Appendix 11

EIAR Chapter 12 - Hydrology

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DERRYNADARRAGH WIND FARM, CO. KILDARE, OFFALY & LAOIS

Volume II – Main EIAR

Chapter 12 – Flooding, Hydrology and Water Quality

Prepared for:

Dara Energy Limited

Dara Energy Limited

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Unit 3/4, Northwood House, Northwood Crescent,
Northwood, Dublin, D09 X899, Ireland

T: +353 1 658 3500 | E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

12. HYDROLOGY AND WATER QUALITY

12.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) examines the likely effects of the Proposed Development on Hydrology and Water Quality. The chapter includes a description of the existing environment in respect of hydrology and water quality and considers the likely significant effects arising from the Proposed Development during construction, operation and decommissioning.

This chapter of the EIAR is supported by Figures in Volume IV, Planning Drawings accompanying the planning application and the following Appendix documents provided in Volume III:

- Appendix 2.1: Construction Environmental Management Plan (CEMP)
- Appendix 2.2: Biodiversity Enhancement Management Plan (BEMP)
- Appendix 2.3: Turbine Delivery Route Assessment
- Appendix 2.4: Turbine Delivery Route Nodes at 5 no. locations

Common terms and acronyms used throughout this EIAR can be found in Appendix 1.4, Volume III of this EIAR.

The Proposed Development assessed in this EIAR comprises the following elements:

- The 'Proposed Wind Farm' (also referred to in this EIAR as the '**Site'**);
- The 'Proposed Grid Connection' (also referred to in this EIAR as the '**GC'**);
- The 'Turbine Delivery Route' (also referred to in this EIAR as the '**TDR'**);
- The 'Biodiversity Enhancement Management Plan Lands' (also referred to in this EIAR as the 'BEMP Lands').

The Site Location of the Proposed Development is shown in Figure 2.1, Volume IV of this EIAR. The general layouts of the Proposed Wind Farm, Proposed Grid Connection, and Turbine Delivery Route are presented in Figures 2.2 to 2.4, Volume IV of this EIAR.

12.1.1 Study Area

The Study Area for hydrology and water quality comprises catchments, sub-catchments and sub-basins within which the Proposed Development is located, along with their associated waterbodies (refer to Figure 12.1, Volume IV). The delineation of the catchments and their waterbodies is defined by the latest "Cycle 3" Water Framework Directive (WFD) (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) reporting and can be viewed via https://www.catchments.ie/ and https://gis.epa.ie/EPAMaps/Water. The characteristics and associated hydrological features of the catchments within which the Site, GC and TDR are located are addressed within this Chapter and are listed in Table 12-1 .

Table 12-1: WFD delineated waterbodies at the Site

Catchment	Sub-catchment	Sub-Basin
The Barrow Catchment (Hydrometric Area 14)	Barrow_SC_040	FIGILE_070
		FIGILE_080

The Site is contained wholly within the one sub-catchment, the Barrow_SC_040. The Site covers two sub-basins, the FIGILE_070 and the FIGILE_080. This is considered the main study area; however, the GC and the TDR cross several other waterbodies which are also considered as an extension of the study area.

As well as the Barrow Catchment (Hydrometric Area 14), the TDR also extends into the Lower Shannon (Hydrometric Area 25A). Within the Lower Shannon Catchment, the TDR crosses the Tullamore_SC_010, the Silver[Tullamore]_SC_010 and the Brosna_SC_020 sub-catchments.

The GC extends into the Barrow_SC_050 and the Barrow_SC_020 sub-catchments.

Groundwater and hydrogeology are addressed in Chapter 11 - Soils, Geology and Hydrogeology, Volume II.

12.2 Statement of Authority

This chapter has been prepared by Mr. Brian Cronin and reviewed by Mr. Pablo Delgado of Fehily Timoney and Company.

Brian Cronin is a Senior Environmental Scientist with a BSc in Environmental Science from University College Cork and an MSc in Environmental Engineering from Trinity College Dublin. He is member of the Institution of Engineers of Ireland (MIEI). Brian has 10 years of postgraduate experience, with four years working in contaminated land and remediation consulting; and more recently, three years working in Environmental Impact Assessment. He has experience working on various renewable energy projects preparing chapters of the EIAR for wind farms, specialising in various disciplines including hydrology and water quality.

Pablo Delgado, a Chartered Civil Engineer, has accumulated more than 8 years of professional experience in the hydraulic engineering domain. His specific area of expertise lies in the planning, design, and construction of hydraulic infrastructure projects, where he closely collaborates with Clients and Contractors. Pablo's primary focus centres around producing practical and efficient designs while proactively addressing any challenges that may arise throughout the project's execution. He possesses extensive knowledge in hydraulic design, enabling him to develop industry-leading guidelines and exhibit a high level of proficiency in drainage design, standards, and tools. Additionally, Pablo has a successful track record of delivering drainage designs within diverse project environments such as Design and Build (D&B) and Public-Private Partnership (PPP), including contributions to hydrologic and hydraulic chapters for Environmental Impact Assessments (EIA). His project portfolio encompasses engagements in the United Kingdom, Ireland, and Spain.

12.3 Methodology

The following sources of information were considered in this assessment:

- The design layout of the proposed project.
- Published literature as described in Section 12.3.1 and 12.3.1.1 below.
- A desk-based assessment of the surface water hydrology in the catchments relevant to the wind farm, including an assessment of the watercourses which will be intercepted by the layout of the wind farm and those which will receive surface water run-off from the proposed wind farm development.
- A field assessment of the existing hydrological environment, to both verify desk-based assessment and record all significant hydrological features was undertaken.

12.3.1 Relevant Legislation and Guidance

12.3.1.1 Policy and Legislation

The following policies and legislation have been considered in the development of this chapter to identify relevant objectives relating the surface water.

- EU Water Framework Directive (2000/60/EC);
- River Basin Management Plan for Ireland 2022-2027;
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities, Nov 2009;
- Offaly County Development Plan 2021-2027;
- Kildare County Development Plan 2023-2029;
- Laois County Development Plan 2021–2027.

Directive 2000/60/EC (WFD - Water Framework Directive) of the European Parliament and Council established a framework for community action in the field of water policy. The WFD requires EU member states to aim to reach good chemical and ecological status for surface and ground waters; with good ecological status for surface waters and good quantitative status for groundwaters. The WFD established a strategic framework for managing the water environment and requires a River Basin Management Plan (RBMP) to be developed every six years. River Basin Management Plan 2018-2021[1] has been prepared by Department of Housing, Planning and Local Government which sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in waterbodies (rivers, lakes, estuaries and coastal waters) by 2027.

The Third Cycle River Basin Management Plan 2022-2027 was published in September 2024. The Plan outlines the intended rollout of guidelines for planning authorities on the relationship between physical planning and river basin management planning.

The WFD has been transposed into Irish law.

[1] Department of Housing, Local Government and Heritage, River Basin Management Plan for Ireland, 2017. Available online here: gov.ie - River Basin Management Plan 2018 - 2021 (www.gov.ie) Accessed March 2023.

County Development Plans

The County Development plans for Laois, Offaly and Kildare have been reviewed and these plans have informed the preparation of this EIAR chapter.

Offaly County Development Plan 2021-2027

Cognisance was taken of particular guidance on hydrology from the policies and objectives of the Offaly County Development Plan 2021-2027 (the CDP). The CDP lays down specific policies in relation to surface water run-off and flooding as follows:

- **WSP-01: Efficient and Sustainable Use of Water Resources:** It is Council policy to ensure the efficient and sustainable use and development of water resources and water services infrastructure in order to manage and conserve water resources in a manner that supports a healthy society, economic development requirements, a cleaner environment and climate change mitigation.

- **WSP-07: Protection of Natura 2000 Network:** It is Council policy to ensure the delivery and phasing of services in the county is subject to the required appraisal, planning and environmental assessment processes and shall avoid adverse impacts on the integrity of the Natura 2000 network. (This indirectly relates to water quality as many Natura 2000 sites are water-dependent or sensitive to water pollution).

- **WSP-08: Groundwater Quality Assessment for Subsurface Exploration:** It is Council policy to ensure any proposal for geothermal or other energy subsurface exploration is accompanied by an assessment that addresses the potential impacts on groundwater quality.

- **WSP-11: Water Conservation and Demand Management:** It is Council policy to promote the conservation and sustainable use of water in existing and new development within the county and to encourage demand management measures among all water users including rainwater harvesting and grey water recycling.

- **WSP-14: Elimination of Untreated Discharges:** It is Council policy to co-operate and support Irish Water to eliminate untreated discharges from settlements in the short-term, while planning strategically for long-term growth in tandem with Project Ireland 2040 and in increasing compliance with the requirements of the Urban Waste Water Treatment Directive.

In addition, the Development Management Standards chapter (Chapter 13) of the CDP promotes the inclusion of sustainable urban drainage systems (SuDS) in developments, which helps manage surface water runoff and can contribute to water quality.

Kildare County Development Plan 2023-2029

As the site boundary extends into County Kildare, the CDP for Kildare was also reviewed (Kildare County Development Plan 2023-2029). The Kildare CDP sets out objectives relating to hydrology and water quality as follows:

- **IN O57 (Assess Applications):** Assess applications for developments, having regard to the impact on the quality of surface waters and any targets and measures set out in the River Basin Management Plan and any subsequent local or regional plans.
- **IN O58 (Site-Specific Assessments):** Require development proposals which may have an impact on water quality to undertake site-specific assessments to determine localized pressures and demonstrate suitable mitigation measures to protect water quality.

- **GO 15 (Groundwater Abstractions):** Ensure that groundwater abstractions that form part of planning applications do not negatively impact on the hydrology of any sensitive areas, particularly European Sites.
- **GO 24 (Water/Wastewater Services):** Liaise with Irish Water to provide adequate water and wastewater services to meet the development needs of each settlement within the Plan period.

River Basin Management Plan: The plan is informed by and aligns with the latest River Basin Management Plan (the Water Action Plan), with inspections to be carried out by Kildare County Council (KCC) in relation to water quality targets.

Protection of European Sites: Avoid encroachment on European Sites and implement buffer zones where feasible to protect their hydrological integrity.

Water Quality Monitoring: Continue to monitor water quality at selected locations in co-operation with relevant agencies.

The Kildare County Development plan puts a strong emphasis on SuDS, similar to what was noted when reviewing the CDP for County Offaly.

Laois County Development Plan 2021-2027

The Laois County Development Plan 2021-2027 includes the following objectives relevant to the preparation of this chapter:

- **CS 03**: In the assessment of development proposals, to take account of transport corridors, environmental carrying capacity, availability and/or capacity to provide waste water and water supply services, potential to conflict with Water Framework Directive objectives, potential to impact on the integrity of European sites and Annexed Habitats and species, features of biodiversity value including ecological networks, impact on landscape and visual characteristics, education and other socioeconomic objectives.

- **NRE 3**: Ensure the provision, where feasible, of electricity cables been located underground, especially in the urban environment, and generally within areas of public open space. Where undergrounding of cables is being pursued, proposals should demonstrate that environmental impacts including the following are minimised:
    - Habitat loss as a result of removal of field boundaries and hedgerows (right of way preparation) followed by topsoil stripping (to ensure machinery does not destroy soil structure and drainage properties);
    - Short to medium term impacts on the landscape where, for example, hedgerows are encountered;
    - Impacts on underground archaeology;
    - Impacts on soil structure and drainage; and
    - Impacts on surface waters as a result of sedimentation

- **NRPO 9:** Encourage and facilitate the development of green infrastructure that recognises the synergies that can be achieved with regard to the following:
    - Provision of open space amenities;
    - Sustainable management of water;
    - Protection and management of biodiversity;
    - Protection of cultural heritage;
    - Protection of protected landscape sensitivities

- **SWD 7:** Ensure that all storm water generated in a new development is disposed of on-site or is attenuatedandtreatedpriortodischargetoanapprovedstormwatersystem
- **SWD 8:** Promote storm water retention facilities for new developments and to incorporate design solutions that provide for collection and recycling of surface water in accordance with Sustainable Urban Drainage Systems as recommended in the Planning System and Flood Risk Management: Guidelines for Planning Authorities(DoEHLG,2009) and Laois County Council's Roads and Drainage Standards, or as amended.

12.3.1.2 Relevant Guidance

The following guidance have been considered in the development of this chapter to identify relevant objectives relating the surface water.

- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environmental Protection Agency (EPA), May 2022;
- The Planning System and Flood Risk Management - Guidelines for Planning Authorities - Department of Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW), November 2009
- Environmental good practice on site guide (fourth edition) (C741) - Construction Industry Research and Information Association (CIRIA), January 2015.
- Best Practice Guide BPGCS005 Oil Storage Guidelines (Enterprise Ireland)
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (National Roads Authority, 2005)
- Guidelines on Planning for Watercourses in the Urban Environment (Inland Fisheries Ireland, 2020)
- Guidelines on protection of fisheries during construction works in and adjacent to waters' to allow cable construction (Inland Fisheries Ireland, 2016)
- Good Practice During Wind Farm Construction (Scottish Natural Heritage 2019)
- The SuDS Manual (C753) - Construction Industry Research and Information Association (CIRIA), 2015
- Control of water pollution from linear construction projects (C648) – Construction Industry Research and Information Association (CIRIA), 2006;
- Control of water pollution from construction sites. Guidance for Consultants and Contractors (C532) - Construction Industry Research and Information Association (CIRIA), December 2001
- UK Guidance for Pollution Prevention (GPP):
- GPP2: Above ground oil storage tanks (Natural Resources Wales (NRW), Northern Ireland Environment Agency (NIEA), the Scottish Environment Protection Agency (SEPA), Energy Institute, Oil Care Campaign, June 2021)
- GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer (NRW, NIEA, SEPA, November 2017)
- GPP5: Works and maintenance in or near water (NRW, NIEA, SEPA, January 2017)
- GPP8: Safe storage and disposal of used oil (NRW, NIEA, SEPA, July 2017)
- GPP21: Pollution Incident Response Plans (NRW, NIEA, SEPA, July 2017)
- GPP22: Dealing with Spills (NRW, NIEA, SEPA, October 2018)
- GPP26: Safe storage of Drums and intermediate Bulk Containers (IBCs), (NRW, NIEA, SEPA, February 2019)
- GE-INT-01203- Introduction to the NRA Design Manual for Roads and Bridges (Transport Infrastructure Ireland, December 2013)
- Coillte (2013): Forest Operations & Water Protection Guidelines.
- Planning Regulatory Guidelines on EIA 2018
- https://www.opr.ie/wp-content/uploads/2019/08/2018-Environmental-Impact-Assessment-1.pdf

12.3.2 Desk Study

The desk-based study assessed the surface water hydrology and water quality in the catchments relevant to the Project, including an assessment of the watercourses that will be crossed (through culvert or bridge) by the road infrastructure and those that will receive surface water runoff from the layout of the Site, GC and TDR. The desk study involved an examination of the hydrological aspects and water quality aspects using the following sources of information (last accessed July 2025):

- Ordnance Survey Ireland mapping.
- Science and Stories about Integrated Catchment Management (https://www.catchments.ie/).
- OPW Indicative Flood Maps (https://www.floodinfo.ie/map/floodplans/).
- Geological Survey of Ireland (www.gsi.ie).
- History of flooding and status of drainage in the vicinity of the Proposed Development (available at http://www.floodinfo.ie/map/floodmaps/).
- Environmental Protection Agency river flow data (http://www.epa.ie/hydronet).
- Met Eireann Meteorological Database (available at https://www.met.ie).

12.3.3 Field Assessment

The field assessment of the existing hydrological environment within the Site, GCR and TDR, was undertaken to both verify desk-based assessment, record all significant hydrological features and assess the proposed crossing points along water features. A site walkover survey was conducted in April 2023 to establish the drainage pattern and to record existing hydrology features; a collection of the site visit photos can be found in the Site Specific Flood Risk Assessment, which itself is presented as Appendix 12.1 (Volume III of the EIAR). The site of the proposed wind farm has a generally flat slope, with a flood plain that starts widening on both sides approximately 470m east of a proposed bridge crossing, following the downstream direction of the Cushina River. This is the main river within the site which flows in an easternly direction and is a tributary of the Figile River.

The Turbine Delivery Route (TDR) intersects the Philipstown River and its flood plain and a bridge is also proposed here. This river flows in an easternly direction, and the surrounding area generally follows a flat slope.

12.3.4 Evaluation Criteria

The significance of likely effects has been assessed in accordance with the Environmental Protection Agency (2022) Guidelines through comparison of the character of the predicted effect to the sensitivity of the receiving environment, as per Plate 12-1.

Categories for defining the sensitivity of the receiving environment are set out in Table 12-2.

The sensitivity of a hydrological receptor is based on its vulnerability to be impacted/altered by the development, i.e. the ability of the receptor to absorb development without perceptible change.

Table 12-2: Criteria for Determining Receptor Sensitivity

Sensitivity	Criteria	Typical Examples	
		Surface Water	Hydro-ecological receptors
High	Receptor has a high quality and rarity on a local scale and limited potential for substitution. Receptor is generally vulnerable to impacts that may arise from the project and recoverability is slow and/or costly.	Surface water providing a regionally important drinking water resource. Surface water with high WFD status objective / Blue Dot catchments. Waterbodies identified as nutrient sensitive areas / waterbodies under WFD RBMP Cycle 3.	Protected under EU or Irish habitat legislation (e.g., Special Area of Conservation (SAC) or Natural Heritage Area (NHA)). Designated Salmonid / Cyprinid Waters. Nationally and internationally designated sites where hydrology/hydrogeology is a key factor in designation (e.g. SAC / NHA/ Special Protection Areas (SPA) sites)/ freshwater pearl mussel designated waterbodies and their associated catchments.
Medium	Receptor has a medium quality and rarity, local scale and limited potential for substitution/replacement or receptor with a low quality and rarity, regional or national scale and limited potential for substitution. Receptor is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high recoverability.	Watercourses with designate features such as Environmental or ecological significance, Cultural or historical value, recreational purposes and Water supply or drinking water sources. Large lakes with an extension of 50ha or more and non-potable reservoirs.	Statutory designated sites where hydrology/hydrogeology is a key factor in designation (e.g. National Nature Reserves (NNR), Local Nature Reserves (LNR)).
Low	Receptor with a low quality and rarity, local scale and limited potential for substitution. Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.	Watercourse with no designated features. Non-sensitive water resources (non WFD classified e.g. small lakes, ponds, land drain). Man-made feature not in hydraulic continuity (e.g. canal).	
Negligible	Attribute has a very low environmental importance and/or rarity on local scale. Receptor is of negligible value, not vulnerable to impacts that may arise from the project and/or has high recoverability.	Man-made feature with no ecological importance (e.g. farm land drainage ditches).	
Note	Professional judgement based on the baseline condition of the receptor should be used to determine a receptor's sensitivity.		

12.3.4.1 Evaluation Criteria in the Context of the Proposed Development

The surface hydrological environment of the Proposed Development and its downstream catchments are considered to be of medium sensitivity given that the surface waters draining the site have no particular ecological or environmental designation, but the site is hydrologically connected with the River Barrow and River Nore SAC, which is approximately 6 km downstream from the site boundary. The Qualifying Interests for the SACs include ten protected species and twelve protected habitats. Many of the QI species are particularly sensitive to agricultural and chemical pressures which a wind farm development would not be likely to increase. However, amongst the QI species are freshwater pearl mussel which are particularly sensitive to siltation, which is a likely impact from wind farm development if the appropriate mitigation measures are not implemented. Information on the likely impacts on Biodiversity in the SAC can be found in Chapter 9 Biodiversity, Volume II.

The scale of effect is determined in relation to the sensitivity of the receptor and the potential magnitude of change from baseline conditions, Plate 12-1, presents how comparison of the magnitude of the predicted impact to the sensitivity of the receiving environment can determine the significance of the impact. Sensitivity of the receiving environment can be 'high', 'medium', 'low' or 'negligible'. Description of impact is defined by its character, magnitude, duration, probability and consequences (pre-mitigation). The magnitude of impact can be 'high', 'medium', 'low' or 'negligible'.

The conventional source-pathway-target model is applied to assess likely effects on environmental receptors resulting from the Proposed Development. The source being the activity that results in the potential effect or the potential source of pollution is described. The pathway being the route by which a potential source of effect can transfer or migrate. The receptor being a part of the natural environment that could potentially be affected, having regard to its sensitivity.

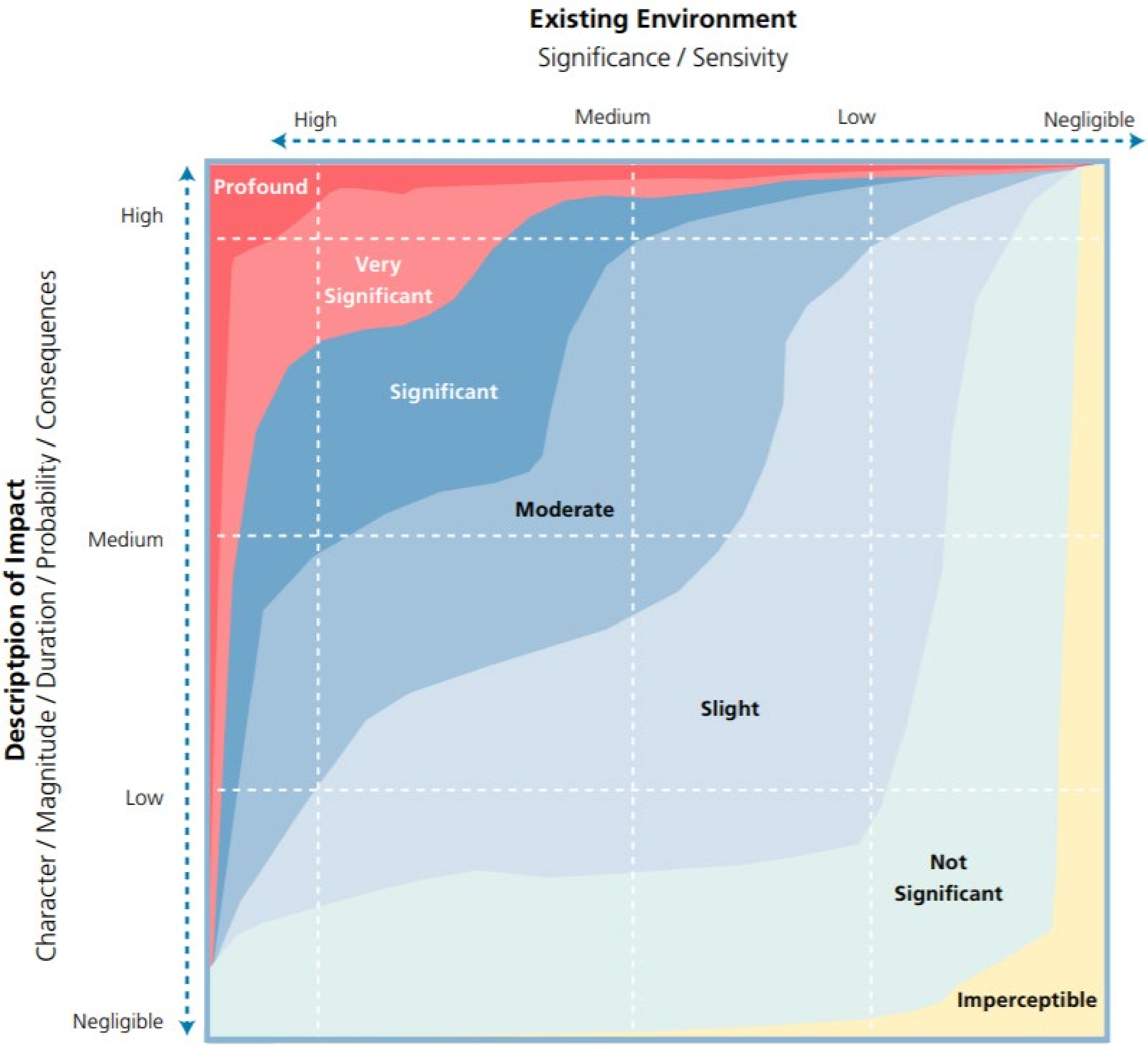

Plate 12-1: Classifications of the Significance of Impacts

12.3.5 Assessment of Cumulative Impacts

The assessment of cumulative effects on the water environment considers the combined potential effects of other developments (existing, approved but not yet built or operational, or proposed), with the potential to affect the water environment, within the same catchment(s) as the Proposed Project, as discussed further in Section 12.7.4.

12.3.6 Consultation

This EIAR chapter has been compiled in light of the comments received from consultees throughout the EIA process, the relevant elements of which are summarised hereunder and presented in detail in Chapter 5 - EIA Scoping and Consultation. Of the consultees contacted, only Inland Fisheries Ireland provided a response which is relevant to the subject of this chapter.

12.3.6.1 Inland Fisheries Ireland

Inland Fisheries Ireland responded to the Scoping Report on 9th January 2025. Their response outlined the following:

- Previous site visits undertaken by the IFI to the section of the Cushina within the development site has highlighted significant over-deepening which has resulted in the removal of all/most gravels from this section of channel and over-widening of the Cushina river which has resulted in a highly degraded hydromorphology.
- Human intervention will be necessary to facilitate the recovery of the fisheries habitat here, and it was a request of the IFI that the proposed development include habitat restoration of the section of the Cushina River flowing through the site.
- Any crossing points of the Cushina River should be clear span structure and the design and construction method statement for same be agreed with the IFI.
- Previous visits by the IFI have identified excellent riparian/terrestrial habitat along sections of the Cushina River. It is requested that in choosing a location for the new river crossing that a location which will limit the necessity to remove any such habitat be chosen.
- The IFI's knowledge of the site is that the subsoils throughout are composed of heavy/fine clay which is prone to erosion and likely to result in the generation of significant suspended solids. The construction of significant roadways and excavations for turbines and associated hardstands through these fine clays have potential to generate significant quantities of suspended solids, with the Cushina or Figile River being the ultimate receptor for this material if adequate steps are not put in place to address this.
- A potential impact of projects such as that proposed is the discharge of silt-laden waters to fisheries streams. Silt can clog salmonid spawning beds, and juvenile salmonids are particularly sensitive to siltation of gill structures. Similarly plant and macro-invertebrate communities can literally be blanketed over, and this can lead to loss or degradation of valuable habitat.
- The IFI requested that systems be put in place to ensure that there shall be no discharge of suspended solids or other deleterious matter to watercourses during any phase of works at this site.
- The design and sizing of the surface water drainage system must ensure that no suspended solids enter the surface water network flowing to the Cushina/Figile, even during periods of prolonged heavy rainfall.
- IFI request that the focus of any works methodology be measures which eliminate/reduce the generation of suspended solids.
- All surface waters from the site and access roads should be channelled through adequately sized petrol/oil interceptors prior and be subject to attenuation prior to discharge to surface waters.
- If silt settlement ponds are proposed for this facility. It is important that they are oversized to cope with all eventualities.
- The activities proposed for this site are likely to result in significant lorry traffic to and from the site, with potential for the generation of significant suspended solids pollution in the associated road run-off. It is imperative that the potential for suspended solids pollution from road run-off associated with vehicles entering and leaving this site is fully addressed.

Further information on the scoping and consultation can be found in Chapter 5 - EIA Scoping and Consultation, Volume II of this EIAR, and its associated appendices.

12.4 Existing Environment

12.4.1 General Description of the Catchments

12.4.1.1 The Site

Within The proposed wind farm site is located within the Barrow Catchment (ID 14) and the Barrow_SC_040 sub-catchment as defined by the WFD. *The waterbody in this sub-catchment that is crossing the proposed site is known as FIGILE_080 (EPA Name: Cushina 14).*

In addition, the wind farm is located within two sub-basins:

- *FIGILE_070- IE_SE_14F010510.*
- FIGILE_080- IE_SE_14F010600.

The elevation range of the overall wind farm site varies between approximately 66 m OD and 59 m OD, and it generally has a flat topography. Turbines will be installed in the range between approximately 64 m OD and 60 m OD.

The main hydrology feature within the wind farm site is the Cushina River (FIGILE_080). A large area of the surface runoff drains into this river within the FIGILE_080 sub-basin. The Cushina River runs in an easternly direction, and is a tributary of the Figile River (FIGILE_080). The remainder of the site drains into FIGILE_070 sub-basin or directly into the Figile River. In addition, there are no lakes or reservoirs within the wind farm site study area.

During the Scoping and Consultation process, Inland Fisheries Ireland pointed out that the Cushina River has a "highly degraded hydromorphology".

Rainfall data from Met Éireann was analysed and recorded at Casement Station, which is c.46 km northeast of the Site and associated infrastructure.

The 30-year annual average rainfall at Casement weather station, recorded from 1991 to 2020, was calculated to be 783.5 mm. The average rainfall at the proposed wind farm site may vary due to its geographical location.

The Standard Average annual Rainfall (SAAR) of the site from the FSU Portal is approximately 827 mm, which gives a more conservative output and it will be used for the Hydraulic Analysis in Section 7.1.

Following further research into the Rainfall data from Met Éireann, Table 3-1 below shows the average annual rainfall recorded from the closest weather station with more available data which is in Lullymore, Co. Kildare. This station is approximately 15 km north-east of the subject site and associated infrastructure.

Table 12-3: Rainfall Data - Lullymore Nature Centre Station

Total rainfall in millimetres for Lullymore Nature Centre Station														
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Average
Rainfall	839	976	818	848	1025	868	877	747	986	1008	845	834	1038	785	892

This station is closer to the Site than Casement weather station, but it is still 15 km away and at a different elevation, therefore the Standard Average Annual Rainfall (SAAR) from the FSU Portal was chosen.

The M5-60 at development location is 16.5 mm according to the Met Éireann rainfall data. This is the predicted rainfall depth in a sixty-minute storm that will occur with a frequency of once every five years.

12.4.1.2 Turbine Delivery Route

The watercourse crossing of the Turbine Delivery Route is located within the Barrow Catchment (ID 14) and the Figile_SC_020 sub-catchment as defined by the WFD*. The waterbody in this sub-catchment that is affected by the TDR is named as Daingean_030 (also known as Philipstown and referred to throughout this chapter as the Philipstown River). This watercourse runs in an easternly direction, and it is a tributary of the Figile River.*

This watercourse crossing is located approximately 5 km east of Daingean town and is bordered by the R402 to the north, where the TDR branches off, and the R400 to the east.

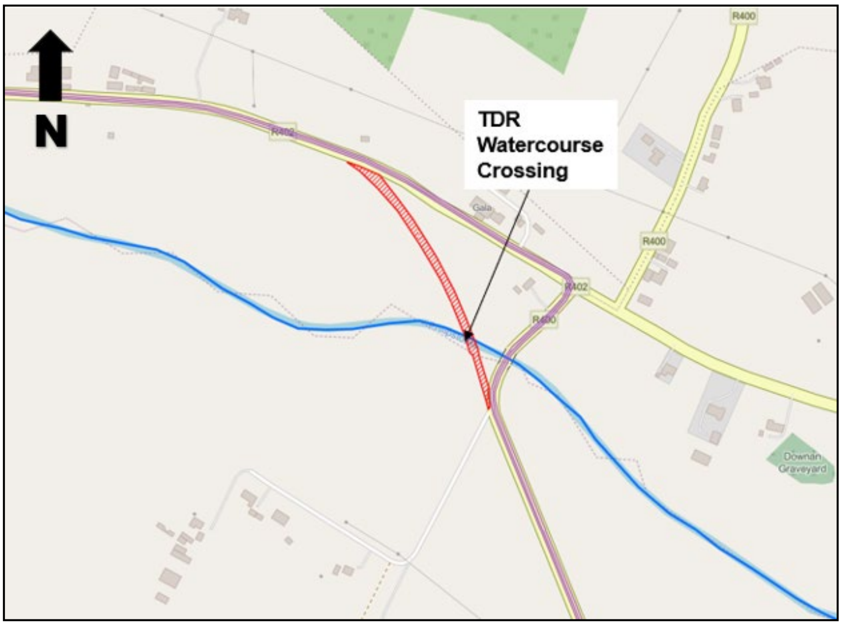

Plate 12-2: TDR Watercourse Crossing

Rainfall data from Met Éireann was also analysed, including records from the Lullymore Nature Centre Station, located approximately 18 km east of the watercourse crossing. However, due to the distance and difference in elevation, the Standard Average Annual Rainfall (SAAR) value from the FSU Portal was used instead.

12.4.2 Flooding

The National Catchment Flood Risk Management (CFRAM) Programme has examined the flood risk, and possible mitigation measures to address flooding, in 300 communities throughout the country at potentially significant flood risk. These communities were identified through the Preliminary Flood Risk assessment (PFRA), which was a national screening assessment of flood risk. The communities recognized as being at a significant flood risk are called Areas for Further Assessment (AFA). For the AFAs a detailed hydraulic modelling has been carried out to produce indicative flood maps (CFRAM Maps).

The subject site and the TDR watercourse crossing are within an AFA and therefore, flooding maps have been produced as part of the CFRAM mapping.

Local Authority is charged with the responsibility of maintaining Drainage Districts. According to the OPW database, the Cushina, Figile and Philipstown Rivers as well as a number of local drains in the area form part of the Drainage Districts.

The CFRAM Programme extends to the subject site and the TDR watercourse crossing showing that both locations are vulnerable to fluvial flooding. Plate 12-3 below shows the flood extents for the 1% annual exceedance event-Current Scenario.

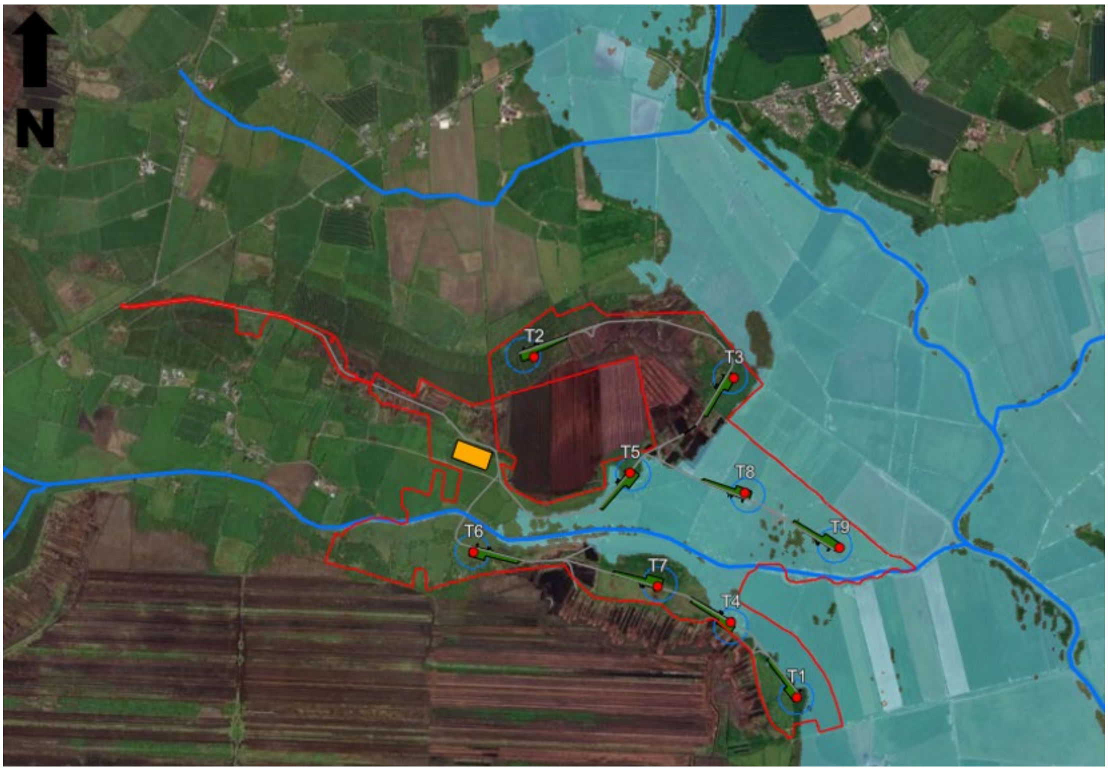

Plate 12-3: CFRAM Flood Map - Medium Probability-Proposed Wind Farm Location (Map from www.floodmaps.ie)

Plate 12-4: CFRAM Flood Map -Medium Probability-TDR Watercourse Crossing (Map from www.floodmaps.ie)

12.4.2.1 Pluvial Flooding

The Winter 2015/2016 Surface Water Flooding map shows fluvial (rivers) and pluvial (rain) floods, excluding urban areas, during the winter 2015/2016 flood event. Plate 12-5 below shows that there was pluvial flooding in combination with fluvial within the site boundary, probably due to the overland flow in these low lying and flat areas.

Pluvial flood risk should be considered, and the proposed development should not increase the flood risk elsewhere due to the construction of new access tracks, hardstanding areas, and the proposed discharge points.

Plate 12-5: GSI Winter 2015/2016 Surface Water Flooding-Proposed Wind Farm Location (Map from www.floodmaps.ie)

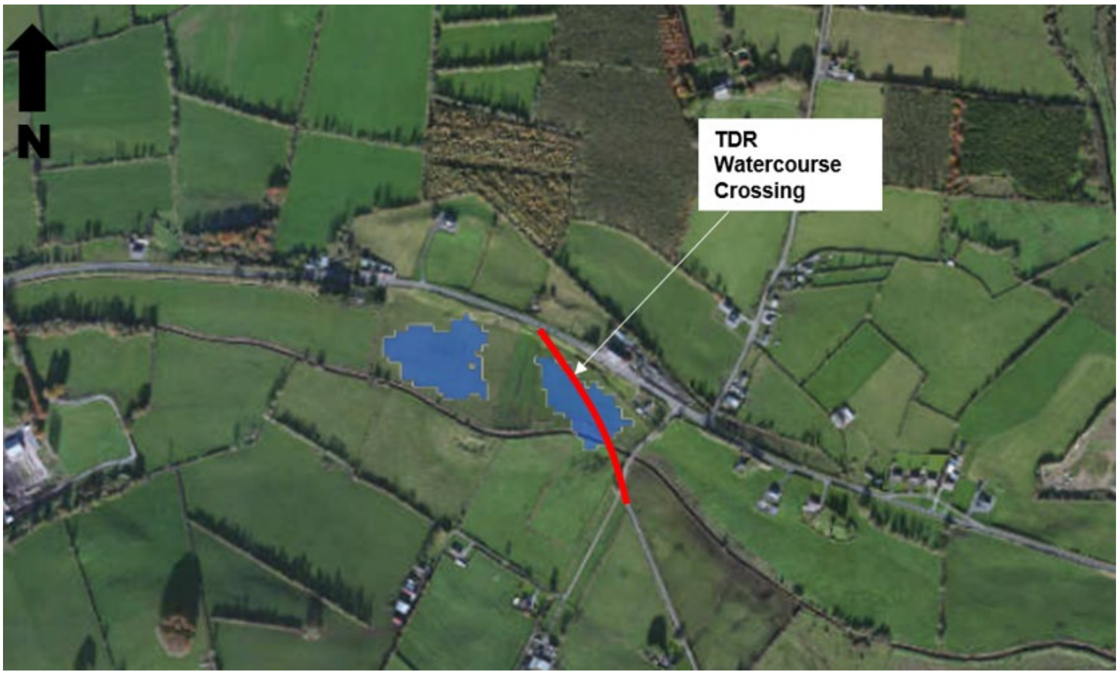

Plate 12-6: GSI Winter 2015/2016 Surface Water Flooding-TDR Watercourse Crossing

12.4.2.2 Historical Flooding

The national flood hazard mapping (www.floodmaps.ie), indicates that there are historical or past flooding events within the proposed site boundary. This past flood event has been mapped defining the extend of the flood along the Cushina River. There are also some single and recurring flood events in the area but are outside of the proposed site boundary.

The past flood event that has been mapped as shown in Plate 12-7 below appears to extend only within County Kildare. However, the floodplain also extends towards County Offaly on the north side of the Cushina River. Therefore, this map is considered only as part of the information gathered and a more detailed assessment will be required.

Plate 12-7: Past Flood Event-Proposed Wind Farm Location (Map taken from www.floodmaps.ie)

Plate 12-8 below shows a recurring flood event to the west of the TDR Watercourse Crossing, approximately less than 1 km away, which appears to be associated with the Philipstown River.

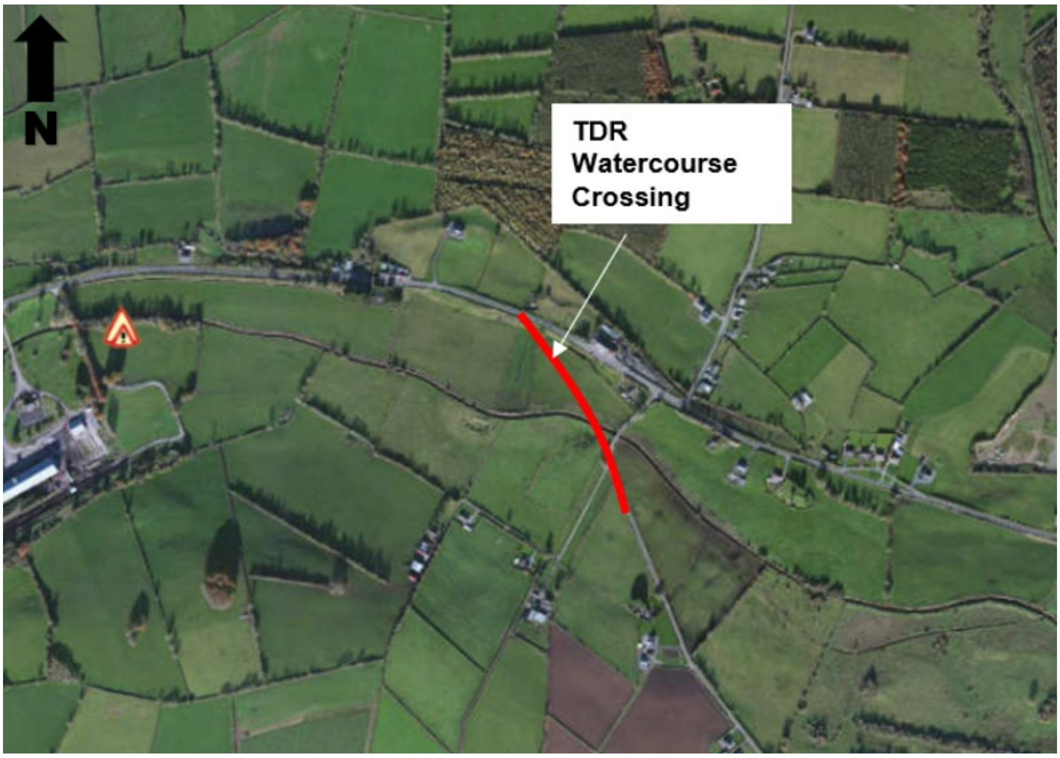

Plate 12-8: Past Flood Event-TDR Watercourse Crossing (Map taken from www.floodmaps.ie)

There are areas defined as 'benefiting lands' within the subject site and the TDR watercourse crossing. Benefiting lands were lands that were drained as part of the Drainage District to improve land for agriculture and to mitigate flooding.

Plate 12-9: Drainage Districts, Benefitting Lands and Channels-Proposed Wind Farm (Map from www.floodmaps.ie)

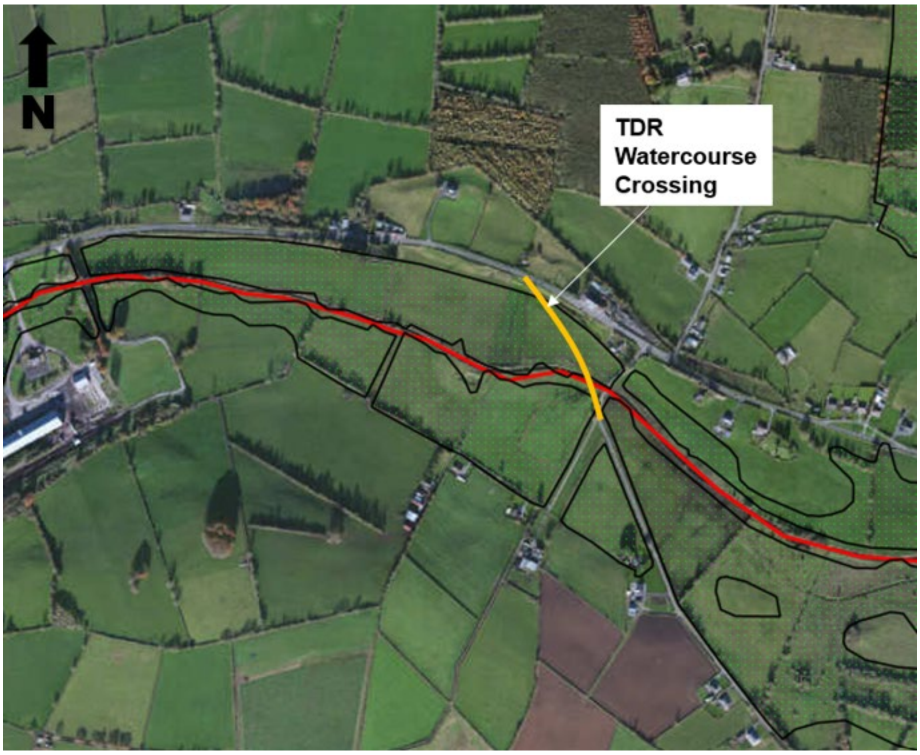

Plate 12-10: Drainage Districts, Benefitting Lands and Channels - TDR Watercourse Crossing (Map from www.floodmaps.ie)

12.4.3 Surface Water Quality

A review of the data available online revealed that little data is available within the study area as defined in Section 1.1.1. As such, data was also reviewed for the CUSHINA_030 waterbody, as due to its proximity to the site it was considered representative of water quality in the locality. Therefore, surface WFD water quality status (2016-2021) and river waterbody risk for the CUSHINA_030 waterbody, the FIGILE_070 and the FIGILE_080 waterbodies are provided in Table 12-4. The Biological Quality Rating for stations in these waterbodies are presented in Table 12-5.

The WFD ecological status is assigned as 'good' for all three waterbodies. The status for the CUSHINA_030 is based on monitoring data and assigns an assessment of 'Good'. All of the Biological Status conditions are classed as 'Good', and the Supporting Chemistry Conditions have been assigned an overall 'Pass'. Within the Supporting Chemistry Conditions, it is noted that Nitrate status is 'Moderate', while all other conditions are classed as 'High', 'Good' or 'Pass'. There are no monitoring results for the FIGILE_070 or the FIGILE_080, the status for each of these has been assigned by modelling the likely status.

The WFD risk projection for the CUSHINA_030 is assigned as 'not at risk', and no risk status has been assigned to either the FIGILE_070 or the FIGILE_080, their current status is recorded as 'Review' and the pressures driving this risk are 'River urban run-off pressures'.

Table 12-4: WFD River Status and River Waterbody Risk

Watercourse	Waterbody	River Status	Reason for River Status	Waterbody Risk	Reason for Waterbody Risk
Cushina	CUSHINA_030	Good	Ecological Status	Not at risk	N/A
Figile	FIGILE_070	Good	Ecological Status	Review	N/A
Cushina, Figile	FIGILE_080	Good	Ecological Status	Review	N/A

Table 12-5: EPA Biological Water Quality Rating

Sub-Basin	Station ID	Station Location	1979	1980	1985	1986	1989	1993	1997	2000	2003	2006	2009	2011	2015	2017	2020	2023	2024
Cushina_030	RS14C040080	Cushina – Br E of Moanvane House					3-4	3-4	3	4-5	4	3-4		4	4	4	4-5	3-4	
Cushina_030	RS14C040081	Br d/s Enaghan Confluence																	3-4
Cushina_030	RS14C040100	Cushina Bridge		4	4		4-5	4-5	3-4	4	4	4	3-4	4	4	4	4	3-4	
Figile_080	RS14F010600	Figile – 1km u/s Barrow R Confluence	5			4	4	4				3-4							

12.4.4 Water Dependent Protected Areas

The EPA in 2018, to inform the WFD River Basin Management Plan Cycle-3, identified Special Areas of Conservation and Special Protection Areas that have protected water dependent habitats or species. While the Site is not located within any of these protected areas, the waterbody sub-catchment in which the Site is located overlap with such protected areas as follows:

- River Barrow and River Nore SAC - approximately 6 km downstream of the eastern site boundary. The Qualifying Interests (QIs) of the SAC include freshwater pearl mussel and white clawed crayfish, as well as a number of fish species and other EU Habitats Directive Annex II species (more information on this can be found in Chapter 9 - Biodiversity, Volume II of this EIAR). Of particular note in terms of hydrology and water quality, is the sensitivity of freshwater pearl mussel to siltation. Mitigation measures are provided in Section 12.9 which minimise the potential siltation to occur as a result of the proposed development.

Further information is provided on protected sites in the Chapter 9 - Biodiversity, Volume II of this EIAR.

12.4.5 Existing Site Drainage

The main hydrology feature within the wind farm site is the Cushina River (FIGILE_080), with a large area of the surface runoff draining into this river within the FIGILE_080 sub-basin. The Cushina River runs in an easternly direction, and it is a tributary of the Figile River (FIGILE_080). The remainder of the site drains into the FIGILE_070 sub-basin or directly into the Figile River. There are no lakes or reservoirs within the wind farm site study area.

Existing access tracks and lands are generally drained by adjacent drainage ditches and swales. These drainage features will be retained and upgraded where necessary to the same standard as the proposed drainage design. Where existing tracks are widened, existing drainage will be realigned or replaced. The replacement sections of drain shall have a similar gradient and width as existing channels to ensure the flow rate and capacity of the existing channel is retained and adequate for the contributing area.

12.5 Flood Risk Identification and Assessment

12.5.1 Methodology

National Planning Policy

The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM Guidelines) was published in 2009 by the Office for Public Works (OPW). These outline the core objectives for the management of flood risk, including those for new planning applications. Flood risk is defined as a combination of two components:

- The likelihood/probability of flooding; and
- The consequences of flooding.

The PSFRM Guidelines divide geographical areas into three flood zones based on the probability of flooding:

- Zone A (High Risk): a probability of greater than 1 in 100 (1% Annual Exceedance Probability) for river flooding or 1 in 200 (0.5% AEP) for coastal flooding;
- Zone B (Moderate Risk): a probability of between 1 in 1000 and 1 in 120 (0.1% - 1.0% AEP) for river flooding and 1 in 1200 and 1 in 200 (0.1% - 0.5% AEP) for coastal flooding; and
- Zone C (Low Risk): a probability of less than 1 in 1000 (0.1% AEP) for both river and coastal flooding.

The PSFRM Guidelines are based on a 'sequential' approach to ensure that new development is directed towards land at a low risk of flooding. If a Proposed Development lies within a higher risk area, appropriate justification is required and measures for mitigating the flood risk are to be identified via the Justification Test.

The consequences of flooding depend on the hazards caused by flooding (e.g. depth of water, speed of flow, rate of onset and water quality) and the vulnerability of the receptor. Table 3.1 of the Guidelines, reproduced as Table 12-6 below, outlines the three vulnerability classifications and examples of the types of development included.

Table 12-6: Vulnerability Class and Development Types

Vulnerability Class	Example Land Use and Types of Development
Highly Vulnerable Development (including Essential Infrastructure)	• Garda, ambulance and fire stations and command centres required to be operational during flooding; • Hospitals; • Dwellings, student halls of residence, hostels, residential institutions (care homes, children's homes and social services homes), dwellings designed/constructed/adapted for the elderly or people with impaired mobility; • Caravans and mobile home parks; • Essential infrastructure including primary transport and utilities distribution, electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution in the event of flooding.
Less Vulnerable Development	• Buildings used for retail, leisure, warehousing, commercial, industrial and non-residential institutions • Land and buildings used for holiday or short-let caravans and camping (subject to specific warning and evacuation plans) • Land and buildings used for agriculture and forestry • Waste treatment (except landfill and hazardous waste) • Mineral working and processing • Local transport infrastructure
Water-Compatible Development	• Flood control infrastructure • Docks, marinas and wharves • Water-based recreation and tourism • Amenity open space, outdoor sports and recreation and essential facilities

Table 3.2 of the Guidelines (reproduced in Table 12-7 below) states what types of development would be appropriate within each Flood Zone and those that would be required to meet the criteria of the Justification Test.

Table 12-7: Appropriate Development within Flood Zones

Vulnerability	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable development (Including Essential Infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-Compatible Development	Appropriate	Appropriate	Appropriate

The OPW published the Flood Risk Management Climate Change Sectoral Adoption Plan for Flood Risk Management in 2015 (updated in 2022) and provides information on the potential changes in flood hazard as a result of climate change. The Plan outlines two potential future scenarios:

- Mid-Range Future Scenario (MRFS) -typical or near to the general average of future climate projections; and
- High-End Future Scenario (HEFS) - a more extreme future based on the upper end of the range of projections of future climatic conditions.

Table 5-1 of the Plan (reproduced as Table 12-8 below) shows the changes to flood-related parameters under both scenarios.

Table 12-8: Allowances Flood Parameters for Mid-Range and High-End Future Scenarios

Vulnerability	Mid-Range Future Scenario	High-End Future Scenario
Extreme Rainfall Depths	+20%	+30%
Peak Flood Flows	+20%	+30%
Mean Sea Level Rise	+500mm	+1200

A series of flood maps were produced in 2015 as part of the National Catchment based Flood Risk Assessment and Management (CFRAM) program. The mapping shows the extent of fluvial and coastal flooding in the present-day scenario, and the Mid-Range and High-End future scenarios.

A further series of flood maps were produced in 2019 as part of the National Indicative Fluvial Mapping (NIFM) project. The mapping extends to areas not covered by the 2015 CFRAM program and includes the present-day scenario, and the Mid-Range and High-End future scenarios.

Local Planning Policy

The Strategic Flood Risk Assessment for Offaly County Development Plan 2021-2027 (SFRA) (CAAS Ltd, 2021) provides a broad assessment of all types of flood risk to inform strategic land-use planning decisions within County Offaly. The SFRA contains flood mapping, a Flood Risk Management Plan, and advice on zoning and land use proposals within settlements. A similar SFRA was prepared for the Kildare County Development Plan 2023-2029 (SFRA), prepared by RPS Group Ltd (2023).

12.5.2 Flood Risk Identification and Assessment

A Site-Specific Flood Risk Assessment (SSFRA)has been prepared for the Proposed Development and is presented as Appendix 12.1, Volume III of this EIAR. The SSFRA investigated the local hydrological conditions relevant to the proposed wind farm and the TDR watercourse crossing. The study indicates that the proposed development, including a section of the TDR, is susceptible to fluvial flooding during 1-in-100-year (Flood Zone A) flood events, as identified in Stage 1 – Flood Risk Identification and further analysed in Stage 2 – Initial Flood Risk Assessment. It was also established that the site is affected by pluvial flooding, as evidenced by historical records.

The areas particularly affected include turbines T1, T4, T5, T8, and T9, along with their associated access tracks, as well as other areas where localised impacts on access roads were identified. A proposed bridge crossing the River Cushina is necessary to access the turbines located on the southern side of the site and to facilitate the grid connection route.

As the proposed development is considered a 'Less Vulnerable Development' under the Planning Guidelines (with the exception of the substation and the joint bays of the grid connection), and some infrastructure lies within Flood Zone A, it was determined that a Justification Test is required in accordance with the Guidelines.

A Stage 3 Detailed Flood Risk Assessment was undertaken to establish design flood levels and assess any likely impacts that the proposed bridge structures—for both the wind farm and the TDR watercourse crossing—may have on existing flood conditions. Hydraulic modelling concluded that a single-span bridge of 19.0 m clear span is required to cross the River Cushina, while a 20.0 m clear span bridge with five flood relief culverts is required to cross the Philipstown River and its associated floodplain.

Mitigation measures have been incorporated to minimise potential impacts, protect the proposed development and its surroundings, and reduce any residual flood risks. It is therefore considered that any residual risks associated with the development can be managed to an acceptable level and that the proposed works are not likely to have a negative impact on flood extents or levels either on-site or elsewhere. The increase in flood levels resulting from the inclusion of the proposed bridge and associated infrastructure is within acceptable limits and not considered significant. In the case of the TDR watercourse crossing, the increase in flood levels is considered negligible.

Accordingly, the proposed development is considered to comply with the core principles of the Planning System and Flood Risk Management Guidelines. More detailed information can be found in the SSFRA, presented as Appendix 12.1, Volume III of this EIAR.

12.6 Description of the Proposed Project - Hydrology and Drainage

12.6.1 Drainage Design

Surface water drainage features will be installed as part of the construction phase and retained where required such that they can be used during the decommissioning phase, ensuring that there would be no increase in the risk of surface water flooding to off-site areas during any phase of the Project. Further details of proposed site drainage is included in Appendix 12.2 - Surface Water Management Plan at Volume III of this EIAR, and in the 1:500 series layout planning drawings (P22-145-0100-0006 to P22-145-0100-0059).

The drainage strategy within internal areas of the Site will incorporate three main components of Sustainable Drainage Systems (SuDS):

- Interceptor drains;
- Swales; and
- Settlement Ponds

A conceptual plan of the proposed drainage regime is included as Plate 12-11 below.

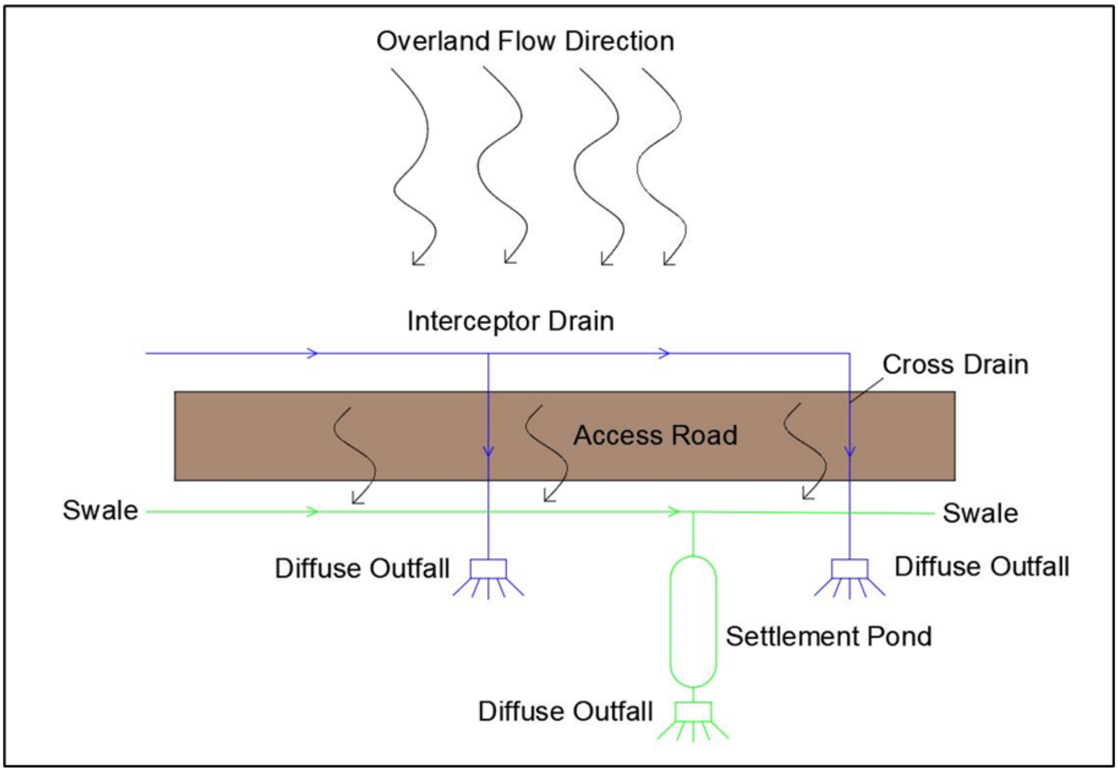

Plate 12-11: Drainage Design Principles

12.6.1.1 Existing Undeveloped Areas

Interceptor drains will be constructed upslope of areas of hardstanding and new sections of access track. These will intercept overland flows from areas of undeveloped land, preventing mixing with runoff from access tracks and hard surfaces. These channels will direct flows around areas of hardstanding and across access tracks via cross drains at appropriate intervals. Flows will then be discharged diffusely across vegetated areas to minimise erosion and encourage evapotranspiration and infiltration to ground. Interceptor drains will be installed as part of the construction phase, in advance of earthworks, road and hardstand construction.

Where interceptor drains have a gradient of greater than 2%, crushed rock 'check dam' structures will be installed at appropriate intervals to reduce the velocity of the flows and prevent erosion.

12.6.1.2 Existing Tracks

Existing access tracks are generally drained by adjacent drainage ditches and swales. These drainage features will be retained and upgraded to the same standard as the proposed drainage design. Where existing tracks are widened, existing drainage will be realigned or replaced. The replacement sections of drain will have a similar gradient and width as existing channels to ensure the flow rate and capacity of the existing channel is retained and adequate for the contributing area.

All track widening will be undertaken using clean, uncrushable aggregate to allow for some dispersal of surface water runoff via infiltration and, therefore, reduce the rate of surface water runoff generated.

12.6.1.3 New Site Access Tracks and Hard Surfaces

The proposed internal access tracks will also be constructed using unbound aggregate materials which will allow a portion of surface water runoff to disperse via infiltration.

Vegetated swales will be installed adjacent to new access tracks and areas of hardstanding. These swales will be 0.5 m in depth with 1 in 1 side slopes. Swales will be installed downslope of access tracks and hardstanding areas where coincident with the topography and will provide some attenuation for the surface water runoff during storm events.

Geotextile silt traps will be installed across the swales during the construction phase to prevent the ingress of silt and will remain in place until the vegetation has been established (refer to the Surface Water Management Plan for further details).

Where swales are constructed on slopes of greater than 2%, check dams will be installed at appropriate intervals to reduce flow velocities (refer to the Surface Water Management Plan for further details). By reducing flow rates, the check dams can also provide upstream storage within the swale allowing some dispersal via infiltration close to source rather than conveying all flows to a single larger downstream drainage feature, in accordance with the principles of SuDS.

Settlement ponds will be installed as construction progresses and will be designed in accordance with the principles of CIRIA C648 (Control of water pollution from linear construction projects) and Stoke's law approach to ensure retention of the runoff and settlement of the particles to prevent sediment pollution to the receiving waterbodies. Ponds will be less than 1.5m deep with 1 in 3 side slopes. Runoff from access tracks and hardstands to the proposed swale networks will be discharged to these ponds and will be temporarily retained to allow for the settlement of sediment and suspended solids. During the construction phase, standing water from excavations will be pumped to settlement ponds and there will be no direct discharge to the existing drainage network prior to settlement.

Settlement ponds will not discharge directly to watercourses. Settled water will be discharged diffusely via an outfall to disperse via overland flow or into natural drainage features as per the existing regime. Discharge will be restricted to a rate at or below the existing greenfield runoff rate during storm events, and the ponds will be sized to accommodate flows for all storm events up to and including the 1 in 100 year event.

The settlement ponds will also contain surface water runoff in the event of a spill or leak, and the outflow can be closed off to retain any potential pollutants within the settlement ponds prior to any necessary treatment. Regular inspection and maintenance will be carried out to ensure the proper functioning of the settlement ponds and check dams (and timely identification of potential corrective maintenance needs). Ciria C753 SuDS manual will be adhered to, which provides guidance on the routine maintenance and inspections requirements for settlement ponds and check dams.

12.6.1.4 Drainage of Temporary Site Compounds

The proposed construction compounds will be drained in a similar manner as the access tracks and hardstands, with surface water runoff from undeveloped areas intercepted and dispersed naturally, and surface water runoff from areas of hardstanding intercepted by swales and conveyed to settlement ponds. Surface water runoff from the compound area will be directed through a Class 1 Full Retention Separator Oil Interceptor (sized relative to area served) before discharge to the surface water drainage network.

There will be no discharge of foul flows from welfare units, with water retained in holding tanks and removed from site by a contractor.

12.6.1.5 Drainage of Substation

The substation will be drained via an underground piped surface water drainage network. The network will also utilise linear drainage channels and filter drains.

The network will discharge overland via a Class 1 Full Retention Oil Separator at a restricted greenfield rate. Attenuation for flows exceeding this rate will be provided within an underground tank.

In accordance with SuDS best practice, a rainwater harvesting tank will be included. Rainwater will be filtered and stored within the underground tank for reuse.

There will also be no discharge of foul flows from welfare units within the substation, with water stored in tanks and removed from site by a contractor.

12.6.2 Watercourse Crossings

Regulation 50 of the European Communities (Assessment and Management of Flood Risks) Regulations 2010 SI 122 of 2010 requires that: "No Person, including a body corporate, will construct any new bridge or alter, reconstruct, or restore any existing bridge over any watercourse without the Consent of the Commissioners or otherwise than in accordance with plans previously approved of by the Commissioners."

The word "bridge" as defined in said Regulations includes a culvert or other like structure. The word "watercourse" as defined in said Regulations includes rivers, streams, and other natural watercourses, and also canals, drains, and other artificial watercourses.

The OPW is responsible for the implementation of the regulations and consent to construct any bridge will be sought from the OPW via their application process.

All watercourse crossings required for the Proposed Development will be subject to the requirements of Regulation 50. Prior to the commencement of any works on watercourse crossings, the developer will apply to the OPW for a consent under Regulation 50 for the watercourse crossing works as described in more detail in section 1.5.2.1 below and will abide by the consents given.

Details on the location and sizing of each watercourse crossing can be found in the Surface Water Management Plan (SWMP) in Appendix 12.2, Volume III of this EIAR.

12.6.2.1 Watercourse Crossings - Site Access Tracks

There will be 35 no. drain crossings and 1 no. watercourse crossing within the Site. It is proposed to construct one single-span bridge to cross the Cushina River between T6 and the on-site substation. The proposed crossing design will be is in line with consultation feedback and in accordance with Inland Fisheries Ireland (IFI) 2016 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' and TII 2008 'Guidelines for the Crossing of Watercourses During the Construction of Road Schemes'. Details of proposed crossing structures are presented in planning drawing P22-145-0300-0001 and the location of the crossing is shown on planning drawing P22-145-0100-0001.

The soffit level of the bridge will provide a minimum freeboard of 300mm to allow a fluvial flood level of 1-in-100 years (+20%). The crossing will also be sized to convey the flow from 1 in 100 year (+20%) flood event unobstructed.

Construction methodologies for the single-span bridge and piped culverts are provided in Chapter 2 – Description of the Proposed Development; with further technical details regarding location and sizing of the bridge provided in the SWMP, presented as Appendix 12.2 Volume III.

With a suitably designed bridge, there will be no impact on flows within watercourses and the risk of flooding will not be increased as a result of the proposed bridge.

For a minor watercourse/drain crossing using a piped culvert, the following shall be employed:

1. The access track construction will finish at least 10m from the nearside bank of the minor watercourse/drain.
2. All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in the Surface Water Management Plan (SWMP) in Appendix 12.2.
3. Pipe culvert installation will only take place during dry periods.
4. The pipe is laid in one lift or in sections using a crane.
5. Suitable bedding material in the form of clean round gravel between 10-100mm diameter, shall be laid in the base of the pipe in accordance with the recommendations set out in Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Watercourses from Inland Fisheries Ireland.
6. Rock armour headwalls will be constructed where necessary to protect pipe ends and the base of slope embankments on either side of the track.

Further details on hydrology and drainage are contained in the Surface Water Management Plan (SWMP) which is contained in Appendix 12.2 (Volume III) and on accompanying planning application drawings.

12.6.2.2 Watercourse Crossings – Turbine Delivery Route

The turbine delivery route will utilise a number of existing watercourse crossings. In addition, a new single span bridge will be constructed along the TDR to cross the Philipstown River, constructed adjacent to the existing Philipstown Bridge.

12.6.2.3 Watercourse Crossings – Grid Connection Route

There will be seven crossing points comprising six watercourse crossings and one dry stone arch bridge crossing at a disused canal. There will be six Horizontal Directional Drilling (HDD) and one flat formation crossing within the road above an existing culvert.

HDD is a method of drilling under obstacles such as bridges, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible.

A competent specialist HDD contractor will be appointed for the proposed works. The HDD Contractor will conduct the drilling works in a safe and controlled manner with due regard for site constraints including environmental issues. The Contractor will be required to ensure that their proposed works do not adversely affect, existing services / utilities, groundwater / aquifers. The drilling methodology is as follows:

- An entry and exit pit will be established on both sides of the river crossing.
- Fuels, lubricants and hydraulic fluids for equipment use on Site will be carefully handled to avoid spillage, properly secured and provided with spill containment kits in case of incident.
- The timing of grid connection cable laying will be carried out during metrologically dry seasons/periods and HDD on the stream crossing will not be carried out during the salmonid spawning season.
- The depth of the bore will be at least 3m below the level of the riverbed so as not to conflict with watercourse hydrology;
- Inert, biodegradable drilling fluid will be used;
- There will be no refuelling within 50m of the watercourse.
- The drilling rig and fluid handling units will be located on one side of the river and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
- Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator. The excavated material will be temporarily stored within the works area and used as a byproduct or disposed of to a licensed facility.
- A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
- The HDD pilot bore will be undertaken using a wireline guidance system. Assembly will be set up by the drilling team and steering engineer. The steering system will provide real time directional information to the surveyor at the driller's console and will be used to navigate the bores.
- A comprehensive monitoring system will be established to closely oversee any procedures involving bentonite, encompassing the careful observation of pumping pressure, the precise formulation of drilling mud (including drilling fluid volume, viscosity and weight), and the accurate measurement of mud returns and pH. A closed-loop drilling fluid mixing and circulation system with recycling capability will be utilised.
- Fluid return lines used in HDD process will be tested for leaks prior to use to check their reliability.
- The pilot bore will be drilled to the pre-determined profile and alignment under the watercourse crossing.
- The steering engineer and drill team will monitor the drilling works to ensure that modelled stresses and pressures are not exceeded.

- The drilled cuttings will be flushed back by drilling fluid to the entry and exist pits and re-cycled for re-use. The nature of the cuttings will be monitored to understand the ground conditions as the drilling progresses.
- Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit side which will then be pulled back to the entry side as part of the pre-reaming/hole opening process to enlarge the hole to the correct size.
- When the pre-reaming/hole opening/hole cleaning has been completed, a reamer of slightly smaller diameter than the final cut will be installed on the drill string to which the ducts will be attached for installation. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
- The ducts will be cleaned and proven, and their installed location surveyed.

12.6.2.4 River Crossing - TDR

The TDR crosses several watercourses from the Port of Entry (POE) in Galway to the site entrance. Of particular note, the TDR will require the construction of a new bridge crossing, adjacent to the existing Philipstown River bridge. The new bridge will be a clear span bridge and will be constructed in accordance with IFI (2016) ' Guidelines on protection of fisheries during construction works in and adjacent to waters'. More details can be found in the TDR report, presented within Appendix 2.3 and Appendix 2.4 of Volume III, and in Chapter 2 - Description of Proposed Development, Volume II of this EIAR.

12.7 Assessment of Effects on Hydrology and Water Quality

12.7.1 Do-Nothing Scenario

The likely evolution of the baseline environment in the absence of the Proposed Development is considered. Land use within the Site will likely remain as per the current scenario for the foreseeable future, i.e. agriculture, with smaller pockets of commercial forestry also present along the periphery, and much of the land scarred from historic peat extraction. A slight increase in commercial forestry may occur in the wider catchment area in line with national policy (Ireland Forestry Strategy 2023- 2030).

Residential property density in the area is low with ribbon development and one-off housing dominating. As such, surface water drainage will continue as it is occurring currently, with pressures on the river waterbodies continuing with regard to agriculture and domestic wastewater as detailed in Table 12-4.

The existing agricultural, turbary and forestry operations are likely to continue into the future. The creation of in-ditch wetlands proposed as part of the BEMP (Appendix 2.2, Volume III) will not proceed and as such, the existing drainage ditches onsite will continue to be intensively managed through regular maintenance, with some ditches carrying significant loads of peat sediment. Discharge of this sediment-laden water will continue into the River Cushina, which is likely contributing to the Poor water quality of the River Cushina. Potential Effects During Construction

Potential construction phase effects, in the absence of mitigation, of the Proposed Development on Hydrology and Water Quality are set out hereunder.

12.7.1.1 Potential Effects on Surface Water WFD Status/Water Quality

WFD Ecological Status for inland surface waterbodies is determined based on biological quality elements and supporting physico-chemical and hydromorphological quality elements.

Effects on WFD biological quality elements are addressed in Chapter 9 - Biodiversity, Volume II of this EIAR. The potential for significant effects on hydromorphology and physico-chemical conditions is discussed hereunder.

12.7.1.1.1 Potential for Effects on Hydrology / Hydromorphology (Including Flood Risk)

Hydromorphology is the physical and hydrological condition of surface water bodies which comprises the habitats and natural processes that support and maintain healthy aquatic ecosystems. Potential significant effects to hydromorphology can be caused by changes in the physical habitat or flow conditions of a waterbody.

12.7.1.1.2 Potential for Effects on Water Quality / Physico-chemical Conditions

The European Communities Environmental Objectives (Surface Waters) Regulations 2009 -25) prescribe physico-chemical conditions for surface waters which are necessary to maintain / achieve Good or High Status. These relate to water temperature, oxygen conditions, pH, and nutrient conditions. Notably the Regulations are mute on the sedimentation conditions required to support biology. As such, reference is made to the European Communities (Quality of Salmonid Waters) Regulations, 1988 which required an average concentration of <25mg/l of suspended solids (measured monthly over a period of 12 months) in order to support salmonid fish species. The Surface Water Regulations also prescribe environmental quality standards for priority substances and priority hazardous substances and requires the progressive reduction / phasing out these substances in waterbody catchments.

Construction phase activities will require earthworks and use of materials that have potential to negatively impact the physico-chemical conditions for surface waters.

Release of Construction or Cementitious Materials

To facilitate the Proposed Development, the incorporation of concrete structures is necessary at turbine foundations and the substation foundation. Additionally, concrete will be required as blinding for culvert and joint bay installations and also as part of the bridge crossing structure on the wind farm site, and the bridge crossing structure being provided for the TDR.

The use of cementitious materials like concrete, cement, or lean mix can lead to changes in soil and water pH, as well as increased concentrations of sulphates and other constituents found in concrete, which can further impact water quality. Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They can generate very fine, highly alkaline silt (pH 11.5) that can alter water chemistry. A pH range of between 6-9 is set in the Surface Waters Regulations (for hard water) as the standard required to support Good / High WFD Status. Inland Fisheries Ireland (2016) 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' prescribe that artificial variations in waters must not be in excess of ±0.5 of a pH units.

All of the wind turbine foundations are located a minimum of 50 m away from any all watercourses and as such it is unlikely that surface water runoff from these installations would enter watercourses. Where land drains are traversed by the development infrastructure these will be intercepted by clean water interceptor drains and carried as needed by cross drains. This drainage separation of clean water channels from dirty water sources will be in place in advance of the works and as such it is unlikely that concrete runoff would enter the clean surface water drainage. The footings of the new bridge crossings are setback 2.5m landward from the riverbank to retain riverbank integrity. Given the proximity of the bridge to the river, it is likely that pre-mitigation concrete runoff could enter the waterbody.

Other foundation works, i.e. for joint bays and the substation foundation, are not located within 50m of any watercourse. Given setback, it is unlikely that surface water runoff from these installations would enter watercourses.

New culvert crossings will be required in land drains. Pre-mitigation, release of concrete to the aquatic environment is likely.

During the construction phase of the Development, the utilization of plant, equipment and vehicles for excavation, material transport, and construction activities introduces the potential for hydrocarbon spillages and leaks which might enter the aquatic environment, especially during regular refuelling procedures. If hydrocarbons are accidentally introduced into the environment, they are expected to be intercepted by the drainage and surface water networks that will be constructed as part of the Proposed Development in accordance with the surface water management plan. However, areas of particular risk of water pollution are where works will be carried out in stream or on the riverbank i.e. for culvert and bridge construction.

Pre-mitigation, the likely effects on water quality (from accidental release of pollutants, cement material, and hydrocarbons) at the site are considered negative, direct/indirect, short term, moderate.

Release of Suspended Solids

The construction phase of the Proposed Development will invariably involve earthworks including: removal of vegetation cover, construction of roads, forestry felling etc. to facilitate the installation of wind farm infrastructure, temporary stockpiling of subsoils (including peat) and bedrock, construction and removal of temporary works e.g. construction compounds, TDR accommodation works and HDD temporary access roads.

Throughout the excavation, storage, and reuse of materials in the Proposed Development, suspended solids could be carried by surface water runoff and into the surface water networks. This likelihood is particularly high during sustained rainfall events. Water dewatered from excavations for foundations and roads can become contaminated whereby soil or water from areas of potential contamination is drawn down. If not properly controlled, such contaminated water can enter the aquatic environment. If the rate of dewatering is not effectively managed, the drainage and attenuation features designed to handle the water could become overwhelmed by a sudden influx of water containing high concentrations of suspended solids and potentially resulting in runoff into nearby surface waters.

The development will inevitably bring about alterations in the drainage patterns at the site. If not effectively managed, these alterations have the potential to create new pathways for runoff, potentially causing erosion of soils and construction materials, as well as the entrainment of solids in the runoff process.

Extensive peat probing for the Proposed Development has been carried out, with approximately 275 locations tested, and a peat stability assessment prepared for the Site (see Appendix 11.2 - Peat Stability and Geotechnical Assessment Report). The findings show that the Site has an acceptable margin of safety and is suitable for the proposed wind farm project. Slope inclinations at the main infrastructure locations have an average slope of 2 degrees. The relatively flat topography/nature of the terrain on site reflects the low risk of peat failure. The purpose of the stability analysis was to determine the stability i.e. Factor of Safety (FoS), of the peat slopes. The FoS provides a direct measure of the degree of stability of a peat slope. A FoS of less than 1.0 indicates that a slope is unstable; a FoS of greater than 1.0 indicates a stable slope. An acceptable FoS for slopes is generally taken as a minimum of 1.3. The stability analysis for this project, which analysed the turbine locations, access roads and substation, resulted in FoS above the minimum acceptable value of 1.3 and hence the site has a satisfactory margin of safety. As such, peat slippage, and the associated release of peat sediment into watercourses at the Site, is unlikely.

Potential effects on water quality from peat slippage or sediment runoff are deemed unlikely.

Horizontal Directional Drilling (HDD)

HDD will be employed at locations to cross watercourses, as described in Section12.6.2.3

The operation will be carried out by an experienced HDD specialist and is expected to take place in a single day per crossing location.

The process will involve setting up a small, tracked drilling rig on one side of the surface water feature. A pilot hole will be bored as per the agreed alignment and will be tracked and controlled using a transmitter in the drill head. By tracking the depth, position and pitch of the drill head the operator can accurately steer the line of the drilling operation. The drilling operation will be lubricated using a fluid (typically a mixture of water and additives like bentonite or polymers, designed to facilitate drilling, stabilize boreholes, and remove cuttings). When the pilot hole has been drilled to the correct profile, its diameter is increased, if necessary, to match the external diameter if the cable duct. The flexible plastic ducting is then pulled through the pre-drilled hole and sealed at each end until required for cable installation.

If not properly managed, there is potential for frac-out to occur during the HDD drilling process. A frac out occurs when the pressure of the drilling fluid in a borehole exceeds the strength of the surrounding soil, causing the soil to fracture and the fluid to escape to the surface.

Pre-mitigation, the likely effects on water quality (from accidental release of pollutants, HDD drilling fluids, cement material, and hydrocarbons) at the site are considered negative, direct/indirect, short term, moderate.

12.7.1.2 Potential Effects on Surface Water Dependent Designated Sites

None of the elements of the Proposed Development are located within the boundaries of any Nationally or European designated sites.

The drains and watercourses within the Site flow to the Cushina and Figile rivers. Downstream extents of the Figile are part of the River Barrow and River Nore SAC. Any negative change to the existing WFD status of the waterbody supporting this SAC or any activity that might impede the achievement of the objective WFD status for such waterbody could have an effect on the attributes (structure and function) required to support the water dependent habitats and species of the designated site. However, having regard to Section 12.7.2.1.2, it is determined that, with the exception of in-stream and riparian works, significant effects on water quality are unlikely.

Pre-mitigation, the likely effects on the water dependent designated site (River Barrow and River Nore SAC) due to potential effects on water quality are considered negative, indirect, short term and significant.

12.7.2 Potential Effects During Operation and Maintenance

12.7.2.1 Potential for Effects on Hydrology / Hydromorphology (Including Flood Risk)

Alteration of Runoff Rates

The Proposed Development will require the excavation and removal of vegetation cover and soil, and replacement with less permeable surfaces with a resulting potential to contribute to the increase in rate and volume of rainfall runoff from the Site.

Any alteration in the existing drainage regime / hydrology of the Site can impact on the volume of surface water which drains to the local streams and watercourses or to the rate at which such drainage occurs. This in turn can have an effect on hydromorphology through, for example, an increase in erosion and sediment transport, increase flow velocity, alteration of flood regime.

The increase in impermeable area caused by the wind farm footprint can directly influence the volume and velocity of runoff. As the footprint expands, there is a larger proportion of lower permeability surfaces compared to natural or vegetated areas. This alteration can disrupt the natural hydrological cycle, reducing the amount of water that can infiltrate the soil and increasing the amount of runoff generated.

Due to the landscape in the area of the proposed development, characterised by relatively flat lands which is heavily channelised by peat drainage networks, run-off from the site is essentially captured across three catchment areas. For the purposes of run-off assessment, these have been named “Catchment 1”, “Catchment 2” and “Catchment 3” as shown in Plate 12-12 below.

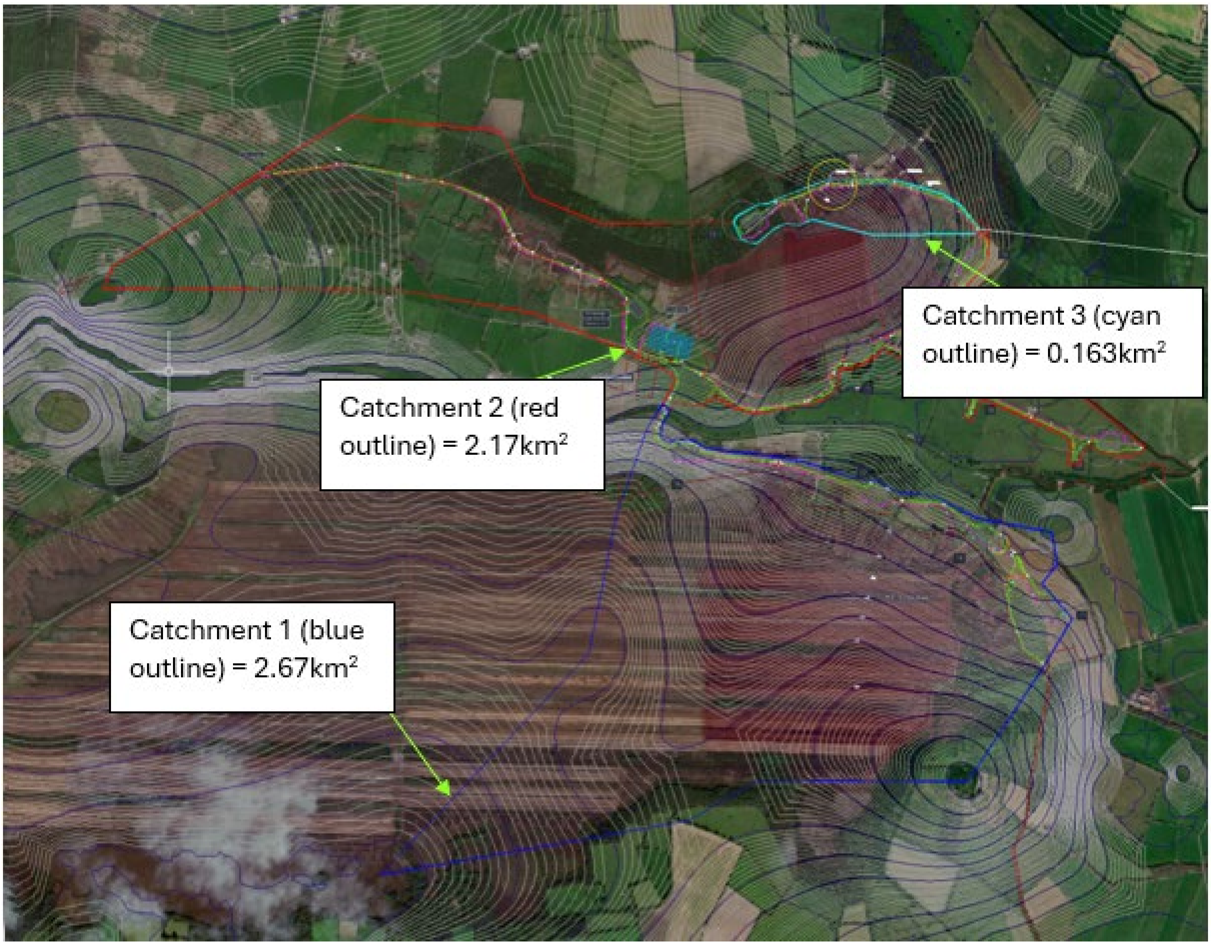

Plate 12-12: Run-off catchment areas

In accordance with *Drainage of Runoff from Natural Catchments (including Amendment no. 1 dated June 2015)* published by Transport Infrastructure Ireland (TII, 2015); the runoff from each of these catchment areas is calculated by either the ADAS method (for catchment areas less than 0.4 km^2) or the IH124 method (for catchment areas greater than 0.4 km^2). Accordingly, as Catchments 1 and 2 are greater than 0.4 km^2, the runoff for these areas has been calculated using the IH124 method. Whereas the runoff for Catchment 3 has been calculated using the ADAS method.

The runoff from the new lower permeability surfaces of the proposed development is then calculated using the modified rational method, and added to the flow of the natural catchment, to compare the existing runoff with the runoff post development.

The runoff calculations have been completed for a 1-in-100 year rainfall event. The results are presented as Table 12-9.

Table 12-9: Impermeable footprint increase ratio

	Catchment 1	Catchment 2	Catchment 3
Catchment area (km2)	2.668	2.168	0.163
Development footprint within the catchment area (km2)	0.037	0.067	0.015
Runoff for 1-in-100 year rainfall event (m3/s) using IH124 or ADAS method (for catchment area minus development footprint)	4.542	3.718	0.419
Run-off from new surfaces (m3/s) using rational method	0.428	0.593	0.043
Increase in run-off due to proposed development (m3/s)	0.37	0.488	0.0009
Percentage increase relative to catchment area	8%	13%	0.2%

At the scale being examined, where catchment areas have been delineated over small areas, the percentage increase in run-off is not significant. It is important to note that the percentage increase in runoff would be much smaller when comparing to the run-off within the wider sub-basin, sub-catchment or WFD catchment, equating to fractions of a percentage point on such a scale. In addition, the SuDS drainage design for the proposed development, while designed for the purposes of maintaining water quality, has additional benefits in attenuating flows such that the actual run-off from the proposed development would be less than those calculated in Table 12-9. As such, it is considered that the values presented in Table 12-10 represents a conservative approach which likely overestimates the increase in runoff due to the proposed development.

Potential Effect on Flood Risk

Infrastructure development can increase the risk of flooding. A flood risk assessment was prepared as supported by a detailed hydraulic model of the catchment informed by detailed Digital Terrain Model (DTM). The model has determined that the Proposed Development will not increase flood risk elsewhere within the catchment.

According to the Flood Risk Assessment (presented as Appendix 12.1- SSFRA, Volume III), some wind farm infrastructure, such as certain access tracks and turbines, are located within Flood Zones A and B. To minimise any impact on existing flood levels, the access tracks and hardstanding areas within these zones will be constructed at ground level. For turbines located within or very close to flood zones—such as T1, T4, T5, T8, and T9—the plinths to which the towers will be bolted will be raised above the design flood levels with a minimum clearance of 500 mm. This will guarantee that the critical electrical and mechanical components housed in the base of the turbine tower will be protected. For more information see Appendix 12.1 - SSFRA, Volume III.

Structures On/Over Water

There will be 35 no. drain crossings and 1 no. watercourse crossing within the Site. The watercourse crossing will comprise a clear span bridge to cross the Cushina River between T6 and the on-site substation. There is also a requirement for a new clear span bridge along the TDR, to be installed adjacent to the existing bridge over the Philipstown River. The bridge structures will be a clear span type structure with a minimum abutment setback from the riverbanks of 2.5m. All culverts and bridge crossings have been sized to convey flows for a 1-in-100 year flood event plus a 20% allowance for climate change, such that the crossings will have no likely significant effects on catchment hydrology.

The Proposed Development will have a direct, long-term and not significant effect on alteration of surface water flow and flood extents.

12.7.2.2 Potential for Effects on Water Quality / Physico-chemical Conditions

During the operational phase, accidental pollution from spills and leaks of fuel, oil and chemicals from vehicles and maintenance works may occur. Additionally, transformer oil will be used in cooling the transformers associated with the sub-station which creates potential for oil spills during any oil replacement activity or leaks during the operational phase, although the likelihood of this is low. Additionally, permanent drains and settlement ponds will be installed and maintained across the Site as shown on the 1:500 series layout planning drawings (P22-145-0100-0006 to P22-145-0100-0059). These will act to attenuate any accidental spills such that they can be controlled and managed in a timely manner.

The significance of the effect of the release of the hydrocarbons into the receiving waters is Slight due to the low likelihood and low quantities involved.

12.7.3 Potential Effects During Decommissioning

As described in Chapter 2, wind turbines will be deconstructed by unbolting the components and disassembling using cranes. The hardstanding and foundation pedestals of the turbines will be covered over (with soil that was stripped during construction) and allowed to re-vegetate. This is less disruptive to the environment than removing the hardstanding and foundations.

Infrastructure that will be left in-situ following decommissioning includes: internal site access tracks, the on-site substation and ancillary electrical equipment.

In the event of decommissioning of the Wind Farm site, similar activities to the construction phase are carried out. Potential impacts would be similar to the construction phase but to a lesser degree.

12.7.3.1 Potential for Effects on Hydrology / Hydromorphology (Including Flood Risk)

The removal of permanent infrastructure and covering with soil could result in a very slight increase in surface water runoff until such time as vegetation has established. However, the settlement ponds on site will be maintained and operated during decommissioning, which will act to control the flow.

The Proposed Development will have a direct, temporary not significant effect on alteration of surface water flow and flood extents during decommissioning.

12.7.3.2 Potential for Effects on Water Quality / Physico-chemical Conditions

As the hard standing infrastructure will remain in place the sediment disturbance is not significant during the disassembly. Potential impacts are similar to the construction phase but less significant as there is no invasive works breaking ground and it is mainly associated with the dis-assembly of the above ground components of the turbines. The potential receptors are the same as the construction phase. No concrete works are required, and roads will be left in situ with only hardstandings being covered over with soil. All hardstandings are located greater than 50m from any watercourse and as such the potential for direct runoff is limited. The settlement ponds on site will be maintained and operated during decommissioning, which will act to control site runoff.

The Proposed Development will have a direct, temporary not significant effect on water quality during decommissioning

12.7.4 Potential Cumulative Effects

Cumulative effects of the proposed project with other developments in the region are presented here in relation to potential significant effects on hydrology and water quality.

Cumulative projects are existing and known developments in the planning system, the subject of an application, appeal or judicial review. It is accepted best practice that developments within the same catchment and at the construction stage need to be taken into consideration when assessing the potential for cumulative effects. According to Entec's 2008 report "it is conceivable that two or more wind farms (or indeed other developments) in the catchment of a water receptor could result in combined runoff impacts to water quality, which then exceed Environmental Quality Standard thresholds. It is generally the case that in such circumstances any such effect is only likely to have the potential to be significant during the construction period. Once operational, any effects are likely to be restricted to high rainfall events when the level of dilution of impact is proportionately increased by higher flow levels that can be anticipated under these circumstances. Despite this theoretical potential impact, it is possible to control construction effects by good management techniques and therefore in practice significant effects, either individually or cumulatively, will rarely occur. Where such impacts occur, other regulation provides additional controls. Due to the existing regulation over water environment there are absolute controls on the manner in which developments are constructed and operated in respect of the water environment which result in any potential effect being designed out. In this way it is unlikely that any cumulative effect would be significant."[2]

As per above only developments that lie in the same catchment(s) as the Proposed Development that have the potential to have their construction stage overlap with the Proposed Development's construction stage are considered.

Relevant projects, that are likely to have an impact on the Hydrology and Water Quality, in proximity to the Site and GCR are listed in Table 12-10.

[2] Entec UK Limited (2008) Review of Guidance on the Assessment of Cumulative Impacts of Onshore Windfarms: Phase 1 Report

Table 12-10: Energy Developments within 20 km of the Proposed Wind Farm Site

Development (Application No.)	Number of turbines	Distance from the Site (km)	Water regions	Status
Cloncreen Wind Farm	21	10.6km to the north of the site	Same catchment as the proposed development, separate sub-catchment	Operational since 2022.
Mount Lucas Wind Farm	28	11.1km to the north of the site	Same catchment as the proposed development, separate sub-catchment	Operational since 2015.
Cushaling Wind Farm	9	12km to the north-east of the site	Same catchment as the proposed development, separate sub-catchment	Permitted since 2020 & construction started in 2022.
Dernacart Wind Farm	8	c.15km west of the site	Same catchment as the proposed development, separate sub-catchment	High Court Ruled in favour of this development in June 2025. An Bord Pleanala (now An Coimisiun Pleanala) approved the development in January 2024 (Appeal Case Ref: 310312)
Moanvane Wind Farm	12	18.6km to the west of the site	Same catchment, same sub-catchment, separate sub-basin	Permitted since 2018 & construction started in 2022.
Yellow River Wind Farm	29	c.19km to the north of the site	Separate catchment	Permitted since 2022 & construction began in 2022, with an expected completion date in 2025.
Cushina Wind Farm	11	c.4.3km northwest of the site	Same catchment, same sub-catchment, separate sub-basin	Pre-Application stage
Clonarrow Wind Farm	4	c.12km to the north of the site	Same catchment as the proposed development, separate sub-catchment	Currently in Planning and awaiting decision (Planning Ref: 2560189)
Ballydermott Wind Farm	47	c.7.7km to the south east of the site	Separate catchment	Pre-Application Stage

Development (Application No.)	Number of turbines	Distance from the Site (km)	Water regions	Status
Old Court Solar Farm	n/a	c.18km north east of the site	Separate catchment	Approved by Kildare County Council in September 2022 under Ref: 22327
Ballyteige Solar Farm	n/a	c.20km to north west of the site	Separate catchment	An Bord Pleanala (now An Coimisiun Pleanala) approved the development in June 2024. (Appeal Case Ref: 318041) Construction not started yet.
Treascon Solar	n/a	c.2km south west of the site	Separate catchment	An Bord Pleanala (now An Coimisiun Pleanala) approved the development in July 2024. (Appeal Case Ref: 318436) Construction not started yet.
Cappakeel Solar Farm	n/a	c.11km south of the site	Separate catchment	Granted by LPA in September 2025 (Ref: 2560148). Appealed. Appeal Pending Decision by ACP (Ref: PL-500061-LS)

The proposed large-scale developments summarised in Table 12-10 have been considered. If construction/ maintenance works for these projects overlap or run concurrently with the development of the Site, there may be a cumulative impact on hydrology and water quality.

Wind Farms

Apart from Yellow River wind farm, all other wind farm developments within 20 km of the site share the same catchment as the Proposed Development. This is not surprising, as the Barrow catchment is a particularly large catchment, covering an area of over 3,000 km^2. At such a scale, wind farm developments within the same catchment are unlikely to act cumulatively with the Proposed Development unless there is a closer hydrological connection, for example if the projects share the same sub-catchment, or closer still by sharing the same sub-basin.

In the case of the Proposed Development, both the Moanvane Wind Farm and the Cushina Wind Farm share the same sub-catchment. Due to the distance from site, the Moanvane Wind Farm is unlikely to act cumulatively with the Proposed Development. However, the Cushina Wind Farm is located relatively close to the Proposed Development and would be likely to act cumulatively with the Proposed Development. Provided the Cushina project implements SuDS drainage design, sizes all watercourse and drain crossings appropriately, there will not be any significant cumulative impacts arising.

Forestry and Turbary

Turbary turf cutting and forestry activities occur in the vicinity of the Proposed Development and within a shared waterbody catchment. These activities can result in sedimentation of the local drains and watercourses and may be impacting the water quality of the Cushina and Figile. While potential effects on water quality from peat slippage or sediment runoff form the Proposed Development are deemed unlikely, there is potential for accidental runoff from the Site to act cumulatively with forestry and turbary activities if not properly mitigated.

12.8 Risk of Major Accidents and Disasters

This section assesses the potential significant adverse effects of the proposed project on the hydrology and water quality deriving from its vulnerability to Major Accidents and/or Natural Disasters, as well as the potential of the proposed project itself to cause potential Major Accidents and/or Natural Disasters during the construction, operation and decommissioning phases which might have an effect on water quality or hydrology.

Potential vulnerability to risks

Flood Risk

The proposed bridge that crosses the Cushina River has been designed with a minimum freeboard of 300 mm between the 1% AEP +CC flood level and the bridge deck to reduce the likelihood of debris blockage and also allows for uncertainties in hydrological and hydraulic design calculations. Sufficient span has been designed to minimise the afflux.

The proposed bridge for the section of the TDR crossing the Philipstown River has been designed following the same principles as the other bridge; however, flood relief culverts have also been included, as the TDR crosses a floodplain in this area.

Some wind farm infrastructure, such as certain access tracks and turbines, is located within Flood Zones A and B. To minimise any impact on existing flood levels, the access tracks and hardstanding areas within these zones will be constructed at ground level. For turbines located within or very close to flood zones—such as T1, T4, T5, T8, and T9—the plinths to which the towers will be bolted will be raised above the design flood levels with a minimum clearance of 500 mm. This will guarantee that the critical electrical and mechanical components housed in the base of the turbine tower will be protected.

Other essential and critical elements of the proposed development such as the substation and the grid connection route joint bays will be placed outside of the flood zones.

More information on flood risk, and the mitigation measures being implemented for the proposed development are contained within the SSFRA, presented as Appendix 12.1 (Volume III).

Potential to cause accidents and / or disasters

Peat Stability

Extensive ground investigation for the Proposed Development has been carried out and a peat stability assessment prepared for the Site (see Appendix 11.2). The stability analysis determined that the Site has a satisfactory margin of safety. As such, peat slippage into local watercourses at the Site is unlikely. Additionally, contingency measures / emergency response measures are set out in the CEMP in Appendix 2.1 of the EIAR, which will deal with any peat destabilisation in the unlikely event that it were to occur .

Water Contamination

Severe weather may cause increased mobilisation of sediment. However, this will be controlled via the project surface water design. Additionally, mitigation measures to protect water quality are fully set out in this Chapter as well as procedures and measures described in the Construction and Environmental Management Plan (CEMP). These will ensure that the risk of water contamination is low.

Flood Risk

A flood risk assessment was prepared as supported by a detailed hydraulic model of the catchment informed by detailed Digital Terrain Model (DTM) and surveyed watercourse cross sectional data from the catchment. The model has determined that the Proposed Development will not significantly increase flood risk elsewhere within the catchment.

12.9 Mitigation Measures

12.9.1 Mitigation By Avoidance

A process of 'mitigation by avoidance', as informed by constraints assessment and consultation, was undertaken by the EIA team during the design of the wind farm layout and selection of grid connection (refer to Chapter 3 - Site Selection and Alternatives for further detail) with the objective of avoiding / minimising the potential for significant effects on water quality and hydrology. The Site layout and drainage infrastructure has been designed such that it is sympathetic to the existing topography and aims to maintain the existing hydrological regime of the Site such that it does not create a changed hydrological response to precipitation. The design has been informed by a detailed flood risk assessment for the Site.

The infrastructure has been located such that it is set back as far as reasonably practicable from hydrological features, with an ethos of ensuring a minimum setback of 50 m between mapped surface waters and wind farm infrastructure, and a minimum setback of 10 m from non-mapped streams and drainage features with the exception of HDD locations and watercourse crossings. The County Development Plans for Kildare, Offaly and Laois require that a riparian buffer zone is maintained between the development works and the top of the riverbank. The design of the Proposed Development meets the objective of the Development Plans, noting that there are a number of watercourse crossings included in the Proposed Development.

A Surface Water Management Plan (SWMP) for the construction, operation and decommissioning stages of the Proposed Development is presented in Appendix 12.2, Volume III. The proposed drainage design will:

- Collect surface water runoff upgradient of the Proposed Development via interceptor drains and will redistribute this 'clean' collected runoff downgradient of the Proposed Development by means of cross drains which will release via diffuse outfalls to vegetated areas (within the same catchment) or will divert the runoff back into the existing network serving the catchment. This drainage design maintains the hydrological regime at the Site.
- Collect surface water runoff from the footprint of the Proposed Development (during construction, operation and decommissioning) and discharge diffusely to adjacent vegetated areas via settlement ponds, such that a deterioration in water quality does not occur.

Attenuation and Flood Risk

The Proposed Development will increase the impermeable area within the Site, however as per Table 12-10, this is not considered to cause a significant change in runoff rates. Notwithstanding, mitigation measures to address surface water runoff and drainage are proposed for this project as set out in Chapter 2, in the Surface Water Management Plan, and in the planning drawings which are primarily for the purposes of maintaining water quality but provide attenuation of flows in addition.

All access tracks will be constructed from aggregate which will allow a portion of rainfall to infiltrate and, therefore, reduce surface water runoff. Adjacent swales will also intercept and retain surface water runoff allowing this to disperse naturally via infiltration and evapotranspiration. Where swales are installed on sloped ground, check dam structures will be used within the channels to provide attenuation, allowing a portion of the flows to disperse naturally.

Swales and drainage channels will discharge runoff from access roads and areas of hardstanding to settlement ponds. These will be suitably sized to accommodate flows from storm events up to and including the 1 in 100-year storm event.

Settlement ponds will not discharge directly to any drain or watercourse. Rather, flows from the ponds will be dispersed diffusely over land to allow natural overland flow and percolation within the catchment.

Watercourse crossings will be designed and suitably sized to accommodate peak, or storm discharge rates so as not to cause risk of impeding flows during extreme storm events and causing flooding upstream of the crossing. All drain and watercourse crossings will be designed in accordance with the requirements of Regulation 50 of the European Communities (Assessment and Management of Flood Risks) Regulations 2010 SI 122 of 2010. The channel width will be maintained, and the crossings will be designed so as not to cause an impediment to the passage of woody debris or sediment transport. Appropriate freeboard will be provided to OPW requirements.

The cable trenches will be excavated in dry weather where possible and infilled and revegetated if required to prevent soil erosion or generation of silt pollution of nearby surface water.

The Flood Risk Assessment for the Proposed Development (Appendix 12.1) has identified that the Proposed Development will not result in a significant increase in flood risk to the locality. Additionally, the drainage design at the Site will ensure that there will be no increase in the risk of surface water runoff as a result of the windfarm development.

12.9.2 Monitoring

An Environmental / Ecological Clerk of Works (EnCoW / ECoW) will be appointed by the Developer with responsibility for monitoring at the Site during the construction phase of the Development. The Clerk of Works will have the authority to temporarily stop works to prevent negative effects on hydrology or to ensure corrective action is taken to mitigate adverse effects.

A Surface Water Quality Monitoring Programme will be established which will commence 12 months prior to construction in order to confirm the baseline physio-chemical conditions and hydromorphological conditions of the watercourses within the Site and will continue throughout construction and for three months post-commissioning phase of the Proposed Development.

Monthly water quality grab samples will be taken from the Cushina River at locations approximately 10m downstream of the proposed watercourse crossings. Water quality sampling will be undertaken in accordance with BS EN ISO 5667 - Water Quality Sampling.

The samples will be checked in situ for:

- pH;
- Temperature;
- Turbidity;
- Conductivity; and
- Dissolved Oxygen.

using a fully calibrated portable pH/temperature/conductivity meter (with pH resolution of 0.01 pH), turbidity probe and a flow impellor.

The samples will then be submitted to an appropriately certified laboratory (ILAB or similar) in accordance with the laboratory custody protocol for assessment of the following parameters:

i. Biological Oxygen Demand;
ii. Chemical Oxygen Demand;
iii. Total Hardness;
iv. Total Suspended Solids;
v. Total Dissolved Solids;
vi. Nitrate;
vii. Nitrite;
viii. Ammoniacal Nitrogen;
ix. Molybdate Reactive Phosphorus;
x. Total Coliforms; and
xi. Faecal Coliforms (E.coli).

A record of monthly meteorological conditions (as a minimum precipitation and temperature) will be maintained.

Biological water quality assessment using the EPA Q-value methodology will be carried out once prior to the commencement of construction and on a six-month basis during the monitoring period.

The hydromorphological baseline at the proposed watercourse crossings within the Site will be reconfirmed pre-construction using the River Hydromorphology Assessment Technique (RHAT). Annual RHAT assessments will be carried out which will be compared against the baseline. The Design and Construction of the bridge crossing and culverts will minimise upstream afflux, avoid turbulence and minimise loss of the natural channel bed due to the culvert or structure in order to ensure that hydromorphology is not affected. The Design will ensure that the baseline river Hydromorphological Condition Score derived from the initial RHAT assessment is not altered such that it would impact the derived WFD hydromorphology classification.

The Contractor will ensure that the daily visual monitoring of the surface water network for visible signs of construction impact is carried out on a daily basis for example, riparian vegetation loss, evidence of oil/fuel slick, sediment plumes, fish kill.

During the construction and commissioning phase, water quality monitoring results will be recorded and compared against baseline data and where there is a deviation beyond the 95%ile, the Contractor will investigate and as necessary sample further upstream and determine if elevated concentrations are coming from the Site, in which case the Contractor will ensure that emergency control measures (set out in the Surface Water Management Plan and CEMP) are put in place to return the levels to the baseline. Similarly, the Contractor will compare results of water quality monitoring with the 95%ile High Status Environmental Quality Standards arising from the European Union Environmental Objectives (Surface Waters) Regulations 2009 as amended. Any deviation beyond these standards will be investigated and the findings will be report to the Community Water Officer, South East Region.

During the construction and commissioning phase, daily inspection of environmental protection measures e.g. silt traps, check dams, ponds and outfalls and drainage channels will be carried out and any improvement works carried out within a timely manner.

12.9.3 Mitigation Measures for the Construction Stage

The mitigation measures prescribed are aimed at ensuring no deterioration in WFD status waterbodies within the catchments of the Project. Strict mitigation measures in relation to maintaining a high quality of surface water runoff from the Proposed Development will ensure that the status of surface waterbodies are not affected.

Best practice construction methods will be used to avoid potential for effects on water quality and hydrology following the documents and guidelines listed below:

- Water Run-Off from Construction Sites - SEPA - (WAT-SG-75)
- The SUDS Manual - CIRIA C753.
- Site Handbook for the Construction of SUDS - CIRIA C698 ISBN 0 86017 698 3.
- Works and maintenance in or near water - PPG5 - (October 2007)
- Environmental good practice on site guide (fourth edition) (C741)
- Guidance for Pollution Prevention, dealing with spills: GPP 22-(October 2018)
- Temporary Construction Methods - SEPA -(WAT-SG-29)
- Guidelines on protection of Fisheries During Construction Works in and Adjacent to Waters - Inland Fisheries Ireland - (IFI 2016)
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes - TII Publications (2008)

Further environmental best practice measures to be used as key parts of the construction phase are outlined in more detail in the Construction Environmental Management Plan CEMP (Appendix 2.1, Volume III), Grid Connection CEMP (Appendix 2.1B, Volume III) and reproduced below for ease of reference.

Control of Accidental Spills and Leaks

Regarding good practice associated with mitigating the risk of hydrocarbon release during construction, as stated in the SWMP, construction vehicles will be refuelled off-site, wherever possible. This will primarily be the case for road vehicles such as vans and trucks. Refuelling of mobile plant during construction will be carried out by mobile fuel tanks equipped with pressure relief valves, built-in vents, handles for easy transportation, pumps, hoses and meters to facilitate fuel transfer operations. Any additional fuel containers and for smaller equipment (such as generators, lights etc.) used on site will be positioned on appropriately sized plant nappy/bund and stored within additional secondary containment e.g. bund for static tanks or drip trays for smaller mobile containers. Taps/nozzles for fuels and storage containers for oils will be fitted with locks to ensure their use is controlled. Only designated trained and competent operatives will be authorised to refuel plant on site.

All tank and drum storage areas will, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:

- 110% of the capacity of the largest tank or drum within the bunded area; or
- 25% of the aggregate volume of all other substance which could be stored within the bunded area.

The purpose of this requirement is to ensure that any potential leaks, spills, or other releases from tanks or drums are effectively contained within the bunded area, preventing any environmental contamination or harm. The bunded area acts as a secondary containment system, providing an additional layer of protection against accidental releases and facilitating proper clean-up and mitigation measures.

All plant and equipment will be in good working order, checked regularly and maintained when necessary and a maintenance log maintained.

Fuels, lubricants and hydraulic fluids will be carefully handled to avoid spillage, properly secured and provided with appropriate type of spill containment kits in case of incident.

All spill-kits will be inspected on a weekly basis by the EnCoW to ensure they are maintained as fit for purpose.

Welfare / hygiene facilities will be located within the construction compounds only.

All water from vehicle wheel washes will be removed from site and disposed of by a licensed waste carrier.

Control of Concrete Runoff

Precast concrete will be used wherever possible for the structural elements of watercourse crossings (single span / piped crossings) as well as cable joint bays. However, ready mix and lean mix concrete will be required during the construction phase for piled turbine foundations, as blinding works for joint bay pits, culverts and cross drains, for concrete pads for bottomless culvert and clear span bridge foundations. On-site batching will not be permitted. Concrete will instead be transported to the Site by concrete truck.

The risk of concrete runoff from turbine foundation works areas will be minimal given that all turbine foundations are located a minimum of 50m from any watercourse. The potential effects associated with wet concrete being introduced below ground level in the form of piled foundations is dealt with in Chapter 11. Additionally, the formwork and site preparation works will contain the concrete in an enclosed, excavated area. For drain crossings requiring concrete works, these works will be carried out under dry works conditions, as discussed further below in relation to 'Works in or Adjacent to Waters'.

The acquisition, transport and use of concrete will be planned fully in advance of commencing works such that volumes are minimised, the route to and through the Site is predetermined so as to aim to avoid drains and watercourses and wash down areas are appropriately located. Additionally, all concrete works will be supervised at all times by the Developer's appointed Environmental / Ecological Clerk of Works.

No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately.

Concrete trucks will not be washed out on Site. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity, and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50m. This requirement will be communicated to all on-site personnel and to each concrete truck driver prior to entering into the works area. Washout areas / mortar bins will be sized such that they can withstand an unexpected heavy rainfall event without overtopping and they will be covered when not in use.

Concrete washing will be contained and managed. Waste concrete slurry, washings and supernatant will be allowed to settle/dry and will be taken to a licensed waste facility for disposal.

Any shuttering / formwork installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting, foams or other sealing products at joints.

Pouring of concrete into standing water within excavations will not be undertaken. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the treatment train and buffered surface water discharge systems in place. Where the isolated working area requires constant dewatering to maintain a dry works area, pumps will be turned off during the concrete pour and remain off until it can be ensured that the discharge will not result in a change in pH of +/-0.5 units for any nearby watercourse or drain. Alternatively, any dewatering from these areas during the concrete pour will be taken off site for disposal at a licensed waste facility for disposal. Once concrete has cured the pH of any water required to be dewatered will be checked and none of that water allowed to enter the environment unless it is back to within the normal baseline range of the local network.

Concrete works will be scheduled during dry weather conditions to reduce the elevated risk of runoff and will avoid foreseen sustained rainfall (any event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3mm/hour) and will not proceed during any yellow (or worse) rainfall warning issued by Met Éireann.

It will be ensured that suitably sized covers are available for freshly poured concrete to avoid wash off in the event of rain.

The EnCoW / ECoW will continually monitor the pH of any watercourse during concrete works in or adjacent to a watercourse or drain. Should any change in pH +/-0.5 be detected, concrete works will immediately be ceased. Steps will then be taken to identify the entry point to the drain or watercourse, and appropriate measures will be implemented to prevent further escape to the environment. The ECoW will consult CIRIA C532 to consider the most appropriate measure.

Spill kits will be readily available at the location of concrete works and will be appropriate for the containment and control of concrete spills and/or runoff.

The Community Water Officer for the Midlands and East Region, National Parks and Wildlife Services and Inland Fisheries Ireland will be notified immediately of any concrete spills / runoff into a watercourse.

Control of Sediment Runoff

The drainage and surface water management systems proposed for the Site as set out in the SWMP and the 1:500-Series planning application drawings will be installed concurrent with the main construction activities in order to control increased runoff and associated suspended solids loads.

Waters arising from dewatering during excavation works will be diverted into the surface water management system such that it is captured in settlement ponds and discharged diffusely over land. Where sediment loading from dewatering works is high, the flow will first pass through settlement tank(s) e.g. Silt Buster or similar. For smaller areas of dewatering, it may be sufficient to dewater onto adjacent lands within the Planning Boundary via filter bags, filter mats or natural vegetation. This will be determined by the EnCoW / ECoW. Water quality in the nearby downstream drains and watercourses will be monitored in real time for turbidity. Where turbidity equals or exceeds 28 Nephelometric Turbidity Units (NTU) the works will be stopped and an investigation into cause carried out and measures taken as appropriate.

A Peat and Spoil Management Plan will be implemented throughout the construction, operation and decommissioning of the Proposed Development and is presented in Appendix 11.3.

No permanent stockpile will remain on the site during the construction or operational phase of the Proposed Development. Excavated material will be either reused as fill / landscaping material within the Site or will be stored temporarily as stockpiles (in accordance with waste legislation) adjacent to the area of excavation and subsequently removed from the site as a byproduct or in accordance with waste legislation. Stockpiles will be covered with plastic sheeting.

The on-site cabling and grid connection will require excavation of cable trenches. All spoil from trenches in public roadways will be removed from Site as it is excavated and transported to a licenced waste facility. Road surfacing materials will be stored in a skip for recycling. Spoil from trenches cut into natural ground will be treated in a similar manner to spoil arising from excavations at turbine locations i.e. the material will be re-used on site in cut-and-fill works or for landscaping.

Earthworks will be scheduled during dry weather conditions where feasible to reduce the elevated risk of runoff and will avoid any foreseen intense rainfall event (>3mm/hour) and will not proceed during any yellow (or worse) rainfall warning issued by Met Éireann.

Silt fences will be established downslope along the perimeter of source areas of contaminated runoff. Silt fences will be installed close to source (as opposed to close to receptor). Silt fences will be constructed using a permeable filter fabric (e.g. Hy Tex Terrastop Premium silt fence or similar) and not a mesh or terram. The base of the silt fence will be bedded at least 15- 30 cm into the ground. Once installed the silt fence will be inspected regularly, daily during the proposed works, weekly on completion of the works for at least one month, but particularly after heavy rains and periodically thereafter. The integrity of the silt fencing will be checked daily by the EnCoW and after poor weather conditions (rain or wind) and any failures rectified immediately. Any build-up of sediment along the fence will be removed as deemed necessary by the EnCoW and in accordance with manufacturers requirements. The silt fencing will be left in place until the works are completed (which includes removal of any temporary ground treatment). Silt fences will not be removed during heavy rainfall. The silt fence will not be pulled from the ground but cutaway at ground level and posts removed. A record of when it was installed, inspected and removed will be maintained by the EnCoW.

Works in or Adjacent to Waters

In-stream works will be required at new culvert new bridge crossings.

All works within and adjacent to watercourses will be carried out in accordance with Inland Fisheries Ireland Biosecurity Protocols: https://www.fisheriesireland.ie/Biosecurity/biosecurity.html.

All in-stream works will be carried out under dry works conditions i.e. the works area will be isolated from the river/stream/drain flow by means of temporarily overpumping (in the case of the culverts) or fluming the flow (in the case of the clear-span bridge). The measures employed at the sheet piled floated road through Cloonbar Bog may be a combination of fluming and overpumping. Further construction details are presented in the Surface Water Management Plan.

The diversion of flow by overpumping / fluming will be into the same waterbody i.e. flows will not be diverted from one watercourse to another. The flume pipe and / or the pumps will be sized appropriate to watercourse flow and will have capacity to accommodate storm flows. Fluming is the preferred option for fishery watercourses and must be such that fish passage is maintained. Where overpumping is proposed, screening will be put in place to ensure that fish do not become entrained in the pump. Additionally, a gravel-lined sump will be provided to reduce sedimentation caused by pumping.

In order to create a dry works area, an upstream barrier will be installed using aquadam or sandbags (which will be double bagged and tied). Straw bales will not be permitted. Flows will either be overpumped or flumed downstream of the works area. A downstream barrier will then be installed and the works area dewatered. Direct dewatering into the watercourse will not be permitted as it will increase the risk of sedimentation. Instead dewatering will be via filter bag, sediment tank, filter mats or natural vegetation adjacent to the watercourse. Discharging of construction water (trade effluent) directly to surface waters will be subject to a water pollution licence. No extracted or pumped or treated construction water from the isolated construction area will be discharged directly to a drain or watercourse (This is in accordance with Local Government (Water Pollution) Act, 1977 as amended).

Any watercourses requiring a dry works area will require a fish salvage exercise which must firstly be authorised under Section 14 of the Fisheries (Consolidation) Act 1959. Fish salvage by electrofishing will not be carried out where water temperature exceeds 20ºC. Fish salvage operations can only be conducted by qualified ecologists under said licence. A detailed method statement will be required as part of the licence application. The work will have regard to the following general guidelines for electrical fishing include Beaumount et al., (2002) "Guidelines for Electric Fishing Best Practice" and Scottish Fisheries Coordination Centre (2007) "Electrofishing team leader training manual" and Central Fisheries Board (2008) Methods for the Water Framework Directive Electric Fishing in wadable reaches".

No in-stream works will be carried out in any WFD mapped watercourse or associated riparian area during the salmonid spawning season (which is October to May inclusive).

If it is necessary to sling concrete in a skip/hopper for the works or to pump concrete into the works area, the pump and/or hopper/skip will be moved only within or above the isolated works area and will not be allowed to operate above the watercourse.

Provided the construction water within the isolation area is managed in accordance with the measures described above and in the Surface Water Management Plan, overpumping / fluming of the surface water features does not pose a significant risk to surface water quality downstream of the watercourse crossings.

The EnCoW / ECoW will monitor the pH, temperature, DO, turbidity and conductivity of the watercourse upstream and downstream of the isolated works area. The works will be immediately stopped and an investigation of cause carried out and mitigated in the event of the following:

- any change in pH +/-0.5 detected between upstream and downstream monitoring locations
- downstream turbidity exceed 28 NTU
- DO drops below 80% saturation

Horizontal Directional Drilling

HDD will be employed at six locations along the grid connection route in accordance with the following methodology:

- A specialist contractor will be appointed to prepare Method Statements of works.
- Fuels, lubricants and hydraulic fluids for equipment use on Site will be carefully handled to avoid spillage, properly secured and provided with spill containment kits in case of incident.
- The depth of the bore will be at least 3m below the level of the stream bed so as not to conflict with the watercourse;
- Fluid return lines used in HDD process will be tested for leaks prior to use to check their reliability;
- Inert, biodegradable drilling fluid will be used;

- A comprehensive monitoring system will be established to closely oversee any procedures involving bentonite, encompassing the careful observation of pumping pressure, the precise formulation of drilling mud (including drilling fluid volume), and the accurate measurement of mud returns.

12.9.4 Proposed Mitigation Measures for Operation and Maintenance Stage

The SMWP will ensure that there is no effect on water quality as a result of operation of the Proposed Development. The proposed drainage system will provide several stages of treatment to surface water runoff from constructed areas, which follows the concept of a multi-stage SuDS 'treatment train'.

Interceptor drains installed upslope of access tracks and areas of hardstanding will divert surface water runoff from undeveloped land around the constructed areas to disperse naturally within open ground without mixing with the construction drainage.

The proposed swales will intercept surface water runoff from access tracks and areas of hardstanding. The grass within the swales will provide some filtration to remove a portion of silt and suspended solids. Silt traps will be provided upstream of outfalls from roadside swales.

The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to discharge. Additional treatment will be provided upstream of the settlement pond with the use of drainage stone at the inlet to provide filtration. In an emergency, the outfall from a settlement pond will be blocked to provide a temporary holding area for accidental spillages on site.

As stated in the SWMP, to adhere to CIRIA C753, the operational phase maintenance routine will involve the regular inspection of the following: drains, check-dams, cross-drains and culverts for blockages; outfalls to existing field drains and watercourses, existing roadside swales for obstructions; progress of re-vegetation.

12.9.5 Proposed Mitigation Measure for Decommissioning Stage

The access tracks will remain in situ for land management purposes, after the end of the operational period. Additionally, the turbine foundations and hardstanding will remain in situ and be covered over with soil from the site to re-vegetate naturally. Silt protection procedures, similar to during construction (as described in Section 12.9.3) will be employed for decommissioning.

12.10 Residual Effects

12.10.1 Residual Effects during Construction Stage

Effects on hydrology and water quality will be mitigated with measures outlined in Section 12.9.3. This will ensure that the residual impacts of the construction stage are Not significant and there will be no perceivable impact on the Cushina River and the downstream Figile River, and Barrow SAC which is a highly sensitive receptor that is hydrologically connected to the Site. Furthermore, the Proposed Development will not result in the deterioration of the status of any waterbody under the WFD or jeopardise the achievement of waterbody objectives (good / high status) of any such waterbody.

12.10.2 Residual Effects during Operation and Maintenance Stage

The unmitigated potential effects during the operational phase of the site was not significant. Visual monitoring and water quality monitoring at appropriate intervals will be undertaken as precautionary measures to inform any required contingency mitigation measures during operation. The main risk to surface water is the release of hydrocarbons, such as fuel into surface waterbodies via runoff. The residual risk is Not Significant.

12.10.3 Residual Effects during Decommissioning Stage

The potential residual effects associated with decommissioning will be similar to those associated with construction but of reduced magnitude.

Turbine bases and hardstanding areas will be covered with soil to encourage vegetation growth and reduce run-off and sedimentation.

Mitigated with measures outlined in Section 12.9.5 will ensure that the residual impacts of the decommissioning stage are Not significant and there will be no perceivable effect on the Cushina and downstream water bodies.

12.11 Limitations or Technical Difficulties

No limitations or technical difficulties were encountered in the preparation of this chapter of the EIAR.

12.12 Conclusions

As a result of the design of the project and prevention and mitigation measures that will be adopted, there will be no significant adverse effect on the environment and on hydrology and water quality as a result of the proposed development on its own or in combination with other plans and projects.

As a result of the design of the project and the prevention and mitigation measures to be taken, the proposed development will not directly or indirectly alone or in combination with other projects , cause a deterioration in the status of any waters or impair the ability of any waters to meet the objectives of the Water Framework Directive or those set for them in the Water Action Plan 2024.

It will not cause or permit any direct or indirect discharge or entry of priority substances or priority hazardous substances or any toxic/dangerous substances to any waters. The proposed development will not adversely affect the integrity of any European or protected site or NHA, pNHA in view of its water related conservation objectives and will not impair the objectives for any protected site and will comply with all relevant standards and will comply with Priority Pathway Action Plans (PPAP) relating to invasive species and soils and spoil when appropriate. The spread of invasive species will be prevented by testing of imported material as detailed in Chapter 11 – Soils, Geology and Hydrogeology. The onsite wheelwash will prevent the spread of invasive species from site to other lands.

The design of the proposed Directive therefore complies with the objectives of the WFD.

The proposed development will also lead to an overall improvement in the status of waters by the provision of wetland drains in accordance with the measures detailed in the BEMP and ensuring better monitoring of waters by the project ecologist.

Note: this is an assessment of the project in the light of the Water Framework Directive.

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