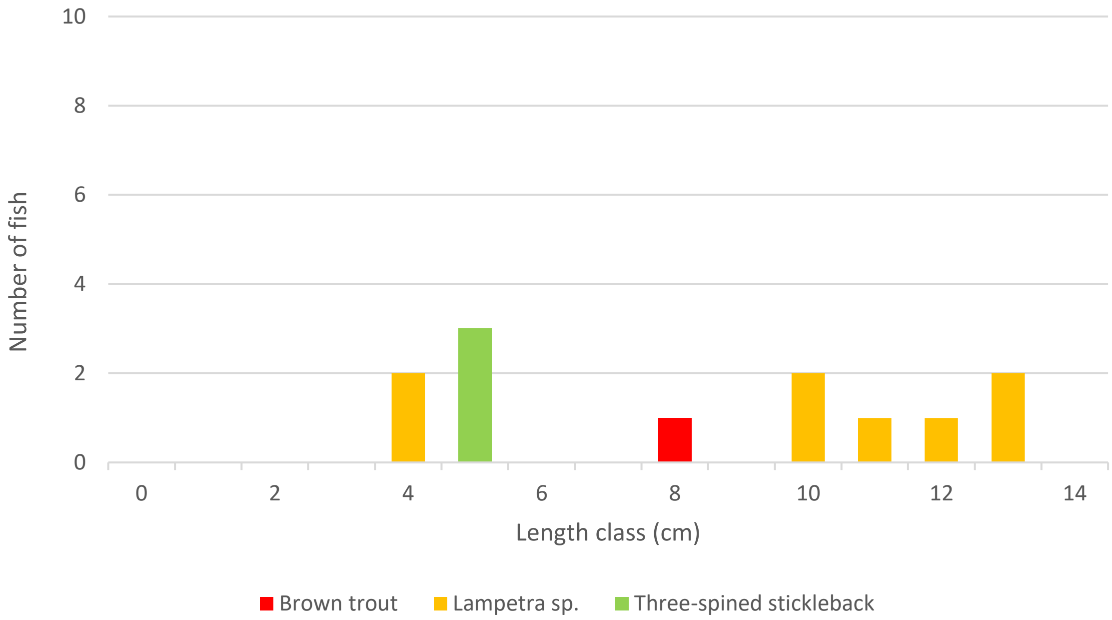

Figure 3.10 Length frequency distribution recorded via electro-fishing at site C5 on the Craddanstown Stream, July 2021

Plate 3.18 Representative image of site C5 on the Craddanstown Stream, May 2021 (facing downstream from bridge)

3.1.19 Site C6 – Clondalee More Stream, Clondalee More

Three-spined stickleback was the only fish species recorded via electro-fishing at site C6 on the Clondalee More Stream (**Figure 3.11**). With the exception of low densities of this species, the historically straightened channel was of very poor fisheries value, i.e., not of value to salmonids or lamprey species given the lack of flow and heavily-silted (peat) nature. Despite an abundance of soft sediment accumulations, these were not of value for larval lamprey given the flocculent and or high humic content, in addition to high clay fractions, locally, resulting in compaction. Suitability or European eel was low given the open, shallow nature of the site and paucity of suitable refugia.

Figure 3.11 Length frequency distribution recorded via electro-fishing at site C6 on the Clondalee More Stream, July 2021

Plate 3.19 Representative image of site C6 on the Clondalee More Stream, May 2021

3.1.20 Site D1 – River Boyne, Scarriff Bridge

A total of four fish species were recorded via electro-fishing at site D1 on the River Boyne (**Figure 3.12**). Low numbers of both Atlantic salmon parr (*n*=9) and brown trout (*n*=5) were recorded, in addition to low numbers of minnow (*n*=5) and stone loach (*n*=4). With the exception of one adult brown trout, all salmonids captured were of the 0+ cohort.

Historical alterations had reduced the salmonid nursery value of the site. The spawning value was moderate as spawning gravels were restricted to isolated pockets between banks of argillaceous clay given historical deepening works. Holding habitat was very good. While no large salmonids were captured, larger fish were observed in deep pool adjoining the glide habitat surveyed - these areas were outside of wadable reach electro-fishing. Lamprey burial habitat was rare but present in association with marginal bur reed beds (however, no ammocoetes were recorded). European eel habitat was moderate with refugia largely limited to overhanging trees and scattered boulders.

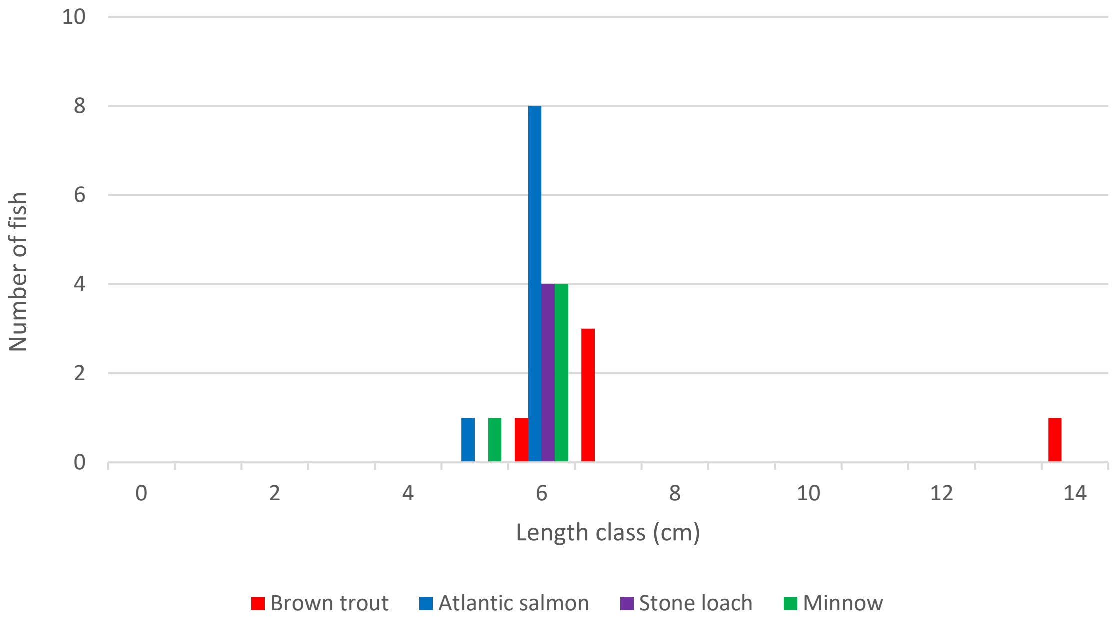

Figure 3.12 Length frequency distribution recorded via electro-fishing at site D1 on the River Boyne, July 2021

Plate 3.20 Stone loach recorded from site D1 on the River Boyne, July 2021

Table 3.1 Fish species densities per m^2 recorded at sites in the vicinity of Ballivor wind farm via electro-fishing in July 2021. Values in bold represent the highest densities recorded for each species, respectively. * = no. ammocoetes per m^2 of targeted habitat fished

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Fish density (number fish per m^2)					
				Brown trout	Atlantic salmon	*Lampetra* sp.	Three-spined stickleback	Minnow	Stone loach
A1	Cartenstown Stream	5	25	0.000	0.000	0.000	**0.280**	0.000	0.000
A2	Stonestown River	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a
A3	Ballinn Stream	5	50	0.000	0.000	0.000	0.240	0.000	0.000
A4	Bolandstown River	10	140	0.000	0.000	***2.8**	0.036	0.000	0.000
A5	Cartenstown Stream	10	200	0.020	0.000	*0.4	0.000	0.000	0.000
A6	Woodtown West Stream	5	25	0.000	0.000	0.000	0.000	0.000	0.000
A7	Stonyford River	10	400	0.048	0.005	*1.75	0.000	0.000	0.000
A8	Carranstown Little River	10	150	0.000	0.000	0.000	0.000	0.000	0.000
B1	Killaconnigan Stream	5	20	0.000	0.000	0.000	0.000	0.000	0.000
B2	Kilballivor Stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a
B3	Unnamed stream	10	160	0.000	0.000	0.000	0.063	0.000	0.000
B4	Unnamed stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a
B5	Ballivor River	10	180	0.000	0.000	0.000	0.056	0.000	0.000
C1	Graffanstown Stream	10	100	0.000	0.000	0.000	0.040	0.000	0.000
C2	Ballynaskeagh Stream	5	45	0.000	0.000	0.000	0.000	0.000	0.000

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Fish density (number fish per m^2)					
				Brown trout	Atlantic salmon	*Lampetra* sp.	Three-spined stickleback	Minnow	Stone loach
C3	Mucklin Stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a
C4	River Deel	10	320	**0.125**	**0.066**	0.000	0.000	0.000	0.000
C5	Craddanstown Stream	10	190	0.005	0.000	*0.8	0.016	0.000	0.000
C6	Clondalee More Stream	10	160	0.000	0.000	0.000	0.069	0.000	0.000
D1	River Boyne	10	340	0.015	0.026	0.000	0.000	**0.015**	**0.012**

4. Discussion

4.1 Most valuable sites

4.1.1 Salmonids

A total of five sites supported brown trout at the time of survey, namely sites A5 (Cartenstown Stream), A7 (Stonyford River), C4 (River Deel), C5 (Craddanstown Stream) and D1 (River Boyne). Sites A7, C4 and D1 also supported Atlantic salmon. The quality of salmonid habitat was typically poor to moderate, with better-quality habitat only present on the Stonyford River, River Deel and River Boyne. The best quality salmonid habitat was present on the River Deel at site C4, where nursery, spawning and holding habitat were all evaluated as excellent quality.

In general, salmonid habitat in the vicinity of the proposed Ballivor wind farm was poor due to historical drainage pressures, low or intermittent/seasonal flows and often excessive siltation (primarily from peat escapement). Diffuse siltation is one of the greatest threats to salmonid populations. Sediment not only blocks interstitial spaces in substrata and limits oxygen supply to salmonid eggs (required for healthy embryonic development and successful hatching) but can also smother substrata, thus reducing available spawning habitat and impact macro-invertebrate communities on which salmonids feed (Soulsby et al., 2001; Walling et al., 2003; Heywood & Walling, 2007; Louhi et al., 2008, 2011; Cocchiglia et al., 2012; Conroy et al., 2016; Davis et al., 2018; Kelly-Quinn et al., 2020). Sedimentation of salmonid habitat is a particular problem in Irish rivers flowing through modified catchments (Evans et al., 2006).

4.1.2 Lamprey

Lampetra sp. ammocoetes were recorded from a total of four sites, namely sites A4 (Bolandstown River), A5 (Cartenstown Stream), A7 (Stonyford River) and C5 (Craddanstown Stream). The highest density recorded were present at sites A4 and A7 (2.8 and 1.75 ammocoetes per m^2 of ammocoete habitat fished, respectively).

However, lamprey habitat was generally poor across the survey area. Owing to their relatively small morphologies, *Lampetra* species such as brook lamprey require clean, fine gravels in which to dig their redds (Lasne et al., 2010; Rooney et al., 2013; Dawson et al., 2015) although areas may also include fractions of sand, larger gravels, and cobble (Nika & Virbickas, 2010). Spawning habitat in the vicinity of the proposed Ballivor wind farm was appreciably sparse and of poor quality due to significant (peat) siltation pressures (as outlined above). Furthermore, lamprey ammocoetes require the deposition of fine, organic-rich sediment ≥5cm in depth in which to burrow and mature (Gardiner, 2003; Goodwin et al., 2008; Aronsuu & Virkkala, 2014). Peat-dominated substrata (i.e., humic deposits), such as those typically found in the vicinity of the proposed Ballivor wind farm, do not provide suitable burial/burrowing habitat complexity or structure for ammocoetes given their invariably fine and flocculent nature (pers. obs.).

4.1.3 European eel

On both a global and Irish scale, the European eel is listed as 'critically endangered' (Pike et al., 2020; King et al., 2011). Despite some suitability across the survey area, no European eel were recorded during the current survey. This was considered as a result of significant siltation (peat sedimentation) pressures within the vicinity of the proposed wind farm, in addition to a paucity of suitable diurnal refugia and low/intermittent flows in numerous watercourses. Nevertheless, even smaller channels with poor or little fisheries value overall can offer potential as European eel migratory pathways, provided they maintain downstream connectivity to larger channels. (e.g., adult migration seawards, usually from September/October onwards).

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8. Appendix B – Q-sample results (biological water quality)

Table 8.1 Macro-invertebrate Q-sampling results for aquatic survey sites A1, A3, A4, A6, A7, A8, A9, B3, B5, C1, C2, C4, C5, C6 & D1

Group	Family	Species	A1	A3	A4	A5	A6	A7	A8	B3	B5	C1	C2	C4	C5	C6	D1	EPA group
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*						1						3			14	A
Ephemeroptera	Heptageniidae	*Heptagenia sulphurea*												10			7	A
Ephemeroptera	Heptageniidae	*Rhithrogena semicolorata*															1	A
Plecoptera	Perlodidae	*Isoperla grammatica*												1			2	A
Plecoptera	Nemouridae	*Nemurella pictetii*														1		A
Ephemeroptera	Leptophlebiidae	*Leptophlebia vespertina*																B
Ephemeroptera	Baetidae	*Baetis muticus*						8						2			7	B
Trichoptera	Glossosomatidae	*Agapetus fuscipes*													2			B
Trichoptera	Hydroptilidae	*Hydroptila* sp.												3			2	B
Trichoptera	Limnephilidae	Unidentified species		1										2				B
Trichoptera	Limnephilidae	*Limnephilus* sp.		1		3			1	3								B
Trichoptera	Limnephilidae	*Drusus annulatus*						3									1	B
Trichoptera	Limnephilidae	*Limnephilus auricula*									4	2				6		B
Trichoptera	Limnephilidae	*Potamophylax cingulatus*											1				3	B
Trichoptera	Sericostomatidae	*Sericostoma personatum*												1	7		1	B
Odonata	Coenagrionidae	*Pyrrhosoma nymphula*	1	1														B
Odonata	Calopterygidae	*Calopteryx splendens*															1	B
Ephemeroptera	Baetidae	*Baetis rhodani*			50	2		84	4	5				6	32		4	C
Ephemeroptera	Ephemerellidae	*Serratella ignita*						2						3			3	C
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*						6						3			11	C
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*						4						6			2	C
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*	6						1									C
Trichoptera	Polycentropodidae	*Polycentropus kingi*				1											1	C
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*				3												C

Group	Family	Species	A1	A3	A4	A5	A6	A7	A8	B3	B5	C1	C2	C4	C5	C6	D1	EPA group
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*			3													C
Coleoptera	Hydraenidae	*Hydraena gracilis*	1															C
Coleoptera	Hydraenidae	*Limnebius* sp.	1															C
Coleoptera	Dytiscidae	Dytiscidae larva		1			1											C
Coleoptera	Dytiscidae	*Nartus (Rhantus) grapii*		1														C
Coleoptera	Dytiscidae	*Hydroporus* sp.		3														C
Coleoptera	Elmidae	*Elmis aenea*			3	1							2	8	2		4	C
Coleoptera	Dytiscidae	*Agabus fuscipes*			3									3				C
Coleoptera	Gyrinidae	*Gyrinus substriatus*					1											C
Coleoptera	Elmidae	*Limnius volckmari*												4			2	C
Coleoptera	Dytiscidae	*Nebrioporus depressus*													1		1	C
Coleoptera	Haliplidae	*Brychius elevatus*															2	C
Crustacea	Gammaridae	*Gammarus duebeni*			4	12		5	5	62	5	8	40	4	11	2	4	C
Diptera	Chironomidae	Unidentified larvae	7		1		3	1	1	4	3	6	3	2	1	10	6	C
Diptera	Dixidae	Unidentified species	1	1			1											C
Diptera	Simuliidae	Unidentified larvae	1		6			23					1	12				C
Diptera	Pediciidae	*Dicranota* sp.	1		2					1		1	4		2	1		C
Diptera	Tipuliidae	*Tipula* sp.				1												C
Diptera	Ceratopogonidae	Ceratopogonidae larva				1												C
Diptera	Chaoboridae	Chaoboridae larva					3											C
Diptera	Pediciidae	*Pedicia* sp.							2									C
Diptera	Limoniidae	*Antocha*larva												1				C
Arachnida	Hydrachnidiae	Unidentified species	1							1	1	3						C
Hemiptera	Veliidae	*Velia caprai*	2								1							C
Hemiptera	Corixidae	*Corixida* nymph					3											C
Hemiptera	Corixidae	*Hesperocorixa sahlbergi*					2											C

Group	Family	Species	A1	A3	A4	A5	A6	A7	A8	B3	B5	C1	C2	C4	C5	C6	D1	EPA group
Hemiptera	Corixidae	*Siagara* sp.																C
Gastropoda	Sphaeriidae	Unidentified species	8								3				3	3		C
Gastropoda	Lymnaeidae	*Galba truncatula*		3														C
Gastropoda	Planorbidae	*Planorbis planorbis*									1							C
Gastropoda	Bithnyiidae	*Bithynia tentaculata*												1			3	C
Gastropoda	Planorbidae	*Ancylus fluviatilis*															6	C
Gastropoda	Lymnaeidae	*Ampullaceana (Radix) balthica*															4	C
Megaloptera	Sialidae	*Sialis* sp.		1		1												D
Crustacea	Asellidae	*Asellus aquaticus*	19	170	8	7	1		28	57	25	87	14		5	173	2	D
Hirudinidae	Glossiphoniidae	Unidentified species								1	2	3				4		D
Hirudinidae	Erpobdellidae	Unidentified species														1		D
Oligochaeta	Lumbricidae	Unidentified species			1	1			5	3			1	1				n/a
Abundance			**49**	**183**	**81**	**33**	**15**	**137**	**47**	**137**	**45**	**110**	**66**	**76**	**66**	**201**	**94**	
Q-rating			2-3*	2-3*	3	3	3*	4	2-3	3	2-3*	2-3*	3	4	3	2-3	4	
WFD status			Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Good	

*tentative Q-rating due to poor flows and or lack of suitable riffle areas for sampling (Toner et al., 2005)

APPENDIX 5

PLANNING APPLICATIONS WITHIN THE VICINITY OF THE PROPOSED DEVELOPMENT

PLANNING HISTORY

Table 7-4 Planning Applications Within the Vicinity of the Proposed Development Site

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Meath	TA170047	23/01/2017	A single storey dwelling, a detached domestic garage, a proprietary domestic effluent treatment system, shared site entrance previously granted under Ref. TA/130317 and all associated site works	Coolronan, Ballivor	Conditional
Meath	TA170178	23/02/2017	Construction of a new club house, the development of training and playing pitches all with access road through pre-existing shared entrance, overall parking facilities, connection to public sewer and public watermain, the provision of a deep bore well.	Ballivor Gaelic Football Club, Killaconnigan, Ballivor	Conditional
Westmeath	176101	04/04/2017	Construction of a three bay cattle shed with ancillary facilities	Craddanstown, Raharney	Conditional
Westmeath	176129	26/04/2017	To demolish existing habitable dwelling and construct a new single storey replacement dwelling	Lisclogher Great, Delvin	Conditional
Westmeath	176145	12/05/2017	New storey and a half type dwelling house, domestic garage	Bellvue, Grangemore, Raharney	Conditional
Westmeath	176190	29/06/2017	New milking parlour and dairy and associated meal bin and new holding yard and all ancillary site works	Crowinstown Great, Delvin	Conditional
Meath	TA170809	11/07/2017	Conversion and extension to existing detached garage area, to include new home studio/office/workshop for collection/restoration of musical equipment, (a small-scale home based economic activity)	Ballynadrimna, Athboy	Conditional
Westmeath	176251	06/09/2017	Construction of a storey and half dwelling	Lisclogher Great, Delvin	Conditional
Meath	TA171125	27/09/2017	A new two storey type dwelling house, domestic garage	Big Ballivor, Ballivor	Conditional
Westmeath	176309	01/11/2017	Construction of an extension circa 925 sqm to the north western end of their existing clubhouse.	Billistown, Delvin	Conditional
Westmeath	176314	03/11/2017	Construction of a new two storey dwelling, domestic garage	Rathrass, Raharney	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Westmeath	176323	13/11/2017	Construction of a new two storey dwelling, domestic garage	Grangemore, Raharney	Conditional
Meath	TA171436	13/12/2017	Demolition of existing dwelling and domestic sheds on the site and construction of a replacement single storey dwelling, domestic garage	Croboy, Hill of Down	Conditional
Meath	TA180421	30/04/2018	A single storey dwelling, a detached domestic garage	Clonycavan, Ballivor	Conditional
Meath	TA180485	11/05/2018	Extension of duration of planning permission TA130317 - Single storey dwelling, detached domestic garage	Coolronan, Ballivor	Conditional
Westmeath	186211	06/07/2018	Permission for a dormer style bungalow dwelling	Balrath South, Delvin	Conditional
Westmeath	186246	15/08/2018	To develop an existing entrance and upgrade it to forestry harvesting standard(bell mouth entrance) onto public road to facilitate access to factory plantation	Bracklin, Delvin	Conditional
Westmeath	186322	25/10/2018	Demolition of existing dungstead, b) construction of an agricultural building to include Cubicles and underground slatted slurry tanks, c) construction of a Milking Parlour, Dairy & Ancillary Rooms, Livestock Waiting Yard, Livestock Handling Facilities	Craddanstown, Raharney	Conditional
Westmeath	186354	22/11/2018	Construction of a two storey dwelling, detached domestic garage & store	Bracklyn, Delvin	Conditional
Westmeath	196079	21/03/2019	Demolition of existing sunroom (21sqm), construction of single storey "granny flat" extension to north side (104sqm), single storey extension to south (36sq	Earlsmeadow, Lisclogher Little, Delvin	Conditional
Meath	TA190457	16/04/2019	The erection of a new 30.05m multiuser telecommunications support structure carrying 9 no. antennas and associated remote radio units. 6 no. communication dishes. 3 no. lighting finials and 7 no. outdoor cabinets, all enclosed within a security compound	Ballivor GAA Club, Killaconnigan, Ballivor	Conditional
Westmeath	196104	18/04/2019	Construction of a new two storey type dwelling, domestic garage	Grangemore, Raharney	Conditional
Westmeath	196155	13/06/2019	Two storey dwelling, associated domestic garage	Lisclogher Little, Delvin	Conditional
Westmeath	196174	27/06/2019	Private dwelling house	Craddenstown, Raharney	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Westmeath	196197	18/07/2019	Provision of a two storey traditional farmhouse type dwelling & domestic use shed	Riverdale, Raharney	Conditional
Westmeath	196200	19/07/2019	Demolition of a vacant house and outbuildings and replace with a new two storey dwelling and detached garage	Balrath North, Delvin	Conditional
Westmeath	196211	02/08/2019	A dwelling, domestic garage	Addinstown, Delvin	Conditional
Meath	TA191441	31/10/2019	Erection of a new 30.05m multi-user telecommunications support structure carrying 9No. antennas and associated remote radio units, 6No. communications dishes, 3No. lighting finials and 7No. outdoor cabinets all enclosed within a security compound	Ballivor GAA Club, Killaconnigan, Ballivor	Conditional
Meath	TA191807	23/12/2019	Single storey dwelling, detached domestic garage	Killaconnigan , Ballivor	Conditional
Westmeath	206001	06/01/2020	To demolish existing single storey cottage, decommission an existing septic tank and erect storey-and-a-half style house	Castletown, Delvin	Conditional
Meath	TA200054	21/01/2020	A single-storey dwelling house, a detached domestic garage	Coolronan , Ballivor	Conditional
Meath	TA200231	25/02/2020	Planning permission is sought for retention and completion of a 2 storey dwelling, retention of foundations / floor slab level and completion of a new 2 storey house with waste water treatment system and all associated site works	Ballynadrimna, Athboy	Conditional
Westmeath	206053	13/03/2020	Construction of a 4-bay dry stock shed and a slatted shed incorporating cattle cubicles	Addinstown,, Delvin	Conditional
Westmeath	206054	13/03/2020	Construction of an 83.9 sq.m extension to existing storey and a half type dwelling and all ancillary site services.	Craddenstown, Raharney	Conditional
Meath	TA200857	03/07/2020	A two storey dwelling	Coolronan, Ballivor	Conditional
Westmeath	206179	14/07/2020	A private dwelling house & domestic garage and carport	Riverdale, Raharney	Conditional
Meath	TA201167	28/08/2020	Construction of detached single storey dwelling & domestic garage	Carranstown Great, Ballivor	Withdrawn
Meath	TA201180	31/08/2020	Construction of a new build two storey dwelling, connecting to existing two storey dwelling.	Condalee More, Hill Of Down	Refused
Meath	TA201217	04/09/2020	Change of house type from a single storey type dwelling to a storey and a half type dwelling and revisions to the site layout plan as previously granted under planning ref TA170047 and all associated site works	Coolronan, Ballivor	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
Westmeath	206242	11/09/2020	One No. residential dwelling consisting of two part single, one part two-storey house, associated garage/shed/workshop	Mucklin, Delvin	Conditional
Westmeath	206331	25/11/2020	Construct dormer type house, domestic garage, site entrance & wastewater unit	Ballynacor, Delvin	Conditional
Meath	TA201841	02/12/2020	A single storey dwelling with domestic double garage	Carranstown Great, Ballivor	Withdrawn
Westmeath	206359	17/12/2020	Demolition of existing single storey dwelling, agricultural shed and domestic shed, and the construction of a single storey replacement dwelling and domestic garage	Balrath North, Delvin	Conditional
Meath	21129	25/01/2021	The proposed development will consist of; construct a two storey style dwelling and detached domestic garage, form new entrance from public road, install waste water treatment system and percolation area, together with all associated site works	Pluckstown, Athboy	Refused
Westmeath	2150	08/02/2021	Construct a new storey and a half type dwelling & domestic garage	Grangemore, Raharney	Conditional
Meath	21281	15/02/2021	Development consists of a Sheep Shed with Sheep Handling Yard, Meal Storage Bin, Concrete Apron, Farm Access Road, Agricultural Entrance and all site works	Woodtown West, Athboy	Conditional
Meath	21847	05/05/2021	A two-storey dwelling & domestic garage	Carranstown Great, Ballivor	Refused
Meath	21930	14/05/2021	The construction of a dwelling, garage, proprietary waste water treatment system and percolation area, new entrance and all associated services	Baskinagh Upper, Athboy	Conditional
Meath	211274	02/07/2021	The construction of 4 bay slatted shed for agricultural use and all associated site works	Clonycavan, Balivor	Conditional
Meath	211594	16/08/2021	Construction of a single storey dwelling, domestic garage, wastewater treatment system, well, change of use of existing agricultural entrance to domestic entrance and associated site works	Clondalee Beg, Hill Of Down, Enfield	Conditional
Westmeath	21401	03/09/2021	Erection of a slatted shed, roofed dungstead, silage slab and ancillary site works (extension of duration)	Belvue, Grangemore	Conditional
Westmeath	21574	27/10/2021	Two storey/dormer dwelling with new site entrance, septic tank/treatment unit, percolation area and all associated site works.	Addinstown, Devlin	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	Planning Ref.	Lodgement Date	Description	Location	Final grant
Westmeath	21380	01/11/2021	Permission to construct a single storey dwelling & install a proprietary wastewater treatment system and all associated site development works	Clonmorrill, Delvin	Conditional
Westmeath	21620	18/11/2021	Retention permission for continued use of an existing Guyed Wind Monitoring Mast with instruments, 100m in height on its lands at Lisclogher Bog, Lisclogher Great, Co. Westmeath for a further period of three years. The purpose of the mast is to assess the suitability of the company's adjacent lands for wind farm development. Previous planning application reference number 16/6259 refers.	Lisclogher Bog, Lisclogher Great.	Conditional
Meath	212235	26/11/2021	The development will consist of the retention of 1: minor variations made to single-storey dwelling and detached domestic garage at the time of construction and minor re-location of both and 2: revised site boundaries previously granted under p.82/424.	Woodtown West, Athboy	Conditional
Meath	212272	02/12/2021	The demolition of the existing single storey dwelling along with the decommissioning of the existing septic tank, the construction of a single storey replacement dwelling, a new wastewater disposal system, upgrade of the existing agricultural entrance t	Inan, Hill Of Down, Enfield	Conditional
Westmeath	21659	13/12/2021	A private dwelling house, proprietary effluent treatment system and percolation area, domestic garage, entrance onto public road and all ancillary site services	Craddenstown, Raherney	Conditional
Meath	212428	30/12/2021	Renovation of the existing dwelling and the construction of a new connecting two storey dwelling, upgrading of the existing entrance to facilitate entrance piers and gates, the installation of a packaged wastewater treatment system and polishing filter, and associated site works	Clondalee, Hill of Down	Conditional
Westmeath	2257	11/02/2022	To construct a new storey and a half type dwelling, domestic garage, installation of a new septic tank & percolation area, new vehicular entrance and all associated ancillary site services	Grangemore, Raharney	Conditional
Westmeath	2259	14/02/2022	Construct one number detached single storey dwelling, one number detached single storey garage, to create new entrance to public road, to connect to public watermain, to install a septic tank and percolation area and all associated site works	Ballynacor, Delvin	Refused
Meath	22186	14/02/2022	To retain and complete the construction of a recessed domestic entrance, a road frontage boundary wall and decorative masonry garden features. the	Cloneygrange, Ballivor	Conditional

Residential, Agricultural, Commercial Planning History					
Local Authority	**Planning Ref.**	**Lodgement Date**	**Description**	**Location**	**Final grant**
			development also includes permission to decommission the existing septic tank and percolation area and re		
Westmeath	22250	13/05/2022	Construct a two storey dwelling with detached domestic garage & store, install a proprietary wastewater treatment system and all associated site development works	Craddenstown, Raherney	Refused
Westmeath	22268	20/05/2022	To extend existing dwelling at the rear to include kitchen, dining, utility and bathroom with two bedrooms and 5 velux windows and construct a porch to the front and a detached garage to the rear and to close up existing entrance and to construct a new entrance and to decommission existing septic tank and install a new septic tank with percolation area with all ancillary site works	Corbetstown, Killucan	Conditional
Westmeath	22287	27/05/2022	Private dwelling house, proprietary effluent treatment system and percolation area, domestic garage, entrance onto public road and all ancillary site services	Killaugh, Bracklyn	Conditional
Westmeath	22315	13/06/2022	Construct a shed at the side of our existing dwelling and a garage at the rear with all ancillary site works	Balrath South, Delvin	Conditional
Meath	22856	29/06/2022	The development will consist of an application to retain (retention planning permission) the house as constructed, and with an external brick finish, a minor extension to the converted garage at the front elevation, the roadside boundary walls and entrance	Kilballivor, Ballivor	Conditional
Meath	22965	21/07/2022	The development will consist of 5 no. purpose-built community care dwellings including 1 no. shared unit for those with intellectual disabilities and associated needs, garage/storage building, proposed on-site well to serve the site, on-site wastewater	Baskinagh, Athboy	Refused
Westmeath	22245	15/08/2022	Construction of agricultural shed consisting of cubicles, feeding area and underground slatted slurry storage tanks and all associated site works.	Craddanstown, Raharney	Conditional
Meath	221555	01/12/2022	The construction of one and a half storey 4 bedroom dwelling, a domestic garage, new access through site, new well, new percolation area and treatment system and all associated site works	Coolronan, Ballivor	Further Information
Westmeath	122067	05/12/2012	Laying two intersecting grass strips, 150m x 7m and 75m x 7m, for use as a take-off and landing area for model aircraft and a grass area, 10m x 30m for car parking	Ballyhealy / Ballinure & Bracklyn	Conditional

Table 7-5 Approved Forestry Licences in the vicinity of the subject site available from the Department of Agriculture, Forestry and the Marine.

Forestry: Afforestation, Clear-fell, Forrest Roads						
Licence Details	Type	Date Approved	Status	Location	Area (ha)	Length (m) Roads
TFL00139818	Private Clearfell and Thinning	25-Jun-18	Approved	Balrath, Meath	29.59	
TFL00153618	Private Clearfell and Thinning	31-Jul-18	Approved	Killaconnigan, Meath	0.98	
CN81456	Forest Roads	02-Aug-18	Built	Balrath, Meath		648
MH04-FL0011	Coillte Clearfell	06-Nov-18	Approved	Killaconnigan, Carranstown Little, Meath	3.78	
TFL00232318	Private Clearfell and Thinning	21-Mar-19	Approved	Coolronan, Meath	4.81	
TFL00219018	Private Clearfell and Thinning	02-Apr-19	Approved	Bracklin, Westmeath	71.06	
TFL00188518	Private Clearfell and Thinning	29-Apr-19	Approved	Dysart, Westmeath	48.17	
CN82331	Forest Roads	11-Jun-19	Built	Bracklin, Westmeath		1865
CN84106	Afforestation	04-Nov-20	Planted	Stonestown, Clonmorrill, Westmeath	23.59	
MH04-FL0021	Coillte Clearfell	06-Jan-21	Approved	Killaconnigan, Meath	6.52	
CN85689	Afforestation	13-May-21	Planted	Clondalee more, Meath	3.74	
CN84476	Forest Roads	16-Nov-21	Approved	Dryderstown, Westmeath		85

CN83973	Forest Roads	15-Dec-21	Approved	Riverdale, Grange beg, Westmeath		1280
TFL00406619	Private Clearfell and Thinning	15-Dec-21	Approved	Riverdale, Grange beg, Westmeath	6.36	
CN90202	Afforestation	22-Jun-22	Approved	Craddanstown, Westmeath	0.8	
TFL00323219	Private Clearfell and Thinning	13-Sep-22	Approved	Dryderstown, Westmeath	3.65	
CN87335	Afforestation	27-Sep-22	Approved	Lisclogher great, Westmeath	3.29	
CN87479	Afforestation	09-Nov-22	Approved	Ballinure or Ballyhealy, Westmeath	21.77	
CN90393	Afforestation	10-Nov-22	Approved	Lisclogher great, Westmeath	22.95	
TFL00702621	Private Clearfell and Thinning		Decision Pending	Clonycavan, Meath	23.16	

APPENDIX 6

SCOPING RESPONSES

An Roinn Cultúir,
Oidhreachta agus Gaeltachta
Department of Culture,
Heritage and the Gaeltacht

Your Ref: 191137
Our Ref: **G Pre00073/2020**
(Please quote in all related correspondence)

26 June 2020

MKO
Tuam Road
Galway
H91 VW84
Via email kmulryan@mkoireland.ie

Re: Ballivor Wind Farm

A chara

On behalf of the Department of Culture, Heritage and the Gaeltacht, I refer to correspondence received in connection with the above.

Outlined below are heritage-related observations/recommendations of the Department under the stated heading(s).

<u>Nature Conservation</u>

1. Cumulative impacts- this appears to suggest that the only cumulative impacts which will be considered are those with other wind farms within 20km of the proposed site. This would not adequately assess the potential impacts on wide ranging species especially those in migration such as geese and swans. Also cumulative effects should include more than just multiple wind farm effects. The cumulative effects of the proposed development with other types of projects should be considered. The indirect effects of the demands for resources to supply and build the development and the impacts these may have elsewhere should be assessed.
2. Interactions with the proposed development and the on-going peat extraction activities at the sites and any impacts arising should be considered. Also detailed rehabilitation plans should be prepared for the peatlands concerned within and adjacent to the proposed site and the potential impacts of the proposed development on rehabilitation of the peatlands should be considered and assessed in an EIAR. Hydrological changes which may prevent future rehabilitation of suitable areas of the site to peat forming habitat are of particular concern.
3. In deciding on the proposed layout of the proposed development, in addition to those proposed, adequate buffers should also be placed around important habitats and species in the locations identified in flora and fauna studies.
4. The EIAR should adequately address the potential impacts to determine local and international bird migration over the proposed site, particularly nocturnal migrants. In this regard, technological methods, for example, radar and sonar surveys, as

outlined in https://www.nature.scot/sites/default/files/2017-09/Guidance%20note%20-%20Guidance%20on%20methods%20for%20monitoring%20bird%20populations%20at%20onshore%20windfarms.pdf should be carried out.

5. Passive bat surveying at height should be undertaken to document highflying species such as Leisler bat. Risk to bats in terms of collision and barotrauma should be addressed.
6. The EIAR should include a robust post development mitigation monitoring plan.

You are requested to send further communications to this Department's Development Applications Unit (DAU) at **manager.dau@chg.gov.ie** (team monitored); if this is not possible, correspondence may alternatively be sent to:

The Manager
Development Applications Unit (DAU)
Department of Culture, Heritage and the Gaeltacht
Newtown Road
Wexford
Y35 AP90

Is mise, le meas

Connor Rooney
Development Applications Unit

Without Prejudice

19th May, 2021

Enda Brady
Corporate Support Unit
Department of Communications, Climate Change and Environment,
Elm House,
Earlsvale Road,
Cavan.
H12 A8H7

Email: CorporateSupport.Unit@DCCAE.gov.ie

FW: 20/91_191137 Proposed Bord na Móna Powergen Ltd Wind Farm Development at Ballivor, Meath/Westmeath - MKO

Dear Enda

Thank you for the opportunity to contribute to the above mentioned consultation. These comments reflect the views of IFI in respect of same.

Background:
This consultation by Powerglen/MKO is part of a pre-application consultation request for a proposed wind farm development (revised scheme) in Ballivor, County Meath/Westmeath further to an initial request to DCCAE in March 2020

About Inland Fisheries Ireland's Role
Inland Fisheries Ireland is the statutory authority tasked under section 7(1) of the Inland Fisheries Act 2010 (No. 10 of 2010) with responsibility for the protection, management, and conservation, of the inland fisheries resource and recreational sea angling. IFI is mandated to ensure that the fisheries of the State are protected. To protect means to keep safe, defend, to shield from danger, injury or change. "Fisheries" includes all inland fisheries recreational and commercial, sea angling and mollusc fisheries stipulated under the Fisheries Acts, the physical habitat upon which the fishery relies, the facilities and access, the quantity and quality of the water and the plant and animal life on which fish depend for shelter and food and the spawning areas where in fish deposit their eggs.

The protective role of IFI relates to all aspects of the aquatic environment and all factors that influence the biotic communities within waters, which in any way relate to the propagation of fish populations. Ireland has in excess of 70,000 km of rivers and streams and 144,000 ha of lakes, all of which fall under IFI's fisheries management jurisdiction.

Many of these watercourses discharge directly to the sea and support species which utilise the marine environment for parts of their life cycle (e.g. salmon, sea trout, eel, lamprey species).

Aquatic Biological Diversity
Under section 7(3) of the Inland Fisheries Act 2010 Act it is stated that IFI shall in the performance of its functions have regard to (g) the requirements of the European Communities (Natural Habitats) Regulations 1997 (S.I. No. 94 of 1997) and the need for the sustainable development of the inland fisheries resource (including the conservation of fish and other species of fauna and flora habitats and the biodiversity of inland water ecosystems), (h) as far as possible, ensure that its activities are carried out so as to protect the national heritage (within the meaning of the Heritage Act 1995). It is important to highlight that there are many surface waters, which are not formally designated but which support populations of Annex II species designated under the Habitats Directive. Projects such as proposed have the potential to impact on downstream fisheries resources if they are not carried out in an environmentally sensitive manner. The potential impacts of the proposed development on fisheries relate largely to the construction of the turbines and access roads and the laying of cables, etc. When this work is carried out in close proximity to a watercourse, there is a potential for negative impacts on the aquatic habitat.

The EU Water Framework Directive
The EU Water Framework Directive (2000/60/EC) is recognised as a critical regulatory legislative provision. The WFD entered into force in December 2000 and requires the protection of the ecological status of surface and ground waters – this encompasses (among other elements) water quality and requires the conservation of habitats for ecological communities.

One of the primary objectives of the Directive is to establish a framework which prevents further deterioration and protects and enhances the status of aquatic ecosystems. Protection of aquatic ecosystems requires that surface water systems be protected. Protection of aquatic ecosystems requires that surface water systems be protected on a catchment basis - a shared objective between all relevant public authorities.

Article 5 of the 2009 Surface Water Regulations requires that a public authority, in performance of its functions, shall not undertake those functions in a manner that knowingly causes or allows deterioration in the chemical or ecological status of a body of surface water. Article 28(2) of the said regulations states that a surface water body whose status is determined to be less than good shall be restored to at least good status not later than the end of 2015.

The River Deel, is currently at *good* status (2020) at Cummer Bridge, (an increase from moderate in 2018,) good at Ratharney Bridge, but *moderate* at Inan Bridge. The River Deel contain stocks of Atlantic salmon, Brown Trout, Eel and Lamprey.

The following observations and comments are of necessity of a general nature, as construction proposals and method statements are not as yet available. While they apply to the proposed development in general, the sites for which details have been received are adjacent to and have potential to impact on a wide range of fisheries waters on the Rivers Deel and Boyne including areas designated as SAC's, angling waters, adult holding areas, nursery and spawning waters, etc. forming parts of the Eastern River Basin District Many proposed turbine sites are to be sited adjacent to a range of smaller watercourses which act primarily as contributories to downstream habitat for juvenile salmonids, lampreys and other species as well as macrophytes, algae and macroinvertebrates which as drift form a significant part of the food supply to the downstream fisheries. All of the waters referred to have, in the context of the proposed development, the potential to convey deleterious matter from those works such as concrete, silt, fuel, paints, thinners and sewage effluent as well as lubricating and hydraulic oils from construction plant and equipment downstream unless proper safeguards are in place. IFI request you have particular regard to the following in the planning stage of the proposed development.

Stream size can be misleading in regard to fish presence. A significant amount of fish rearing occurs in very small channels and seasonal streams. These streams may not be recognised as fish or macroinvertebrate habitat and their importance to fisheries sometimes overlooked.

All natural watercourses which have to be traversed during site development and road construction works should be effectively bridged prior to commencement. The crossing of watercourses at fords is unacceptable because of the amount of uncontrolled sedimentation that can be generated by their use. If temporary crossing structures are required, IFI approval will be necessary as regards specification and timing of installation. There is sometimes a serious misconception that in installing temporary crossing structures, the only issue is keeping water flowing from above a temporary crossing to below it. Design and choice of temporary crossing structures must provide for passage of fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over wintering areas, as well as preventing erosion and sedimentation. In certain circumstances, access for angling or commercial fishing purposes may also be required. No temporary crossing on any watercourse shall be installed without the approval of IFI as regards sizing, location, duration and timing. The preferred option is for clear span 'bridge type' structures on fisheries waters. The crossing of watercourses at natural fords is not permitted because of the amount of uncontrolled sedimentation that can be generated. The creation of fords on streams and rivers through the introduction of stone is prohibited.

Where circumstances such as space or access difficulties preclude use of clear span structures, temporary crossings structures shall:

- Comprise one or more metal or concrete pipes, prefabricated culverts or such other material as IFI may permit of minimum diameter 900 mm. Pipes or culverts may be vertically stacked.
- Be laid in such manner as to maintain the existing stream profile.
- Ensure no significant alteration in current speed or hydraulic characteristics, in particular not result in scouring, deposition or erosion upstream or downstream the temporary crossing location.
- Have capacity to convey the full range of flows including flood flows likely to be encountered without the crossing being overtopped.
- Be covered with clean inert material such as to allow for the safe crossing of the widest items of plant and equipment without cover material being dislodged and entering waters.

The approach and departure routes to temporary crossing structures should be designed and installed so that drainage will fall away from the watercourse being crossed. In the event that the fall of ground does not permit sufficient control on drainage, additional earthworks settlement areas shall be provided. Temporary crossing structures should be fenced with terram or similar material to prevent wind blow carrying dusts and other potentially polluting matter to waters. Side armour (e.g. reinforced concrete traffic barriers) should be provided on temporary crossing structures to ensure machinery cannot drive over its edge, or force the discharge of material from the bridge deck to waters. IFI wish to emphasise that site selection for temporary crossings should have regard to all access and construction needs ranging from those of fencing contractor's vehicles to the longest wheelbase of multi-axle cranes. It is not permissible, except in exceptional circumstances, to reposition temporary crossing structures where these are not of a clear span type.

Where connection from the proposed wind farm is to be made to the national grid the crossing of important fisheries waters may be an issue where our specific approval will be required.

Permanent crossing structures should not damage fish habitat or create blockages to fish and macroinvertebrate passage. As in the case of temporary crossing structures, design and choice of structure should be based on its technical and economic feasibility to pass fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over-wintering areas, provision in certain areas of angling and commercial fishing access including boat access and prevention of erosion and sedimentation. Culverts are the most frequently used river/stream crossing structures and are associated with some of the most common fish passage problems. The culverting of long stretches of fisheries water is extremely undesirable and can result in significant loss of valuable habitat.

In the case of crossing structures over fishery waters, the preferred position is for clear span structures (bridges), so as not to interfere in any way with the bed or bank of the watercourses in question. Bridge foundations should be designed and positioned at least 2.5 metres from the river bank so as not to impact on the riparian habitat. Generally, bridges and bottomless culverts are the best option for maintaining natural stream channel characteristics and have the least impact on habitat. However, because of design and load bearing considerations, bottomless culverts may not always be suitable for installation particularly on narrow river channels, as foundations may encroach on the channel itself and possibly result in future scouring or erosion. Taking account of recent advances and investigations in the area of climate change and flood studies, designs should be such as to verifiably have carrying capacity for a 1 in 100 year fluvial flood flow whilst maintaining a minimum freeboard of 300 mm. The Office of Public Works (OPW) is the lead agency for flood risk management in the Republic of Ireland. Design and capacity of structures must also be in accordance with their requirements. IFI strongly recommends that contact be made with OPW at the earliest stage in the planning and design process. (www.opw.ie). Clear span designs maintain channel profile, do not alter gradients, readily pass sediment and debris and provide unrestricted passage for all size classes of fish by retaining the natural stream bed and gradient. Water velocity is not changed and they can be designed to maintain the normal stream width. Foundations should be positioned at least 2.5 metres from waters.

Embedded box and pipe culverts are less preferable to bridges and bottomless culverts. Embedded culverts must maintain the natural channel gradient, width and substrate configuration. They should be buried to a minimum of 500 mm. below the stream bed at the natural gradient. Box and pipe culverts must be sized to maintain the natural stream channel width. The gradient should not exceed 3%.

The availability of suitably sized material (depending on hydraulic conditions) to initiate "simulation" of the stream bed is the most preferable approach to establish fish and faunal passage through culverts. Culverts should be positioned where the watercourse is straightest and aligned with its bed.

In the case of bridges and bottomless culverts, structures should be designed and installed so as to:

- Allow for the maintenance of channel profile and existing gradient.
- Be capable of passing such debris as might arise during flood flow conditions.
- Ensure adequate light penetration to minimise loss in primary productivity.
- Not result in damage to the riparian habitat or necessitate construction within 2.5 metres of waters.
- Provide at locations specified by IFI, angling access and/or access for commercial fishing purposes.

- While the preferred option is for bottomless culverts, IFI is prepared in certain circumstances to consider proposals for the installation of box or pipe culverts on fisheries waters. These may be installed subject to structures being sized so as to meet the above requirements in terms of channel profile, gradient, flood debris capacity, light, access and:
- Be positioned such that both the upstream and downstream invert shall be 500 mm. below the upstream and downstream river bed invert levels respectively.
- Never exceed a slope of 5%, in which circumstances baffles generally are required, and preferably not exceed a slope of 3%.
- As baffles can reduce the hydraulic efficiency of culverts, appropriate capacity provision must be included in the overall design.
- In the case of box culverts on angling waters, be 3 meters in height.

Pipe culverts are not generally considered acceptable on fisheries waters. They are normally only appropriate for use on minor watercourses and drainage ditches where these can be demonstrated as not being significant in terms of fisheries habitat.

Bank protection works are often required upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs. In carrying out bank protection works, it is essential that large enough boulders are selected and strategically positioned, to ensure they cannot be undercut. Normally this entails part burying boulders up to one third of their depth below stream bed level and securing them into their final position. In areas of high water energy, to ensure stability, boulders size should be a minimum of 0.5 ton. To facilitate revegetation, each course of boulders laid should be back filled with a layer of top soil. Selection of boulders in terms of shape to facilitate their placement and stability is a major consideration. Irregularly shaped boulders are very difficult to work with in terms of building multiple stable courses.

The height to which rock armour is built must take account not only of the riparian zone requiring protection, but also in certain circumstances of the need to protect e.g. kingfisher and sand martin habitat. In many instances, one or two layers of armour will be sufficient to protect and stabilise the toe of embankments while allowing nesting.

Gabions are not a preferred option when it comes to bank protection. They can easily be vandalised and once the mesh is cut or broken, baskets can collapse. Gabion baskets can be unsightly and it is difficult to successfully establish and maintain vegetation on side walls. Gabion baskets are normally only acceptable at locations where due to access constraints it is not possible to install rock armour.

There are significant variations in the timing and duration of spawning activity throughout the Republic of Ireland. To minimise adverse impacts on the fisheries resource works in rivers, streams and watercourses should normally (except in exceptional circumstances and with the agreement of IFI) be carried out during the period **July-September**. The appropriate 'window' for instream works can vary depending on the nature of the fishery resource concerned and the existence of other factors such as catchment or sub catchment specific Bye Laws and Regulations.

In terms of stability both during the construction and operational phases, it is essential that you assess and critically review the soil type and structure at the proposed turbine locations, and along the route of any proposed access track(s)/road(s) including areas where temporary or permanent stock piling of excavated material takes place. This is particularly important if the areas concerned contain peat soils.

One of the potential impacts of the proposed development is the discharge of silt-laden waters to fisheries streams from newly developed sites at which earth moving and excavation works are on-going. Silt can clog salmonid spawning beds, and juvenile salmonids are particularly sensitive to siltation of gill structures. Similarly, plant and macroinvertebrate communities can literally be blanketed over, and this can lead to loss or degradation of valuable habitat. It is important to incorporate best practices into construction methods and strategies to minimise discharges of silt/suspended solids to waters.

The potential for soil erosion/ suspended solids generation is higher, during / after periods of prolonged rainfall. Systems should be put in place to ensure that there shall be no discharge of suspended solids or any other deleterious matter to watercourses during the construction / operational phase and during any landscaping works. Stockpiles of sand and other materials to be used in the works should be covered with sheeting when not in use to prevent washout of fines during rainfall. Stockpiles of topsoil and associated materials arising during site development such as turbine base excavations and installation of site road networks should be similarly protected. Silt traps should be constructed at locations that will intercept run-off to the drainage network. Traps should not be constructed immediately adjacent to natural watercourses. In designing silt traps account must be taken of the anticipated particle size(s) and the volumes of water likely to be focused through the trap(s). Retention time to allow appropriate settlement is a critical factor. A buffer zone should remain between silt trap(s) and watercourses with natural vegetation left intact so as to assist silt interception. Consideration should be given to the judicious positioning of silt fences. A comprehensive plan should be drawn up at the planning stage with specific measures to address the high potential for silt pollution of nearby watercourses during works on site.

During the construction process and operational phase, natural flow paths should not be interrupted or diverted so as to give rise to or create potential for erosion. Furthermore, excavation and installation of road(s)/access track(s) should be undertaken so as not to result in the creation of preferential flow paths that may result in erosion or which might otherwise interrupt the natural movement of waters for instance in peat bog areas. Where imported materials are used in road construction, these should be such as not to be liable to become crushed by vehicular movement, and lead to discharge of fine particulates to downstream receiving waters.

Uncured concrete can kill fish and macroinvertebrates by altering the pH of the water. Pre-cast concrete should be used whenever possible, to eliminate the risk to all forms of aquatic life. When cast-in-place concrete is required, all work must be done in the dry and effectively isolated from any water that may enter the drainage network for a period sufficient to cure the concrete. Concrete delivery vehicles should be precluded from washing out at locations which would result in a discharge to surface waters. Specific controlled and environmentally safe vehicle washout areas must be provided. If cement is stored on site during construction work, it should be held in a dry secure area when not in use.

All oils and fuels should be stored in secure bunded areas, and particular care and attention should be taken during refuelling and maintenance operations on plant and equipment. Bunding should be to a volume not less than the greater of the following; 110% of the capacity of the largest tank or drum within the bunded area, or 25% of the total volume of substance that could be stored within the bunded area. All plant and equipment should carry oil/fuel spill kits. Where temporary diesel or petrol driven pumps are required, they should be sited within portable temporary bunded units. Where site works involve the discharges of drainage water to receiving rivers and streams, temporary oil interceptor facilities should be installed and maintained. Waste oils, empty oil containers and other hazardous wastes should be disposed of in accordance with the requirements of the Waste Management Act, 1996.

Biosecurity The employment of effective bio-security measures during the construction phase are an important mitigation against the introduction and spread of invasive species. Notable invasive aquatic and riparian plant species can be introduced during the construction phase via contaminated machinery and topsoils. Taking further note that the development location is near the headwaters of a number of tributary catchments, any such introduction would have particular potential to allow the spread of an invasive downstream and affect the greater river catchment.

No instream works shall be carried out without the written approval of Inland Fisheries Ireland.

IIE Baile Átha Cliath, 3044 Céide an Locha, Campas Gnó Iarthar Na Cathrach, Baile Átha Cliath 24
IFI Dublin, 3044 Lake Drive, Citywest Business Campus, Dublin 24
+ 353 (0)1 8842 600 - dublin@fisheriesireland.ie - www.fisheriesireland.ie

In the event of the project proceeding, it is the responsibility of the developer and the contractors to ensure that works will not give rise to a discharge of deleterious or polluting matter to waters.

At all times the precautionary principle should be applied throughout for the entire development. Particular attention should be paid to the various environmental directives including the Water Framework Directive, the Habitat and Birds Directives, the Fisheries Acts in particular and the Local Government (Water Pollution) Acts. Other environmental legislation should be considered as appropriate.

I trust these observations which are without prejudice will be of assistance. Notwithstanding statutory obligations under the planning process requiring the referral of certain applications for planning permission to us, IFI would be obliged to receive advance notification in the event our your clients proposing to submit an application for planning permission be it as strategic infrastructure to An Bord Pleanala, or at local authority level to the various planning authorities concerned.

Concluding Remarks

The long-term environmental sustainability of any activity that may impact on the status of fish species, their habitats, fisheries and/or the recreational angling or related commercial activities that may utilise these resources is of primary concern to IFI. IFI is among the public bodies that have a role in making policies, plans or programmes relevant to surface waters in Ireland. Critical and sensitive habitats and species (both designated and otherwise) must be protected. A number of fish species and associated habitats are protected under European Directives in Ireland. From an IFI perspective, all fish species and associated habitats within its remit require protection and management for conservation and development. IFI advocates application of the precautionary principle when considering the fisheries resource / aquatic ecology in the current process. In addition, it must be highlighted that all available consideration and support should be afforded to the national 'Blue Dots Catchment Programme' which focuses on the protection or restoration of high ecological status water bodies – a vital component in fisheries ecology, freshwater ecosystems and in Ireland's aquatic biological diversity more generally.

All works should also be carried out as per Guidelines (attached).

We are also aware of another potential windfarm at Bracklyn. Thus cumulative effects should also be considered.

IFI are grateful for the opportunity to have these views considered and incorporated as a component of the proposed windfarm application.

Yours sincerely

Noel McGloin

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Noel Gloin

SFEO, IFI Dublin

Please note that any and all further pre application correspondence regarding this matter should be addressed to Mr. Noel McGloin, Senior Fisheries Environmental Officer, IFI Dublin, 3044 Lake Drive, Citywest Business Campus, Dublin 24. Email noel.mcgloin@fisheriesireland.ie

From: Environmental Co-ordination (Inbox) <Environmental_Co-ordination@agriculture.gov.ie>
Sent: 28 May 2020 11:58
To: Karen Mulryan
Subject: RE: 191137 Proposed Bord na Móna Powergen Ltd Wind Farm Development at Ballivor, Meath/Westmeath.

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Ms Mulryan,

I refer to your recent correspondence concerning the above and please find comments from the Department of Agriculture, Food & the Marine below;

If the proposed development will involve the felling or removal of any trees, the developer must obtain a Felling License from this Department before trees are felled or removed. A Felling Licence application form can be obtained from **Felling Section, Department of Agriculture, Food and the Marine, Johnstown Castle Estate, Co. Wexford**. Tel: 076-1064459, Web
https://www.agriculture.gov.ie/forestservice/treefelling/treefelling/

A Felling Licence granted by the Minister for Agriculture, Food and the Marine provides authority under the Forestry Act 2014 to fell or otherwise remove a tree or trees and/or to thin a forest for silvicultural reasons. The Act prescribes the functions of the Minister and details the requirements, rights and obligations in relation to felling licences. The principal set of regulations giving further effect to the Forestry Act 2014 are the Forestry Regulations 2017 (S.I. No. 191 of 2017).

The developer should take note of the contents of **Felling and Reforestation Policy** document which provide a consolidated source of information on the legal and regulatory framework relating to tree felling; https://www.agriculture.gov.ie/media/migration/forestry/treefelling/FellingReforestationPolicy240517.pdf.
As this development is within forest lands, particular attention should be paid to deforestation, turbulence felling and the requirement to afforest alternative lands.

In order to ensure regulated forestry operations in Ireland accord with the principles of sustainable forest management (SFM), as well fulfilling the requirements of other relevant environmental protection laws, the Department (acting through its Forest Service division) must undertake particular consultations, and give certain matters full consideration during the assessment of individual Felling Licence applications. This includes consultation with relevant bodies, the application of various protocols and procedures (e.g. Forest Service Appropriate Assessment Procedure), and the requirement for applicants on occasion to provide further information (e.g. a Natura Impact Statement).

Consequently, when the Forest Service is considering an application to fell trees, the following applies:

1. The interaction of these proposed works with the environment locally and more widely, in addition to potential direct and indirect impacts on designated sites and water, is assessed. Consultation with relevant environmental and planning authorities may be required where specific sensitivities arise (e.g.

local authorities, National Parks & Wildlife Service, Inland Fisheries Ireland, and the National Monuments Service);

2. Where a tree Felling Licence application is received, the Department will publish a notice of the application before making a decision on the matter. The notice shall state that any person may make a submission to the Department within 30 days from the date of the notice. The notices for 2020 are published online at: https://www.agriculture.gov.ie/forestservice/publicconsultation/environmentalimpactassessmenteiapublicconsultationforafforestationforestroadconstructionandfellinglicenses2020/

3. Third parties that make a submission or observation will be informed of the decision to grant or refuse the licence, and on request, details of the conditions attached to the licence, the main reasons and considerations on which the decision to grant or refuse the licence was based, and where conditions are attached to any licence, the reasons for the conditions. Both third parties and applicants will be also informed of their right to appeal any decision within 28 days to the Forestry Appeals Committee. Felling Licence decisions for 2020 are published online at: https://www.agriculture.gov.ie/forestservice/publicconsultation/environmentalimpactassessment-2020registerofdecisions/

It is important to note that when applying to **a Local Authority**, or **An Bord Pleanàla**, for planning permission where developments are:

a) subject to an EIA procedure (including screening in the case of a sub-threshold development) and any resulting requirement to produce an EIAR; and/or

b) subject to an Appropriate Assessment procedure (including screening) and any resulting requirement to a Natura Impact Statement (NIS); and

c) the proposed development in its construction or operational phases, or any works ancillary thereto, would directly or indirectly involve the felling and replanting of trees, deforestation for the purposes of conversion to another type of land use, or replacement of broadleaf high forest by conifer species,

1. that there is a requirement inter alia under the EIA Directive for an overall assessment of the effects of the project or the alteration thereof on the environment to be undertaken, including the direct and indirect environmental impact of the project;

   and

2. pursuant to Article 2(3) of the EIA Directive, the Department of Agriculture, Food and the Marine strongly recommends that, notwithstanding the fact that a parallel consent in the form of felling licence may also have to be applied for, any EIAR and/or NIS produced in connection with the application for planning permission to the Local Planning Authority or An Bord Pleanàla, should include

an assessment of the impact of and measures, as appropriate, to prevent, mitigate or compensate for any significant adverse effects direct or indirect identified on the environment arising from such felling and replanting of trees, deforestation for the purposes of conversion to another type of land use, or replacement of broadleaf high forest by conifer species.

Kind regards

Cathy Hewitt
Executive Officer
An tAonad um Chomhordú Timpeallachta, An Rannóg um Athrú Aeráide agus Beartas Bithfhuinnimh,
Environmental Co-ordination Unit | *Climate Change & Bioenergy Policy Division* |
An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine
Pailliún A, Páirc Gnó Grattan, Bóthar Átha Cliath, Port Laoise, Co Laoise, R32 K857
Pavilion A, Grattan Business Park, Dublin Road, Portlaoise, Co Laois, R32 K857
T +353 (0)57 868 9915 environmentalco-ordination@agriculture.gov.ie
www.agriculture.gov.ie

From: Karen Mulryan <kmulryan@mkoireland.ie>
Sent: Monday 11 May 2020 09:50
To: Environmental Co-ordination (Inbox) <Environmental_Co-ordination@agriculture.gov.ie>
Subject: FW: 191137 Proposed Bord na Móna Powergen Ltd Wind Farm Development at Ballivor, Meath/Westmeath.

CAUTION: This Email originated from Outside of this department. Do not click links or open attachments unless you recognise the sender and know the content is safe. Otherwise Please Forward any suspicious Emails to Notify.Cyber@agriculture.gov.ie .

Good morning,

MKO is preparing an Environmental Impact Assessment Report (EIAR) for a proposed Bórd na Móna Powergen Ltd wind energy development at Ballivor and the surrounding townlands located at the Meath-Westmeath border. The proposed development will be located on 5 bogs and will be referred to as the Ballivor Wind Farm. The site is located approximately 2.2km west of Ballivor Village, Co. Meath, and 3.7km east of Raharney and 2.5km south-southeast of Devlin, which are both located in Co. Westmeath.
The proposed project will likely encompass 25-35 turbines and will have an output of at least 50 megawatts. Should the project be of this scale, an application will be made to An Bord Planeála seeking a determination in relation to the SID status, or otherwise, of the proposed wind energy development. If the board determine that the development is indeed SID, the planning application will be submitted directedly to An Bord Planeála, under the provision of the Planning and Development (Strategic Infrastructure) Act 2006. Should the project be of a scale lower than the SID thresholds, an application for planning permission will be made to Meath and Westmeath County Councils.
As part of the EIA process, we would welcome any comments that you may have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is attached.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Kind Regards,

Karen.

Karen Mulryan
Environmental Scientist
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Disclaimer:

Department of Agriculture, Food and the Marine

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An Roinn Talmhaíochta, Bia agus Mara

Tá an t-eolais san ríomhphost seo, agus in aon ceangláin leis, faoi phribhléid agus faoi rún agus le h-aghaigh an seolaí amháin. D'fhéadfadh ábhar an seoladh seo bheith faoi phribhléid profisiúnta nó dlíthiúil. Mura tusa an seolaí a bhí beartaithe leis an ríomhphost seo a fháil, tá cosc air, nó aon chuid de, a úsáid, a chóipeál, nó a scaoileadh. Má tháinig sé chugat de bharr dearmad, téigh i dteagmháil leis an seoltóir agus scrios an t-ábhar ó do ríomhaire le do thoil.