Chapter 9: Water

Coolglass Wind Farm EIAR Vol. 2

Coolglass Wind Farm Limited

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Table of Contents

Acronyms and Abbreviations ..... **vi**
9.0 Water **7**
9.1 Introduction 7
9.2 Statement of Authority 7
9.3 Proposed Development 8
9.3.1 Turbine Layout 8
9.3.2 Turbine Foundations 8
9.3.3 Access Track Formation 8
9.3.4 Recreational Amenity Trail 8
9.3.5 Borrow Pit 8
9.3.6 On-Site Substation 8
9.3.7 Cable Routes 9
9.3.8 Watercourse Crossings 9
9.3.9 Drainage 9
9.4 Scope of work 10
9.4.1 Consultations 10
9.5 Regulatory Background 10
9.5.1 Legislation 10
9.5.2 Planning Policy and Development Control 11
9.5.3 Guidelines and Technical Standards 11
9.6 Receiving Environment 11
9.6.1 Study Area 11
9.6.2 Baseline Study Methodology 11
9.6.3 Sources of Information 12
9.6.4 Site Walkover 12
9.6.5 Site Topography 12
9.6.6 Rainfall and Climate 13
9.6.7 Soils and Geology 13
9.6.8 Surface Water - Hydrology 13
9.6.9 Groundwater: Hydrogeology 22
9.6.10 Water Framework Directive 31
9.6.11 Ecological Designated Sites 33

9.6.12 Water Environment Receptors 34
9.7 Receiving Environment: Baseline Summary 35
9.8 Potential Impacts 35
9.8.1 Evaluation Methodology 35
9.8.2 Do Nothing Scenario 36
9.8.3 Worst Case Scenario 36
9.8.4 Potential Impacts: Construction 36
9.8.5 Potential Impacts: Operational 38
9.8.6 Potential Impacts: Decommissioning 39
9.9 Mitigation Measures 42
9.9.1 Mitigation by Avoidance 42
9.9.2 Mitigation by Prevention and Reduction 43
9.9.3 Mitigation Measures - Construction 43
9.9.4 Mitigation Measures: Operational 49
9.9.5 Mitigation Measures: Decommissioning 49
9.9.6 Residual Impacts 49
9.10 Cumulative Effects 50
9.11 Conclusion 52
9.12 Figures 54

Tables in Text

Table 9-1 Regional Data Consultation 12
Table 9-2 LTA (1981-2010) Monthly Rainfall (mm) for Oak Park Weather Station 13
Table 9-3 Relationship between Biotic Indices and Water Quality Classes 16
Table 9-4 EPA Biological Water Quality Ratings 17
Table 9-5 Surface Water Sampling Locations 17
Table 9-6 Watercourse Crossings Along Cable Routes 21
Table 9-7 Aquifer Classification 23
Table 9-8 Groundwater Vulnerability Underlying Each of the Main Features of the Proposed Development 24
Table 9-9 Groundwater Bodies and WFD Classification 25
Table 9-10 Details of Groundwater Monitoring Well T2 28
Table 9-11 Met Éireann Daily Rainfall Data for Oak Park (precipitation in mm) 29

Table 9-12 Groundwater Quality Results for BH T2 30
Table 9-13 Comparison of hydrogeological features underlying the two cable route options 31
Table 9-14 Waterbodies and WFD Classification 32
Table 9-15 Existing Environment - Significance and Sensitivity / Importance 34
Table 9-16 Description of Impacts and Impact Rating 41
Table 9-17 Potential Cumulative Impact Developments in Proximity to the Proposed Development 50

Figures in Text

Figure 9-1 Existing and Proposed Watercourse Crossings 55
Figure 9-2 Surface Water Catchment 56
Figure 9-3 Surface Water Monitoring Locations 57
Figure 9-4 Bedrock Aquifer and Karst Features 58
Figure 9-5 Groundwater Vulnerability 59
Figure 9-6 Groundwater Bodies 60
Figure 9-7 Groundwater Supply Wells and Groundwater Monitoring Well 61

Photos in Text

Plate 9-1 Shallow Drainage 15
Plate 9-2 Land Drains 15
Plate 9-3 Surface Water Sampling Locations 19

Appendices

Appendix 9

1. EU Directives / National Legislation and Regulations / Guidelines / Technical Standards
2. Water Framework Directive
3. Flood Risk Assessment
4. Groundwater Sampling Field Record Sheets
5. Surface Water and Groundwater Screening

6. Surface Water and Groundwater Laboratory Reports
7. Borehole Logs
8. Rating of Existing Environmental Significance / Sensitivity (IGI, 2013 Guidelines)
9. Description of Effects (EPA, 2022)
10. Classification of the Significance of Impacts (EPA, 2022)

Acronyms and Abbreviations

SLR	SLR Consulting Limited
EIAR	Environmental Impact Assessment Report
EIA	Environmental Impact Assessment
CEMP	Construction and Environmental Management Plan
IGI	Institute of Geologists of Ireland
ABP	An Bord Pleanála
EU	European Union
EIS	Environmental Impact Statement
ESBN	ESB Networks
EPA	Environmental Protection Agency
GSI	Geological Survey Ireland
IGVs	Interim Guideline Values
IFI	Inland Fisheries Ireland
IFS	Irish Forest Soils
OPW	Office of Public Works
CFRAM	Catchment Flood Risk Assessment Management
AOD	Above Ordnance Datum
LTA	Long-Term Average
WFD	Water Framework Directive
DoEHLG	Department of the Environment, Heritage and Local Government
AEP	Annual Exceedance Probability
MRFS	Mid-Range Future Scenario
GRO	Gasoline Range Organics
EPH	Extractable Petroleum Hydrocarbons
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compounds
SI	Inner Protection Area
SO	Outer Protection Area
TDR	Turbine Delivery Route
GCR	Grid Connection Route / Cable Route
GWB	Groundwater Bodies
PWS	Public Water Scheme
SPA	Supply Source Protection Areas
ZOC	Zone of Contribution

9.0 Water

9.1 Introduction

This chapter of the EIAR provides a description of the surface water and groundwater conditions in the existing Site (as defined in Section 3.1.1 of this EIAR) within the context of the regional setting, and assesses the potential impacts the Proposed Development (as defined in Section 3.1.1 of this EIAR) will have on surface water and groundwater. The Site and Proposed Development are defined in Section 31., 3.1.1 and Table 3.1 in Chapter 3 . Mitigation measures, if required, are proposed, to reduce any potential negative effects associated with the construction, operation and decommissioning of the Proposed Development. Any residual effects are also assessed.

The total area of the Proposed Development is 68.14Ha. This is divided into two distinct areas identified as Fossy Mountain (northern turbine cluster) and Wolfhill (southern turbine cluster). These areas are predominantly comprised of agricultural lands and forestry. The nearest urban areas are Timahoe village to the north and The Swan to the south. The nearest towns are Portlaoise and Carlow.

For the purposes of this assessment, the area within a 5km buffer of the proposed permanent footprint of the Proposed Development Site forms the primary study area. The application includes for all necessary connections to the electricity grid. All elements of the Proposed Development, including cable route, works associated with the turbine delivery route and amenity trail options have been assessed as part of this EIAR. The overall Project has assessed all design permutation from the dimensions set out in Table 3.1 of this EIAR.

9.2 Statement of Authority

This chapter of the EIAR was prepared by SLR Consulting Ireland. The project team consists of:

- Dominica Baird BSc, MSc (Hydrogeology), CGeol, EurGeol, MIAH
- Kristian Divjak BSc, MSc, MIEI
- Orlaith Tyrrell BSc, MIGI, MIAH

Dominica Baird is Technical Director (Hydrogeology) and has over twenty years' experience in environmental consulting, specialising in hydrogeology and water. Dominica's areas of expertise cover hydrogeology, groundwater risk assessment and contaminated land with experience gained in London, Edinburgh and Dublin. Dominica has worked on various renewable projects, mainly wind farms, as well as cable routes in Ireland and Scotland as lead hydrogeologist and has undertaken field surveys including installation of groundwater monitoring wells, water supply surveys and peat surveys. Dominica has presented findings of hydrogeological assessments at oral hearings and prepared briefs of evidence in arbitration cases.

Kristian Divjak is a civil engineer with over 7 years of experience in flood risk assessments, hydraulics and drainage design. Throughout his career he worked on projects in Croatia and Ireland. He has worked on numerous renewable energy projects, flood risk assessments and drainage design. He has inspected various sites for potential wind farm and solar farm developments. This allowed him to identify potential risks at early stage of the project and gave him the ability to communicate complex technical information to a range of project stakeholders.

Orlaith Tyrrell is a Graduate Hydrogeologist with 2 years' experience working in groundwater consultancy. She is a member of the Institute of Geologists of Ireland (IGI) and of the International Association of Hydrogeologists (IAH). Orlaith has worked on multiple scale renewables projects and has co-authored several EIAR Water chapters for wind farm developments.

9.3 Proposed Development

All elements of the Project are described in Section 3.5 of this EIAR and the description of the Proposed Development is found in section 3.8.1 of this EIAR.

9.3.1 Turbine Layout

The turbine layout consists of 13 no turbines among two clusters within Fossy Hill and Wolfhill, Co Laois.

- The northern cluster (Fossy Hill) consists of seven turbines (nos 1-7) broadly arrayed in mostly commercial forestry plantation with varying stages of maturity. Turbine 4 is to be located within an existing agricultural field.
- The southern cluster will comprise 6 no. turbines (nos 8-13), all arrayed within commercial plantation at varying stages of maturity.

9.3.2 Turbine Foundations

The steel base of the turbine will be cast into a concrete foundation and the foundations of the turbine will be 30m in diameter.

Figure 9-1a – 3-1c illustrate the internal access tracks within the Proposed Development Site. The proposed internal site track layout will permit access for vehicles during the construction phase, for maintenance during the operational phase, and for vehicles to decommission the turbines at the end of the life of the Proposed Development.

9.3.3 Access Track Formation

Approximately 15.5 kilometres of internal access tracks will be required to be upgraded as part of the Proposed Development. Existing access tracks will be utilised wherever possible and access track formation will consist of a 500m hard core on a geotextile membrane. Existing drainage infrastructure along the tracks will be maintained and upgraded where necessary.

9.3.4 Recreational Amenity Trail

A c. 9km trail loop originating from Timahoe town to and through the northern cluster of the Proposed Development will form a separate planning consent process but will be assessed as part of this EIAR. This trail loop will largely utilise existing forestry tracks around the Fossy Mountain Loop and local public roads. This recreational amenity trail is shown in Figure 3-6 of this EIAR.

9.3.5 Borrow Pit

The Proposed Development will include a singular borrow pit at the access point of the southern cluster as demonstrated in **Figure 3-1a** of this EIAR.

9.3.6 On-Site Substation

It is proposed to construct one on-site 110kV electricity substation within the Proposed Development site as shown in **Figure 3-1a** of this EIAR. The proposed substation will

contain 2 no. control buildings which will each have storage and welfare facilities. Due to the nature of the Proposed Development, there will be a small water requirement for occasional toilet flushing and hand washing with rainwater harvesting tank adjacent to the control buildings.

9.3.7 Cable Routes

For the purposes of this assessment, two cable routes will be assessed as part of this EIAR and the most suitable will be taken forward into a separate planning application:

- Option 1 comprises a cable route between the proposed substation and the option 1 substation. This route is 9.9km in length.
- Option 2 comprises a cable route between the proposed substation and option 2 substation. This route is 10.1km in length.

The electricity generated from wind turbines between the Northern and Southern clusters will be collected at a medium voltage 33 KV cable circuits which connects the Northern and Southern clusters will follow on site access tracks. The specifications for cables and cable installation will be in accordance with EirGrid requirements. A description of cable installation works is found in Section 9.10 of the CEMP.

Joint bays are precast concrete chamber buildings where cables are joined to form one continuous cableThe cable routes assessed in this EIAR do not form part of the Proposed Development the subject of this planning application., Joint bays will be required at each 90-degree bend and approximately every 750m. For the purposes of this assessment, 9 no. joint bays will be located in public roads with 5 no. joint bays located on private lands (Option 1) or 12 no. joint bays will be located in public roads with 3 no. joint bays located on private lands (Option 2).

A joint bay will be constructed in pits. Each joint bay will be 4.5 m x 1.8 m x 1.2 m deep. A reinforced concrete slab will be constructed in the bay to accommodate the jointing enclosure.

Communication chambers, which are similar to small manholes, will also be installed at the joint bay locations to facilitate connection of fibre-optic communication cables.

9.3.8 Watercourse Crossings

Existing and proposed watercourse crossings are shown in **Figure 9-1a** to **9-1c**.

9.3.8.1 Internal Access Track Watercourse Crossings

The proposed wind turbine layout will utilise in total 5 crossings.

9.3.8.1 Watercourse Crossings Along the Turbine Delivery Route

There are five watercourses along Option 2's route and the turbine delivery route which run in parallel along the entire cable corridor, as shown in **Figure 3-5**.

9.3.8.2 Watercourse Crossings Along the Cable Routes

The proposed cable routes will cross twelve watercourses in total. Seven crossings are along Option 1's route while there are five watercourses along Option 2's route.

9.3.9 Drainage

The proposed drainage system will be based on two key methods. The first method will involve keeping clean water clean by avoiding disturbance to natural drainage features,

minimising any works in or around drainage features, and diverting clean surface runoff around excavations and construction areas. The second method will involve collecting any drainage water from works area that might carry silts or sediments, and to route them towards settlement ponds prior to controlled diffuse release over vegetated natural surfaces.

9.4 Scope of work

This Chapter describes the local hydrological and hydrogeological environment at and around the site at Coolglass. The study area comprises the application site and the surrounding area up to 5 km to reflect the sensitivity of the subsurface in the area (IGI EIS Guidelines, 2013).

The scope of this chapter includes:

- An assessment of the existing water (hydrology and hydrogeology) within approximately 5km of the application area at the Site;
- An assessment of the potential impact of the Proposed Development, and associated ancillary works on surface water and groundwater; and
- Where necessary, recommendation(s) of mitigation measures to reduce or eliminate any potential adverse impacts.

9.4.1 Consultations

Consultation took place with a number of organisations including the following relevant bodies:

- GSI, EPA, IFI, OPW, Coillte

In accordance with the response from the IFI, see Table 2-2, physio-chemical surface water quality monitoring was undertaken at the Site. The results from this monitoring round show that the surface waters in the area surrounding the Proposed Development, and associated development are of good quality, with only minor exceedances of the relevant assessment criteria at two locations. These results are discussed in detail in Section 9.5 (Surface Water Quality).

9.5 Regulatory Background

9.5.1 Legislation

The key EU Legislation which apply to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are:

- Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending ('EIA Directive'); and
- Directive of the European Parliament and of the Council amending Directive 2011/92/EU on assessment of effects of certain public and private projects on the environment (2014/52/EU).

Other EU Directives to which this EIAR makes reference, or has had regard, are listed in Technical Appendix 9-1 found in Volume III of this EIAR.

National Legislation which applies to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein is also listed in Technical Appendix 9-1 found in Volume III of this EIAR.

Most notably, under Regulation 4 of S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended ('the Groundwater Regulations'), a duty is placed on public authorities to promote compliance with the requirements of the Groundwater Regulations and to take all reasonable steps including, where necessary, the implementation of programmes of measures, to:

> *"(a) prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;*
>
> *(b) protect, enhance and restore all bodies of groundwater and ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater quantitative status and good groundwater chemical status by 2015 or, at the latest, by 2027;*
>
> *(c) reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater;*
>
> *(d) achieve compliance with any standards and objectives established for a groundwater dependent protected area included in the register of protected areas established under Regulation 8 of the 2003 Regulations [S.I. No. 722 of 2003] by not later than 2015, unless otherwise specified in the Community legislation under which the individual protected areas have been established."*

9.5.2 Planning Policy and Development Control

The Planning Policy and Development Control relating to water at the site in this EIAR is set out in the:

- Laois County Development Plan 2021-2027.

9.5.3 Guidelines and Technical Standards

The following key guidelines apply to this hydrology and hydrogeology assessment:

- Institute of Geologists of Ireland. Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, April 2013; and
- National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

Additional guidelines and technical standards which apply to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are listed in Technical **Error! Reference source not found.**1 found in Volume III of this EIAR.

9.6 Receiving Environment

9.6.1 Study Area

For the purposes of this assessment, the study area comprises the application site and the surrounding area up to 5km for a study area with karst (IGI EIS Guidelines, 2013).

9.6.2 Baseline Study Methodology

Existing information on the geology, hydrogeology, and hydrological features of the Coolglass area and its surrounds was collated and evaluated.

The methodology involved in the assessment of the hydrology and hydrogeology at the site can be summarised as follows:

Most notably, under Regulation 4 of S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended ('the Groundwater Regulations'), a duty is placed on public authorities to promote compliance with the requirements of the Groundwater Regulations and to take all reasonable steps including, where necessary, the implementation of programmes of measures, to:

> *"(a) prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;*
>
> *(b) protect, enhance and restore all bodies of groundwater and ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater quantitative status and good groundwater chemical status by 2015 or, at the latest, by 2027;*
>
> *(c) reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater;*
>
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Additional guidelines and technical standards which apply to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are listed in Technical Appendix 1 found in Volume III of this EIAR.

9.6 Receiving Environment

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9.6.2 Baseline Study Methodology

Existing information on the geology, hydrogeology, and hydrological features of the Coolglass area and its surrounds was collated and evaluated.

The methodology involved in the assessment of the hydrology and hydrogeology at the site can be summarised as follows:

- A desk study, in which existing data and relevant regional data sources for the area were examined;
- Site walkovers;
- Installation of groundwater monitoring borehole;
- Groundwater quality and level sampling; and,
- The analysis of the information gathered.

9.6.3 Sources of Information

The desk study involved the examination of several datasets to determine the hydrological, geological and hydrogeological setting of the area, as detailed in **Table 9-1**.

Table 9-1 Regional Data Consultation

Data	Dataset
Soils	Irish Soils Information System - Teagasc
Subsoil Geology	Teagasc/GSI/EPA Subsoil Mapping
Bedrock Geology	GSI Groundwater Data Viewer - Bedrock Geology
Surface Water	OSi Discovery Series mapping; Environmental Protection Agency; Water Framework Directive; and OPW CFRAM.
Groundwater	GSI Groundwater Data Viewer - bedrock and gravel aquifers, vulnerability, water supplies, groundwater recharge; GSI Groundwater body description documents; and Environmental Protection Agency water maps.
Climate	Met Eireann
Protected Areas, Environmental Pressures	Environmental Protection Agency, National Parks and Wildlife Service

9.6.4 Site Walkover

On 14th December 2021, a walkover study was conducted to assess the hydrology and hydrogeology features of the Proposed Development, and identify constraints. The site walkover involved an initial review of available information gathered in the desk study. No constraints for the proposed wind turbine locations for the current scheme were noted in terms of hydrology and hydrogeology during the site visits.

Drilling of borehole BH T2 took place on site on 12th August 2022 and was supervised by an SLR hydrogeologist.

Surface water quality monitoring has been undertaken at the site in March 2023.

9.6.5 Site Topography

The southern portion of the Proposed Development site (Wolfhill) is characterised by elevated lands with elevations between 196 – 300 m AOD, with moderate to gentle slopes down to the north and west throughout the site boundary. Slopes within the Proposed Development area and at proposed infrastructure locations generally comprise gentle to moderate slopes.

The Fossy Lower stream flows in the western direction where it joins the Aghoney Stream approximately 0.6 km south-west of the Proposed Development. The Aghoney Stream, in turn, is a tributary of the River Stradbally.

The surface runoff from the western area of the northern cluster flows towards the Honey and Orchard_Lower Stream. The Orchard_Lower joins the Honey Stream which runs in the northerly direction where it ultimately joins the River Crooked approximately 3.7 km north of the site.

The surface runoff from the eastern area of the northern cluster flows towards the Fallowbeg Upper Stream which runs in north-eastern direction where it flows into the River Crooked.

The Proposed Development site entrance to the Northern Cluster is located at the confluence of the Scotland Stream and Owveg [Nore] Stream. The Owveg [Nore] Stream flows in the south-western direction where it joins the River Nore approximately 17.6 km from the site.

The surface runoff at the Southern Cluster of the Proposed Development flows towards the Clogh Stream, Brennanshill, and Moyadd Streams. The Brennanshill and Moyadd streams are tributaries of the Clogh Stream. The Clogh Stream flows in the southern direction for approximately 5.8 km where it joins the River Dinin [North] which is a tributary of the River Nore.

The Water Framework Directive water quality status and river waterbody risk associated with the wind farm are provided in the Water Framework Directive section further in this chapter.

9.6.8.2 Catchments

The Proposed Development and cable route areas fall within the boundary of two catchments, as shown in **Figure 9-2**. The north of the area is within the Barrow catchment (ID 14) and the surface water bodies are comprised of the tributaries of Stradbally River and Crooked River. The Crooked River joins the Stradbally River approximately 6.7 km north of the site.

The southern extent of the site is part of the Nore catchment (ID 15) with tributaries of the river Owveg to the west of the site, and River Clough to the south of the site traversing this area.

The Proposed Development and cable routes are also situated within three sub-catchments. These are:

- Barrow_SC_050
- Nore_SC_060
- Dinin [North]_SC_010

9.6.8.3 Surface Water Drainage

Following the site walkovers, a number of streams/drainage channels were identified to be flowing through or adjacent to the Proposed Development. There is extensive shallow drainage and man made land drains across the site, as shown in **Plate 9-1** and **Plate 9-2** below.

Plate 9-1 Shallow Drainage

Plate 9-2 Land Drains

9.6.8.4 Flooding

The Planning System and Flood Risk Management Guidelines (OPW/DoEHLG, 2009) classify electricity generating stations as "essential infrastructure" considered appropriate in Flood Zone C. The Proposed Development has therefore been assessed against a 0.1% AEP MRFS flood (i.e., a 1000-year flood in a likely climate change scenario).

The Flood Risk Assessment is provided in Technical Appendix 9-3 found in Volume III of this EIAR, and the initial flood risk assessment is summarised below.

The Office OPW is the government agency with statutory responsibility for flooding in Ireland. The OPW and DoEHLG guidelines for planning authorities addressing the management of flood risk in the planning system[1]; where guidelines were followed with respect to the preparation of a site-specific flood risk assessment for the Proposed Development.

According to the available flood mapping all the proposed turbines, hardstanding areas and on-site substation for the Proposed Development are situated within 'Flood Zone C', -Low risk of flooding (less than 0.1%).

No significant pluvial flood zones are mapped within the Site, as will be expected in mountainous terrain with sloping topography.

Fluvial Flooding

Based on the indicative flood mapping produced as part of the National PFRA Study, it is estimated that the Proposed Development is not at risk of fluvial flooding from watercourses in the area.

Pluvial Flooding

There is no record of pluvial flooding or surface water ponding at the Proposed Development Site.

Groundwater Flooding

There is no evidence from Geological Survey Ireland mapping to suggest that groundwater is a potential source of flood risk to the Proposed Development

Based on the results of the Flood Risk Assessment, it is estimated that the risk of flooding to the Proposed Development will be minimal and that the Proposed Development will not increase the risk of flooding elsewhere.

9.6.8.5 Surface Water Quality

The Environmental Protection Agency (EPA) regularly monitors water bodies in Ireland as part of their remit under the WFD (2000/60/EC), which requires that rivers are maintained or restored to good/ favourable status. The quality of watercourses is assessed in terms of 4 No. quality classes; 'unpolluted' (Class A), 'slightly polluted' (Class B), 'moderately polluted' (Class C) and 'seriously polluted' (Class D). These water quality classes and the water quality monitoring programme are described in the EPA publication 'Water Quality in Ireland, 2003'. The water quality assessments are largely based on biological surveys. Biological Quality Ratings or Biotic Indices (Q values) ranging from Q1 to Q5 are defined as part of the biological river quality classification system. The relationship of these indices to the water quality classes defined above, are set out in **Table 9-3** below.

Table 9-3 Relationship between Biotic Indices and Water Quality Classes

Biotic Index	Quality Status	Quality Class
Q5, 4-5, 4	**Unpolluted**	**Class A**

13 The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009): Office of Public Works and the Department of the Environment, Heritage and Local Government.

Biotic Index	Quality Status	Quality Class
Q3-4	**Slightly Polluted**	**Class B**
Q3, 2-3	**Moderately Polluted**	**Class C**
Q2, 1-2, 1	**Seriously Polluted**	**Class D**

There are a number of water quality monitoring locations monitored by the EPA at locations downstream of the Proposed Development and the cable route, shown on **Figure 9-3**. The most recent Biological Water Quality Ratings at these stations are outlined in **Table 9-4**, only for those stations where Q-value data is available since 2016. Q rating is Q4 at all stations, which indicates "unpolluted" status.

Table 9-4 EPA Biological Water Quality Ratings

Station ID	Station Name	Watercourse	2016	2017	2019	2020
RS14S020030	Bridge Northwest of Ballintela	Stradbally (Laois)	N/A	Q4	N/A	Q4
RS14C020200	Bridge west of Luggacurren	Crooked (Stradbally)	N/A	Q4	N/A	Q4
RS15O010050	Bridge west of Spink	Owveg (Nore)	Q4	N/A	Q4	N/A
RS15O010080	Boleybeg Bridge	Owveg (Nore)	Q4	N/A	Q4	N/A

9.6.8.6 On-Site Surface Water Quality Monitoring

A baseline surface water quality round was undertaken by Kristian Divjak on 15th and 16th March 2023. The sampling locations are located to determine the baseline condition for the receiving waters, targeting upstream and downstream locations of river stretches as well as watercourse crossings. Seventeen samples were collected in total.

The surface water monitoring locations, the watercourses they were collected from, and the reference sample IDs used by the laboratory in their analysis results, are included in **Figure 9-5** below. The monitoring locations are mapped in **Plate 9-3** below. Where the sampling locations coincide with locations where ecological aquatic baseline surveys are being carried out, the ecological sampling reference has been included in **Table 9-5**. See Chapter 15 for details on fisheries and aquatic ecology.

Table 9-5 Surface Water Sampling Locations

ID	Lab ID Reference	Watercourse	Ecological Sampling Reference
SW-CABLE ROUTE 1	1	Grainguenahown Stream*	-
SW-CABLE ROUTE 2	2	Owveg (Nore) River*	-
SW-CABLE ROUTE 3	3	Owveg (Nore) River*	-

ID	Lab ID Reference	Watercourse	Ecological Sampling Reference
SW-CABLE ROUTE 4	4	Garrintaggart Stream*	-
SW-CABLE ROUTE 5	5	Cleanagh Stream*	-
SW-CABLE ROUTE 6	6	Owveg (Nore) River*	-
SW-CABLE ROUTE 7	7	Aghoney Stream*	A7
SW-CABLE ROUTE 8	8	Fossy Lower Stream*	A9
SW-CABLE ROUTE 9	9	Stradbally (Laois) Stream*	A11
SW-CABLE ROUTE 10	10	Cremorgan Stream*	A12
SW-A1	11	Owveg (Nore) River*	B2
SW-A2	12	Honey Stream*	A4
SW-A3	13	Fallowbeg Upper Stream	0.8km downstream of A1
SW-B1	14	Moyadd Stream	B8
SW-B2	15	Clogh Stream	0.3m km upstream of B7
SW-B3	16	Clogh Stream	2.1km downstream of B5
SW-B4	17	Brennanshill Stream	1.0km downstream of B6

** Water crossing*

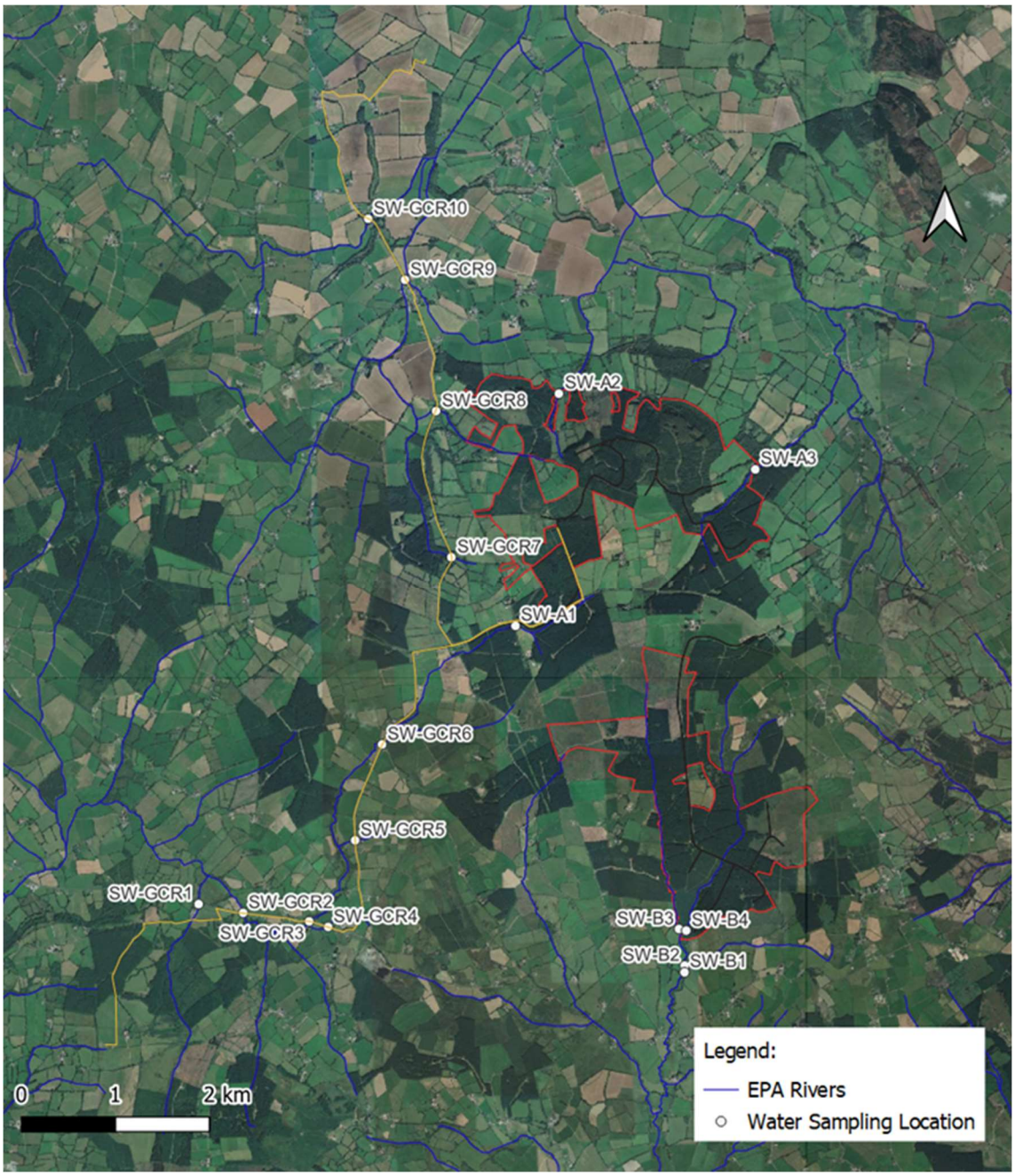

Plate 9-3 Surface Water Sampling Locations

The samples were collected in the appropriate sample containers, which are supplied by the laboratory for the required analysis. Sample containers were filled so that there was minimum free air space. The containers were securely sealed so that there was no loss of volatile components and no separation of components. All samples' containers were clearly and uniquely labelled with details including ID and sampling date.

All samples were placed into a cooler box with ice packs to maintain a temperature below 5±3°C. The samples were forwarded to ALS Ltd for analysis. The analysis required for each sample was listed on the Chain of Custody Record which accompanied samples.

The surface water samples were analysed for the following suite of parameters:

- total organic carbon;
- inorganics:

- ammoniacal nitrogen as N, BOD, COD, conductivity, nitrate as NO3, pH, orthophosphate as P, suspended solids, turbidity;
- metals (total, unfiltered):

- phosphorous;
- gasoline range organics (GRO), extractable petroleum hydrocarbons (EPH) and total petroleum hydrocarbons (TPH); and
- volatile organic compounds (VOCs).

9.6.8.7 Surface Water Quality Monitoring Results

This section summarises the surface water results reported for this baseline monitoring round for surface waters at or near the proposed watercourse crossing points. The results are compared against several assessment criteria: S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended and S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019, (collectively, 'the Surface Water Regulations') and S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988 ('the Salmonid Water Regulations'), in that order.

The results compared against assessment criteria are presented in Technical Appendix 9.5 found in Volume III of this EIAR and the laboratory reports are presented in Technical Appendix 9.6 found in Volume III of this EIAR.

The following are the only reported exceedances of the assessment criteria:

- There were two reported exceedances of the Surface Water Regulations limit of 1.5mg/l for good status of Biological Oxygen Demand (BOD), with a concentration of 1.98mg/l at SW-B3 and 2.13mg/l at SW-B4.
- There was one exceedance of the Salmonid Water Regulations limit of 25mg/l for suspended solids, with a concentration of 26.4mg/l reported at SW-B3. There are no limits outlined in the Surface Water Regulations for suspended solids.

SW-B3 and SW-B4 are located along the Clough Stream and Brennanshill Stream, respectively, and are directly downstream of the proposed area of the southern turbine cluster.

9.6.8.8 Cable Routes

The proposed cable routes for the Proposed Development are shown on **Figure 3-2** of this EIAR. The cable route options will connect the Proposed Development to one of two potential 110kV substations as set out below.

- Option 1 (to south) – 7 no. crossings of the Owveg River, tributary to the River Nore.
- Option 2 (to north) – 4 no. crossings of the Stradbally (Laois) river, tributary to the River Barrow. A number of drainage/watercourse crossings were identified from site visits and from mapping along the two cable route options. These are listed in **Table 9-6** and the locations are shown in **Figure 9-1**, with the twelve key crossings outlined below:

Crossing point GCR12 is common to both cable route options at the point where the cabling initially leaves the Proposed Development.

Further details of the cable crossings, and the proposed methodologies, are provided in Chapter 3 of this EIAR. No instream works are proposed for the cable works. Minor forest and farm drains crossings will be culverted or open trenched.

The specification for cables and cable installation will be in accordance with EirGrid requirements and within the parameters assessed in this EIAR.

Table 9-6 Watercourse Crossings Along Cable Routes

Crossing Point	Existing / Proposed	X coordinate (ITM)	Y coordinate (ITM)	Crossing type	Watercourse
WF-HF1	Existing	656795	688332	Culvert	Unnamed
WF-HF2	Existing	656707	687931	Culvert	Unnamed
WF-HF3	Existing	656548	688049	Culvert	Unnamed
WF-HF4	Proposed	656531	688072	Culvert	Unnamed
WF-HF5	Existing	656810	688357	Culvert	Brennanshill
GCR-1	Existing	651288	683688	Culvert – double concrete pipe	Grainguenahown
GCR-2	Existing	651826	683756	Bridge – single arch	Owveg (Nore)
GCR-3	Existing	652531	683670	Bridge – triple arch	Owveg (Nore)
GCR-4	Existing	652727	683607	Not possible to inspect	Garrintaggart
GCR-5	Existing	653089	683731	Not possible to inspect	Garrintaggart
GCR-6	Existing	653020	684530	Bridge – bricks	Cleanah
GCR-7	Existing	643308	685552	Bridge – single arch	Owveg (Nore)
GCR-8	Existing	654047	687545	Bridge – single arch	Aghoney
GCR-9	Existing	653875	689103	Bridge – single arch	Fossy Lower
GCR-10	Existing	643556	690491	Bridge – single arch	Stradbally (Laois)
GCR-11	Existing	653156	691140	Bridge – single arch	Cremorgan
GCR-12	Existing	655421	687083	Bridge – single arch	Scotland

Should a watercourse be required to be crossed for the purposes of the cable route, the most relevant of the following methodologies will apply, to be assessed on a case-by-case basis:

- **piped culvert crossings** – where sufficient cover is available, the cable ducts will be laid above the covert with a minimum separation distance of300 mm. Where sufficient cover is not available, cable ducts will be laid under the culverts with a separation distance of 300 mm.

- **Flatbed formation over culvert** – where the cable duct is to be installed over an existing covert where sufficient cover is not available, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the covert. The ducts will be laid in this trench in a flatbed formation over the existing covert and it will be encased in 6 mm thick steel galvanised pleat with the concrete surround as per EirGrid specification.

New crossings are designed to convey 1% AEP MRFS (Annual exceedance probability Mid-range future scenario) storm event with minimum 300mm freeboard level. This is in line with the OPW requirements. A Section 50 application will be required to obtain the consent of the OPW for the construction of the crossings.

9.6.8.9 Access Tracks & Recreational Amenity Trail

The Proposed Development includes c. 15.5 Km of internal access tracks and a c. 9km recreational amenity trail loop. Existing access tracks and local public roads will be utilised wherever possible.

The proposed wind turbine layout will utilise in total 5 crossings as shown on **Figure 3-7** (WF-HF crossing points) in this EIAR. There will be one new crossing (WF-HF4) over the Fallowbeg Upper stream, between turbines T6 and T7 at the northern cluster. Proposed methods for crossing existing watercourses along the cable routes are set out in **Table 9-6**.

Existing drainage infrastructure along the tracks and trail loop will be maintained and upgraded where necessary.

9.6.8.10 Turbine Delivery Route

There will be no works proposed along the vast majority of the TDR, with only relatively minor temporary works proposed at a number of specific locations (refer to planning drawings). Therefore, there will be no potential for hydrological impacts along the vast majority of this route. Works at these locations will involve some topsoil stripping and placement of hardcore to allow passage of the wind turbine components.

9.6.9 Groundwater: Hydrogeology

9.6.9.1 Aquifer Classification

Lithologies underlying the site area, with a variety of hydrogeological classifications are presented in **Table 9-7** and shown on **Figure 9-4**.

At the northern sector, the Luggacurren Shale Formation and Killeshin Siltstone Formation are classified by the GSI's groundwater resources maps and classification system as "*Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones*". The northern cable route option also extends into the Ballyadams Formation which is classified as "*Rkd - Regionally Important Aquifer - Karstified (diffuse)*". Karst features associated with this aquifer are discussed in the following 'Karst' section.

Southbound the Bregaun Flagstone Formation and Moyadd Coal Formation are classified as "Pu - Poor Aquifer - Bedrock which is Generally Unproductive".

There is a band of Carboniferous sandstone in the southern sector, the Clay Gall Sandstone Formation which is classified as "*Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive*". The remainder of the Coolbaun Formation in the area is classified as "*Pu- Poor Aquifer - Bedrock which is Generally Unproductive*".

To the north of the site area is alluvium, gravels and till derived from limestone are classified as "Lg – Locally important gravel aquifer".

Table 9-7 Aquifer Classification

Unit Name	Aquifer Classification
Moyadd Coal Formation	Pu- Poor Aquifer - Bedrock which is Generally Unproductive"
Bregaun Flagstone Formation	Pu- Poor Aquifer - Bedrock which is Generally Unproductive"
Killeshin Siltsone Formation	Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
Luggacurren Shale Formation	Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
Clay Gall Sandstone Formation	Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive"
Coolbaun Formation	Pu- Poor Aquifer - Bedrock which is Generally Unproductive"
Ballyadams Formation	Rkd - Regionally Important Aquifer - Karstified (diffuse)
Unnamed gravel Aquifer	Lg - Locally important gravel aquifer

9.6.9.2 Karst

Within 5 km buffer zone from the Proposed Development Site and cable route there are two springs and three caves, as shown in **Figure 9-7**. Orchard Spring is located approximately 0.5km north of the site, and Kyle (Toberading) Spring is approximately 2.8km respectively north of the Site.

- Clopook Cave is located 2.4 km north-east of the Proposed Development Site,
- Luggacurren Cave is located 1.1 km south of Clopook Cave.

The karst features are associated with the limestone bedrock to the north of the Proposed Development Site (Clogrenan Formation Ballyadams Formation).

9.6.9.3 Groundwater Vulnerability

The GSI's national groundwater vulnerability map has indicated the groundwater vulnerability in the Proposed Development is classified as 'Low' to 'Extreme'. The majority of the area is classified as both the category of X - 'Extreme' and E - "indicative of near surface rock", see **Figure 9-5**.

As can be seen on **Figure 9-5**, in the northern sector Turbines 1-4 and Turbine 7 are underlain by a groundwater vulnerability rating of E – Rock at or near the surface. Turbine 6 is underlain by a groundwater vulnerability rating of X – Extreme whilst Turbine 5 is underlain by a groundwater vulnerability rating of Moderate.

The substation compound is underlain by a groundwater vulnerability rating of X – Extreme.

In the southern sector, all locations except Turbine 11 are underlain by aquifers with a groundwater vulnerability rating of X – Extreme. Turbine 11 is underlain by a groundwater vulnerability rating of E – Rock at or near the surface.

The groundwater vulnerability rating has a strong influence on groundwater recharge, and areas in the northern sector where the aquifer has a groundwater vulnerability rating of E have a much higher groundwater recharge than areas where the groundwater vulnerability rating is X.

Table 9-8 Groundwater Vulnerability Underlying Each of the Main Features of the Proposed Development

Feature	Groundwater Vulnerability Classification
Turbines T1 – T4, T6 and T7 (northern cluster)	Extreme or Rock at or near Surface
Turbine T5 (northern cluster)	Medium
Turbines T8 – T13 (southern cluster)	Extreme or Rock at or near Surface
Option 2 Cable Route	Predominantly Medium to High with some lesser areas of Extreme to Rock at or near surface near the Proposed Development, and Low further north
Option 1 Cable Route	Predominantly Medium with areas of Low and Extreme to Rock at or near surface. Some lesser areas of High vulnerability.
Borrow Pit	Extreme to Rock at or near surface
Substation Compound	Rock at or near surface
Temporary Construction Compound	Rock at or near surface at TCC1 and High at TCC2
Amenity Trail / Access Track	Predominantly Extreme to Rock at or near surface. Some lesser areas of High vulnerability with a short section of Medium vulnerability as the track reaches Timahoe

9.6.9.4 Groundwater Body

The wind turbines in the Northern Cluster of the Proposed Development are within the Shanragh and Balingarry Groundwater Bodies (GWB). The wind turbines in the Southern Cluster of the Proposed Development are within the Ballingarry and Castlecomer GWBs. The Option 2 Cable Route also crosses the Bagnelstown Upper GWB as well as small areas of the Timahoe Gravels and Newtown GWB, see **Figure 9-6**. The GWBs are all good status/quality under the WFD and classified either as not at risk or under review.

The GSI has issued a Summary of Initial Characterisation report[2] for the GWBs.

Shanragh GWB

This groundwater body consists of the Westphalian shales of the Castlecomer plateau that lie within the Barrow catchment. The groundwater body is not considered to be an important aquifer. Recharge will occur at the elevated eastern peaks of the plateau, the groundwater will flow, most likely in the shallow weathered bedrock, downhill following the surface topography and it will discharge, sometimes via springs at the base of the hills, into the Barrow Valley.

Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions will occur. Baseflow to rivers and streams is likely to be relatively low.

[2] Available on:

https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx

Ballingarry GWB

This groundwater body consists of the Wesphalian shales in the Nore Valley, extending from the Slieveardagh Hills to the Castlecomer Plateau. The groundwater body stretches the whole width of the Nore River basin. The groundwater development and monitoring in this area is concentrated on the gravel aquifers which overly the body. Flow within the bedrock will not be very large and will be constricted to the upper few metres of the bedrock. Recharge and discharge will occur locally to surface water features. This groundwater body is considered to be extremely vulnerable.

Again, owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions will occur.

Castlecomer GWB

This groundwater body comprises a Locally Important fractured sandstone aquifer, which is unconfined in a small strip around the perimeter and confined over most of its area in the centre of the Plateau. Rainfall recharge occurs only in the unconfined portion. Downward leakage from confining layers is unlikely because of artesian pressure. Groundwater flows through the Body from the perimeter inwards, with some discharging into the Dinin River. Artificial discharge mainly occurs from Swan Water Supply Scheme, which has artesian pressures in wells.

Timahoe Gravels GWB

This groundwater body comprises a locally important gravel aquifer. There are no overlying deposits and therefore a high proportion of effective rainfall will infiltrate through the permeable deposits to the water table. This also means that the vulnerability of the groundwater resource is high. The groundwater flow will be diffuse and the direction of groundwater flow is to the northeast of the Proposed Development. The groundwater body will discharge as baseflow to the associated surface water bodies and also as seepages and springs.

Bagenalstown GWB

Regionally important karstified aquifer. This groundwater body is considered a major aquifer. It comprises water-bearing units of pure limestone and dolomitised limestone and calp. The dolomitisation is not complete and therefore there may be areas of undolomitized limestone that act as aquitards. It is probable that the bulk of the discharge from the aquifer enters the river in the lower section between Milford and Bagenalstown where there is a restriction in the cross-sectional area of this aquifer. There is hydraulic continuity between the Barrow Valley sands and gravels and the underlying aquifer.

The groundwater bodies underlining the Proposed Development and cable route, and their WFD classification are listed in **Table 9-9.**

Table 9-9 Groundwater Bodies and WFD Classification

Groundwater Body	Groundwater ID	WFD Status	WFD Risk
Shanragh	IE_SE_G_124	Good	Review
Ballingarry	IE_SE_G_009	Good	Review
Castlecomer	IE_SE_G_034	Good	Not at Risk

Groundwater Body	Groundwater ID	WFD Status	WFD Risk
Cable Route Only			
Timahoe Gravels	IE_SE_G_144	Good	Review
Bagenalstown Upper	IE_SE_G_153	Good	Review
Newtown	IE_SE_G_104	Good	Not at Risk

9.6.9.5 Public Water Scheme (PWS) Areas

The Public Supply Source Protection Areas (SPA) comprises area around groundwater abstraction points that are managed by Irish Water to supply public water supply across Ireland. The objective of the SPAs is to provide protection by placing tighter controls on activities within all or part of the zone of contribution (ZOC) of the source. The ZOC is the land area that contributes water to the well or spring.

Two SPAs are delineated. The Inner Protection Area (SI), designed to protect against the effects of human activities that might have an immediate effect on the source. The Outer Protection Area (SO), encompasses the remainder of the ZOC to the groundwater abstraction points.

Public water schemes in the vicinity of the site are shown on **Figure 9-6**.

The proposed turbine T2 is located within the SO area of Kyle & Orchard Spring Water Supply Scheme. Kyle Spring (also known as Toberading Spring) is a high yielding spring issuing from a regionally important karstified limestone aquifer, overlain by a locally important gravel aquifer. The SO area underlain by poorly productive aquifers. The SI area of the Orchard Spring contains a medium-yield spring from the regionally important karstified limestone aquifer, overlain by a locally important gravel aquifer. According to the Kyle & Orchard Spring Groundwater Source Protection Zones report (GSI, 2000)[3], particular care should be taken when assessing the location of any activities or developments which might cause contamination of the spring.

The Swan Water Supply Scheme is located to the south of the Southern Cluster of the Proposed Development. The planning boundary of the Proposed Development overlays the Swan Water Supply Scheme. However, no construction works are proposed within this area. The closest turbine to the Swan Water Supply Scheme is T12, located 75m away.

The aquifer supplying The Swan Source is a confined sandstone which is well protected from contamination near the source by the relatively impermeable shales which overlie and confine it, and by the positive hydraulic pressure in the aquifer, which tends to keep out any contaminated infiltration. Contamination could occur through other boreholes penetrating the same aquifer up-gradient. However, such contamination is unlikely as long as an artesian pressure is maintained.

According to the Swan Water Supply Scheme Groundwater Source Protection Zones report (GSI, 2000)[4] , the Swan groundwater source enjoys a high level of protection from

[3] Available on: https://secure.dccae.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/SPZ/LS_PWSS_SPZ_Swan_November_2000_GSI.pdf

4 Available on: http://spatial.dcenr.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/SPZ/LS_PWSS_SPZ_Kyle_and_Orchard_Springs_Stradbally_Ballylynan_and_Timahoe_November_2000_GSI.pdf

contamination by virtue of its confined condition and long distance from its recharge area. Contamination of the aquifer by persistent chemicals could occur but would not be likely to affect the source for many hundreds of years under present conditions.

Approximately 3.5km north-east of the Proposed Development, Castlemitchell (Churchtown) Water Supply is located.

Portlaoise Water Supply Scheme is located approximately 3.5km north-west of the Option 2 Cable Route.

9.6.9.6 Groundwater Supply Wells

Geological Survey Ireland (GSI)[5] has an online database of wells and springs in Ireland; however it should be noted this database is not extensive.

According to the GSI well database, there are a number of wells within a 2km radius of the site, these are shown on **Figure 9-6**.

The closest well at the northern cluster is a dug well 2317NEW017 less than 300m south-west of the proposed turbine T2. The well is 5.2m deep and depth to rock is 0.2m. The yield is poor (32.7 m^3/day). The location accuracy of the well is up to 2km.

The closest well at the southern cluster is a dug well 2317NEW038 less than 300m north-east of the proposed turbine T14. The well is 4.5m deep and depth to rock is not available. The location accuracy of the well is up to 1km.

The majority of wells within 2 km are of unknown use, are poor yield, and encounter shallow bedrock quite shallow (<8m depth).

A dug well with an accuracy up to 500m is located approximately 0.9km southeast of the proposed turbine T7.

9.6.9.7 Groundwater Monitoring Well

As the proposed turbine T2 is located within the SO area of Kyle & Orchard Spring Water Supply Scheme. Kyle Spring, a groundwater monitoring well was installed in the vicinity of T2 to monitor groundwater quality and groundwater levels in the area. The borehole log is presented in Technical Appendix 9.1 found in Volume III of this EIAR and groundwater monitoring well details are outlined in **Table 9-10** below.

Drilling of borehole BH T2 took place on site on 12th August 2022 and was supervised by an SLR hydrogeologist. Planned access routes to the proposed drilling location were inaccessible due to overgrowth, saturated grounds and rough terrain. The well was drilled just outside the boundary of the outer protection zone for the Group Water Scheme supplying Stradbally, Ballylynan and Timahoe, to allow monitoring of the water quality of the aquifer supplying this scheme.

Drilling was undertaken using an air rotary drilling rig to allow for the recording of water strikes. During drilling, a dry fracture was encountered at 9.00 m bgl and groundwater was breached at 13.90m bgl. Water strike was weak, arising from the poorly productive mudstone aquifer. The borehole was extended to 5 m below the groundwater table in the poorly productive bedrock, and the borehole was completed at 19.00 m bgl. The borehole

5 Available on: https://secure.dccae.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/SPZ/LS_PWSS_SPZ_Swan_November_2000_GSI.pdf

installation comprised 6m slotted pipe at the end of the borehole to accommodate groundwater flow through the well from the deeper fracture zone.

The mud and sandstone bedrock was overlain by 0.40 m of clay. Due to the shallow nature of these overlying soils, a protective fence could not be erected around the well. Sections of felled tree trunks were instead placed around the well to provide some protection to the well headworks.

Table 9-10 Details of Groundwater Monitoring Well T2

Measurement Type	Measurement
Depth (m)	19.0
Easting	655699.24
Northing	688500.75

9.6.9.8 Groundwater Quality Monitoring

A baseline groundwater quality round was undertaken on 5th September 2022.

The measurement taken of the groundwater level indicated that the water in the well had risen to 2.78m bgl (3.24 m b toc), a rise of 11.12m from the date of drilling. During sampling, the groundwater was bailed from the well and readings of various parameters were recorded live using an Aquatroll multiprobe. The readings stabilised by the time of sampling, suggesting a steady inflow of groundwater from the bedrock aquifer had been reached. The multiprobe recordings at the time of sampling are detailed in the field record sheet (see Technical Appendix 9.4 found in Volume III of this EIAR).

There was no evidence of visual or olfactory contamination during sampling. The groundwater sample was slight grey and medium opaque in colour with a low silt concentration.

The samples were collected in the appropriate sample containers, which are supplied by the laboratory for the required analysis. Sample containers were filled so that there was minimum free air space. The containers were securely sealed so that there was no loss of volatile components and no separation of components. All samples' containers were clearly and uniquely labelled with details including ID and sampling date.

All samples were placed into a cooler box with ice packs to maintain a temperature below 5±3°C. The samples were forwarded to ALS Ltd for analysis. The analysis required for each sample was listed on the Chain of Custody Record which accompanied samples.

The groundwater samples were analysed for a detailed suite of parameters:

- inorganics:
    - ammoniacal nitrogen as N and NH4, chloride, conductivity, cyanide (free and total), nitrate as NO3, pH, orthophosphate as P, sulphate, sulphide, total oxidised nitrogen as N;
- metals (dissolved, filtered):
    - alluminium, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, zinc;
- total petroleum hydrocarbons (TPH) and extractable petroleum hydrocarbons (EPH); and
- volatile organic compounds (VOCs).

9.6.9.9 Groundwater Level Monitoring

As discussed above, the groundwater level measurement taken during the groundwater quality monitoring round indicated that water in the well had risen significantly by 11.12m from the date of drilling to 2.78m bgl (3.24 m b toc) during monitoring.

The date of sampling had been preceded by notably heavy rainfall in the area. However, in the slightly longer term prior to sampling, the summer months had been especially dry with much lower rainfall levels than usual for this time of year in the area.

The closest rainfall station is Oak Park, near Carlow, approximately 19km south-east of the site. The rainfall data from Oak Park the week before sampling is presented in **Table 9-11** below. The monitoring round was preceded by two days of heavy rainfall.

Table 9-11 Met Éireann Daily Rainfall Data for Oak Park (precipitation in mm)

29/08/2022	30/08/2022	31/08/2022	01/09/2022	02/09/2022	03/09/2022	04/09/2022
0.0	0.0	0.0	0.0	0.1	16.4	24.3

9.6.9.10 Groundwater Quality Monitoring Results

This section summarises the groundwater results reported for this baseline monitoring round for borehole BH T2. The results are compared against several assessment criteria S.I. No. 366/2016 - European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016 ('Groundwater Amendment Regulations 2016'), S.I. No. 122/2014 - European Union (Drinking Water) Regulations 2014 ('Drinking Water Regulations') and the EPA Interim Guideline Values (IGVs), in that order.

The results compared against assessment criteria are presented in Technical Appendix 9.5 found in Volume III of this EIAR and the laboratory reports are presented in Technical Appendix 9.6 found in Volume III of this EIAR. The inorganics and metals results can be seen in **Table 9-12**, red font indicates assessment criteria exceedances.

EPHs, TPHs and VOCs did not exceed the laboratory detection limits and are not listed in this table but can be seen in Technical Appendix 9.5 found in Volume III of this EIAR.

Table 9-12 Groundwater Quality Results for BH T2

Parameter	Unit	BH T2
Inorganics		
Ammoniacal Nitrogen as N (low level)	mg/l	0.051
Ammoniacal Nitrogen Low as NH4	mg/l	0.0656
Chloride	mg/l	15.9
Conductivity @ 20 deg.C	mS/cm	0.349
Cyanide, Free (low level)	µg/l	<2.5
Cyanide, Total (low level)	µg/l	<5
Nitrate as NO3	mg/l	<0.3
pH	pH Units	7.02
Phosphate (Ortho as P)	mg/l	<0.02
Sulphate	mg/l	6.1
Sulphide	mg/l	<0.01
Total Oxidised Nitrogen as N	mg/l	<0.1
Filtered (Dissolved) Metals		
Aluminium (diss.filt)	µg/l	<10
Arsenic (diss.filt)	µg/l	<0.5
Cadmium (diss.filt)	µg/l	<0.08
Chromium (diss.filt)	µg/l	<1
Copper (diss.filt)	µg/l	<0.3
Iron (Dis.Filt)	mg/l	**2.24**
Lead (diss.filt)	µg/l	<0.2
Mercury (diss.filt)	µg/l	<0.01
Nickel (diss.filt)	µg/l	<0.4
Zinc (diss.filt)	µg/l	11.6

The only reported exceedance of the assessment criteria was an Iron concentration of 2.24 mg/l, exceeding the Drinking Water Regulations limit and EPA IGVs limit of 0.2 mg/l. There are no concentrations limits for lead outlined in the Groundwater Amendment Regulations 2016. .

9.6.9.11 Turbine Delivery Route, Access Tracks & Recreational Amenity Trail

The groundwater vulnerability underlying the proposed access track and recreational amenity trail routes is moderate to extreme vulnerability, with the majority of the routes in areas of Extreme vulnerability with bedrock recorded at or near the surface.

The majority of the routes are over Poorly Productive Bedrock aquifers, with a shorter section to the north underlain by a Regionally Important Karstified aquifer. However, there are no karst features recorded along the proposed routes.

The proposed access track and recreational amenity trail routes run through both the inner and outer source protection areas for the Kyle & Orchard Spring Water Supply Scheme. The most northern section of the track as it enters Timahoe village passes the vicinity of 8 no. private water supply wells.

9.6.9.12 Cable Routes

As aforementioned, there are two proposed cable route options, Option 1 which extends to the southern substation, with the initial c.1.5 km section being common to both route options and Option 2 which extends to the northern substation.

The shared section overlies an area of Moderate to Extreme groundwater vulnerability. Option 2 overlies areas of predominantly High groundwater vulnerability. Option 1 overlies areas of predominantly Moderate groundwater vulnerability.

The shared section and Option 1 are located over Poorly Productive groundwater bodies. The Option 2 also overlies areas of Regionally Important Karstified bedrock and a Locally Important Gravel aquifer to the north.

Neither of the cable route options run through source protections areas for water supplies. Option 1 is >50m to the location of the 2 nearest private water supply wells. Option 2 cuts through the approximate locations for 6 no. private water supply wells.

Table 9-13 Comparison of hydrogeological features underlying the two cable route options

Hydrogeological Feature	Coolnabacky Option (North)	Pinewoods Option (South)
Aquifer Classification	Poorly productive aquifer	
	Poorly productive aquifer, regionally important karstified bedrock, locally important gravel aquifer	
Groundwater Vulnerability	Predominantly Medium to High with some lesser areas of Extreme to Rock at or near surface near the Proposed Development, and Low further north	Predominantly Medium with areas of Low and Extreme to Rock at or near surface. Some lesser areas of High vulnerability
Groundwater Body	Four GWBs - Shanragh, Balingarry, Bagenalstown Upper and Timahoe Gravels GWB	Ballingarry GWB only
Public Water Scheme Areas	Does not cross any water scheme protected areas	Does not cross any water scheme protected areas

9.6.10 Water Framework Directive

The EU Water Framework Directive[5] (WFD) became EU law in December 2000 and provides for a single European framework to assess water quality (Ecological status) and allows for the comparison of results across European Member States. The WFD covers rivers, lakes, estuaries or transitional waters, coastal waters as well as groundwaters. Details on the WFD are presented in Technical Appendix 9.2 found in Volume III of this EIAR.

9.6.10.1 Surface Water

The Site and cable route area fall within the boundary of two catchments, as shown in **Figure 9-2**. The north of the area is within the Barrow catchment (ID 14) and the surface water bodies are comprised of the tributaries of Stradbally River and Crooked River. The Crooked River joins the Stradbally River approximately 6.7 km north of the site.

The southern extent of the site is part of the Nore catchment (ID 15) with tributaries of the river Owveg to the west of the site, and River Clough to the south of the site traversing this area.

The Barrow catchment includes the area drained by the River Barrow upstream of the River Nore confluence and all streams entering tidal water between the Barrow railway bridge at Great Island and Ringwood, Co. Kilkenny, draining a total area of 3,025km². The largest urban centre in the catchment is Carlow. The other main urban centres in this catchment are New Ross, Graiguenamanagh, Athy, Portlaoise, Mountmellick, Portarlington, Monasterevin and Kildare. The total population of the catchment is approximately 188117 with a population density of 62 people per km². The Barrow catchment is underlain in its flat northern area by limestones of varying purity which continue down the western side of the catchment and sustain good groundwater resources in places. On the eastern side of the catchment, granites dominate, culminating in the summits of the Blackstairs Mountains.

The Nore catchment includes the area drained by the River Nore and all streams entering tidal water between its confluence with the River Barrow at Ringwood, and the Barrow railway bridge at Drumdowney, Co. Kilkenny, draining a total area of 2,595km². The largest urban centre in the catchment is Kilkenny. The other main urban centres in this catchment are Abbeyleix, Callan and Thomastown. The total population of the catchment is approximately 94,700 with a population density of 37 people per km². The Nore rises on the north-eastern slopes of Borrisnoe Mountain, from where it runs northeast over an area underlain by a large gravel aquifer and past Borris-in-Ossory. The southern slopes of the Slieve Bloom Mountains are drained by the Tonet, Delour and Mountrath Rivers which join the Nore east and south of Mountrath. The Nore becomes tidal just upstream of Inistioge before continuing southeast to its confluence with the River Barrow at Ringwood. Flood relief works were completed during 2006. The River Arrigle flows north until it meets the River Nore to the north of Thomastown.

The Proposed Development and cable routes are also situated within three sub-catchments. These are:

- Barrow_SC_050
- Nore_SC_060
- Dinin[North]_SC_010

WFD water quality status and river waterbody risk associated with the Proposed Development are provided in **Table 9-14** below. The river status and waterbody risk of the receiving waters of the Proposed Development are classified as 'Good' and 'Not at Risk' apart from Clogh_010 which is classified as 'Moderate' and 'At Risk'. For waterbodies associated with the proposed cable routes and access tracks/recreational amenity trail route, the river status is 'Good'.

Table 9-14 Waterbodies and WFD Classification

Catchment (Catchment ID)	WFD Sub-catchment (Sub-catchment ID)	River Network EPA Name (Segment Code)	River Waterbody WFD Status 2016-2021 (River Name & Code)	River Waterbody WFD Risk 2016-2021
Barrow (14)	Barrow_SC_050	STRADBALLY (LAOIS)_020	Good	Not At Risk
		CROOKED (STRADBALLY)_010	Good	Not At Risk

Catchment (Catchment ID)	WFD Sub-catchment (Sub-catchment ID)	River Network EPA Name (Segment Code)	River Waterbody WFD Status 2016-2021 (River Name & Code)	River Waterbody WFD Risk 2016-2021
Nore (15)	Nore_SC_060	OWVEG (NORE)_010	Good	Not At Risk
		OWVEG (NORE)_020	Good	Not At Risk
		OWVEG (NORE)_030	Good	Not At Risk
	Dinin[North]_SC_010	CLOGH_010	Moderate	At Risk

9.6.11 Ecological Designated Sites

Within the Republic of Ireland designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs), Special Areas of Conservation (SAC) / candidate SAC's(cSAC) and Special Protection Areas (SPAs) / candidate SPA's (cSPAs).

Designated protected areas are mapped on **Figure 15-3** and **Figure 15-4** and are detailed in Chapter 15 of this EIAR. The closest designated site is the Timahoe Esker pNHA which is located 83m from the Option 2 Cable Route at the nearest point. The Option 1 cable route and the TDR are located 5km west of the Ballyprior Grassland SAC. The closest designated site to the Proposed Development is the Clopook Wood pNHA, which is 2.6km at the nearest point.

The Project and cable route do not traverse any designated protected area. Designated sites within 5km of the Proposed Development, which could have potential hydrological and hydrogeological connections are outlined below:

- Designated sites which could have potential hydrological connections (due to being within the same surface water catchment, having direct downstream connection), include:
  - River Barrow and River Nore SAC (002162)
  - Timahoe Esker pNHA (000421)
- Designated sites which could have potential hydrogeological connections (due to the bedrock type and presence of karst features), include:
  - River Barrow and River Nore SAC (002162)
  - Ballyprior Grassland SAC (002256)
  - Timahoe Esker pNHA (000421)
  - Clopook Wood pNHA (000860)

The Proposed Development is indirectly connected via surface water to the River Barrow and River Nore SAC (002162), through the tributaries of the River Barrow and River Nore. The northern cluster and cable route ultimately discharge into the River Barrow approximately 16 km downstream of the Proposed Development.

The southern cluster and approximately 2.8km of the cable route drain towards the River Nore. The River Nore is approximately 20.8 km downstream of the cable route and 27.1 km of the southern cluster of the Proposed Development.

Ballyprior Grassland SAC is located in a karstified bedrock aquifer with several karst features between the SAC and the Proposed Development. The Site is located in a separate and less productive bedrock aquifer, however the Option 1 cable route does overly the karstified aquifer in areas.

Timahoe Esker pNHA is located in proximity to the northern cable route option and has direct hydrological connection downstream of the cable route .

Clopook Wood pNHA is a small site located to the northeast of the Proposed Development.

9.6.12 Water Environment Receptors

From the baseline study undertaken here, the following water environment sensitive receptors have been identified in the receiving environment:

- Water courses across the site, tributaries of the River Barrow and River Nore;
- Locally important and poorly productive bedrock aquifers beneath the site;
- Orchard Spring Public Water Supply;
- Swan Water Supply Scheme;
- Local groundwater supply wells in the surrounding area.

For each identified receptor, the significance and sensitivity of the receptor is assessed in **Table 9-15** below and a rating (High/Medium/Low/Negligible) applied, based on the methodology outlined in existing guidance and reproduced in Technical Appendix 9-8 found in Volume III of this EIAR.

Table 9-15 Existing Environment - Significance and Sensitivity / Importance

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
1	Water courses at the site	Local streams at the site. Tributaries of the River Barrow and River Nore. Good water quality status – WFD.	In hydraulic continuity with the site through groundwater - surface water interactions (recharge and discharge) and located downgradient. WFD waterbody risk of the streams at the Proposed Development are classified as 'Good' and 'Not at Risk' apart from Clogh_010 which is classified as 'At Risk'	**Medium** - Attribute has a medium quality or value on a local scale.
2	Designated Sites	Sites within 5km are River Barrow and River Nore SAC Ballyprior Grassland SAC Timahoe Esker pNHA Clopook Wood pNHA	Timahoe Esker pNHA and Clopook Wood pNHA are potentially located in a hydrogeological continuity area within the site. All four are potentially located in a hydrological continuity within the site.	**High** - Attribute has a high quality or value on a local scale
3	Bedrock and gravel aquifers beneath the site	Bedrock aquifers are classified as locally important and poorly productive. Small section	Bedrock aquifers are in hydraulic continuity with surface water courses through groundwater -	**Medium** - Attribute has a medium quality or value on a local scale.

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
		of cable route is underlain by regionally important karstified aquifer. Gravel aquifer is locally important.	surface water interactions (recharge and discharge).	
4	Orchard Spring Public Water Supply	Orchard Spring Public Water Supply	One turbine within outer supply area.	**High** - Attribute has a high quality or value on a local scale (Locally important potable water source supplying >1000 homes.)
5	Local groundwater supply wells	Private water supplies in the vicinity of the site.	Local groundwater supply wells (agriculture and/or domestic supply).	**Low** - Attribute has a low quality or value on a local scale (no source protection area, potable water source supplying <50 homes)

9.7 Receiving Environment: Baseline Summary

- The north of the Proposed Development is within the Barrow catchment (ID 14) and the surface water bodies are comprised of the tributaries of Stradbally River and Crooked River. The Crooked River joins the Stradbally River approximately 6.7 km north of the site.
- The southern extent of the Proposed Development is part of the Nore catchment (ID 15) with tributaries of the river Owveg to the west of the Proposed Development and River Clough to the south of the site traversing this area.
- The site drains into the tributaries of the River Barrow and River Nore.
- River Barrow and River Nore SAC are approximately 8.1km downstream of the northern cluster and approximately 3.3km downstream of the southern cluster
- Under WFD, all watercourses receiving surface runoff from the site are classified as being of good status based on its physio-chemical and biological quality, apart from Clogh_010 which is classified as 'Moderate' and 'At Risk'
- The proposed turbine T2 is located within the SO area of Kyle & Orchard Spring Water Supply Scheme. A groundwater monitoring well has been installed nearby to monitoring groundwater quality
- Swan Water Supply Scheme is approximately 110m south of the proposed turbine T12.

9.8 Potential Impacts

9.8.1 Evaluation Methodology

The impacts on the surface water and groundwater environment of the Proposed Development are assessed in this chapter without any mitigation measures in place.

The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts is described in terms of the character, magnitude, duration, probability and consequence of the impact are considered.

The description of the potential impact is screened against the significance and sensitivity of the receiving environment to determine the significance of the impact.

This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the Proposed Development. This approach allows effort to be focused on reducing risk where the greatest benefit may result.

The assessment of risk is based on a matrix on importance of attributes and magnitude of impacts. Various criteria tables outline the assessments for the likelihood and magnitude of hydrological and hydrogeological impacts; these can be found in Technical Appendix 9.9 and Technical Appendix 9.10, both of which can be found in Volume III of this EIAR.

In addition to their nature and significance, the potential impacts will be assessed in terms of their duration, whether they are direct or indirect impacts.

The following sections identify the impacts of the Proposed Development on the hydrogeological and hydrological environments. It also assesses the likelihood of occurrence of each identified impact in accordance with to above. As noted above, the impacts are initially assessed with no mitigation or design measures incorporated to reduce the effects.

9.8.2 Do Nothing Scenario

If the Proposed Development does not proceed, the Site will remain as an agriculture and forestry site.

The Site will remain as areas of agriculture and forestry, where normal agricultural and forestry activities will continue to occur into the future. Commercial forestry operations (including the associated drainage measures) would continue at the site. Agricultural practices (including the associated drainage measures) would continue at the site. The increasing or decreasing pressures on the local water quality will continue without separate intervention. There are no significant impacts to the hydrological and hydrogeological environment in a do-nothing scenario.

9.8.3 Worst Case Scenario

Localised and short-term contamination of surface water streams could occur during the construction and operational phases, which in turn could affect the ecology and quality of the downstream water bodies. Also, potentially localised groundwater contamination may occur. However, good environmental practice on site and mitigation measures outlined in Section 9.8 will be put in place to prevent this from happening.

9.8.4 Potential Impacts: Construction

The potential impacts during construction are detailed in this section and summarised in the table below. For the Proposed Development, the construction sequence will be as follows:

- tree felling, 54.36 Ha,
- upgrading of existing site tracks and the provision of new site tracks,
- drainage infrastructure to be constructed in parallel with access track construction,
- construction of the turbine foundations and
- the provision of the hardstanding areas

Construction of the substation and internal cable network in conjunction with off-site connection works to the National Grid will be carried out in tandem to the Proposed Development sequenced activities outlined above.

A Construction and Environmental Management Report (CEMP) is contained in Technical Appendix 3.2 found in Volume III of this EIAR, which includes a description of construction techniques and proposed management measures for the construction phase of the Proposed Development.

The CEMP sets out the key environmental management measures associated with the construction, operation, and decommissioning of the Proposed Development, to ensure that during these phases of the Proposed Development, the environment is protected, and any potential impacts are minimised. In the event that An Bord Pleanála (ABP) decides to grant approval for the Proposed Development, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by ABP.

9.8.4.1 Erosion and Sediment

Construction phase activities of the Proposed Development will require earthworks resulting in the removal of vegetation cover and excavation of mineral subsoil. No significant peat was identified on site. Exposed and disturbed ground may increase the risk of erosion and subsequent sediment laden surface water runoff. The release of suspended solids is primarily a consequence of the physical disturbance of the ground during the construction phase, if not correctly compacted.

The construction phase of the Proposed Development will involve the following earthworks activities that could have potential impacts on surface water and groundwater conditions:

- Construction of temporary and permanent infrastructure on site, including turbine foundations, hardstands, site access tracks, substation, construction compounds, and all associated onsite infrastructure;
- Laying of underground electrical cabling, both within the Proposed Development, and as part of the cable route;
- 12 no. watercourse crossings between the Option 1 and Option 2 cable routes;
- Minor works at a number of locations along the TDR, including excavations for cable route trenches and the temporary alterations;
- Borrow Pit excavations; and
- Stockpiling material.

Potential sources of sediment laden water include:

- Soil stripping, if necessary, to construct the access tracks, site compounds, turbine foundations, hardstands, turbines/hardstanding/tracks and substation;
- Run-off and erosion from soil stockpiles (prior to reinstatement/profiling/side casting);
- Drainage and seepage water resulting from infrastructure excavation;
- Construction of the cable route cable trench resulting in entrainment of sediment from the excavations during construction; and
- Erosion of sediment from emplaced/upgraded site drainage channels and at water crossings.

These activities can result in the release of suspended solids to surface watercourses 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.

9.8.4.2 Pollution Risk

During the construction phase, there is the potential for a pollution event to affect surface water and local groundwater bodies impacting on their water quality.

Contamination of surface water runoff from machinery, leakage and spills of chemicals from vehicle use and the construction of hardstanding also have the potential to affect surface water bodies. Potential pollutants include oil, fuels and cement.

This would have a negative effect on the receptor and the resulting degradation of the water quality could impact on private water supplies abstracting from the watercourse/aquifer.

9.8.4.3 Fluvial Flooding

Tree felling, access track construction, construction of the turbine foundations and other new, hard surfaces have the potential to result in a small increase in surface water run-off in the catchment. An increase in run-off has the potential to result in soil erosion and consequently sediment release into nearby receiving watercourses.

The flood mapping produced as part of the OPW National Indicative Flood Mapping (NIFM) does not extend to the Proposed Development The risk of an increase in downstream flooding due to the Proposed Development is considered to be low due to the small increase in run-off from surfaced and hard stand areas for the Proposed Development relative to overall catchment areas.

Sediment erosion on site has the potential to cause blockages in on-site drainage infrastructure if not maintained, and which have the potential to cause some minor increase in surface water flooding across the infrastructure areas from site runoff.

9.8.4.4 Groundwater Levels & Flow

Dewatering of borrow pits and other deep excavations (i.e. turbine bases) have the potential to impact on local groundwater levels. Groundwater level impacts are not anticipated to be significant due to the local hydrogeological regime.

Groundwater inflows may need to be pumped, resulting in short term localised drawdown of the water table and discharges to surface water channels. This could impact on groundwater levels and groundwater wells.

9.8.5 Potential Impacts: Operational

The potential impacts during the operational stage are detailed in this section and summarised in the table below. The expected physical lifetime of the Proposed Development is 35 years, and permission is sought for a 35-year operation period, commencing from full operational commissioning of the Proposed Development at the end of the proposed 10 year construction phase.

During the operational phase of the Proposed development, it is anticipated that routine maintenance of infrastructure and tracks will be required across the Site. This may include work such as maintaining access tracks and drainage and carrying out wind turbine maintenance. Should any maintenance be required onsite which would involve construction type activities; mitigation measures will be adhered to along with the measures in the CEMP to avoid potential effects.

There will be a limited number of vehicles required onsite for routine maintenance and operational activities. Twice a year each turbine will undergo a scheduled service. The operation of the wind turbines will be monitored remotely. Storage of fuels/oils onsite will be limited to the hydraulic oil required in turbine gearboxes and this is bunded to (110% bund capacity) to prevent fluid escaping.

During the operation of the Proposed Development, it is not anticipated that there will be any excavation or stockpiled material, reducing the potential for erosion and sedimentation effects. Should any excavation be required, this is likely to be limited and required for maintenance of tracks. Any excavation, handling and placement of material from borrow pits will be subject to the same safeguards that will be used during the construction phase of the Proposed Development.

Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation would not have matured. Appropriate design of the drainage system, incorporating sediment traps, will reduce the potential for the increased delivery of sediment to natural watercourses. Potential effects from sedimentation or erosion during the operational phase are considered to come from linear features on steeper slopes, where velocities in drainage channels are higher. Immediately post-construction, flow attenuation measures will remain and be maintained to slow runoff velocities and prevent erosion until vegetation becomes established.

Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually onsite by a contractor or operational personnel) there will be potential for erosion and sedimentation effects to occur due to the existence of disturbed material. Should this type of activity be required, then the good practice measures as detailed for the construction phase will be required on a case-by-case basis.

Operation of the Proposed Development requires limited activities relative to the construction phase. The presence of access tracks and hardstanding, as opposed to their construction, may affect the potential infiltration and groundwater conditions as well as the sub-surface flow paths around the infrastructure. In addition, cabling and crane hardstanding will also remain in situ to serve the Proposed Development.

Drainage will be required to service new sections of access track, which could also potentially alter recharge.

9.8.6 Potential Impacts: Decommissioning

During the decommissioning phase of the Proposed Development, cranes will disassemble the above grounds turbine components which will be removed off-site for recycling.

The foundations will be covered over and allowed to re-vegetate naturally. Leaving turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise and vibration and dust. It is proposed that the internal site access tracks will be left in situ, subject to agreement with Laois County Council and the relevant landowners.

The proposed on-site substation will be taken in charge by ESBN /EirGrid upon completion and will be left in place forming part of the national electricity network

Underground cabling will be cut back and left in situ.

These impacts have been assessed as similar to the Construction Phase and, therefore, the mitigation measures for the Construction Phase will also be implemented during decommissioning.

A detailed decommissioning plan will be agreed in advance of construction with Laois County Council. A decommissioning plan is contained within the CEMP in Technical Appendix 3.2 found in Volume III of this EIAR.

Table 9-16 Description of Impacts and Impact Rating

No.	Potential Impact	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
		Construction Stage – Surface Water (Direct)	
1	Reduction in surface water quality from sediment release during construction	**Medium** - Potential to affect surface water quality in the local surface waterbodies during soil stripping and construction of turbine foundations, hardstands, site access tracks, substation, underground cabling, water crossings. WFD classify the surface water bodies as Good status, other than Clough_10 which is Moderate. There are no water crossings at Clough_10.	**Moderate**
2	Reduction in surface water quality from accidental spillage of oil, fuels and cement during construction	**Medium** - Potential to affect surface water quality in the local surface waterbodies during construction. WFD classify the surface water bodies as Good status, other than Clough_10 which is Moderate. There are no water crossings at Clough_10.	**Moderate**
3	Increase in risk of flooding due to increase in surface water run-off and sediment release	**Low** - Risk of an increase in downstream flooding is considered to be low due to the small increase in run-off from surfaced and hard stand areas for the Proposed Development relative to overall catchment areas	**Slight – Not Significant**
		Construction Stage – Surface Water (Indirect)	
4	Impact on designated sites from potential reduction in surface water quality from sediment release / accidental spillage at downstream locations	**Low** - Potential to affect surface water quality in nearby designated sites. The closest designated site is the Timahoe Esker pNHA which is located 83m from the cable route at the nearest point. Impact to surface water quality is unlikely due to short term and limited nature of the cable route works. The closest designated site to the Proposed Development is the Clopook Wood pNHA, which is 2.6km at the nearest point. Impact to surface water quality from the Proposed Development is unlikely due to the pNHA being at distance.	**Slight**
		Construction Stage – Groundwater (Direct)	
5	Reduction in groundwater quality from sediment release during construction	**Low** Potential to affect groundwater quality in underlying bedrock and gravel aquifers beneath the site through vertical migration. Areas of exposed bedrock / gravel will be localised (borrow pit excavations / turbine bases). Bedrock and gravels aquifers are locally important and poorly productive at Proposed Development.	**Slight**
6	Reduction in groundwater quality from the accidental spillage of oil, fuels and cement	**Low** - Potential to affect groundwater quality in underlying bedrock and gravel aquifers beneath the site through vertical migration. Bedrock and gravels aquifers are locally important and poorly productive at Proposed Development. Any leakage / spillage will be accidental only and of limited volume.	**Slight - Moderate**
7	Reduction in groundwater levels from dewatering of borrow pits and other deep excavations	**Low – Negligible** Potential to lower groundwater quality in underlying bedrock and gravel aquifers is limited by the localised and short term nature of any dewatering required.	**Not Significant**
		Construction Stage – Groundwater (Indirect)	
8	Reduction in groundwater quality at Public Water Supply	**Low** - Potential to affect groundwater quality in Public Water supplies in wider area through vertical migration followed by lateral migration. T2 is located within the source outer protection area, however the SO area is	**Slight - Moderate**

No.	Potential Impact	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
	from sediment release / accidental spillage	underlain by poorly productive aquifers and will have limited contribution to the supply. Impact is unlikely as areas of exposed bedrock / gravel will be localised. Any leakage / spillage will be accidental only and of limited volume.	
9	Reduction in groundwater quality at local domestic water supplies from sediment release / accidental spillage	**Low** - Potential to affect groundwater quality in domestic water supplies in wider area through vertical migration followed by lateral migration. Most of the identified domestic water supplies are of unknown use and are poor yield. Impact is unlikely as areas of exposed bedrock / gravel will be localised. Any leakage / spillage will be accidental only and of limited volume.	**Slight**
10	Impact on designated sites potentially in hydrogeological continuity with the site from potential reduction in groundwater quality from sediment release / accidental spillage	**Low** - Potential to affect groundwater quality in nearby designated sites through vertical migration followed by lateral migration. The closest designated site is the Timahoe Esker pNHA which is located 83m from the cable route at the nearest point. Impact to groundwater quality is unlikely due to short term and limited nature of the cable route works. The closest designated site to the Proposed Development is the Clopook Wood pNHA, which is 2.6km at the nearest point. Impact to groundwater quality from the Proposed Development is unlikely due to the pNHA being at distance.	**Slight**
Operational Stage – Surface Water (Direct)			
11	Reduction in surface water quality from sediment release / accidental spillage	**Low – Negligible** Potential to affect surface water quality in the local surface waterbodies from site access and maintenance. Impact to surface water quality is unlikely due to short term nature of maintenance works.	**Slight – Not Significant**
12	Increase in risk of flooding due to increase in surface water run-off	**Low - Negligible -** Risk of an increase in downstream flooding is limited due to the small increase in run-off from surfaced and hard stand areas for the Proposed Development relative to overall catchment areas	**Slight – Not Significant**
Operational Stage – Groundwater (Direct)			
13	Reduction in surface water quality from sediment release / accidental spillage	**Negligible** Potential to affect groundwater quality in the local in underlying bedrock and gravel aquifers beneath the Site through vertical migration from site access and maintenance. Impact to surface water quality is unlikely due to short term nature of maintenance works.	**Not Significant**

9.9 Mitigation Measures

As stated in Chapter 3, the design of the Proposed Development has considered a range of best practice construction measures which will ensure avoidance and reduction of impacts throughout the construction, operational and decommissioning phases. Additional measures have been developed to mitigate the impacts identified in the preceding section.

9.9.1 Mitigation by Avoidance

The Proposed Development has undergone design iterations and evolution in response to the constraints identified as part of the baseline studies and field studies so as to avoid potential effects on receptors where possible.

In identifying and avoiding sensitive surface waters, the Proposed Development has implemented 'avoidance of impact' measures. Mitigation by avoidance is viewed as part of the 'Reasonable Alternatives' outlined in Chapter 17.

A buffer distance between watercourses and any proposed construction activities or infrastructure was applied to those watercourses within the Site, including fuel storage and construction compounds. A 50 m buffer has been applied for the wind turbine infrastructure and the cable route was moved away from streams discharging into the River Nore and River Barrow. No marked streams are crossed by the turbine access tracks.

9.9.2 Mitigation by Prevention and Reduction

A number of mitigation measures are outlined below and are considered as in-built to the design of the Project. These mitigation measures are a combination of measures to comply with legislation and best practice construction methods to be implemented in order to prevent water (surface water and groundwater) pollution. Examples of these measures are the storage of potentially polluting materials in fully bunded tanks and controlling / reducing runoff from hardstand areas.

9.9.3 Mitigation Measures - Construction

In order to mitigate potential impacts during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes.

A CEMP (Technical Appendix 3-2 found in Volume III of the EIAR) has been developed for the Project to ensure adequate protection of the water environment. All personnel working on the Project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

During the construction phase, all works associated with the construction of the Proposed Development will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016).

9.9.3.1 Buffer to Water Courses

A buffer distance of 50m will be between watercourses and any proposed construction activities or infrastructure.

9.9.3.2 Good Practice Measures

Implementation of good practice measures as a matter of course during the construction of the proposed development are not considered to be mitigation measures but form an integral part of the design/construction process. Key good practice measures are stated below and the assessment incorporates these measures as part of the proposed development.

Measures to prevent the release of any pollution/sediment are as follows:

- prior to construction, section specific drainage plans will be produced. These will take into account any existing local drainage which may not be mapped and incorporate any section specific measures identified during the assessment;

- measures are included in the CEMP (see Technical Appendix 3.2 of Volume 3 of this EIAR) for dealing with pollution/sedimentation/flood risk incidents and will be developed prior to construction;
- the CEMP (see Technical Appendix 3.2 of Volume 3 of this EIAR) will contain details on the location of spill kits, will identify 'hotspots' where pollution may be more likely to originate from, provide details to Site personnel on how to identify the source of any spill and state procedures to be adopted in the case of a spill event. As identified in the CEMP, a specialist spill response contractor will be identified to deal with any major environment incident;
- a wet weather protocol will be developed. This will detail the procedures to be adopted by all staff during periods of heavy rainfall. Toolbox talks will be given to engineering / construction / supervising personnel. Roles will be assigned, and the inspection and maintenance regimes of sediment and runoff control measures will be adopted during these periods; and
- In extreme cases, the above protocol will dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow.

9.9.3.3 Site Drainage

During the construction phase of the Proposed Development, measures will be adopted, in order to prevent silt, chemicals and/or other contaminants from being washed into existing watercourses. Areas exposed due to the removal of existing structures and/or vegetation are more susceptible to erosion during heavy rainfall so areas will be reinstated prior to heavy rainfall to minimise this effect.

This would include specific guidance in relation to drainage (and control of pollution to the water environment) around the following aspects of site infrastructure:

- access routes;
- foundations;
- hardstanding areas and new structures

The appropriate methodologies to cover water control and the means of drainage from all hard surfaces and structures within the Site are described in the following sections.

9.9.3.4 Management of Sediment and Surface Waters

Good practice construction techniques outlined in the CEMP will be adopted for the management of sediment and surface water run-off generated during the construction phase of the Proposed Development. Sustainable Drainage Systems (SuDS) will be used where applicable.

Drainage from the site would include elements of SuDS design. SuDS replicate natural drainage patterns and have a number of benefits:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream; and
- SuDS will treat run-off, which can reduce sediment and pollutant volumes in run-off before discharging back into the water environment; and
- SuDS measures, such as lagoons or retention ponds, where appropriate and correctly implemented will produce suitable environments for wildlife.

In addition, a wet weather protocol (see the CEMP in Technical Appendix 3.2 found in Volume III of this EIAR) will be implemented to manage activities during periods of heavy and prolonged precipitation to be approved by Laois County Council in consultation with the EPA.

Heavy or prolonged rainfall during construction and operation may lead to sediment transport or vegetation causing blockage to infrastructure drainage channels or any temporary watercourse crossing structures. Regular monitoring and prompt maintenance of these assets will ensure that the drainage system continues to function as designed.

Good practice measures for the management of earthworks to reduce erosion and sedimentation are outlined in the CEMP and are as follows:

- all stockpiled materials will be located out with a 50 m buffer from watercourses;
- where possible, stockpiled material will either be seeded or appropriately covered;
- water will be prevented as far as possible, from entering excavations such borrow pits through the use of appropriate cut-off drainage
- where the above is not possible, water that enters a borrow pit will pass through a number of settlement lagoons and silt/sediment traps to remove silt prior to discharge into the surrounding drainage system. will be
- clean and dirty water onsite will be separated, and dirty water will be filtered before entering the water environment;
- if the material is stockpiled on a slope, silt fences will be located at the toe of the slope to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, will be kept to a minimum and appropriate drainage will be in place to prevent surface water entering deep excavations, specifically borrow pit excavations;
- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses will be developed - this may include silt traps, check dams and/ or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales will be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment will avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor will carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

9.9.3.5 Foul Drainage

Effluent and waste from onsite construction personnel will be either treated at a package sewage treatment plant or captured and stored for offsite disposal by a licensed contractor, where there is no connection to the public foul sewer. The system will be designed for approval by the EPA prior to the construction phase of the Proposed Development.

9.9.3.6 Pollution Risk

Good practice measures in relation to pollution prevention will include the following:

- refuelling will take place at least 50m from watercourses and where possible it will not occur when there is risk that oil from a spill could directly enter the water environment, for example, periods of heavy rainfall or when standing water is present will be avoided;
- a vehicle management plan and speed limit will be strictly enforced onsite to minimise the potential for accidents to occur;
- drip trays will be placed under stationary vehicles which could potentially leak fuel/oils;
- areas will be designated for washout of vehicles which are a minimum distance of 50 m from a watercourse;
- washout water will also be stored in the washout area before being treated and disposed of;
- if any water is contaminated with silt or chemicals, runoff will not enter a watercourse directly or indirectly prior to treatment;
- water will be prevented as far as possible, from entering excavations such as borrow pits;
- areas of battery storage will be bunded and positively drained so that the quality of runoff can be monitored and contained if required;
- procedures will be adhered to for storage of fuels and other potentially contaminative materials to minimise the potential for accidental spillage (e.g. stored in 110% bunded storage facilities); and
- a plan for dealing with spillage incidents will be designed prior to construction, and this will be adhered to should any incident occur, reducing the effect as far as practicable. This will be included in the CEMP for the proposed development.

9.9.3.7 Fluvial Flood Risk

It is proposed to adopt SuDS as part of the Proposed Development. SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at Site prior to development. Good practice in relation to the management of surface water runoff rates and volumes and potential for localised fluvial flood risk will include the following:

- drainage systems will be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- onsite drainage will be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding.
- appropriate drainage will attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk;
- where necessary, check dams will be used within cable trenches in order to prevent trenches developing into preferential flow pathways; and
- as per good practice for pollution and sediment management, prior to construction, section specific drainage plans will be developed, and construction personnel made familiar with the implementation of these.

Drainage design for the Proposed Development is demonstrated in the planning drawings accompanying this EIAR.

9.9.3.8 Water Quality Monitoring

Water quality monitoring during the construction phase will be undertaken for the surface water catchments that serve the Site, to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring will be carried out at a specified frequency on these catchments.

With regard to the protection of the water environment the following risks will be addressed:

- siltation of watercourses;
- discolouration of raw water;
- potential pollution from construction traffic due to diesel spillage or similar;
- alteration of raw water quality resulting from imported track construction material;
- excavation and earthworks
- use of large quantities of concrete;
- site compound and associated drainage/foul drainage and diesel spill issues; and
- the Project Supervisor Construction Stage (PSCS) will compile a monitoring and maintenance plan for the drainage system and surface water runs which will as a minimum include:
    - visual monitoring/inspections

during site works and water crossing construction works, the relevant drainage/surface water runs potentially being impacted by these works will be inspected on a daily basis by the Environmental Clerk of Works (ECoW) while works are ongoing in this area.

A Water Quality Monitoring Plan (WQMP) will be developed to form part of the Construction Method Statement (CMS), which will be submitted to the appropriate planning authorities prior to construction and development. The WQMP will be implemented to monitor surface water quality, fish populations and macroinvertebrate community prior to, during and post-construction. A robust baseline of water quality in surface watercourses / drainage channels downstream of construction works will be established prior to construction commencing and used as a benchmark of water quality for the construction phase monitoring.

The purpose of the WQMP is to:

- Ensure that the commitments put forward in the EIAR are fulfilled with regards to identified ground and surface water receptors;
- Provide a specification for monitoring prior to, during and after construction;
- Provide a record of water quality across the site that can be compared to rainfall and site activities;
- Provide reassurance of the effectiveness of pollution prevention measures installed to protect surface watercourses throughout the construction period; and
- Provide data to identify any potential pollution incidents, and to inform a structured approach to manage and control such incidences.

The WQMP will outline details for the monitoring of surface watercourses down gradient of works areas including watercourse crossings, access tracks, turbine foundations and borrow pits and at control sites (up gradient of works areas), and will include:

- Planning level monitoring locations;
- Frequency of monitoring prior to, during and after construction;
- Parameters for field hydrochemistry testing and laboratory analysis including as a minimum ph, electrical conductivity, suspended solids, dissolved metals, nutrients and hydrocarbons;
- Sampling and analysis protocols;
- Relevant environmental quality standards (eqs);
- Responsibilities for monitoring – it is expected that the ECoW will be responsible for daily monitoring of watercourses particularly around active works areas and watercourse crossings;
- Procedures to be followed in the event of an environmental incident; and
- Recording and communicating of results.

Details of the Private Water Supply (PWS) Action Plan are provided in Section 8.1 of the CEMP. A PWS will be developed and will include details regarding all water monitoring and reporting, pollution incident reporting and emergency mitigation measures to address a temporary or permanent material change in either the quality or quantity of an existing private water supply. Details are provided in Section 8.1 of the CEMP.

9.9.3.9 Emergency Response

Drainage networks provide a conduit for rapid transport of silty water and potential contamination from surface spills of fuels / oils, concrete or chemicals. A pollution emergency incident will include any discharge to the drainage network that could potentially cause environmental damage. Examples of pollution emergency incidents include:

- fuel drips or spills during refuelling;
- leaking plant or equipment;
- leaks from fuel or chemical containers;
- contaminated water or sediment / silt entering a watercourse or drainage network;
- windblown dust and waste;
- excess silt deposition in drainage ditches, channels, culverts following heavy rainfall events;
- operational failures of pumps and pipelines; and
- failures of treatment or sediment controls.

The PSCS will be required to prepare an Environmental Incident and Emergency Response Plan (as noted in Section 6.1 of the CEMP which will provide emergency response contacts, reporting procedures, and procedures for dealing with all potential pollution incidents during the construction of the Proposed Development.

9.9.4 Mitigation Measures: Operational

During the operational phase of the proposed development, it is anticipated that routine maintenance of infrastructure and tracks will be required across the Site. This may include work such as maintaining access tracks and drainage and carrying out wind turbine maintenance.

Should any maintenance be required onsite which would involve construction type activities; mitigation measures will be adhered to along with the measures in the CEMP to avoid potential effects.

During the operation of the Proposed Development, it is not anticipated that there will be any excavation or stockpiled material, reducing the potential for erosion and sedimentation effects. Should any excavation be required, this is likely to be limited and required for maintenance of tracks etc. Any excavation, handling and placement of material from borrow pits will be subject to the same safeguards that will be used during the construction phase of the Proposed Development.

9.9.5 Mitigation Measures: Decommissioning

The risk of a pollution incident occurring will be managed using good practice measures as detailed in the CEMP. Many of these practices are concerned with undertaking construction activities away from watercourses and identifying safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution of watercourses.

Potential pollution events occurring during the construction of the turbines, or any hardstanding will be controlled by good practice measures and will be subject to some attenuation in the soils before reaching groundwater.

Adherence to good practice measures would ensure that any material generated is not transported into nearby watercourses.

Location specific good practice measures will be in place for sediment control for each of the track construction activities and borrow pit to control the amount of fine sediment that could potentially enter a watercourse if not managed appropriately. These measures will be dependent upon the final borrow pit designs and stone quality, but would potentially include cut-off drainage, sediment traps, sediment lagoons and flocculation stations.

In particular, drainage, some of which will be temporary, will be required around turbine working areas, the construction compound and borrow pits to manage surface flows. Excavation of turbine foundations may require temporary de-watering for the period of the foundation build. These drainage activities may lead to temporary changes in the water table surrounding these construction activities (where de-watering is required below the level of the natural water table).

Excavations associated with constructions works (e.g. cut tracks, turbine bases foundations, cable trenches, borrow pits) can result in local lowering of the water table. Dewatering associated with construction of wind turbine foundations is commonly temporary and dewatering following construction will not be required.

9.9.6 Residual Impacts

With the above mitigation measures in place at the Site, it is projected that the following reduction in the assessed significance of impacts will result in:

- Reduction of the potential impact on surface quality in bedrock aquifer from accidental fuel leakage/ spillage during the operational stage from "**moderate"** to "**slight**" (No. 8).

- Reduction in surface water quality from sediment release during the construction stage from "**moderate**" to "**slight**" (No. 1);
- Reduction in the surface water quality from accidental spillage of oils, fuels and cement during the construction stage from "**moderate**" to "**slight**" (No. 2);
- Reduction in the groundwater quality from accidental spillage of oils, fuels and cement during the construction stage from "**slight - moderate**" to "**slight – not significant**" (No. 6);
- Reduction in groundwater quality at Public Water Supply from sediment release / accidental spillage from "**slight - moderate**" to "**slight – not significant**" (No. 8);

The significance of all other potential impacts during the construction and operational stage will be reduced to "**slight**" or lower to the water environment receptors. Additionally, the Proposed Development will not cause a deterioration of the status of any surface or groundwater body under the WFD and will not undermine the attainment by any such body of good status

9.10 Cumulative Effects

For the assessment of cumulative effects, any other permitted or proposed and unbuilt projects in proximity to the site (wind energy or other) have been considered where they have the potential to generate an in-combination or cumulative impact with the Proposed Development.
To determine the permitted, proposed or unbuilt projects in proximity to the site, a monthly desktop-based planning search spanning 10 years within a radius of 20km was undertaken. Sources consulted included the EIA portal, An Bord Pleanála, Laois County Council and Carlow County Council planning lists. The list was refined be eliminating all single homes from 2km outside the red line boundary of the Proposed Development and focused on planning applications of over 50 houses and planning applications which contained an EIAR or an NIS. This formed our cumulative long list of developments. Further refinement was undertaken to ascertain developments within this list. These refinements included:

- All wind farms and cable route planning applications within 20km where the planning status is to be determined, or where the construction period would likely coincide with the construction period of the Proposed Development;
- All infrastructural projects which are operational and utilising the same road networks that are proposed by the Proposed Development;
- All quarries within 2km of the Proposed Development red line boundary;
- All Strategic Infrastructure and Strategic Housing Developments within 20km where the same road network would be utilised;
- All Strategic Housing Development and Large Scale Residential Developments within 5km.

The result formulated the cumulative development short list. These are assessed for cumulative and in-combination effects in Table 9-17.

Table 9-17 Potential Cumulative Impact Developments in Proximity to the Proposed Development

Reg Ref	Applicant	Development Summary	Distance
20247 (Laois) Granted 19/11/2020	Michael Johnson	Restoration of a quarry- 15,000 tonnes per year	4km

Potential Effects:	Potential of impact on groundwater and surface water quality and quantity in the area.		
Cumulative Assessment	The construction phase of the Proposed Development may coincide with the operational (restoration) phase of the Michael Johnson quarry. However, as the quarry is located 4km from the Proposed Development the cumulative effect is low and of a short-term duration (less than 3 years). No mitigation is required.		
Reg Ref	**Applicant**	**Development Summary**	**Distance**
Laois (20281) / Carlow (20282) Date Granted: 15.02.2022	Bilboa Wind Farm	4.6 ('km') of underground cables within Carlow County Council ('CCC') boundary and 2.0km within Laois County Council ('LCC') boundary and associated works, new substation, upgrading of existing forestry track; construction of two new onsite access track, amendments to a crane hardstanding area; road strengthening and widening along an updated turbine delivery route,	17 km
Potential Effects:	Potential of impact on groundwater and surface water quality and quantity in the area.		
Cumulative Effects (if any)	The construction phase of the Proposed Development may coincide with construction phase of Bilboa Wind Farm. However, as the wind farm is located 17km from the Proposed Development, the predicted cumulative effect is low and of short-term duration (less than 3 years).No mitigation is required.		
Reg Ref	**Applicant**	**Development Summary**	**Distance**
PL11.232626 (ABP) / 13268 (Laois(Granted 14/6/2014	Cullenagh Wind Farm	develop 18 no. wind turbines each with a hub height of up to 85m and a rotor diameter of up to 93m with an overall tip height of up to 131.5m (including associated transformers and hardstands at each turbine) and all ancillary infrastructure	3.5 km
Potential Effects:	Potential of impact on groundwater and surface water quality and quantity in the area.		
Cumulative Effects (if any)	Cullenagh Wind Farm was permitted in 2014. However, the associated grid connection has is under assessment and is expected to be submitted for development consent in the coming months. It is therefore likely that the construction phases of the Proposed Development with the construction of Cullenagh wind farm will coincide near the same time. As the Wind Farm is located 3.5km from the Proposed Development, the predicted cumulative effect is low and of short term duration (less than 3 years). No mitigation is required.		
Reg Ref	**Applicant**	**Development Summary**	**Distance**
ABP-309293-21 / 19530 (Laois) 3rd Party appealed on 06/10/2022	Bord Na Móna Powergen Ltd.	Develop a Renewable Gas Facility, associated peat deposition area and external and internal road upgrades at Cúil Na Móna Bog within the townland of Clonboyne and Clonkeen, Portlaoise, Co. Laois. 1. Renewable Gas Facility (6.85 Ha) 2. Peat deposition and surrounding area (9.13Ha) 3. External road upgrades including proposed new roundabout, upgrade of R445 and local access road to existing site entrance - 660m in length (0.91Ha) 4. Internal upgrade of site access road - 443m in length (0.45Ha).	14 km
Potential Effects:	Potential of impact on groundwater and surface water quality and quantity in the area.		
Cumulative Effects (if any)	The construction phase of the Proposed Development may coincide with construction phase of the Renewable Gas Facility. However, as the Facility is located 14km from the Proposed Development, the predicted cumulative effect is low and of short-term duration (less than 3 years). No mitigation is required.		
Reg Ref	**Applicant**	**Development Summary**	**Distance**
21700 (Laois)(Under Appeal currently APB-314760-22)	Lagan Materials Limited (Spink Quarry)	the continued use and operation of the existing quarry including deepening of the quarry. comprising an extraction area of c. 14.5 ha within an overall application area of c. 19.6 ha. new site infrastructure, including portacabin site office / canteen, toilets, concrete batching plant and truck washdown facility, hydrocarbon interceptors, mobile crushing and screening plant, upgrading of the water management system, provision of holding tank for wastewater, and other ancillaries.	3 km

Potential Effects:	Potential of impact on groundwater and surface water quality and quantity in the area.		
Cumulative Effects (if any)	The construction stage of the Proposed Development may coincide with the operational phase of the Spink quarry. However, as the quarry is located 3km from the Proposed Development the cumulative effect is low and of a short-term duration (less than 3 years). No mitigation is required.		
Reg Ref	**Applicant**	**Development Summary**	**Distance**
PL11.248518 (ABP) / 16/260 (Laois) Granted 03/09/2021 ABP-308448-20 Granted 22/11/2021 PL10.248392 (ABP) /17/62 (Laois) Granted 03/09/2019	Pinewoods Wind Farm (3 applications)	11 wind turbines, electricity substation, switch room, equipment compound, site access tracks, 7 site entrances, meteorological mast, upgrade of road junction. Townlands: Knockardugar, Boleybawn, Garrintaggart, Ironmills, Co. Laois A 110kv 'loop in/loop-out' Air-Insulated Switchgear substation, electricity lines, on-site access tracks and all associated site development works. Townlands: Knockardagur, Ballinakill, County Laois 2 kilometres of site access tracks, underground electricity and communications cabling and site drainage works. Townlands: Lands at Crutt, County Kilkenny.	11km
Potential Effects:	Potential of impact on groundwater and surface water quality and quantity in the area.		
Cumulative Effects (if any)	The construction phase of the Proposed Development may coincide with construction phase of Pinewoods Wind Farm. As the Wind Farm is located 11km from the Proposed Develpment, the predicted cumulative effect is low and of short term duration (less than 3 years). No mitigation is required.		

9.11 Conclusion

This chapter has presented an assessment of the potential impacts of the Proposed Development on surface water and groundwater.

The north of the area is within the Barrow catchment (ID 14) and the surface water bodies are comprised of the tributaries of Stradbally River and Crooked River. The Crooked River joins the Stradbally River approximately 6.7 km north of the site.

The southern extent of the site is part of the Nore catchment (ID 15) with tributaries of the river Owveg to the west of the site, and River Clough to the south of the site traversing this area.

The site drains into the tributaries of the River Barrow and River Nore. River Barrow and River Nore SAC are approximately 8.1km downstream of the northern cluster and approximately 3.3km downstream of the southern cluster.

Under the WFD, all watercourses receiving surface runoff from the site are classified as being of good status based on its physio-chemical and biological quality, apart from Clogh_010 which is classified as 'Moderate' and 'At Risk'.

The proposed turbine T2 is located within the SO area of Kyle & Orchard Spring Water Supply Scheme. A groundwater monitoring well has been installed nearby to monitoring groundwater quality in January of 2023.

Swan Water Supply Scheme is approximately 110m south of the proposed turbine T12 and no significant effects are envisaged.

From the baseline study undertaken here, the following water environment sensitive receptors were identified in the receiving environment:

- Water courses across the site, tributaries of the River Barrow and River Nore;
- Locally important and poorly productive bedrock aquifers beneath the Site;
- Orchard Spring Public Water Supply;

- Swan Water Supply Scheme;
- Local groundwater supply wells in the surrounding area.

The design of the Proposed Development considered a range of best practice construction measures to ensure avoidance and reduction of impacts throughout the construction, operational and decommissioning phases. Additional measures were also developed to mitigate the potential impacts identified on the water environment receptors.

This chapter comprehensively assesses all scenarios within the Turbine Range which is described in section 3.8.2 of Chapter 3 of this EIAR. The potential impacts that could arise from the Proposed Development during the construction, operational and decommissioning phases are set out in this conclusion. There will be no change to the potential impacts or predicted effects irrespective of which turbine is selected within the Turbine Range. Although there are slight changes to the effects associated between hub heights [99m] and rotor diameter [162m] compared to hub height [102.5m] and rotor diameter [155m] relating to a difference in MW output per turbine of 6.6MW to 7.2MW, such changes are not assessed to be alter the significance of the effects. As such, the predicted significance of the effect applies to all permutations with the range.

With mitigation measures in place at the Site, the significance of potential impacts during the construction and operational stage will be reduced to “slight” or lower to the water environment receptors.

9.12 Figures

Figure 9-1 Existing and Proposed Watercourse Crossings

646000 648000 650000 652000 654000 656000 658000 660000 662000 664000

694000 692000 690000 688000 686000

N

Option 2
Option 1
TCC1
TCC2
T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13

0 0.5 1
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)
- Existing Watercourse Crossing
- Proposed Watercourrse Crossing
- Watercourse
- Watercourse 50 m Buffer

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EXISTING AND PROPOSED WATERCOURSE CROSSINGS

FIGURE 9-1-a

Scale	Date
1:60,000 @ A3	JUNE 2023

02036.00787.0099.0 Existing and Proposed Watercourse Crossings

656000

688000

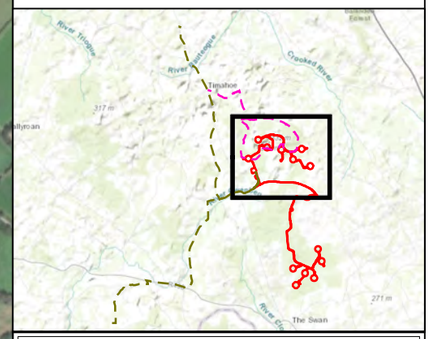
N

T1
T2
T3
T4
T5
T6
T7
TCC1
WF-HF1
WF-HF2
WF-HF3
WF-HF4
Horay
Fossy Lower
Owveg
Fallowbeg Upper Stream

0
0.5
1
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Access Track
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)
- Existing Watercourse Crossing
- Proposed Watercourrse Crossing
- Watercourse
- Watercourse 50 m Buffer



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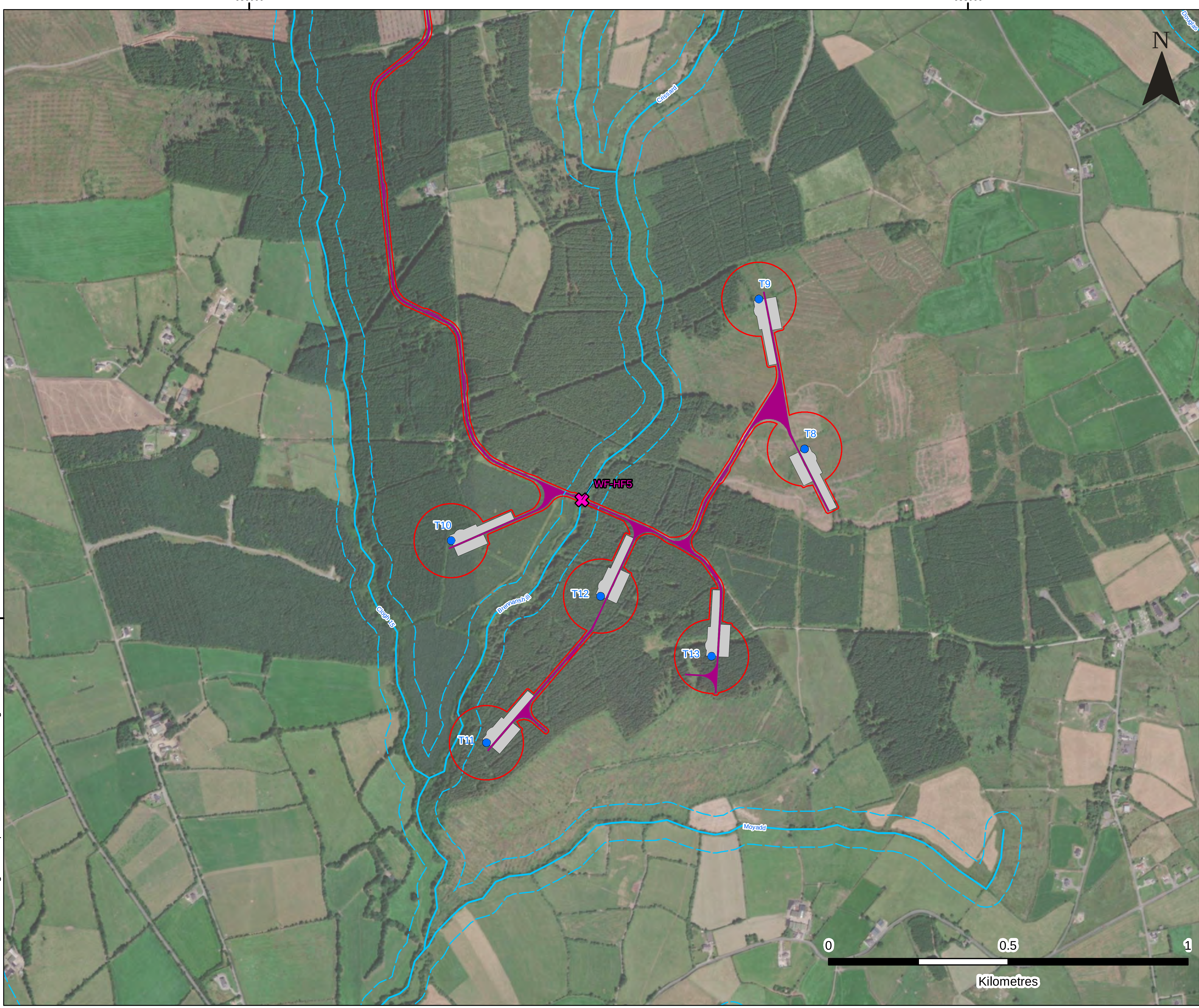
EXISTING AND PROPOSED WATERCOURSE CROSSINGS

FIGURE 9-1-b

Scale 1:10,000 @ A3

Date JUNE 2023

02036.00787.0099.0 Existing and Proposed Watercourse Crossings



LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Hardstanding
- Proposed Access Track
- Existing Watercourse Crossing
- Watercourse
- Watercourse 50 m Buffer

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EXISTING AND PROPOSED WATERCOURSE CROSSINGS

FIGURE 9-1-c

Scale	Date
1:10,000 @ A3	JUNE 2023

02036.00787.0099.0 Existing and Proposed Watercourse Crossings

Figure 9-2 Surface Water Catchment

650000 655000 660000

690000

685000

02036.00787.0100.0 Surface Water Catchment Map

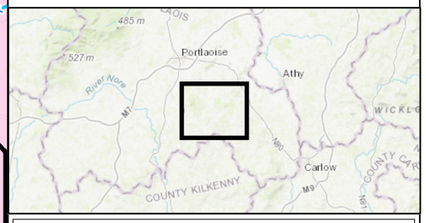
N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Access Track
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)
- Watercourse
- Catchment Boundary
- River Sub-Basin Boundary

Sub-Catchment Boundary

- Barrow_SC_020
- Barrow_SC_050
- Barrow_SC_070
- Dinin[North]_SC_010
- Nore_SC_040
- Nore_SC_060



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WATER

SURFACE WATER CATCHMENT

FIGURE 9-2

Scale 1:40,000 @ A3

Date JUNE 2023

0 1 2 Kilometres

Figure 9-3 Surface Water Monitoring Locations

650000

655000

660000

690000

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Access Track
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)
- Watercourse

Surface Water Monitoring Locations (Last Recorded Q-Value)

- Q4 - Q5 Unpolluted
- Q3 - Q4 Slightly Polluted

RS14S020050
RS14S020040
RS14S020030
RS14C020400
RS14C020200
RS15B010030
RS15O010060
RS15O010080
RS15O010050
RS15O010100
RS15C030100

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13

Option 1
Option 2

0 1 2
Kilometres

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SURFACE WATER MONITORING LOCATIONS

FIGURE 9-3

Scale 1:40,000 @ A3

Date JUNE 2023

02036.00787.0102.0 Surface Water Monitoring Locations

Figure 9-4 Bedrock Aquifer and Karst Features

650000
655000
660000
690000
685000

Option 2
Option 1

T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13

N

0
1
2
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Access Track
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)

Karst Feature

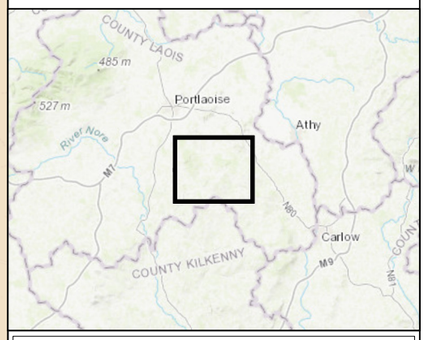
- Cave
- Spring
- Bedrock Fault

Gravel Aquifer

- Locally Important Gravel Aquifer

Bedrock Aquifer

- Regionally Important Aquifer - Karstified (Diffuse)
- Locally Important Aquifer - Bedrock Which is Generally Moderately Productive
- Poor Aquifer - Bedrock Which is Generally Unproductive Except for Local Zones
- Poor Aquifer - Bedrock Which is Generally Unproductive



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ENVIRONMENTAL IMPACT
ASSESSMENT REPORT

WATER

BEDROCK AQUIFER AND KARST FEATURES

FIGURE 9-4

Scale 1:40,009 @ A3

Date JUNE 2023

02036.00787.0133.0 Bedrock Aquifer

Figure 9-5 Groundwater Vulnerability

650000

655000

660000

690000

685000

02036.00787.0104.0 Groundwater Bodies

N

Option 2

Option 1

T1

T2

T3

T4

T5

T6

T7

T8

T9

T10

T11

T12

T13

0 1 2

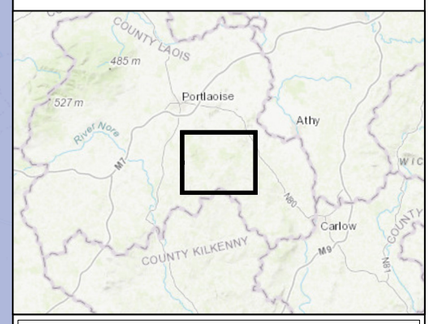
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Access Track
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)

Groundwater Bodies

- Gravel
- Karstic
- Poorly Productive Bedrock
- Productive Fissured Bedrock



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GROUNDWATER BODIES

FIGURE 9-6

Scale 1:40,000 @ A3

Date JUNE 2023

Figure 9-6 Groundwater Bodies

650000

655000

660000

690000

N

Option 2

Option 1

T1

T2

T3

T4

T5

T6

T7

T8

T9

T10

T11

T12

T13

Fossy Hill

Timahoe

Cullenagh Mountain 317 m

Rock of Cashel

Dooary Cross

McCoy's Cross

Graigue Cross

Phelim's Cross

Keating's Cross

Dysart Cross

Cooper's Hill

Lagan Macadam Quarry

The Municipal District of Portlaoise

The Municipal District of Graiguecullen - Portarlington

County Laois

County Kilkenny

R426

R430

R420

L3777

L3838

L3839

L7853

L3850

L3856

L3858

L3859

L3870

L7797

N80

0

1

2

Kilometres

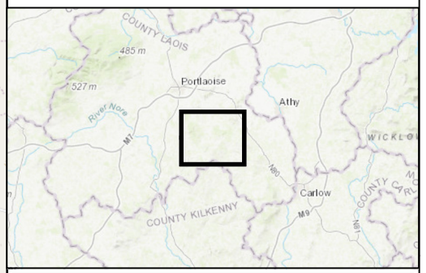
LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Access Track
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)

Public Supply Protection Area

- SI - Inner Protection Area
- O - Outer Protection Area
- GSI Groundwater Supply Wells
- Groundwater Monitoring Well BH T2

Note
Private Water Supply Well circle repesents the area in which a well may be located within. 1-2 km Accuracy Wells not included.



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GSI GROUNDWATER SUPPLY WELLS AND GROUNDWATER MONITORING WELLS

FIGURE 9-7

Scale 1:40,000 @ A3

Date JUNE 2023

02036.00787.0105.0 Groundwater Supply Wells and Groundwater monitoring Well

Figure 9-7 Groundwater Supply Wells and Groundwater Monitoring Well

650000 655000 660000

690000

685000

Option 2

Option 1

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13

TCC1 TCC2

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Substation Compound
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Access Track
- Proposed Met Mast Hardstanding
- Proposed Cable Routes to be Assessed (Separate Planning Application)
- Proposed Recreational Amenity Trail to be Assessed (Separate Planning Application)

Groundwater Vulnerability

- Extreme Vulnerability
- High Vulnerability
- Medium Vulnerability
- Low Vulnerability
- X - Rock at or Near Surface

0 1 2 Kilometres

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GROUNDWATER VULNERABILITY

FIGURE 9-5

Scale 1:40,000 @ A3

Date JUNE 2023

02036.00787.0103.0 Groundwater Vulnerability

Appendix 9

1. EU Directives / National Legislation and Regulations / Guidelines / Technical Standards

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29 June 2023

European Directives

Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014;

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy;

Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration;

Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks; and

Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries.

Irish Government Acts, National Legislation and Regulations

S.I. No. 349 of 1989, European Communities (Environmental Impact Assessment) Regulations, and subsequent amendments (S.I. No. 84 of 1994, S.I. No. 352 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001);

The Planning and Development Acts, 2000 to 2009, The Planning and Development (Amendment) Act 2010, S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments including, S.I. No. 364 of 2005 and S.I. 685 of 2006.

National legislation on the protection of the water environment. Since 2000 water management in EU member states has primarily been directed by the Water Framework Directive (2000/60/EC) and the associate 'daughter' Groundwater Directive (2006/118/EC). Irish legislation implementing these, and other relevant directives currently includes:

S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 and amendments (S.I. No. 389 of 2011 and S.I. No. 149 of 2012);

European Union (Drinking Water) Regulations 2014 (S.I. No. 122 of 2014);

S.I. No. 278 of 2007 European Communities (Drinking Water) (No. 2) Regulations;

S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009 and amendment (S.I. No. 327 of 2012);

S.I. No. 684 of 2007 Waste Water Discharge (Authorisation) Regulations, 2007, as amended (S.I. No. 231 of 2010);

S.I. No. 122 of 2010 European Communities (Assessment and Management of Flood Risks) Regulations 2010;

S.I. No. 457 of 2008 European Communities (Environmental Liability) Regulations which bring into force the European Liability Directive (2004/35/EC);

European Union (Planning and Development) (Environmental Impact Assessment) (No. 2) Regulations 2018 (S.I. No. 404 of 2018);

Local Government (Water Pollution) Acts 1977 to 1998;

European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988);

European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268 of 2006) and amendments (S.I No. 55 and 464 of 2009), and;

Bathing Water Quality Regulations, 2008 (S.I. No. 79 of 2008) and amendments (S.I No. 351 of 2011 and S.I. No. 163 of 2016);

Guidelines

DEHLG (2019). Draft Revised Wind Energy Development Guidelines

Irish Wind Energy Association (2012): Best Practice Guidelines for the Irish Wind Energy Industry

CIS (2007). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC) Guidance on preventing or limiting direct and indirect inputs in the context of the Groundwater Directive 2006/118/EC. Guidance Document No. 17.

CIS (2010). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC). Guidance on risk assessment and the use of conceptual models for groundwater. Guidance document No. 26.

DEHLG (2004). National Urban Waste Water Study. National Report.

DEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities.

DELG/EPA/GSI (1999). Groundwater Protection Schemes. Document prepared jointly by the Geological Survey of Ireland (GSI), the Environmental Protection Agency, and the Department of Environment, Heritage and Local Government.

EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

EPA (2010b). Methodology for Establishing Groundwater Threshold Values and the Assessment of Chemical and Quantitative Status of Groundwater, Including and Assessment of Pollution Trends and Trend Reversal.

EPA (2011). Guidance on the Authorisation of Discharges to Groundwater. Version 1, December 2011.

EPA (2003). Towards Setting Guideline Values for the Protection of groundwater in Ireland. Interim Report.

EPA (2006). Ireland Water Framework Directive Monitoring Programme.

Fitzsimons, V., Daly, D. and Deakin, J. (2003). Draft GSI guidelines for assessment and mapping of groundwater vulnerability to contamination. Groundwater Chapter, Geological Survey of Ireland.

GSI (2006). Criteria used in aquifer classification. Available from http://www.gsi.ie/Programmes/Groundwater/Aquifer+Classification.htm

IGI (2007). Guidelines on Water Well Construction. Available from http://www.gsi.ie/Programmes/Groundwater/Aquifer+Classification.htm

Kilroy, G., Dunne, F., Ryan, J., O'Connor, A., Daly, D., Craig, M., Coxon, C., Johnston, P. and Moe, H. (2008). A Framework for the Assessment of Groundwater – Dependent Terrestrial Ecosystems under the Water Framework Directive. Environmental Research Centre Report Series No. 12.

Institute of Geologists of Ireland, 2007. Recommended collection, presentation and interpretation of geological and hydrogeological information for quarry developments.

Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in an Adjacent to Waters.

DEHLG (2009). The Planning System and Flood Risk Management- Guidelines for Planning Authorities.

RDEHLG (2018). River Basin Management Plan 2018-2021.

DAFM (2017), Felling and Reforestation Policy

DAFM (2019). Standards for Felling and Reforestation

DAFM (2015). Forestry Standards Manual

Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010).

Wind Energy Development Guidelines for Planning Authorities (2006)

Technical Standards

British Standards (2015). Code of Practice for Ground Investigations BS5930:2015.

CIRIA (2007). The SuDS Manual. (C697). CIRIA publication, February 2007.

CIRIA (2015). Environmental good practice on site guide (C741)

CIRIA (2001). Control of water pollution from linear construction projects (C648)

SLR Standard operating Procedures (SoP) for surface water and groundwater sampling:

- 090330 Hydro SOP Number 1107 0 V 1 0 Drilling Supervision & Monitoring Well Construction;
- 090330 Hydro SOP Number 1102 0 V1 0 Surface Water Sampling;
- 201015 Hydro SOP 1101 V3 Groundwater Sampling;

2. Water Framework Directive

Chapter 9: Water

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Coolglass Wind Farm Limited

SLR Project No.: 501.V00727.00006

29 June 2023

Introduction

The EU Water Framework Directive6 (WFD) became EU law in December 2000 and provides for a single European framework to assess water quality (Ecological status) and allows for the comparison of results across European Member States.

The WFD covers rivers, lakes, estuaries or transitional waters, coastal waters as well as groundwaters.

Surface waters are classified into five quality classes (Ecological status) under the WFD; High, Good, Moderate, Poor and Bad Ecological status. Groundwater is classified into just two quality classes, Good and Poor Ecological status. High Ecological status is when the water is unpolluted, while at the opposite end of the classification Bad Ecological status is when the water is highly polluted.

The WFD required baseline water quality in all waterbodies to be established for biological, chemical and hydromorphology quality. These three quality variables are combined to give the overall Ecological status classification of the waterbody; good or high ecological status and good chemical status for surface waters and good chemical and quantitative status for groundwaters.

The two principal objectives of the WFD are:

that all water bodies must reach at least 'Good' overall status by 2027, at the latest. For surface waters, good overall status is a combination of good ecological status (or potential) and good chemical status; and

that the status of each water body, including all the quality elements which make up the overall status, must not deteriorate relative to the baseline reported in the relevant RBMP.

The WFD identifies where actions are required to achieve Good Ecological status or maintain waterbodies which are already Good or High Ecological status. Waterbodies can be restored to Good and High Ecological status by using targeted actions and measures to reduce the impact of human activities on them.

For heavily modified or artificial water bodies, which are incapable of achieving Good Ecological status without impairing an existing specified water use, the environmental objective is to achieve good ecological potential.

The WFD requires that management plans are prepared on a river basin basis and specifies a structured method for developing these plans.

River Basin Management Plans

The River Basin Management Plans (RBMP) provide a single system of water management based on the natural delineation of river catchments and is the method by which the aims of the WFD are achieved.

For each river basin district in Ireland a RBMP needs to be established and updated every six years, to provide the context for the co-ordination requirements of the WFD key aims which are to:

Provide for protection to all waters, surface waters and groundwater;

achieving Good Ecological status for all waters by 2027;

establish water management measures based on river basin catchment areas;

establish a combined approach of emission limit values and quality standards for waters;

involving citizen more closely in the WFD and RMBMP; and

streamlining and aligning national legislation.

The RBMP provides a detailed account of how the objectives set for each river basin in terms of ecological status, quantitative status, chemical status and protected area objectives are to be

[6] **Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.**

reached within the timescale of the plan. The plans include the results of the catchment analysis including the river basin's characteristics, a review of the impact of human activity on the status of waters in the basin, estimation of the effect of existing legislation and the remaining gap to meeting these objectives; and establish a set of measures designed to meet the objectives.

River Basin Management Plan for Ireland 2022-2027

The current RMBP report for Ireland is at the draft stage[7]. The draft report states that while substantial progress has been made in the management of water services and how we work together to protect, restore and improve water quality with the improvement in some areas and aspects of water quality, many waterbodies are still subject to mounting environmental pressures and overall water quality is in decline primarily due to nutrient pollution.

The RMBP states that due to the overall decline in water quality stronger measures are now required which will improve overall water quality; the sustainable management of water resources is important to address and adapt to the impacts of climate change, with many of the required measures having co-benefits for climate mitigation and biodiversity. Protecting and restoring water quality in Ireland will most of all need measures to address:

the loss of agricultural nutrients to water;

continue to improve waste water treatment; and

to re-establish natural free-flowing conditions in more rivers.

The plan states that Ireland's water resources and services face challenges on a number of fronts including a continued need for investment in infrastructure and an ever increasing demand for water services due to urbanisation, population and economic growth. These challenges are set against a backdrop of widespread, rapid, and intensifying climate change.

[7] Draft River Basin Management Plan for Ireland 2022-2027, Government of Ireland

3. Flood Risk Assessment – Stage 1 and 2

Chapter 9: Water

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29 June 2023

4. Groundwater Sampling Field Record Sheets

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5. Surface Water and Groundwater Screening

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6. Surface Water and Groundwater Laboratory Reports

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7. Borehole Logs

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8. Rating of Existing Environmental Significance / Sensitivity (IGI, 2013 Guidelines)

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9. Description of Effects (EPA, 2022)

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10. Classification of the Significance of Impacts (EPA, 2022)

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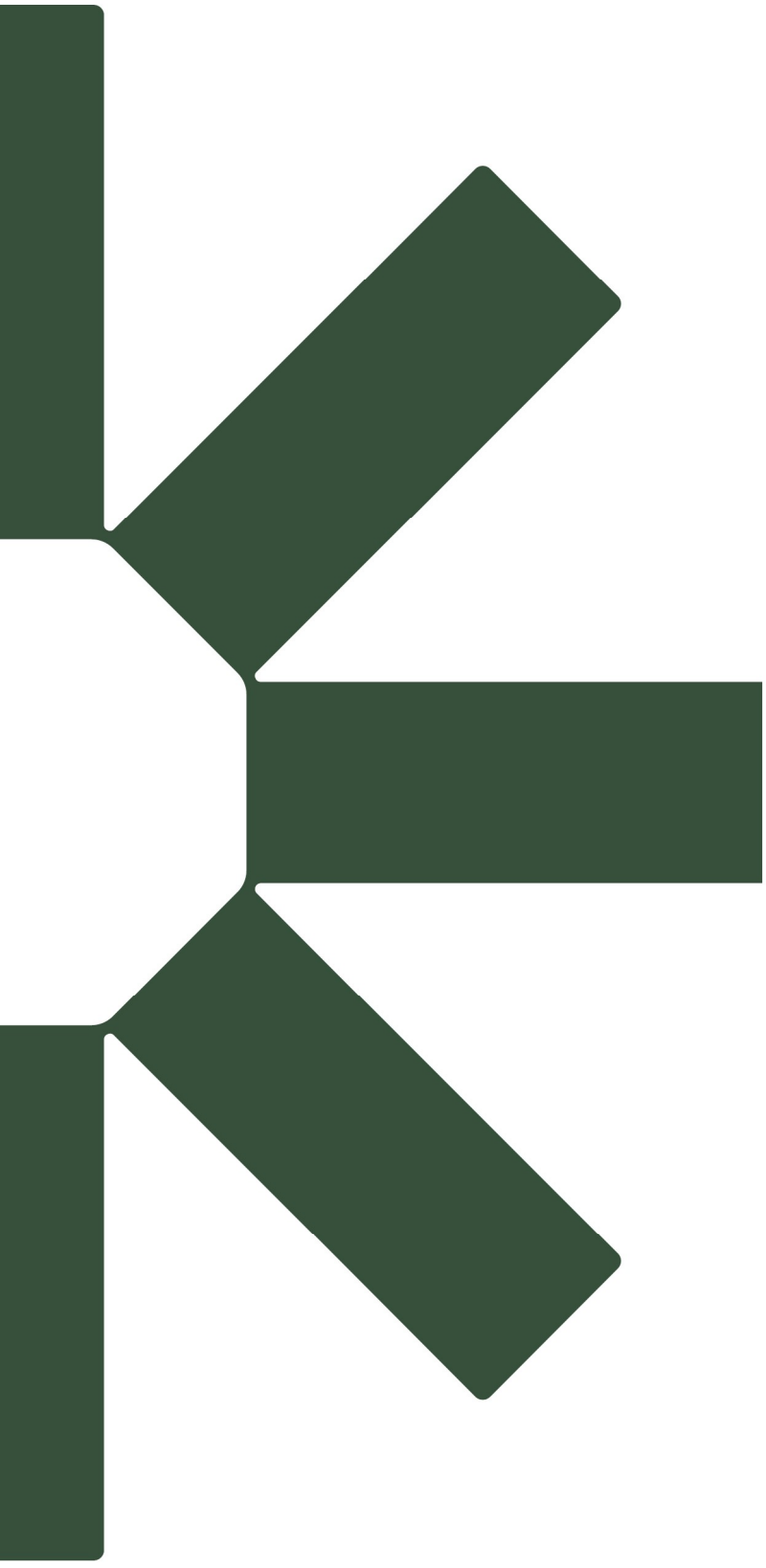

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