9. HYDROLOGY & HYDROGEOLOGY

9.1 Introduction

9.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO to carry out an assessment of the potential likely and significant effects of the Prospective Development on the water aspects (hydrology and hydrogeology) of the receiving environment.

The Prospective Development is described in full in Chapter 4 of this Environmental Impact Assessment Report (EIAR). The Prospective Development relates to the completion of construction, operation and decommissioning of the Meenbog Wind Farm. As detailed in Section 1.1.1 in Chapter 1 of this EIAR, the various development components are described and assessed using the following references: 'Subject Development', 'Existing Development', 'Prospective Development', 'Permitted Development', 'Site', 'Wind Farm Site', 'Grid Connection Site', 'BMEP Site', 'Grid Connection', ' November 2020 Peat Slide', '2017 EIAR' and 'proposed turbines' or 'proposed turbine locations'.

This chapter provides a baseline assessment of the environmental setting of the Site, as described in Chapter 4, in terms of hydrology and hydrogeology, and discusses the potential likely significant effects that the construction, operation and decommissioning of the Prospective Development will have. Where required, appropriate mitigation measures to avoid any identified significant effects to hydrology and hydrogeology are recommended and the residual effects of the Prospective Development post-mitigation are assessed. This chapter includes an assessment of the potential cumulative effects arising from the Prospective Development in combination with other relevant plans and projects and considers the potential for transboundary effects were relevant. The chapter also assesses the potential in-cumulation effects with the Existing Development as well as the cumulative effects of the Subject Development

9.1.2 Statement of Authority

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

Our core areas of expertise and experience include upland hydrology and windfarm drainage design. We routinely complete impact assessment reports for hydrological and hydrogeological aspects for a variety of project types.

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

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on 100 wind farm-related projects including original application for Meenbog Windfarm.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 5 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the hydrology and hydrogeology chapters of environmental impact assessment reports for wind farm developments. Conor has also prepared several flood risk assessments and Water Framework Directive compliance assessments for various renewable energy developments in Ireland.

9.1.3 Scoping and Consultation

The scope for this chapter of the EIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process and the List of Consultees is outlined in Section 2.6 of this EIAR. Matters raised by Consultees in their responses with respect to the water environment are summarised in **Table 9-1** below.

Table 9-1: Summary of Water Environment Related Scoping Responses

Consultee	Description	Addressed in Section
Geological Survey of Ireland (GSI)	The Groundwater Data Viewer indicates a 'Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones' and a 'Locally Important Aquifer - Bedrock which is Generally Moderately Productive' underlie the proposed wind farm. A 'Locally important gravel aquifer' is located adjacent to the wind farm boundary area.	All relevant GSI data sources have been used in the preparation of this EIAR chapter. The areas of 'High' and 'Extreme' groundwater vulnerability are identified in Section9.3.9
Donegal County Council (DCC)	DCC made several comments and recommendations regarding the completion of the wind farm with respect to hydrology and hydrogeology.	This is addressed throughout this chapter.
Health Service Executive (HSE)	"All drinking water sources, both surface and ground water, must be identified. Public and Group Water Scheme sources and supplies should be identified in addition to any private wells supplying potable water to houses in the vicinity of the proposed development. Measures to ensure that all sources and supplies are protected should be described. The Environmental Health Service recommends that a walk-over survey of the site is undertaken in addition to a desktop analysis of Geological Survey of Ireland data in order to identify the location of private wells used for drinking water purposes. Any potential significant impacts to drinking water sources should be assessed. Details of bedrock, overburden, vulnerability, groundwater flows, aquifers and catchment areas should be considered when assessing potential impacts and any proposed mitigation measures."	Section 9.3.13 identifies all water resources. An assessment of the potential effects is presented in Section 9.5.2.12 (private groundwater well supplies) and Section 9.5.2.11 (surface water abstractions).
Uisce Éireann	"Where the development proposal has the potential to impact an Uisce Éireann Drinking Water Source(s), the applicant shall provide details of measures to be taken to ensure that there will be no negative impact to Uisce Éireann's Drinking Water Source(s) during the construction and operational phases of the development. Hydrological / hydrogeological pathways between the applicant's	An assessment of the potential effects is presented in Section 9.5.2.12 (private groundwater well supplies) and Section 9.5.2.11 (surface water abstractions).

Consultee	Description	Addressed in Section
	site and receiving waters should be identified as part of the report.”	
	“Where the development proposes the backfilling of materials, the applicant is required to include a waste sampling strategy to ensure the material is inert.”	No fill material will be imported to the site. All backfilling will be completed with local peat and overburden which will be excavated from the work areas during the construction process.
	“Mitigations should be proposed for any potential negative impacts on any water source(s) which may be in proximity and included in the environmental management plan and incident response”	All mitigation measures which were implemented for the protection of surface waters are detailed in Section 9.5.2.
	“Any and all potential impacts on the nearby reservoir as public water supply water source(s) are assessed, including any impact on hydrogeology and any groundwater/ surface water interactions”	All effects on the Lough Mourne surface water abstraction are detailed in Section 9.5.2.11.
	“Any potential impacts on the assimilative capacity of receiving waters in relation to Uisce Éireann discharge outfalls including changes in dispersion / circulation characterises. Hydrological / hydrogeological pathways between the applicant’s site and receiving waters should be identified within the report”	All effects on the Lough Mourne surface water abstraction are detailed in Section 9.5.2.11.
	“Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence / present a risk to the quality of the water abstracted by Uisce Éireann for public supply should be identified within the report.”	All effects on the Lough Mourne surface water abstraction are detailed in Section 9.5.2.11.
Inland Fisheries Ireland (IFI)	IFI made comments relating to the Grid Connection as they state the Wind Farm Site is not within IFI’s jurisdiction. IFI note that the Eske is an important sub-catchment for brown trout, Atlantic salmon and European eel. IFI state that it is imperative that water quality are protected in the Lowerymore_020 and _030 waterbodies which both achieved High status in the most recent EPA report. The rEIAR should assess the impacts with regards to water pollution and changes to hydrology and should include all aspects of the development.	It is noted that all works associated with the Grid Connection have already been completed as part of the Existing Development and the effects are assessed in the rEIAR. With regard to the Wind Farm, detailed mitigation measures for the protection of downstream watercourses, and associated fisheries, have been prescribed in Section 9.5.2.

Consultee	Description	Addressed in Section
Northern Ireland Environmental Agency (NIEA)	The Site is located upstream of the Corgary Trout Farm (AFFNI 7). The Groundwater Team request an assessment of the potential impact on groundwater flows, aquifers and private groundwater well supplies. The Site is connected to the River Derg which form part of the River Foyle and Tributaries SAC and ASSI and is adjacent to the Killeter Forest Bogs and Lakes ASSI and Croagh Bogs ASSI.	Effects on downstream designated sites are presented in Section 9.5.2.10. Effects on groundwater levels are presented in Section 9.5.2.4, effects on groundwater quality are presented in Sections 9.5.2.5 (hydrocarbons), 9.5.2.6 (cement-based products) and 9.5.2.7 (wastewater). Effects on groundwater wells supplies are presented in Section 9.5.2.12.
Irish Peatland Conservation Council (IPCC)	The IPCC requested that several items were addressed with respect to the Existing Development. These related to impacts on WFD status and compliance and effects on designated sites. No comments were raised in relation to the Prospective Development.	All comments relating to the Existing Development are addressed in the rEIAR. The potential effects of the Prospective Development on designated sites is presented in Section 9.5.2.10. The effects on WFD status are addressed in Section 9.5.2.13.

9.1.4 Transboundary Effects

The Site is located nearby (within 3-5kms), or in some places adjacent to (actually running along the border) the Northern Ireland border and therefore is proposed in river catchments located in both Ireland and Northern Ireland. The following impact assessment therefore considers both trans-border hydrological and hydrogeological impacts, with the former generally being potentially more significant. The potential cumulative impacts of other wind farm developments located in Northern Ireland are also assessed where required. Consultation letters were also issued to relevant Northern Ireland agencies regarding the Prospective Development and their responses are summarised in Section 9.1.3 above.

9.1.5 Relevant Legislation

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

The requirements of the following legislation are also complied with:

- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);

- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 477/2011: European Communities (Birds and Natural Habitats) Regulations, implementing EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD").
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC).
- European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003);
- S.I. No: 122/2010: European Communities (Assessment and Management of Flood Risks) Regulations, resulting from EU Directive 2007/60/EC;
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

Relevant Northern Irish legislation was also reviewed and considered during the assessment of transboundary hydrological impacts. The following legislation was consulted:

- S.R. 2017 No. 81: Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017;
- S.R. 2015 No. 351: Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015;
- S.R. 2009 No. 254: Groundwater Regulations (Northern Ireland) 2009;
- S.R. 2009 No. 376: Water Environment (Floods Directive) Regulations (Northern Ireland) 2009; and,
- S.R. 2007 No. 147: Water Supply (Water Quality) Regulations (Northern Ireland) 2007.

9.1.6 Relevant Guidance

The Hydrology and Hydrogeology chapter of this EIAR is carried out in accordance with guidance contained in the following:

- Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Environmental Protection Agency (EPA) (2022): Guidelines on the information to be contained in Environmental Impact Assessment Reports; (hereafter referred to as 'EPA, 2022');
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- DoE/NIEA (2015): Wind farms and groundwater impacts - A guide to EIA and Planning considerations";

- OPW (2009) The Planning System and Flood Risk Management;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Energy Development Guidelines for Planning Authorities, 2006 (the DoEHLG 2006 Guidelines) and the Draft Revised Wind Energy Development Guidelines (Draft DoHLGH 2019 Guidelines);
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- Wind Farms and Groundwater Impacts: A guide to EIA and Planning considerations (DoE/NIEA, April 2015);
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001;
- Land Types for Afforestation (Forest Service, 2016b):
- Forest Protection Guidelines (Forest Service, 2002);
- Forest Operations and Water Protection Guidelines (Coillte, 2013);
- Forestry and Water Quality Guidelines (Forest Service, 2000b); and,
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plant 2018-2021 (DAFM, 2018).

9.2 Methodology

9.2.1 Desk Study

A desk study of the Site and the water study area (refer to Section 9.2.5) below for a definition of the study area) was completed in January and February 2024 to collect all relevant hydrological, hydrogeological and meteorological data. The desk study was completed to supplement site specific data which has been gathered for the Site and detailed in Section 9.2.2. This desk study was checked and updated, where necessary (as new data may have been published), in November 2025, January 2026, and again in June 2026.

The desk study involved consultation with the following sources for the Republic of Ireland:

- Environmental Protection Agency Databases (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 3 (Geology of South Donegal). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Flood Mapping (www.floodmaps.ie);
- Environmental Protection Agency – Hydrotool Viewer (www.epa.ie);
- Aerial Photography, 1:5,000 and 6" base mapping; and,
- My plan.ie: National Planning Applications Map Viewer ((https://myplan.ie/national-planning-application-map-viewer).

The desk study also included a review of all available site-specific reports and assessments which have been previously in relation to the Site. The consulted documents included the following:

- Meenbog Wind Farm Environmental Statement (2017). Environmental Impact Assessment Report for the Proposed Meenbog Wind Farm, County Donegal. Prepared for Energia Renewables.
- Meenbog Wind Farm 2019 Construction and Environmental Management Plan (CEMP) updated from 2017 under condition compliance and submitted to Donegal County Council).

The following online data sources were used for Northern Ireland:

- Department of Agriculture, Environment and Rural Affairs (DAERA) online mapping databases); and,
- Northern Ireland Environment Agency (www.ni-environment.gov.uk).

9.2.2 Baseline Monitoring and Site Investigations

A comprehensive and robust hydrological dataset has been collected at the Site across multiple phases of site investigations which included site investigations completed as part of the baseline assessment for the 2017 EIAR, site investigations completed during the construction phase of the Existing Development, site investigations completed in the aftermath of the November 2020 Peat Slide and site investigations completed specifically for the purposes of this EIAR.

HES completed a detailed review of the 2017 EIAR planning application, associated files and site investigations as part of the baseline hydrology and hydrogeology assessment of this EIAR. The intrusive site investigations (detailed in full in Chapter 8: Land, Soils and Geology of this EIAR) included mapping the distribution and depth of blanket peat along with assessing the mineral subsoil/bedrock interface beneath the peat at key locations. Hydrological surveys and monitoring included drainage mapping, surface water flow monitoring, surface water quality sampling and field hydrochemistry.

Additional hydrological monitoring was completed during the construction of Existing Development by MKO and HES in line with the requirements set out in the 2017 EIAR and the associated 2019 Construction Environmental Management Plan (CEMP) (an updated version of the 2017 CEMP which was submitted to DCC in compliance with the conditions of grant for the Permitted Development). This monitoring comprised of the following:

- Installation of sondes to provide continuous turbidity monitoring. 3 no. sondes were installed on 9th September 2019 and 3 no. additional sondes were installed following the November 2020 Peat Slide;
- A suitably qualified Ecological Clerk of Works (ECoW) undertook daily visual check of waterbodies during the construction phase. These checks included the maintenance of sondes, visual inspection of surface water sampling points and visual inspection of all visual check locations (12 no. locations);
- Monthly grab sampling at 4 no. sampling locations from August 2019 to April 2026;
- Intensive grab sampling was also completed on the Mourne Beg River in the aftermath of the November 2020 Peat Slide; and,
- MKO completed biological monitoring at 19 no. locations in November 2020;
- Triturus Environmental Ltd. completed 2 no. rounds of biological water quality monitoring (18 no. kick samples each) in July 2024 and July 2025.

For the specific purposes of this EIAR:

- MKO have also completed several multi-disciplinary walkover surveys at the Site between 2024 and 2026. These surveys included the BMEP Site;
- 5 no. groundwater monitoring wells were drilled at the Wind Farm Site in April 2025 by Peterson Drilling Services Ltd under the supervision of HES;

- Groundwater samples were obtained from 3 of these wells on 10th April 2025 and at 2 no. nearby streams in order to characterise the existing groundwater quality at the Site;
- Subsequent groundwater sampling was completed on the 5 no. monitoring wells on 5th February 2026; and,
- Triturus Environmental Monitoring also completed extensive aquatic monitoring in July 2024 and July 2025 including biological Q-rating monitoring.

The data obtained from all of these site investigations have been used in the characterisation, description and assessment of the hydrological and hydrogeological environment.

9.2.3 Impact Assessment Methodology

The guideline criteria in EPA, 2022 for the assessment of likely significant effects require that likely effects are described with respect to their quality (i.e. negative, positive or neutral), significance, extent, context, probability, duration, frequency and reversibility. The descriptors used in this environmental impact assessment are those set out in the EPA, 2022 Glossary of effects as shown in Section 1.6.2 of Chapter 1 of this EIAR.

In addition, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of sensitivity which are defined in **Table 9-2** and **Table 9-3** for hydrogeology are used to assess the potential effect that the Prospective Development may have on them.

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

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

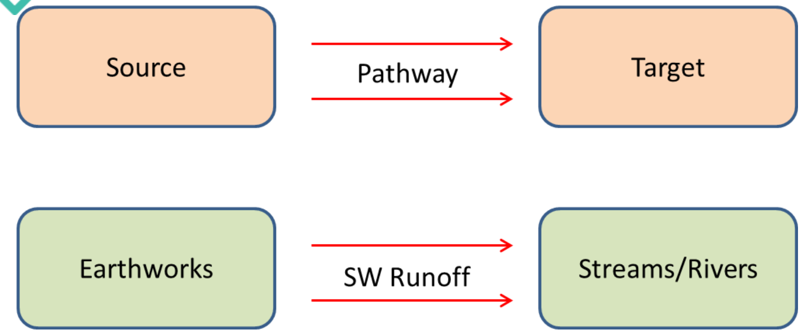
Importance	Criteria	Typical Example
		Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes. Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 9-3: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)

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

9.2.4 Overview of Impact Assessment Process

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



The descriptors used in this EIAR are those set out in the EPA, 2022 classification of effects as shown in Chapter 1 of this EIAR. The description process clearly and consistently identifies the key aspects of any impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

Where potential effects are identified, the classification of impacts in the assessment follows the descriptors provided in the classification of effects contained in EPA, 2022.

The description process clearly and consistently identifies the key aspects of any potential impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

In order to provide an understanding of the stepwise impact assessment process applied below (Sections 9.5.2 to 9.5.4), a summary guide is presented in **Table 9-4** below, which defines the steps (1 to 7) taken in each element of the impact assessment process. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA, 2022 impact descriptors are combined.

Using this defined approach, this impact assessment process is then applied to all Prospective Development construction, operation and decommissioning activities which have the potential to generate a source of significant adverse impact on the geological and hydrological/ hydrogeological (including water quality) environments.

Table 9-4: Impact Assessment Process Steps

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

9.2.5 Water Study Area

The water study area for the hydrological environment (surface water) is delineated by the surface water catchments within which the Site is located. The regional surface water catchments and sub-catchments within which the Site is located are detailed in Section 9.3.3.

The water study area for the hydrogeological environment (groundwater) is delineated by the bedrock aquifers and groundwater bodies which are mapped beneath the Site. These bedrock aquifers and groundwater bodies are detailed in Section 9.3.8.

9.2.6 Limitations and Difficulties Encountered

The EIAR assessment has been carried out based on the available information. A large quantum of data (water quality data) is available for the watercourse draining the Site. This data was accrued as part of the 2017 EIAR studies and during the construction phase of the Existing Development (a detailed water monitoring programme was implemented as per the 2017 EIAR and the 2019 CEMP associated with the Permitted Development). Sufficient information is available to characterise the receiving hydrological and hydrogeological environment and to inform a robust impact assessment

9.3 Baseline/ Receiving Environment

9.3.1 Site Description and Topography

The Site, which refers to the three distinct elements – the Wind Farm Site, Grid Connection Site, and BMEP Site combined, measures approximately 1,018 hectares (ha) within the townlands of Meenbog, Croaghonagh, Ardinawark, Keadew Upper, Keadew Lower, Cullionboy, Cashelnavean, Tawnawully Mountains, Friarsbush and Tievecloghoge.

9.3.1.1 Wind Farm Site

The Wind Farm Site, which efers to the area of the Site surrounding the wind turbines and associated infrastructure (including the onsite 110kV substation) from the wind farm site entrance off the N15 National Road, is located in Co. Donegal, ~8km to the southwest of the twin towns of Ballybofey and Stranorlar, and ~12km northeast of Donegal Town. The eastern and southern boundaries of the Wind Farm Site are defined by the border with Co. Tyrone, Northern Ireland. The closest town in Northern Ireland is Castlederg which is located ~17.1km to the southeast. The Wind Farm Site has a total area of ~892ha in area.

Current land-use at the Wind Farm Site is comprised of the partially constructed Meenbog Wind Farm, areas of commercial forestry and blanket bog, and roadways. The surrounding land-use predominantly comprises peat bogs, commercial forestry and other seminatural areas with limited residential use along local roads.

Prior to the construction of the Existing Development, a network of existing forestry roads provided access in and around the Wind Farm Site. The Wind Farm Site was covered by blanket bog with very few natural mineral subsoil or bedrock exposures. However, a number of pre-existing borrow pits where the subsoil and bedrock profile were observed and showed that the peat directly overlies bedrock, weathered bedrock or very thin pockets of subsoils.

The elevation of the Wind Farm Site ranges between ~180 and 313mOD (metres above Ordnance Datum), with elevations generally decreasing and sloping in a north or north-westerly direction. A small section in the south of the Wind Farm Site slopes to the southeast. The Wind Farm Site is generally bordered on all sides by forestry plantations with the eastern and southern boundaries also being defined by the Northern Ireland border. The Wind Farm Site drains directly to the Bunadowen River, and the Shruhangarve stream to the north, each of which are tributaries of the larger Mourne Beg River that proceeds to flow downstream into the River Derg. The Wind Farm Site also drains into the Glendergan River to the south-southeast, which is also a tributary of the River Derg. Topography of the Wind Farm Site is shown in **Figure 9-1**.

Existing access is from the N15 National Road in the northwest of the Wind Farm Site and via a local road in the north Wind Farm Site. The N15 National Road runs south-west to north-east, with the Wind Farm Site lying about 2km east of the road.

Construction of the Existing Development commenced in November 2019, at which point the majority of the civil engineering works, including wind farm access roads, 110kV onsite electrical substation, turbine hardstands, turbine foundations, and ancillary works were substantially completed over the following 12-month period up to the November 2020 Peat Slide. The Existing Development footprint (~32.6ha) covers only a small percentage (~3.7%) of the overall Wind Farm Site (892ha).

9.3.1.2 Grid Connection Site

The Grid Connection Site has a total area of 9ha and extends along the N15 National Road national route to the L-2595 Local Primary Road, then proceeds to the L-1985 Local Primary Road, continues along the L-19852 Local Road, with a small section along private lands to reach the Clogher 110kV substation. The Clogher substation is situated approximately 6.5 km southwest of the on-site 110kV Substation. The Grid Connection Site traverses the townlands of Ardinawark, Keadew Upper, Keadew Lower, Cullionboy, Cashelnavean, Tawnawully Mountains and Friarsbush.

The land use in the lands surrounding the Grid Connection Site is predominantly forestry with sections of peat cutting, farming and open peatlands.

Ground elevations along the Grid Connection Site are greatest in the vicinity of the Wind Farm Site entrance where ground elevations stand at ~153mOD. Elevations decrease along the N15 National Road to the southwest, with the lowest elevations being at ~80mOD. Ground elevations along the Grid Connection rise again from the N15 National Road towards Clogher 110kV substation which stands at ~142mOD.

9.3.1.3 BMEP Site

The BMEP Site comprises two blocks of land both contained entirely within the townland of Tieveclohoge, referred to as Parcel 1 (the eastern block) and Parcel 2 (the western block), which have a combined area of approximately 117ha, 108ha of which are intended for enhancement. Land use on site within both parcels of land currently comprises coniferous forestry which is proposed to be felled and converted to peatland and scrub habitats. There is an elevation difference of 4m (174m elevation SW to 170 m elevation NE) on the BMEP Site.

Site access to Parcel 1 is via a new access track located along the L65242 Local Road, whilst site access to Parcel 2 is via an existing access track (to be extended and upgraded) located along the L2974 Local Road. Parcel 2 is located approximately 2.3km east of the Wind Farm Site, and Parcel 1 is located approximately 4.2km east of the Wind Farm Site. There are also existing forestry access tracks, which are proposed for upgrade and extension to facilitate the tree felling works at both sites. Parcel 2 is located approximately 2.3km east of the Wind Farm Site, and Parcel 1 is located approximately 4.2km east of the Wind Farm Site. A full description of the proposed enhancement/restoration measures is contained in Section 4.4.1.10 and EIAR Appendix 6-4 Biodiversity Management and Enhancement.

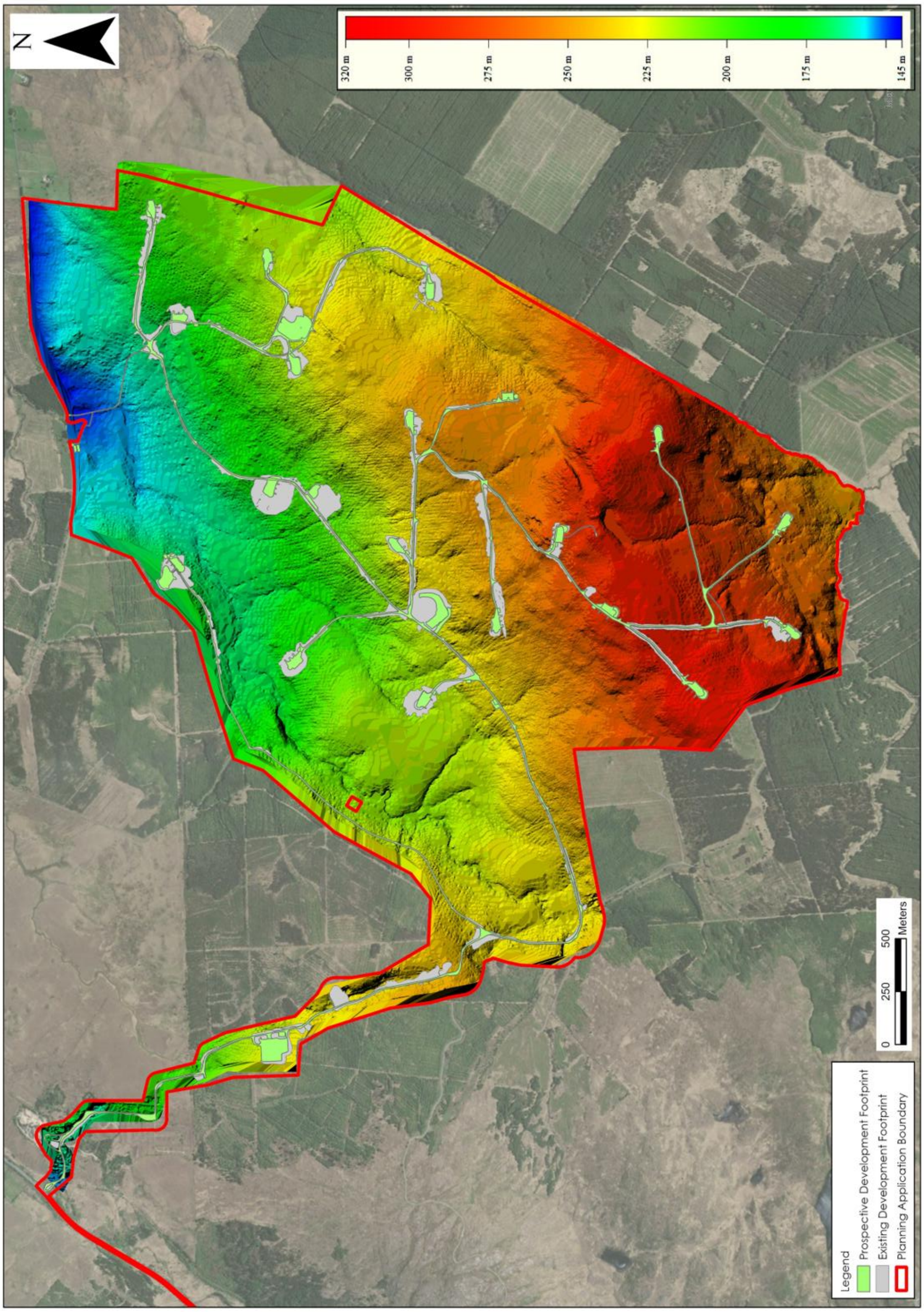


Figure 9-1 Topography of the Wind Farm Site

9.3.2 Water Balance

9.3.2.1 Wind Farm Site

Long-term Annual Average Rainfall (AAR) and evaporation data were sourced from Met Éireann (www.met.ie). The 30-year AAR (1981-2010) (more up-to-date, site-specific data is presented below) recorded at Ballybofey (Lough Mourne), located ~2km northwest of the Wind Farm Site are presented in **Table 9-5**. The long-term AAR at Ballybofey (Lough Mourne) is 1,931mm/year.

However, the rainfall data from Ballybofey (Lough Mourne) is likely to underestimate the actual AAR at the Wind Farm Site due to elevation differences. Ballybofey (Lough Mourne) rainfall station stands at an elevation of 101mOD, whilst the topography at the Wind Farm Site ranges up to 327mOD.

Met Éireann also provide a grid of AAR for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the AAR at the Wind Farm Site ranges from 2,004 to 2,185mm/year. The conservative value of 2,185mm/year is taken as the AAR for the Wind Farm Site. This is considered to be the most accurate estimate of AAR from the available desk study sources.

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

Station		X-Coord		Y-Coord		Ht (MAOD)		Opened		Closed		
Lough Mourne		110700		23500		101		1963		N/A		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
214	152	170	113	101	107	122	154	162	211	204	221	1,931
Wind Farm Site (X-Cord: 205000 Y-Cord:387000)												
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
237	199	177	128	126	127	152	165	169	213	235	257	2,185

In addition, HES installed a rain gauge at the Wind Farm Site on 24th November 2020. The daily rainfall volumes from 24th November 2020 to 17th December 2025 have subsequently been recorded and the data is presented in **Figure 9-2** below. The greatest daily rainfall was recorded on 20th February 2022 with 75.6mm of rainfall. During the monitoring period the month with the greatest rainfall was February 2022 with a total volume of 399mm of precipitation recorded at the Wind Farm Site.

Note that the rain gauge was not recording correctly between 22nd February and 24th April 2024. Following routine maintenance, the rain gauge resumed operation and continued recording the daily rainfall totals for the Wind Farm Site.

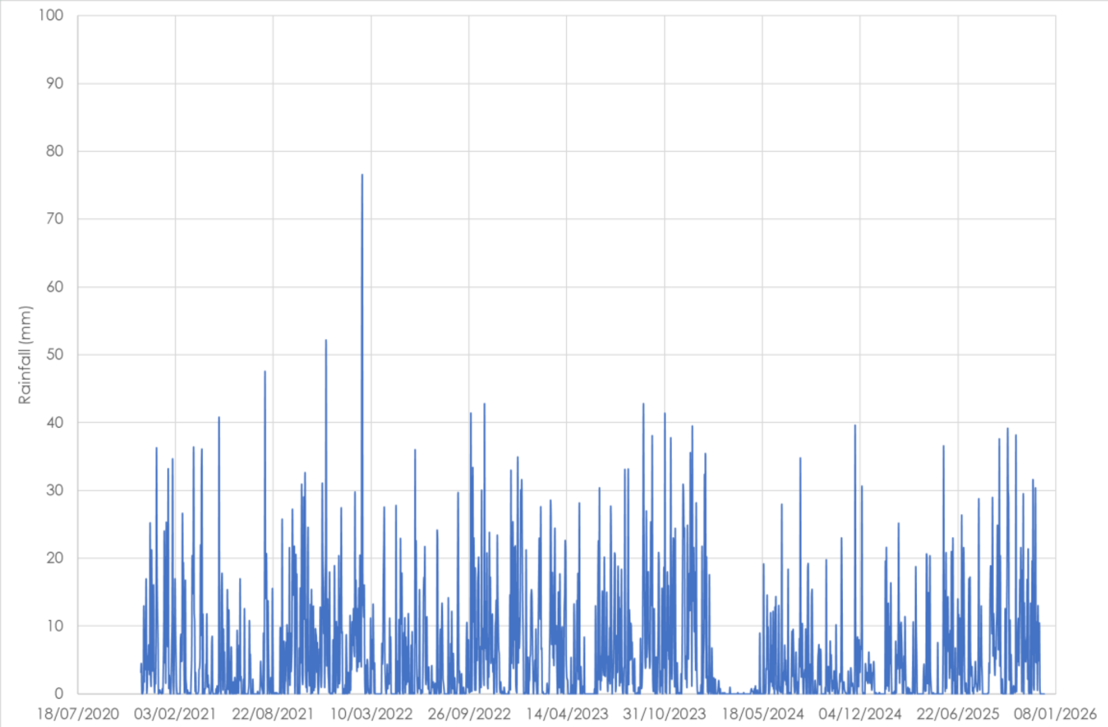


Figure 9-2: Daily Rainfall Data at Site (Dec 2020 – December 2025)

The closest synoptic[1] station where the average Potential Evapotranspiration (PE) is recorded is at Belmullet, located ~36km west of the Wind Farm Site. The long-term average PE for this station is 527.1mm/year. This value is used as a best estimate of the PE at the Wind Farm Site. Actual Evaporation (AE) is estimated as 500.7mm/year (which is 0.95 × PE).

The Effective Rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the Wind Farm Site is calculated as follows:

Effective Rainfall (ER) = Average Annual Rainfall (AAR) – Actual Evapotranspiration (AE)

= 2,185mm/year – 501mm/year

ER = 1,684mm/year

Groundwater recharge coefficient estimates are available from the GSI (www.gsi.ie). Within the Wind Farm Site groundwater recharge coefficients are mapped as ranging from 4 to 10% due to the coverage of blanket peat, the sloping nature of the local topography and the low to moderate permeability of the underlying bedrock aquifer.

An estimate of ~67mm/year average annual groundwater recharge is given for the Wind Farm Site. This calculation is based on a conservative recharge coefficient of 4% (*i.e.* 96% surface water runoff). This means that the hydrology of the Wind Farm Site is characterised by high surface water runoff rates and relatively low groundwater recharge rates. This is supported by on-site observations made during the Site walkover surveys whereby a high density of headwater streams and drains were recorded within the Wind Farm Site.

Therefore, conservative annual recharge and runoff rates for the Wind Farm Site are estimated to be ~67mm/yr and 1,617mm/yr respectively. These calculations do not consider the footprint of the Existing Development and therefore, reflects the baseline recharge and runoff rates of the Wind Farm Site prior to the onset of construction activities. Section 9.5.2.19 of the rEIAR presents an assessment of the effects

[1] Meteorological station at which observations are made for synoptic meteorology and at the standard synoptic hours of 00:00, 06:00, 12:00, and 18:00.

of the Existing Development on runoff rates at the Wind Farm Site. The assessment assumes that the footprint of the Existing Development (32.6ha) is impermeable as a worst-case scenario. The assessment concludes that the Existing Development resulted in an increase of ~0.1% in the average daily surface water runoff from the Wind Farm Site in comparison to the pre-development condition (~2,354mm/month with an increase of ~75.9mm/day due to the Existing Development). This is a conservative representation of the existing baseline environment for the Prospective Development.

Met Éireann's Translate Project (https://www.met.ie/science/translate) provides projections for a range of future climate change scenarios, as Ireland's future climate will depend on global greenhouse gas emissions reductions. The severity of any future climate change will depend on the degree of future warming. In relation to precipitation chances, the models show that summer rainfall may decrease by approximately 9% and winter rainfall could increase by up to 24%. In a 1.5°C world, average winter and summer precipitation rates are projected to be 5.41mm/day and 3.53mm/day respectively in Co. Donegal. In a 4°C world, the average winter and summer precipitation rates in Co. Donegal are projected to be 5.88mm/day and 3.27mm/day respectively.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. **Table 9-6** presents return period rainfall depths for the area of the Wind Farm Site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 50-year, 100-year).

Table 9-6: Return Period Rainfall Depths (mm) for the Wind Farm Site

Return Period (Years)				
Storm Duration	1	5	30	100
5 mins	4.9	5.9	8.7	10.7
15 mins	8.1	9.7	14.3	17.6
30 mins	10.9	13.8	19.3	23.7
1 hour	14.8	18.7	26.1	32.1
6 hours	32.2	40.7	56.9	70.0
12 hours	43.6	55.1	77.0	94.7
24 hours	59.0	74.6	104.2	128.2
2 days	76.78	90.1	125.6	150.4

9.3.2.2 Grid Connection Site

The AAR along the Grid Connection Site ranges from a minimum of 1,723mm/yr in the southwest to a maximum of 2,185mm/yr in the vicinity of the Wind Farm Site. The conservative AAR for the Grid Connection Site is also taken to be 2,185mm/year.

9.3.2.3 BMEP Site

The AAR in the area of the BMEP Site ranges from a minimum of 1,584mm/yr in the east to a maximum of 1,797mm/yr in the west. The conservative AAR for the BMEP Site is taken to be 1,797mm/yr.

9.3.3 Regional and Local Hydrology

9.3.3.1 Wind Farm Site

The vast majority of the Wind Farm Site is located in the Foyle River surface water catchment within Hydrometric Area No. 1. This river basin district is an international river basin district with ~3% of this district located in Northern Ireland. Meanwhile, a small area in the northwest of the Wind Farm Site is mapped in the Donegal Bay North regional surface water catchment, with Hydrometric Area No. 37 of the North Western River Basin District.

Within the Foyle River catchment, the Wind Farm Site is located in the Mourne Beg River sub-catchment (MourneBeg_SC_010). The Mourne Beg River, a tributary of the Mourne River, flows to the southeast from Lough Mourne, situated ~2km northeast of the Wind Farm Site entrance. The Mourne Beg River flows to the east, ~150m north of the Wind Farm Site before it crosses into Northern Ireland. Further downstream, this watercourse discharges into the River Derg, ~15km to the east. The River Derg continues to the east. The Mourne River is formed at the meeting of the River Derg and the River Strule, ~27km east of the Wind Farm Site. The Mourne River then flows to the north, through the town of Strabane, before it confluences with the Finn River to form the River Foyle.

In terms of WFD river sub-basins, the Wind Farm Site is located in a total of 5 no. WFD river sub-basins within the Mourne Beg River sub-catchment.

- The northwest of the Wind Farm Site is located in the Mourne Beg_010 WFD river sub-basin. This area is drained by the EPA mapped Croaghonagh Stream (EPA Code: 01C31). Note that this stream is referred to as the Mary Breen's Burn on local OSI mapping (note that the Mary Breen's Burn will be utilised for the remainder of this chapter). Mary Breen's Burn flows to the northeast and discharges into the Mourne Beg River (EPA Code: 01M01), ~1.8km northeast of the Wind Farm Site.
- A small area in the northeast of the Wind Farm Site is also mapped in the Mourne Beg_010 WFD river sub-basin. Here, the Mourne Beg River is located ~100m north of the Wind Farm Site.
- Much of the Wind Farm Site is located in the Bunadaowen_010 WFD river sub-basin (i.e. the Bunadowen River which is spelt "Bunadaowen" on EPA WFD mapping). This area is drained by the Bunadowen River (EPA Code: 01B01) and several of its smaller tributaries. There is a high density of mapped watercourses in this area of the Wind Farm Site.
- A small area in the northeast of the Wind Farm Site is mapped in the Mourne Beg River (Derrygoonan) WFD river sub-basin. This area is drained by the Shruhanagarve Stream (EPA Code: 01S26) which flows to the northeast, before it discharges into the Mourne Beg River.
- The southeast of the Wind Farm Site is located in the Glendergan River WFD river sub-basin. An unnamed tributary of the Glendergan River flows to the south from the area of the Wind Farm Site. The Glendergan River itself forms the southeastern boundary of the Wind Farm Site. This watercourse discharges into the River Derg ~3.7km to the southeast.

Within the Donegal Bay North surface water catchment, the Wind Farm Site is mapped in the Eske River sub-catchment (Eske_SC_010). Within this area, a tributary of the Lowerymore River, referred to by the EPA as the Barrack Hill Stream (EPA Code: 37B16) flows to the southwest in the vicinity of the Wind Farm Site entrance. The Lowerymore River (EPA Code: 37L01) flows to the southwest, through Barnesmore Gap, before discharging into Lough Eske ~8.7km to the southwest.

A regional hydrology map showing the WFD catchments and sub-catchments is shown as **Figure 9-3**. A local hydrology map showing WFD river sub-basins is shown as **Figure 9-4**. Meanwhile, **Table 9-7** below details the locations of the components of the Prospective Development with respect to the WFD regions.

9.3.3.2 Grid Connection Site

The Grid Connection Site is predominantly located in the Donegal Bay North catchment and the Eske River sub-catchment (Eske_SC_010). The Grid Connection passes through the Lowerymore_020 and Lowerymore_030 WFD river sub-basins.

Within the Donegal Bay north catchment there are a total of 14 no. watercourse crossings along the Grid Connection. These crossings include the following:

- A crossing over the EPA mapped Barrack Hill Stream (EPA Code: 37B16) occurs at the Wind Farm Site entrance.
- 2 no. crossings over the Lowerymore River along the N15 National Road, at Barnes Bridge and further to the west at Keadew Bridge.
- A total of 7 no. crossings over tributary streams of the Lowerymore River between Barnes Bridge and Keadew Bridge. These streams are generally unnamed by the EPA with the exception of the Friarsbush Stream (EPA Code: 37F07). These streams flow to the south from the slopes of Croaghconnellagh Mountain.
- 2 no. crossings over watercourses along the L1495. A crossing over an unnamed stream close to the N15 National Road and a crossing over the Millanalamphry River (EPA Code: 37M37).
- A crossing along a local road over the outfall stream from Lough Craig.
- A crossing over a small 1st order stream (unnamed) to the north of Clogher 110kV substation. This stream feeds into Lough Craig.

9.3.3.3 BMEP Site

The BMEP Site is located in the Foyle River sub-catchment and the Mourne Beg River sub-catchment (MourneBeg_SC_010). More locally, the BMEP Site is located in the Mourne Beg River (Derrygoonan) WFD river sub-basin.

As stated above, the Mourne Beg River flows to the south/southeast immediately to the south of Parcel 2. A tributary of the Mourne Beg River, the Trusk Stream (EPA Code: 01T05) flows to the southwest along the western boundary of Parcel 2. The EPA also map a small stream to originate within the BMEP Site.

With regards to Parcel 1, the Corraffrin River (EPA Code: 01C18) flows to the south along the eastern boundary of the BMEP Site. This river discharges into the Mourne Beg River ~1.9km to the south. The EPA also map a tributary stream of the Corraffrin River, referred to by the EPA as the Tievecloghoge Stream (EPA Code: 01T09) to flow to the northeast, through the BMEP Site. Inspection of local 6" base mapping and satellite imagery also reveals the presence of a lake waterbody known as Lough Beg ~90m to the west of the forestry plantation. The small stream flows to the southeast from this lake and discharges into the Tievecloghoge Stream within the BMEP Site.

Table 9-7 below details the locations of the BMEP Site with respect to the WFD regions.

Table 9-7: Components of the Prospective Development with Respect to WFD Regions

Prospective Development	Main EPA Mapped Watercourses	WFD River Sub-Basin	WFD Sub-Catchment	WFD Regional Surface Water Catchment
Upgrades of existing site roads	Lowerymore River	Lowerymore_020	Eske_SC_010	Donegal Bay North
Completion of T2 foundation, extension and completion of turbine hardstand areas, blade set down areas, upgrades of existing site roads and construction of new roads	Glendergan River	Glendergan River	Leaghany River_SC_010	Foyle
Completion of T19 foundation, extension and completion of turbine hardstand areas, blade set down areas, upgrades of existing site roads and construction of new roads, extension to borrow pit, peat cell and temporary construction compound	Mary Breen's Burn Stream and Mourne Beg River	Mourne Beg_010	Mourne Beg_SC_010	
Completion of T18 foundation, extension and completion of turbine hardstand areas, blade set down areas, upgrades of existing site roads and construction of new roads, extraction of rock from BP1, BP2 and BP3, met mast	Bunadowen River	Bunadaowen_010		
Construction of T7 and completion of T16 foundations, extension and completion of turbine hardstand areas, upgrades of existing site roads and construction of new roads, and BMEP Site	Shruhanagarve Stream at the Wind Farm Site. Corraffrin River, Trusk Stream and Mourne Beg river at BMEP Site.	Mourne Beg River (Derrygoonan)		

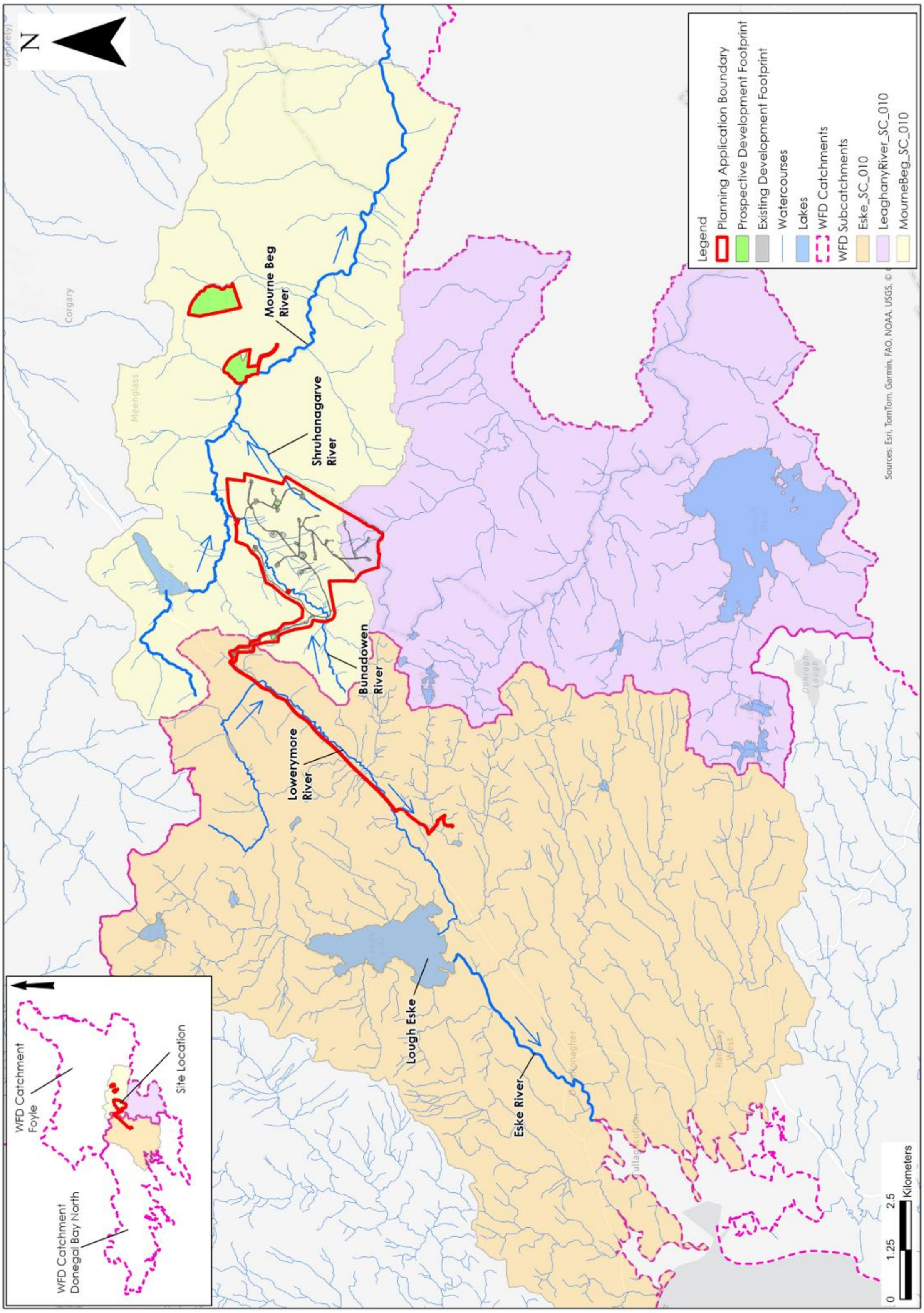


Figure 9-3: Regional Hydrology Map

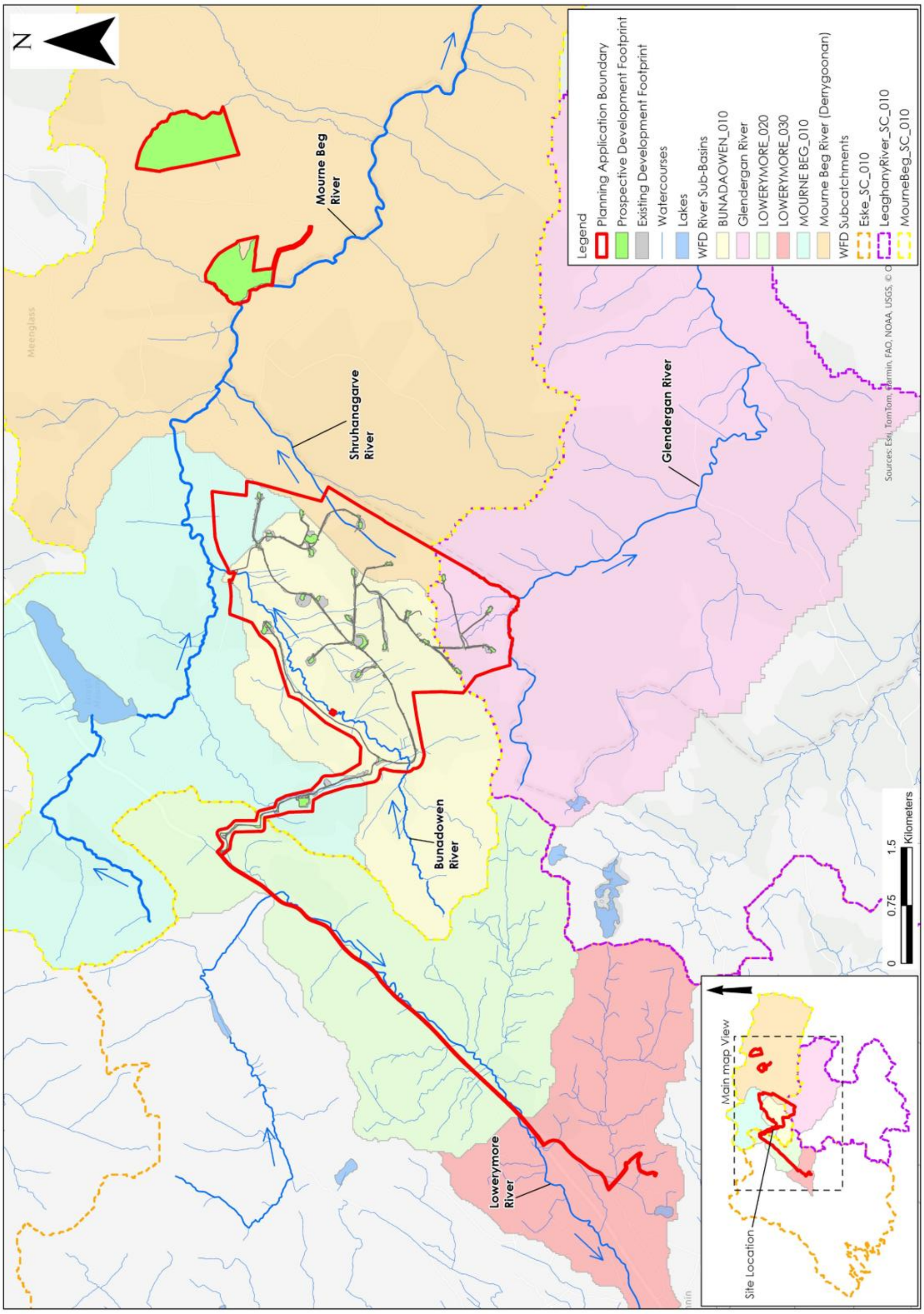


Figure 9-4: Local Hydrology Map

9.3.4 Surface Water Flows

An OPW gauging station is located on the Bunadowen River within the Wind Farm Site. This station, named the Croaghnagawna Station (Station No: 01054), records water levels and flow volumes. The Bunadowen River at this location has an upstream catchment size of 4.9km^2 and the 95%tile (percentile) flow volume is recorded as being 0.021m^3/s. This means that 95% of the time the flow in the Bunadowen River at this location is at or above 0.021m^3/s. However, there are no gauging stations along the Mourne Beg or Glendergan rivers in the vicinity of the Wind Farm Site for which flow data is available.

Therefore, the EPA's Hydrotool, available on www.catchments.ie, was consulted in order to estimate baseline flow volumes in the local area. The Hydrotool dataset contains estimates of naturalised river flow duration percentiles. Several nodes were consulted in the vicinity and downstream of the Wind Farm Site. **Figure 9-5** below presents the estimated flow duration curves for each of the consulted Hydrotool Nodes downstream of the Wind Farm Site.

EPA Hydrotool Nodes are available on the Bunadowen River and the Mourne Beg River in the vicinity of the Wind Farm Site. No modelled flow volumes are available for the watercourses within Northern Ireland. Flow volumes are also available on the Lowerymore River downstream of the Wind Farm Site and the Grid Connection.

The 95%tile flow at Node 01_373 on the Bunadowen River, upstream of its confluence with the Mourne Beg River, is estimated to be 0.045m^3/s (45l/s). This indicates that 95% of the time, the flow at this location is estimated to be at or above 0.045m^3/s. Due to the increasing catchment size, the 95%tile flow at the nodes along the Mourne Beg River downstream of the Wind Farm Site are larger. For example, at Node 01_1848, the furthest available downstream node, the 95%tile flow is estimated to be 0.258m^3/s (253l/s). Similarly, the flow volumes in the Lowerymore River increase progressively downstream. The increasing flow volumes downstream are associated with the increased upstream catchment of the respective waterbodies.

This means that those watercourses in close proximity to the Wind Farm Site would have been more susceptible to effects than those located further downstream. It is worth nothing that the construction of the Prospective Development will not in any way rely upon the dilution/assimilative capacity of any downstream watercourse. The implementation of the mitigation measures prescribed in this EIAR, will ensure the protection of all downstream watercourses.

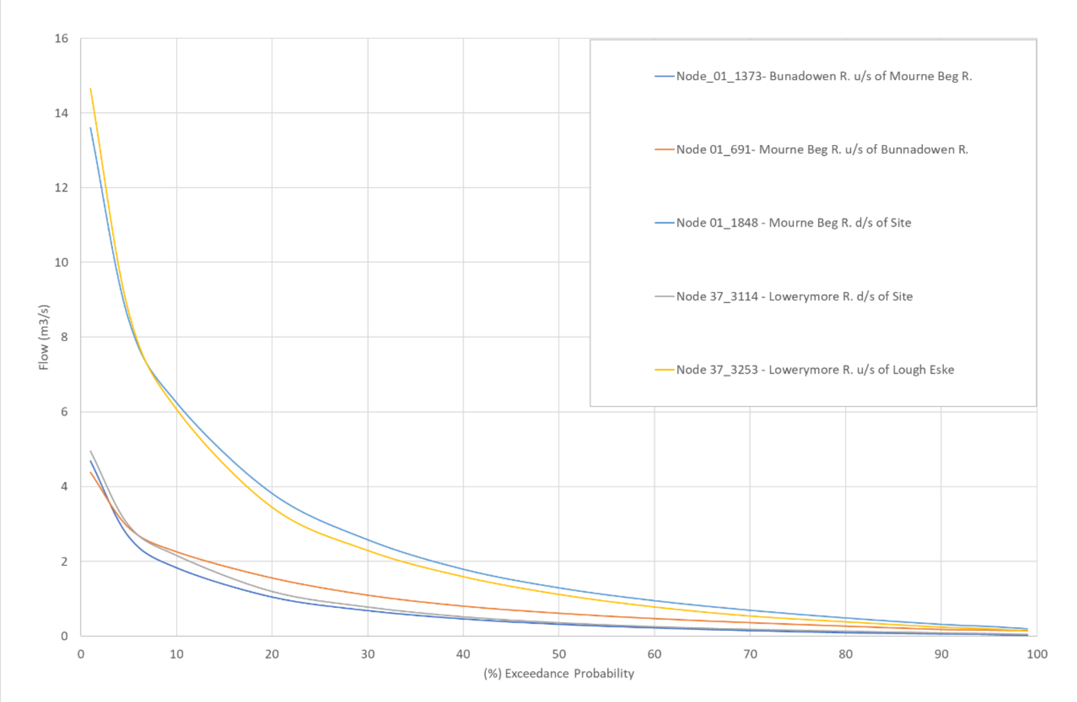


Figure 9-5: EPA Hydrotool Node Flow Duration Curves

Surface water flows were measured by HES at the Wind Farm Site on 20th September 2017. The recorded flow volumes are shown in **Table 9-8** below. The watercourses monitored are typical of the headwater streams that drain towards the Bunadowen River.

Table 9-8: Surface Water Flow Monitoring (20th September 2017)

Location	Easting	Northing	Channel Width (m)	Water Depth (m)	Flow Volume (m^3/s)
FM1	208130	387062	1.1	0.35	0.033
FM2	206135	385190	0.5	0.09	0.013
FM3	205791	385190	1.1	0.15	0.080
FM4	206593	386681	0.4	0.09	0.011

9.3.5 Existing Wind Farm Site Drainage

The Wind Farm Site is comprised largely of coniferous forestry plantations. The internal forestry drainage pattern is influenced by the local topography, peat cover, layout of the forest plantation and by the pre-existing forestry road network. The forestry plantations are generally drained by a network of mound drains which typically run perpendicular to the topographic contours and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains and ploughed ribbon drains are generally spaced approximately every 15-20m and 2m respectively. Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. Interceptor drains are also located up-gradient of existing forestry access roads. Culverts are located on forestry existing access roads at stream and drain crossings and at low points under access roads which drain runoff onto down-gradient forest plantations.

A schematic of a typical standard forestry drainage network and one which is representative of the drainage network within the forestry plantations at the Wind Farm Site is shown as Figure 9-6. The forestry drains are the primary drainage routes towards the natural streams, but the flows in the higher elevated drains are generally very low or absent most of the time.

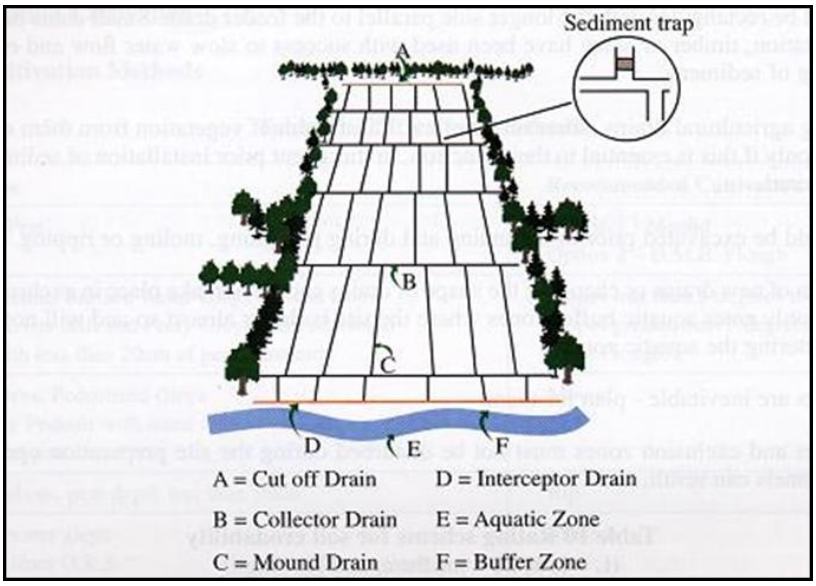


Figure 9-6: Schematic of Forestry Drainage

Construction of the Existing Development began in November 2019. Prior to the onset of the construction works, drainage management system were inserted around work areas and were integrated with the forestry drainage network.

The layout of the Existing Development drainage network included the use of the following:

- Interceptor Drains: These were installed upgradient of works areas to collect clean surface water runoff and prevent it from reaching construction areas. Clean water is diverted around the works area where it is released over the ground as sheet flow.
- Swales: These shallow drains were used to collect runoff from the construction areas and collects any sediment laden water.
- Check Dams: These dams controlled the velocity of flows within the interceptor drains and drainage swales, ensuring that the flow is non erosive. The check dams are comprised of straw bales or stone and were installed at regular intervals.
- Stilling Ponds: These ponds are located at the end of swales and intercept runoff which is potentially laden with sediment and provide attention which promotes the settlement of suspended solids. A primary and secondary pond were constructed at each location. Water outflows from the settlement pond through a stone dam, partially wrapped in a geotextile membrane, which controls flow velocities and trapped any sediment that had not yet settled out of suspension. Downstream of the ponds the water is redistributed as diffuse sheet flow in filter strips.
- Roadside Berms: Low-level berms were used to contain sediment within the road corridor and prevent runoff into the wind farm drainage system at uncontrolled locations. The berms ensure that runoff is allowed to access the drainage system only via the stilling ponds.
- Culverts: Culverts were constructed where required to maintain drainage pathways and/or pre-existing culverts were upgraded along pre-existing access tracks.
- Silt Fences: These were used as an additional water protection measure around the existing watercourses in certain locations, particularly where works were completed within the 50m stream buffer or 100m lake buffer.

9.3.6 Summary of Flood Risk Assessment

9.3.6.1 Wind Farm Site

A Flood Risk Assessment of the Wind Farm Site has been carried out by HES, the findings of which are presented in full in Appendix 9-1 of this EIAR and are summarised below.

To identify those areas as being at risk of flooding, the OPW's Past Flood Events Maps, the National Indicative Fluvial Mapping, CFRAM River Flood Extents, historical mapping (i.e. 6" and 25" base maps) and the GSI Groundwater Flood Maps were consulted. These flood maps are available to view at Flood Maps - Floodinfo.ie.

The OPW Past Flood Events Maps have no records of recurring or historic flood instances within the Wind Farm Site. Similarly, identifiable text on local available historical 6" or 25" mapping does not identify any lands that are "liable to flood". There is one mapped historic flood event located ~4.24km to the southwest of the Wind Farm Site (Flood ID: 4194) that is of no consequence to the Prospective Development.

The GSI's Winter 2015/2016 Surface Water Flood Map shows surface water flood extents for this winter flood event. This flood event is recognised as being the largest flood event on record in many areas. The flood map for this event records 1 no. surface water flood zone within the south of the Wind Farm Site. This area has the possibility of flooding again if there is similar heavy rainfall to 2015/2016 winter. However, this flood zone is not in the vicinity of the Prospective Development.

No CFRAM mapping has been completed for the area of the Wind Farm Site. The closest mapped CFRAM fluvial flood zones are along the Finn River, ~5.5km to the northeast at Stranorlar.

The National Indicative Fluvial Flood Map for the Present Day Scenario maps a flood zone within the centre of the Wind Farm Site along the Bunadowen River. The flood zones from this river are constrained to be immediate vicinity of the channel. The Prospective Development avoids Flood Zones A and B with the exception of the amenity proposals. The proposed car park, community garden and picnic area adjacent to the L6554 are mapped within the modelled NIFM 100 year flood zone. The total footprint of the Prospective Development mapped within the flood zones is 1,567m^2. This area is infinitely small in comparison to the total area of the NIFM fluvial flood zones within the Wind Farm Site (171,095m2). Therefore, the proposed footprint within the flood zone represents ~1% of the flood zone within the Wind Farm Site. Given the prevailing soils/subsoils geology across the Wind Farm Site and at the amenity proposals (peat, over thin glacial till/shallow bedrock comprising Pre-Cambrian quartzites/gneisses and schists (which form a poor bedrock aquifer (Pl)), recharge to ground is generally low (4% across the Wind Farm Site), and runoff is the dominant hydrological process. As such, the drainage proposals at the amenity proposals reflect these prevailing baseline conditions. Surface water runoff generated from the amenity areas will be managed through appropriate drainage measures, including a silt trap and hydrocarbon interceptor, to protect the receiving water quality. During flood events, the floodplain will continue to function naturally and to minimise potential impacts on flood storage and flood conveyance, the car park will be constructed with porous stone. Where required culverts will also be utilised in order to main the hydrological regime during flood events and to prevent the occurrence of a damming effect. The culverts, silt trap, and hydrocarbon interceptor will be inspected and maintained annually to ensure ongoing functionality. A small area of the playground is mapped in the flood zone but there is no potential for significant effects due to its small footprint and the prevailing high rates of runoff. Considering, the limited encroachment upon the flood zone and the permeable construction of the car park, the Prospective Development will not result in any significant effects on the upstream or downstream flood risk. Furthermore, the Wind Farm Site is not mapped within any historic or modelled groundwater flood zones.

The main risk of flooding at the Wind Farm Site is via fluvial flooding along the Bunadowen River. As stated previously, none of the components of the Prospective Development are located within the modelled flood zones.

Surface water ponding/pluvial flooding may occur in some flat areas of the Wind Farm Site due to the presence of low permeability peat at the surface. Mostly the risk of pluvial flooding is low.

In general, the risk of flooding at the Wind Farm Site is low due to the elevated and sloping nature of the land and the high density of forestry drains and natural streams which flow downslope.

9.3.6.2 Grid Connection Site

In addition to the Flood Risk Assessment completed for the Wind Farm Site, the potential for flooding at the Grid Connection Site has also been assessed.

The OPWs Past Flood Events Map records the presence of a recurring flood event (Flood ID: 4194) on the Lowerymore River near Barnesmore Gap in close proximity to the Grid Connection Site along the N15 National Road.

The GSI's Winter 2015/2016 Surface Water Flood Map does not record any historic flood zones along the Grid Connection. Flood zones are mapped at Lough Eske downstream of the Grid Connection Site.

No CFRAM mapping has been completed for the area of the Grid Connection Site.

The National Indicative Fluvial Flood Map for the Present-Day Scenario maps fluvial flood zones along the Lowerymore River adjacent to the Grid Connection Site. The flood zones are largely constrained to the immediate vicinity of the river channel to the east of the N15 National Road. The flood zones do overlap with the N15 National Road at the existing watercourse crossings located at Barnes Bridge and Keadew Bridge. The flood zones are also mapped to encroach upon a small section of the N15 National Road in the townland of the Tawnawully Mountains.

The Grid Connection Site is not mapped within any historic or modelled groundwater flood zones.

In summary, the vast majority of the Grid Connection Site is at low risk of flooding. However, there are areas which may be prone to flooding, principally at watercourse crossings over the Lowerymore River along the N15 National Road.

9.3.6.3 BMEP Site

The potential for flooding at the BMEP Site has also been reviewed.

The OPWs Past Flood Events Map and the GSI's Winter 2015/2016 Surface Water Flood Map do not record any historic flood events of flood zones in the area of the BMEP Site.

No CFRAM mapping has been completed for the area of the BMEP Site. The National Indicative Fluvial Flood Map for the Present-Day Scenario indicates fluvial flood zones along the Mourne Beg River. The flood zones are constrained to the immediate vicinity of the river and do not encroach upon the BMEP Site.

The BMEP Site is also not mapped within any historic or modelled groundwater flood zones.

In summary, the BMEP Site is at low risk of flooding.

9.3.7 Surface Water Quality

9.3.7.1 EPA Water Quality Monitoring

Biological Q-rating[2] data for EPA monitoring points in the local catchments downstream of the Site are presented below. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from Q1 (Bad) to 4-5 (High).

A map of EPA monitoring locations, and the most recent status results, are shown on **Figure 9-7** below and are presented in **Table 9-9**.

In 2022, the Bunadowen River achieved a 'Good' Q-status upstream of its confluence with the Mourne Beg River (Station ID: RS01B010100). Further downstream, the Mourne Beg River was also found to be of 'Good' Q-status at a bridge southwest of Tonreagh (Station ID: RS01M010200). The Shruhanagarve Stream, was found to be of 'Poor' Q-status (Q3/0) at Shruhanagarve Bridge (Station ID: RS01S260830). A biological Q3/0 quality rating indicates poor ecological status with evidence suggesting potential toxic effects on macroinvertebrate communities. This status was an improvement on the 'Bad' Q-status that this stream achieved in 2020 following November 2020 Peat Slide. Downstream of the Shruhanagarve Stream, the Mourne Beg River was found to be of 'Moderate' Q-status (Q4) upstream of Croagh Bridge (Station ID: RS01M010420).

Within the Eske sub-catchment, the Lowerymore River achieved a 'Good' Q-status at Barnes Bridge (Station ID: RS37L010100) in 2024. The Lowerymore River also achieved a Q4-5 rating ('High' Q-status) downstream of the Site at Keadew Bridge (Station ID: RS37L010300) in 2021. The Lowerymore River was also found to be of 'High' Q-status in 2021 upstream of Lough Eske (Station ID: RS37L010400).

Table 9-9: Recent EPA Q-Ratings (2021 – 2024)

Watercourse	Station ID	Easting	Northing	Years	EPA Q-Rating Status Range
Mourne Beg River Sub-Catchment					
Bunadowen	RS01B010100	208140	387608	2022	Q4
Mourne Beg	RS01M010200	209903	388300	2022	Q4
Shruhanagarve	RS01S260830	210229	387230	2023	Q3/0
Mourne Beg	RS01M010420	212470	385903	2022	Q4
Eske Sub-Catchment					
Lowerymore	RS37L010100	203974	387034	2024	Q4
Lowerymore	RS37L010300	201129	383850	2021	Q4-5
Lowerymore	RS37L010400	197985	381990	2021	Q4-5

2 The Q-Rating scheme method is used whereby a Quality-index is assigned to a river or stream based on macroinvertebrate data.

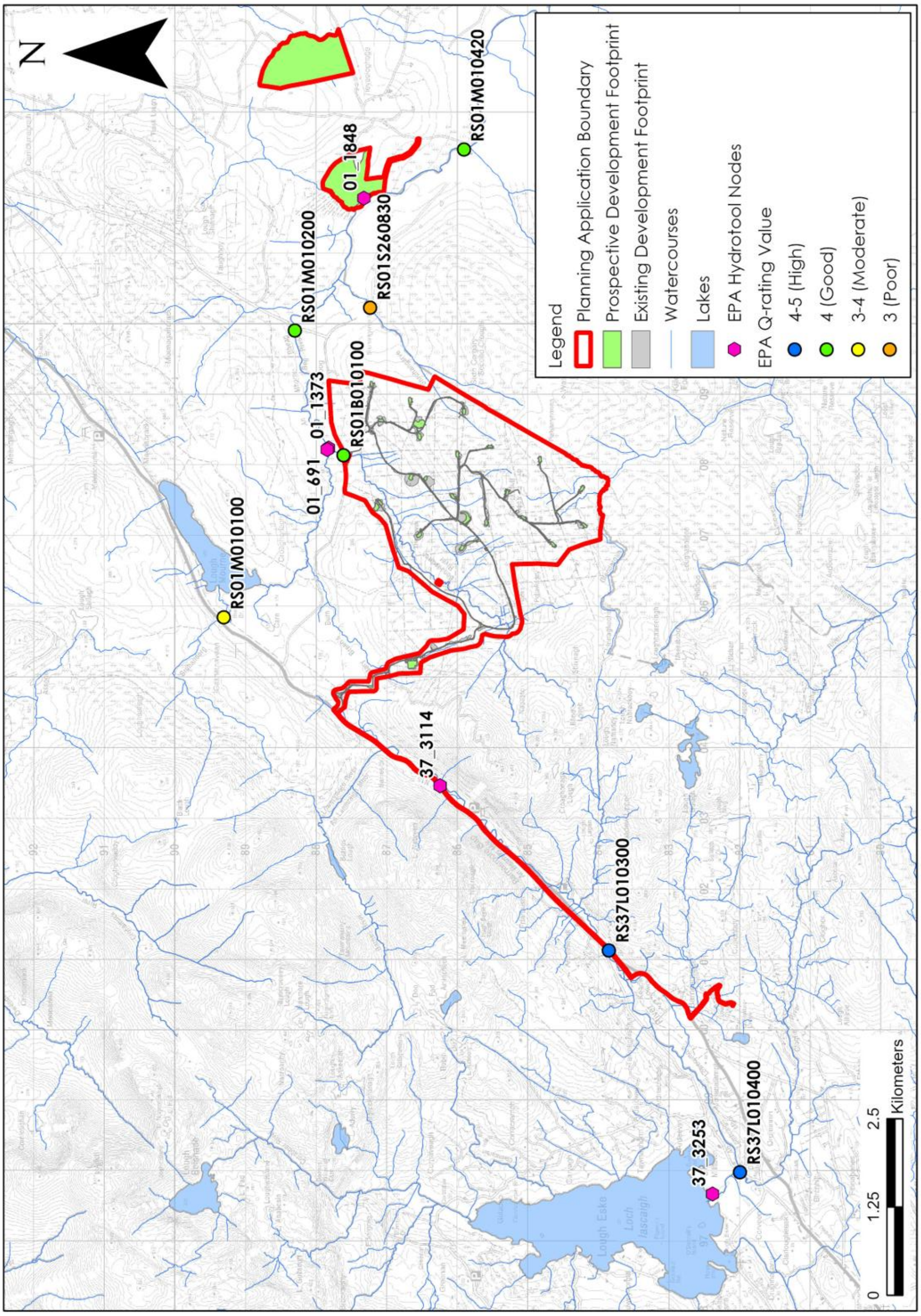


Figure 9-7: EPA Water Quality Locations and EPA Hydrotool Nodes

9.3.7.2 Northern Ireland Environmental Agency Monitoring

The Northern Ireland Environment Agency (NIEA), an agency with the Department of Agriculture Environment and Rural Affairs (DAERA) is responsible for water quality monitoring in Northern Ireland. The Northern Ireland Water Framework Directive Statistics Report 2021 is the latest available water quality report. Water bodies are assessed against a number of elements as required by the Water

Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. For surface waters, ecological status is assessed against five classes: bad; poor; moderate; good; and high. Chemical status surface water bodies are assessed against two classes: good and failing to achieve good. The status of a water body is determined by the lowest test element and follows the one-out, all-out rule. The ecological status of a river waterbody is consequently assigned as a combination of lowest test element from the chemical testing and biological testing.

The Glendergan River was classified in 2015 and 2018 as 'Moderate' and in 2021 as 'Poor' ecological status. In 2021, due to the inclusion of 'forever' chemicals and Cybermethrin in the assessment process, none of the assessed water bodies met good or high 'Overall Surface Water Status', which in turn decreased ecological status classification of most catchments in Northern Ireland. The decrease in ecological status in the Glendergan River is a result of change in assessment methodology, rather than being attributed to activities at the Site. This is also highlighted in the NIEA's Northern Ireland Water Framework Directive Statistics Report 2021. In 2024 the status returned to 'Moderate'.

When river water quality was assessed without 'forever' chemicals in Glendergan River, it was assigned status 'Good' in 2021, an improvement from the 2015 and 2018 classification, when it was classed as 'Moderate'.

9.3.7.3 Additional Biological Water Quality Assessments

Triturus Environmental Ltd completed 2 no. rounds of biological water quality monitoring (18 no. kick samples each) in July 2024 and July 2025. The monitoring locations are shown in **Figure 9-8**. The results are presented in **Table 9-10** and are summarised below:

- Mary Breen's Burn (SP2) and an unnamed stream (SP1) achieved 'Poor' and 'Good' Q-status respectively in both monitoring rounds.
- The Bunadowen River achieved 'Poor' Q-status at all locations (SP3-SP5) in both monitoring rounds.
- The Shruhanagarve Stream (SP6) achieved 'Poor' Q-status in 2024 and an improved 'Moderate' Q-status in 2025.
- The Glendergan River achieved 'Poor' Q-status at both locations (SP7 and SP8) in both monitoring rounds.
- The status of the Mourne Beg River typically remained constant throughout both monitoring rounds. 4 of the 8 no. monitoring locations recorded 'Good' Q-status in the 2024 monitoring round, with 5 no. locations achieving 'Good' Q-status in 2025. 1 no. location (SP9) achieving 'Poor' Q-status in both rounds. An improvement in Q-status was also recorded at SP10, SP11 and SP15. Meanwhile, only 1 no. location experienced a deterioration in status (SP12).
- Within the Eske catchment, the Barrack Hill Stream and the Lowerymore River achieved 'Good' Q-status in both monitoring rounds.

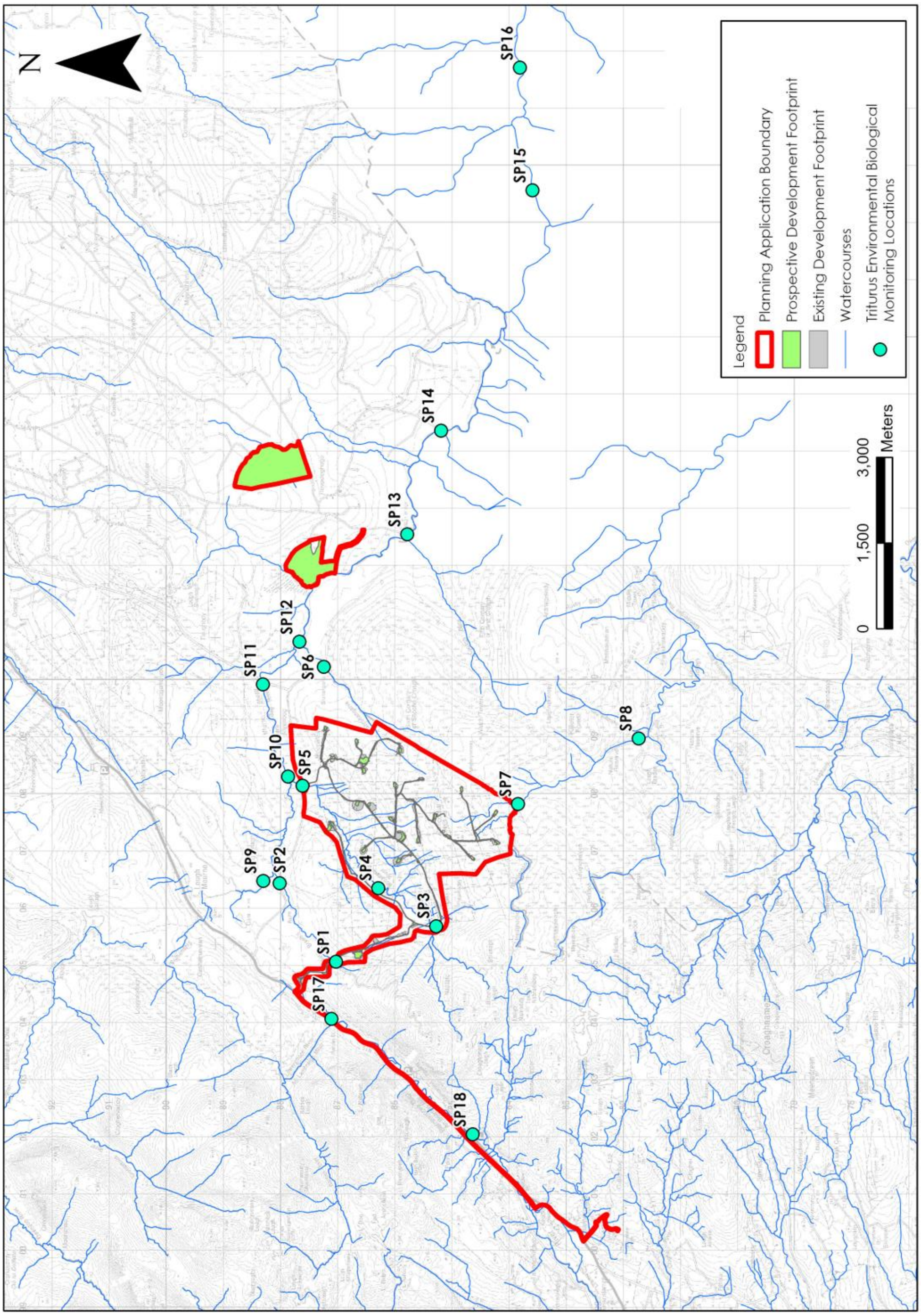


Figure 9-8: Additional Biological Monitoring Locations

Table 9-10: Recent Triturus Environmental Ltd Monitoring (2024 - 2025)

Watercourse	Sampling Location ID	July 2024	July 2025
Mourne Beg River Sub-Catchment			
Unnamed Stream	SP1	Q4	Q4
Mary Breen's Burn	SP2	Q3	Q3
Bunadowen River	SP3	Q3	Q3
Bunadowen River	SP4	Q3	Q3
Bunadowen River	SP5	Q3	Q3
Shruhanagarve Stream	SP6	Q3	Q3-4
Glendergan River	SP7	Q3	Q3
Glendergan River	SP8	Q3	Q3
Mourne Beg River	SP9	Q3	Q3
Mourne Beg River	SP10	Q3-4	Q4
Mourne Beg River	SP11	Q3	Q3-4
Mourne Beg River	SP12	Q4	Q3
Mourne Beg River	SP13	Q4	Q4
Mourne Beg River	SP14	Q4	Q4
Mourne Beg River	SP15	Q3-4	Q4
Mourne Beg River	SP16	Q4	Q4
Eske Sub-Catchment			
Barrack Hill Stream	SP17	Q4	Q4
Lowerymore River	SP18	Q4	Q4

9.3.7.4 Surface Water Quality Monitoring During Construction Phase of the Existing Development

During the construction phase of the Existing Development, MKO was engaged to undertake a water quality monitoring programme in line with the requirement set out in the 2017 EIAR. This included continuous turbidity monitoring, daily visual checks of waterways and monthly hydrochemistry monitoring.

Visual Checks

The visual checks were completed at 12 no. locations on watercourses in the vicinity and downstream of the Site. The locations of these inspection points are shown on **Figure 9-9**.

Daily visual checks noted any localised increases in turbidity in onsite water courses, general site conditions, and recorded mitigation measures necessary as outlined in the CEMP or discussed with the relevant personnel such as the project hydrologist, geologist, or site manager.

Surface Water Chemistry Monitoring

Surface water monitoring (grab sampling) has been ongoing throughout the construction phase of the Existing Development. Monthly grab sampling commenced at 4 no. locations within the Wind Farm Site in September 2019. These locations (SW1-SW4) were on the Bunadaowen River and Mary Breen's Burn. Monthly sampling at these locations was paused between February 2023 and November 2024, with the exception of sampling completed in October 2024, May 2024 and July 2024, as all key water quality parameters had been stable for almost 2 years. Monthly monitoring started again November 2024 to inform this EIAR.

Additional monitoring locations were added to the water quality monitoring programme in response to the November 2020 Peat Slide. These locations were situated on the Mourne Beg River upstream (M-Beg 2) and downstream (M-Beg 1) of the Shruhanagarve Stream. Sampling was also completed further downstream on the River Derg (Derg-1 and Derg-2). The frequency of grab sampling at these locations has been amended in response to water quality trends, particularly the concentrations of suspended solids. Daily sampling commenced on 13th November 2020 at these locations following the November 2020 Peat Slide and continued until late December 2020. Weekly sampling was undertaken throughout 2021 on the Mourne Beg River whilst sampling ceased on the River Derg in March 2021 as concentrations had returned to baseline levels. Monthly monitoring continued on the Mourn Beg River until Spring 2026 to inform this EIAR.

Table 9-11 below presents a summary of the surface water grab sampling completed on local natural watercourses for each year of the construction phase. A comprehensive water quality dataset has been obtained with more than 500 no. grab samples obtained from the local watercourses. The sampling locations are shown on **Figure 9-9**.

Table 9-11: Surface Water Monitoring Summary (Grab Sampling on Natural Watercourses)

Year	Sampling Frequency	No. Samples	Locations
2019	Monthly - commenced in Sept 2019	16	SW1, SW2, SW3, SW4
2020	Monthly	48	SW1, SW2, SW3, SW4
	Daily - commenced 13/11/2020	142	M-Beg 1, M-Beg 2, Derg-1, Derg-2
2021	Monthly (No data for Fab/Aug/Dec)	36	SW1, SW2, SW3, SW4
	Weekly	96	M-Beg 1, M-Beg 2
	Weekly – ceased 03/03/2021	18	Derg-1, Derg-2
2022	Monthly (No data for Jan/Dec)	40	SW1, SW2, SW3, SW4
	Monthly (No data for Dec)	22	M-Beg 1, M-Beg 2
2023	Sampling in Jan/Feb/Oct	12	SW1, SW2, SW3, SW4
	Sampling in Jan/Dec	4	M-Beg 1, M-Beg 2

Year	Sampling Frequency	No. Samples	Locations
2024	Sampling in May/July Monthly sampling recommended in Nov	24	SW1, SW2, SW3, SW4, M-Beg 1, M-Beg 2
2025	Monthly Sampling	72	SW1, SW2, SW3, SW4, M-Beg 1, M-Beg 2
2026	Monthly Sampling – data available until end April	24	SW1, SW2, SW3, SW4, M-Beg 1, M-Beg 2

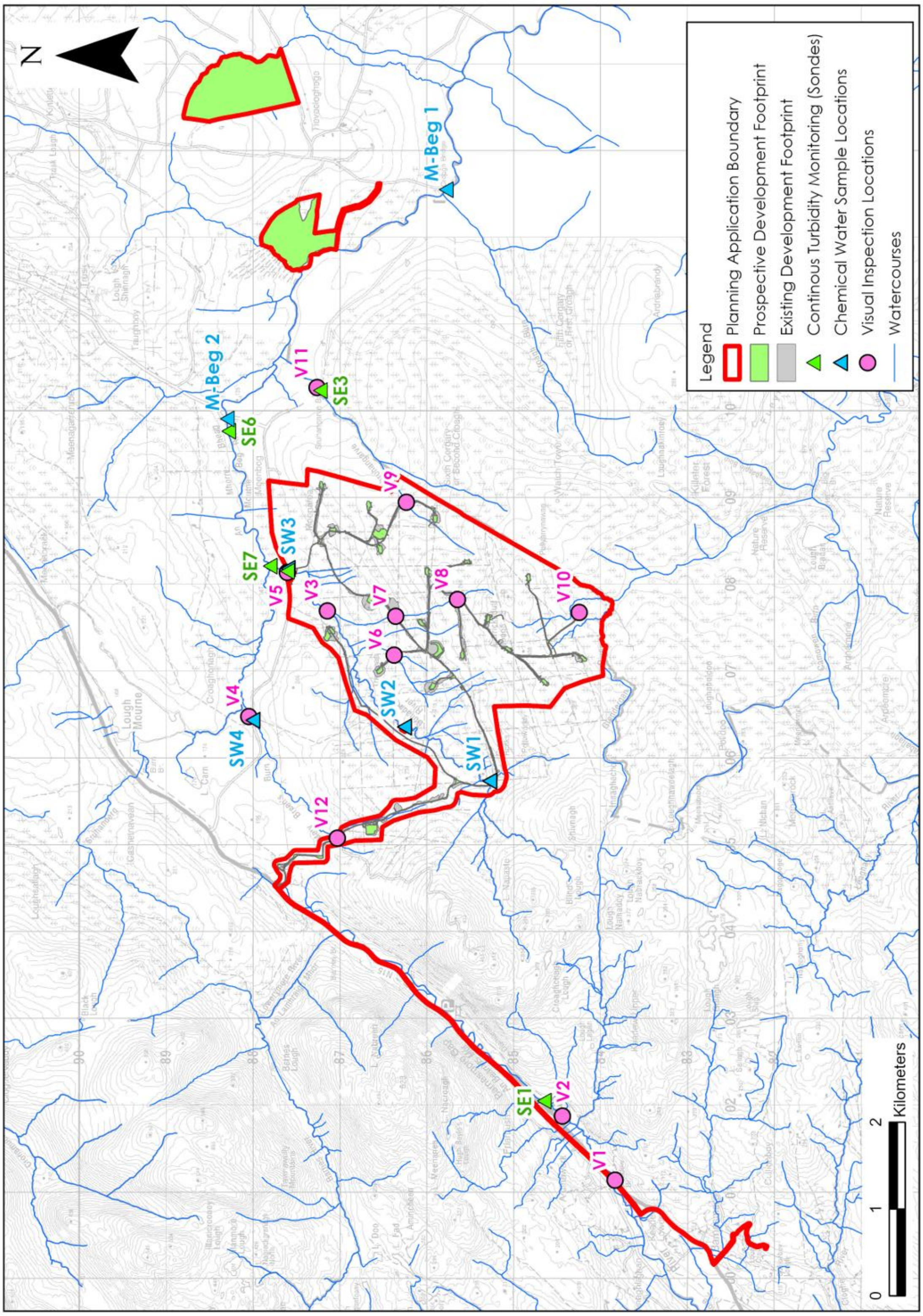


Figure 9-9: Water Quality Monitoring Locations

To characterise the surface water conditions in the local watercourses, a statistical analysis of the dataset was completed using the median, mean and 95%tile concentrations of the key parameters. The results are presented against the relevant Environmental Quality Standards (EQS) for BOD, Ammonia and Orthophosphate as per S.I. 272/2009. The analysis used a screening value equal to the 95%tile Good status threshold as set out in S.I. 272. Meanwhile, the EQS of 25mg/l was used for TSS as per S.I. 293/1988. The results are summarised in **Table 9-12** below and as follows:

- Suspended solids concentrations at SW1 to SW4 have largely been well below the below 25mg/l EQS. Only 1 no. exceedance has been recorded with respect to suspended solids concentrations. This occurred at SW2 on the 30th November 2020. Note that an additional analysis and discussion with respect to suspended solids concentrations is provided below for the monitoring locations on the Mourne Beg and Derg rivers downstream of the Shruhanagarve Stream as these results have been impacted (albeit a short-term impact) by the November 2020 Peat Slide.
- Samples have largely found to be compliant with respect to Ammonia. The watercourses in the vicinity of the Wind Farm Site have greatest compliance (94 - 100%). Meanwhile, slightly more exceedances were recorded further downstream in the River Derg.
- Elevated levels of orthophosphate were recorded across all sampling stations in the monthly samples dating from March, April, and June 2020. Exceedances were recorded at SW3 and SW4 in November 2021, at SW5 in September 2025, at SW3 in June 2025 and at SW4 in January 2026. Levels subsequently returned to baseline concentrations. Samples were found to be 93 - 100% compliant with respect to orthophosphate.
- Elevated BOD concentrations have been recorded at several monitoring stations throughout 2024, 2025 and 2026. Samples were found to be 81 - 100% compliant with respect to BOD.

Table 9-12: Water Quality Monitoring 2019-2026 (Surface Water Grab Sampling)

Sampling Location	Parameter	Mean	Median	95%tile	Max	EQS
SW1	TSS	6	5	10	18	≤25
	BOD	1.32	1.0	3.0	3.0	Good status ≤2.6 (95%ile)
	Ammonia	0.03	0.02	0.05	0.07	Good status ≤0.140 (95%ile)
	Ortho-P	0.03	0.03	0.06	0.12	Good status ≤0.075 (95%ile)
SW2	TSS	7.1	5	10.1	68	≤25
	BOD	1.4	1.0	3.0	3.0	Good status ≤2.6 (95%ile))
	Ammonia	0.03	0.03	0.04	0.09	Good status ≤0.140 (95%ile)
	Ortho-P	0.03	0.03	0.06	0.06	Good status ≤0.075 (95%ile)
SW3	TSS	6.4	6	10	17	≤25
	BOD	1.5	1.0	3.0	3.0	Good status ≤2.6 (95%ile)
	Ammonia	0.03	0.02	0.05	0.11	Good status ≤0.140 (95%ile)
	Ortho-P	0.04	0.03	0.06	0.36	Good status ≤0.075 (95%ile)
SW4	TSS	6.4	7	10	16	≤25
	BOD	1.4	1.0	3.0	3.0	Good status ≤2.6 (95%ile)
	Ammonia	0.08	0.03	0.18	1.48	Good status ≤0.140 (95%ile)
	Ortho-P	0.04	0.03	0.06	0.24	Good status ≤0.075 (95%ile)
	BOD	1.2	1.0	3.0	4.0	Good status ≤2.6 (95%ile)
	Ammonia	0.03	0.03	0.08	0.31	Good status ≤0.140 (95%ile)
	Ortho-P	0.04	0.03	0.06	0.83	Good status ≤0.075 (95%ile)
	BOD	1.3	1.0	3.0	5.0	Good status ≤2.6 (95%ile)
	Ammonia	0.03	0.02	0.05	0.12	Good status ≤0.140 (95%ile)

Sampling Location	Parameter	Mean	Median	95%tile	Max	EQS
	Ortho-P	0.03	0.03	0.03	0.06	Good status ≤0.075 (95%ile)
	BOD	1.5	1.0	6.7	10.0	Good status ≤2.6 (95%ile)
	Ammonia	0.08	0.06	0.16	0.37	Good status ≤0.140 (95%ile)
	Ortho-P	0.04	0.03	0.07	0.11	Good status ≤0.075 (95%ile)
	BOD	1.0	1.0	1.0	2.0	Good status ≤2.6 (95%ile)
	Ammonia	0.13	0.07	0.16	2.52	Good status ≤0.140 (95%ile)
	Ortho-P	0.06	0.03	0.08	0.72	Good status ≤0.075 (95%ile)

Suspended Solids Concentrations – Post November 2020 Peat Slide

Surface water grab sampling commenced on the Mourne Beg River on the 13th November 2020 following the November 2020 Peat Slide. This dataset records the immediate impact of the November 2020 Peat Slide on the receiving waters and their subsequent recovery. The TSS concentrations are presented graphically in **Figure 9-10** and summarised in **Table 9-13**.

The highest concentrations were recorded immediately following the November 2020 Peat Slide at the downstream monitoring locations on the Mourne Beg River and the River Derg. A maximum concentration on the Mourne Beg River of 875mg/l was recorded on the 13th November 2020 at M-Beg 1. The effects extended downstream along the River Derg with concentrations of 349mg/l and 951mg/l recorded at Derf-1 and Derg-2 on the same date. However, the grab sampling results indicate that TSS concentrations stabilised and returned to background concentrations in the Mourne Beg River and the River Derg by the 24th November 2020. The effect with regard to suspended solids concentrations was therefore a temporary effect.

Following 2020, TSS concentrations decreased substantially across all monitoring locations, indicating progressive recovery of water quality conditions. At M-Beg 1, mean annual TSS concentrations ranged from 3.0 to 6.8 mg/L between 2021 and 2026, while 95%tile concentrations ranged from 4.8 to 12.4 mg/L. No exceedances of the 25 mg/L screening threshold were recorded during this period, with all samples remaining below the threshold.

Similarly, TSS concentrations at Derg-1 and Derg-2 returned to low levels by 2021, with mean concentrations of 4.3 mg/L and 3.9 mg/L, respectively, and 95%tile concentrations of 8.0 mg/L and 5.6 mg/L. No exceedances of the 25 mg/L threshold were recorded following 2020.

Overall, the monitoring results indicate that the November 2020 Peat Slide caused a temporary increase in suspended sediment concentrations. However, the receiving waters quickly recovered and all grab samples obtained since 2021 were below the 25mg/L EQS. The data indicate no evidence of persistent sediment-related impacts in the receiving watercourses following the initial post-slide period. This data is consistent with the improvement in biological q-ratings discussed above.

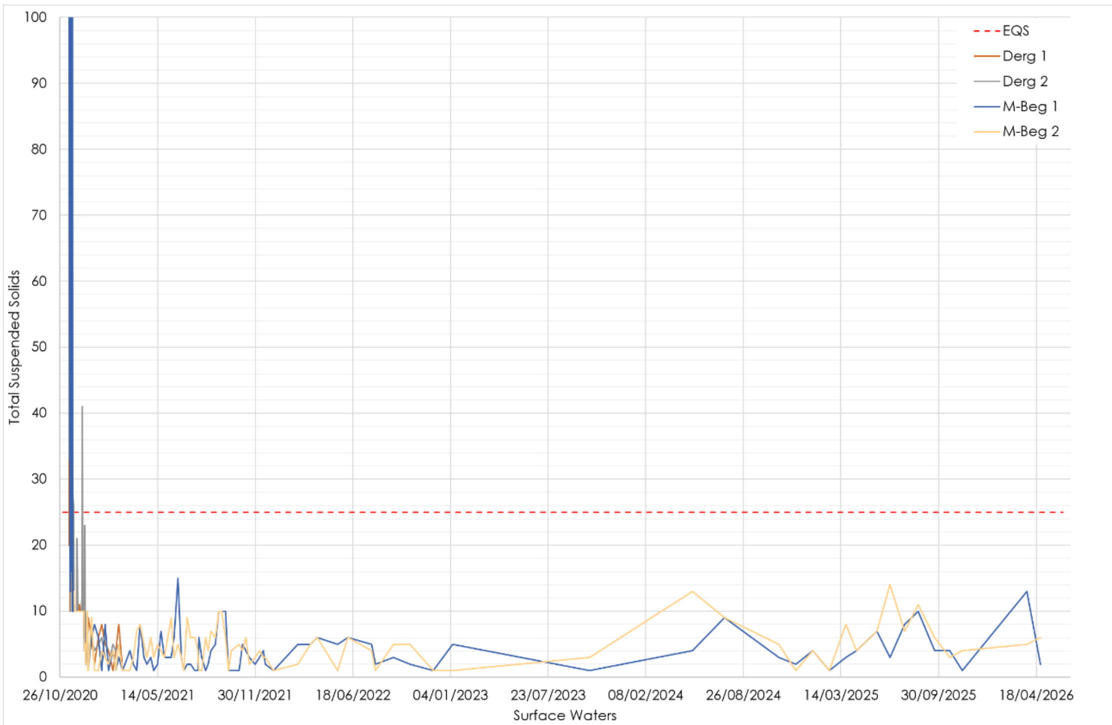


Figure 9-10: Suspended Solids Concentrations on the Mourne Beg and Derg Rivers (Grab Sampling)

Table 9-13: Summary of Suspended Solids Concentrations in Grab Samples Downstream of the November 2020 Peat Slide

Location	Year	N	Median (mg/l)	Mean (mg/l)	Max (mg/l)	95%tile (mg/l)	EQS	No. Exceedance	% Compliant
M-Beg 1	2020	36	10	54.1	875	248	25	6	83.3%
	2021	48	3	3.7	15	10		0	100%
	2022	11	5	3.7	6	6		0	100%
	2023	2	3	3	5	4.8		0	100%
	2024	4	3.5	4.5	9	8.2		0	100%
	2025	12	4	4.2	10	8.9		0	100%
	2026	4	6	6.7	13	12.4		0	100%
Derg-1	2020	35	10	40.1	951	53.4		3	91.4%
	2021	9	4	4.3	8	8		0	100%
Derg-2	2020	35	10	27.8	349	68.8		9	71.4%
	2021	9	4	3.8	6	5.6		0	100%

Continuous Turbidity Monitoring

3 no. sondes (MSe1. MSe3 and MSe4) were installed as a water quality early warning system on the Lowerymore, Bunadowen and Shruhanagarve watercourses on 9th September 2019, prior to the commencement of construction. MSe 5, 6, and 7 were subsequently installed in various locations along the Mourne Beg River to monitor turbidity upstream of active works and downstream of the Shruhanagarve Stream which had been effected by the November 2020 Peat Slide. Please note than MSe3, located on the Shruhanagarve Stream was lost during the November 2020 Peat Slide and was reinstated on 18th December 2020. The locations of the sondes are shown in **Figure 9-9**.

Turbidity is a measure of the cloudiness of a fluid and may be used as an indicator of potential suspended solids. The purpose of the sondes was to act as an early warning system of potential sediment input into receiving waters and allowed further investigations and remedial action to be undertaken if required. The sondes were not used as a measure of water quality, which was instead assessed through chemical and biological monitoring.

The continuous turbidity monitoring results are presented in **Figure 9-11** below. The data has been recorded at 15-minute intervals and is summarised in **Figure 9-11** as average daily turbidity concentrations. Turbidity can be used as a proxy for total suspended solids (3 NTU = ~1 mg/L TSS), with the TSS EQS of 25mg/L included in the figure as ~75NTU.

The data can be summarised as follows:

- The vast majority of the daily turbidity averages are well below the equivalent TSS EQS.
    - A total of 0.73% of the average daily turbidity data exceeded 75NTU at MSe1.
    - A total of 1.95% of the average daily turbidity data exceeded 75NTU at MSe 3 on the Shruhanagarve Stream.
    - A total of 3.6% of the average daily turbidity data exceeded 75NTU at MSe4.

- A total of 0.23% of the average daily turbidity data exceeded 75NTU at MSe5.
- A total of 0.08% of the average daily turbidity data exceeded 75NTU at MSe6.
- A total of 0.09% of the average daily turbidity data exceeded 75NTU at MSe7.

- The average daily turbidity data exceeded 75NTU on several occasions. On 28th May 2020, the average turbidity concentration at MSe3 on the Shruhanagarve was recorded as 153NTU. An exceedance was also recorded at MSe4 on the Bunadowen River on
12th August 2020 (92.8NTU). The daily average turbidity concentrations returned to background concentrations on the succeeding days.
- Several exceedances were also recorded at MSe3 in late September 2020. Several elevated average daily turbidity concentrations were recorded between 25th and 1st October 2020. The average daily turbidity concentrations exceeded 400NTU on each of these dates. The concentrations returned to background levels for much of October, with some brief peaks recorded on 10th, 11th, 13th and 14th October 2020;
- A peat failure occurred on 12th November 2020 and the NTU concentrations in the Shruhanagarve Stream were at background concentrations in the preceding days. Some elevated turbidity concentrations were recorded following reinstallation of MSe3 on 21st, 22nd and 26th December 2020. However, the turbidity concentrations quickly returned to background levels. There have also been brief spikes in the daily average turbidity concentrations at MSe3 on 16th January 2021, 21st July 2021 and 8th December 2021. Inspection of the 15-minute interval turbidity readings revealed that the turbidity spikes on these dates were brief, typically lasting 15 minutes to 1 hour. Such short-term spikes in turbidity are common in peatland environments, particularly following periods of heavy rainfall. A review of the rainfall data has shown that many of these spikes were preceded by a period of intense precipitation and likely represent a small plume of suspended sediment moving through the water column. The spikes could also have resulted from temporary obstruction from a leaf or organic debris. Importantly, the short-term spikes are common, interpreted as transient sediment pulses or localised obstructions/disturbances and are not indicative of sustained water quality impacts;
- Several exceedances have also been recorded at other monitoring station since the suspension of construction activities, during the winter of 2021/2022 and in the spring and early summer of 2022. Many of these occurred on the Lowerymore River (MSe1), with some elevated concentrations also recorded at MSe7 in August 2022. Again, these spikes in turbidity were brief and not indicative of significant water quality issues.
- All daily average turbidity concentrations have been well below 75NTU since August 2022, with the exception of MSe5 on 29th November 2023. A brief spike in turbidity was recorded across a 30-minute interval on this date, with concentrations quickly returning to baseline levels. Therefore, this represented a short-term localised disturbance and is not indicative of any wider water quality issue.

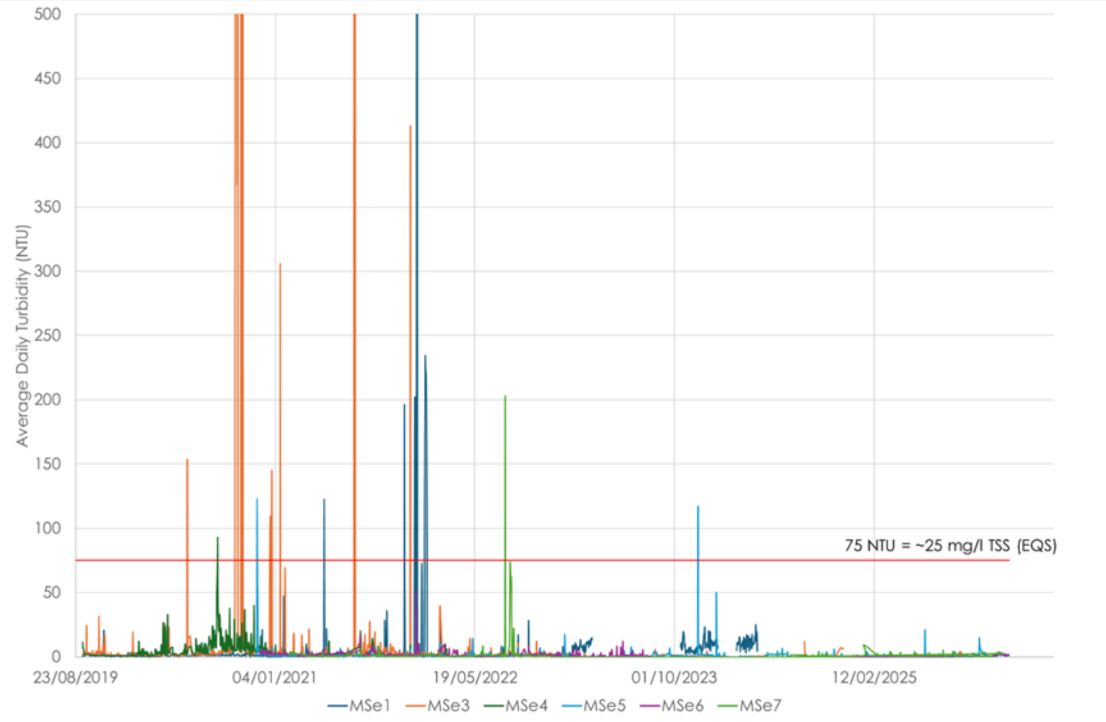


Figure 9-11: Continuous Turbidity Monitoring Data

9.3.8 Hydrogeology

9.3.8.1 Wind Farm Site

The vast majority of the Wind Farm Site is underlain by Precambrian quartzites, gneisses and schists. A very small section near the main Wind Farm Site entrance off the N15 National Road is mapped to be underlain by granites and other igneous intrusive rocks. These rocks are classified by the GSI as being a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl) (www.gsi.ie). A bedrock geology aquifer map is attached as **Figure 9-12**.

The 5 no. boreholes drilled at the Wind Farm Site in April 2025 encountered typically strong grey SCHIST with occasional weak layers at depths of 0.4 to 3.5mbgl. No significant ingress of groundwater was recorded with slow to very slow groundwater strikes recorded on the drilling logs.

In terms of Groundwater Bodies (GWBs), the vast majority of the Wind Farm Site is underlain by the Castlederg GWB. Meanwhile, a small area in the west is underlain by the Donegal South GWB. Both GWBs are characterised by poorly productive bedrock.

The Precambrian and igneous rocks generally have an absence of inter-granular permeability, and most groundwater flow is expected to be in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3m thick, a zone of interconnected fissuring 10m thick, and a zone of isolated poorly connected fissuring typically less than 150m (GSI, 2004). Recharge occurs diffusely through the thin/permeable subsoil and rock outcrops, although is limited by any thicker till/peat and the low permeability bedrock itself. Therefore, most of the effective rainfall is not expected to recharge the aquifers.

No significant groundwater flow is expected either in the deeper bulk of bedrock as any jointing or fractures visible at the exposures were noted to be very tight. Some of the pre-existing borrow pits had depths of up to 5 - 6m below the local ground surface and no groundwater seepage (or evidence of past or intermittent seepage) was noted.

Groundwater flowpaths (where present) are short (30-300m), with groundwater discharging to nearby streams and small springs. Groundwater flow directions are expected to follow topography and therefore groundwater directions within the Wind Farm Site are expected to be towards the primary streams draining the Wind Farm Site (GSI, 2004).

The above desk study information is supported by on-site observations from the bedrock exposures at the existing borrow pits. The bedrock was noted to be largely competent and massive. Limited groundwater flow is restricted to the top of the rock or within a very thin weathered zone (0.2 – 03m). Also, the pockets of mineral subsoil (where present) are not expected to act as preferential groundwater flowpaths due to their silty composition, limited thickness and disconnected lateral distribution. Therefore, the overall potential for groundwater flow at the base of the peat is anticipated to be insignificant. Groundwater baseflow contribution to local streams is expected to be very low all year round. Overall, the hydrology of the Wind Farm Site is dominated by surface water runoff on the bog surface and within the existing drainage channels.

Local groundwater flow directions will mimic topography, whereby groundwater flows from topographic high points to lower elevated discharge areas at local streams (GSI, 2004).

9.3.8.2 Grid Connection Site

The Grid Connection Site is also underlain by Precambrian quartzites, gneisses and schists and granites and other igneous intrusive rocks. In terms of GWBs, the Grid Connection Site is underlain by the Donegal South GWB. The GSI's Characterisation Report (GSI, 2004) states that this GWB is composed of low transmissivity rocks. Most of the groundwater flux is likely to be in the uppermost weathered part of the aquifer. Recharge is limited in areas of thick till/peat and also due to the low permeability bedrock itself. Therefore, most of the effective rainfall is not expected to recharge the aquifers. Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to the streams crossing the aquifer.

9.3.8.3 BMEP Site

The BMEP Site is underlain by the Lough Eske Psammite Formation (i.e. Precambrian quartzites, gneisses and schists) and the Castlederg GWB. These rocks are classified as a Poor Bedrock Aquifer.

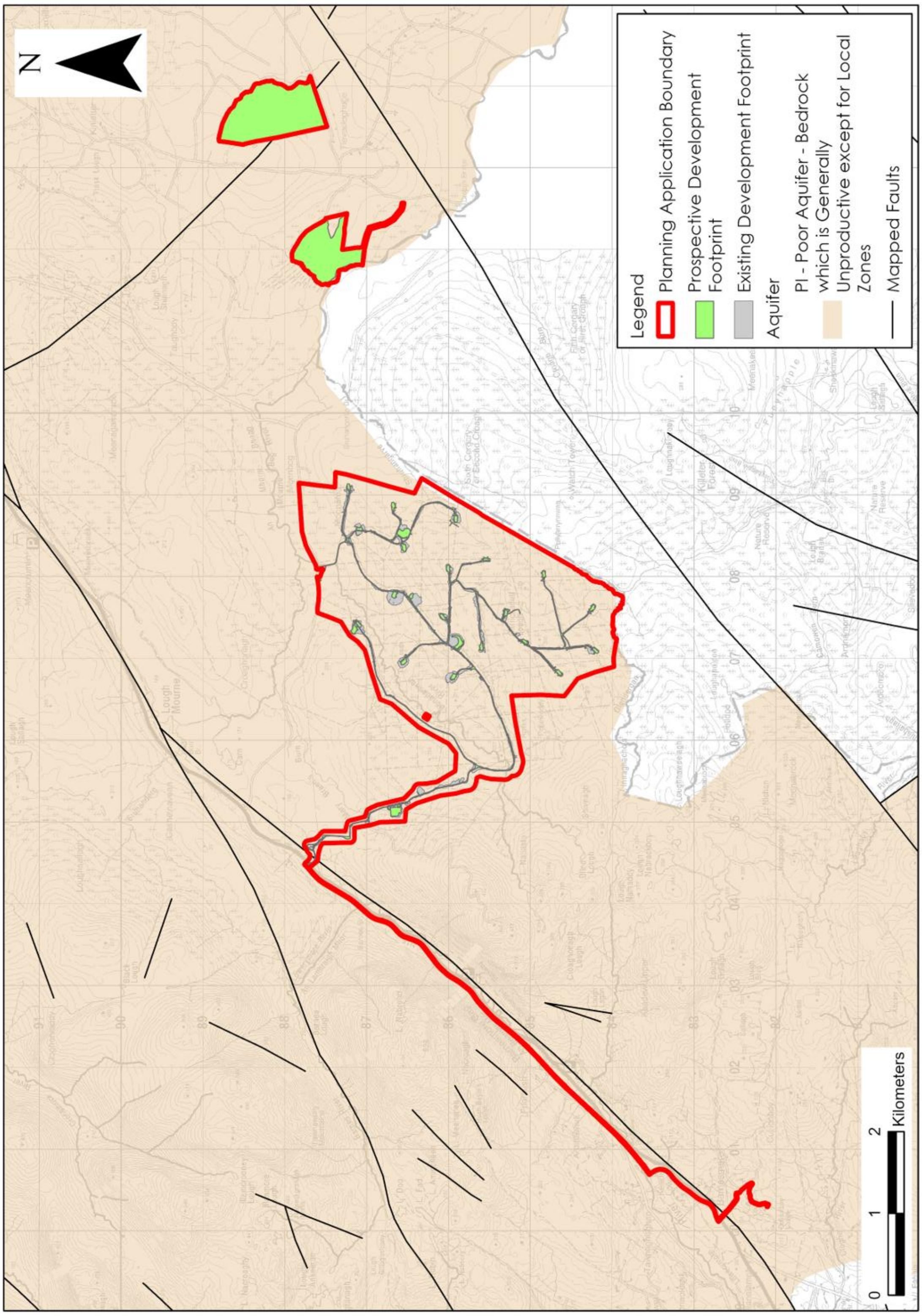


Figure 9-12: Bedrock Aquifer Map

9.3.9 Groundwater Vulnerability

9.3.9.1 Wind Farm Site

The GSI describe groundwater vulnerability as a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability embodies the characteristics of the intrinsic geological and hydrogeological features at a site that determine the ease of groundwater contamination. Groundwater vulnerability is related to recharge acceptance, whereby in areas where recharge occurs more readily, a higher quantity of contaminants will have access to groundwater.

The vulnerability rating of the bedrock aquifer underlying Wind Farm Site is mapped by the GSI (www.gsi.ie) to range from 'Moderate' to 'Extreme-X'. Most of the Wind Farm Site has a vulnerability rating of 'Moderate' to 'High', with the 'Extreme' rating relating to areas where subsoil is shallow or absent and where bedrock is outcropping.

Site investigations at the Wind Farm Site comprising of peat probes, trial pits and gouge cores have revealed that the depth to rock is typically shallow. Given the shallow depth to rock and the nature of the subsoils (silts, clays, sands and gravels), the vulnerability at the Wind Farm Site ranges from 'High' to 'Extreme' in accordance with **Table 9-14**.

However, due to the low permeability nature of the underlying bedrock aquifers, groundwater flowpaths are likely to be short (30 – 300m), with recharge emerging close by and discharging into local surface water streams. This means there is a low potential for groundwater dispersion and movement within the aquifer, therefore surface water bodies such as drains and streams/rivers are more vulnerable (to contamination from human activities) than groundwater at the Wind Farm Site.

9.3.9.2 Grid Connection Site

The GSI mapped groundwater vulnerability along the Grid Connection Site ranges from 'Moderate' to 'Extreme'. The areas of 'Extreme' vulnerability are located in the south of the Grid Connection in the vicinity of the Clogher 110kV substation. This area is underlain by a Poor Bedrock Aquifer which is of low permeability and surface water is considered to be the primary sensitive receptor.

9.3.9.3 BMEP Site

The GSI mapped groundwater vulnerability ranges from 'Moderate' to 'High' in the western section of the BMEP Site. The mapped vulnerability ranges from 'High' to 'Extreme' in the eastern area of the BMEP Site. This area is underlain by a Poor Bedrock Aquifer which is of low permeability and surface water is considered to be the primary sensitive receptor.

Table 9-14: Groundwater Vulnerability Classes (EPA, 2008)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

9.3.10 Groundwater Hydrochemistry

9.3.10.1 Wind Farm Site

The GSI's Groundwater Body Characterisation Reports for the Castlederg and Donegal South GWBs state that no data is available with respect to these particular GWBs. However, based on data from Calcareous/Non-calcareous classification of bedrock in the Republic of Ireland (WFD,2004), alkalinity for this bedrock type generally ranges from 14 – 400mg/L while electrical conductivity and hardness were reported to have mean values of 446µS/cm and 200mg/L respectively.

Groundwater sampling of the 3 no. monitoring wells (25MW1, 25MW and 25MW3) was completed by HES on 10th April 2025. In addition, 2 no. surface water samples (SWA and SWB) were obtained from local watercourses adjacent to 25MW4 and 25MW5. The local hydrogeological regime. *i.e.* short groundwater flowpaths which discharge to local surface watercourses, allowed these surface water samples to be used as a proxy from groundwater quality at 24MW4 and 25MW5. A second round of groundwater sampling was completed at all 5 no. monitoring wells on 5th February 2026.

The field chemistry data, taken with a calibrated YSI ProDSS, are presented in **Table 9-15**. The recorded pH ranges between 6.30 – 7.48, while dissolved oxygen ranges between 1.61 – 11.73mg/L. The specific electrical conductivity ranged 126 - 768µS/cm is typical of groundwaters from Precambrian rocks, although the lower range may also indicate shallower/newer groundwater, or leakage from surface water (noting all the wells were sealed using packed bentonite).

Table 9-15: Summary of field chemistry from GWS sample locations (April 2025 and February 2026)

Location	Date	Temp (°C)	DO (mg/L)	SPC (µS/cm)	pH [H^+]
25MW1	10/04/2025	10.6	1.61	377	6.90
	05/02/2026	9.2	4.23	476.9	7.0
25MW2	10/04/2025	9.1	1.84	126	6.44
	05/02/2026	9.6	5.3	225	7.18
25MW3	10/04/2025	9.6	6.5	257	7.27
	05/02/2026	9.3	6.23	579	7.48

SWA	10/04/2025	6.5	11.73	235	6.30
SWB	10/04/2025	9.4	11.66	252	6.85
25MW4	05/02/2026	9.4	4.06	669	7.33
25MW5	05/02/2026	9.7	4.9	768	7.23

The laboratory data of the samples indicates that the water is typically of an acceptable chemical quality relative to the Groundwater Regulations (S.I 9/2010). Nitrate and nitrite were below the limit of detection of the laboratory in all samples apart from nitrate in SWA (5.01 mg/l NO_3) in April 2025 and 25MW04 (5.5mg/l NO_3) in February 2026. Chloride ranged from 2.5 to 38.8mg/l and was generally well below the EQS. All samples were below the EQS set out in S.I 9/2010 (24mg/l) with the exception of 25MW05 in February 2026. This is slightly above the expected background concentrations but remains well below the drinking water parametric value of 250mg/l and does not in itself indicate contamination of groundwaters but may represent slight natural variability. No petroleum hydrocarbons were recorded in any of the samples. Iron and manganese concentrations were high in most of the groundwater samples, but this can likely be attributed to the presence of peat soils at the Wind Farm Site. Elevated concentrations of these parameters are commonly associated with reducing groundwater conditions and can be naturally occurring and are not necessarily indicative of groundwater contamination.

Summary results are presented in **Table 9-16** and **Table 9-17** whilst the full laboratory reports are included in Appendix 9-2 of this EIAR.

Table 9-16: Groundwater Sampling Laboratory Results (April 2025)

Parameter	EQS	Sample ID				
		MW01	MW02	MW03	SWA	SWB
Ammonia as N (mg/l)	-	0.165	0.164	0.198	0.353	0.048
Nitrite – N (mg/l)	0.5*/0.1+	<0.01	<0.01	<0.01	<0.01	<0.01
Ortho-phosphate (mg/l)	0.035*	0.025	0.034	0.029	0.025	0.03
Nitrate – NO_3 (mg/l)	37.5+	<4.4	<4.4	<4.4	5.01	<4.4
Chloride (mg/l)	24*/250+	3.5	15.3	18.9	19.1	15.7
BOD (mg/l)		2.2	1.9	1.5	1.9	<1
Iron (µg/L)	200*+	**478**	**5,470**	43	**1,000**	**227**
Magnesium (mg/L)	50*	20.3	3.98	26.3	1.46	1.2
Manganese (µg/L)	50*+	**1,240**	**1,010**	**533**	6.76	6.58
TDS (mg/L)	-	331	285	739	149	91.0
Sulphate (mg/L)	187.5*/250+	16.5	4.09	15.2	<1	1.59
Total TPH (>C6-C40) (ug/l)	-	<10	<10	<10	<10	<10

(*) S.I. No. 9/2010 – Groundwater Regulations
(+) S.I. 99/2023 – Drinking Water Regulations

Table 9-17: Groundwater Sampling Laboratory Results (February 2026)

Parameter	EQS	Sample ID				
		25MW01	25MW02	25MW03	25MW04	25MW05
Ammonia as N (mg/l)	-	0.035	0.123	0.041	0.159	0.21
Nitrite – N (mg/l)	0.5*/0.1^{+}	<0.01	<0.01	<0.01	<0.01	<0.01
Ortho-phosphate (mg/l)	0.035*	0.012	0.014	<0.01	<0.01	0.017
Nitrate – NO_3 (mg/l)	37.5^{+}	<4.4	<4.4	<4.4	5.5	<4.4
Chloride (mg/l)	24*/250^{+}	14.4	10.9	19.4	21.5	38.8
BOD (mg/l)		1.8	1.8	2.9	2.6	5.3
Iron (µg/L)	200*$^{+}$	**1,120**	**4,090**	21.1	**800**	**4,030**
Magnesium (mg/L)	50*	20.1	3.76	21.4	20.3	19.4
Manganese (µg/L)	50*$^{+}$	**1,580**	**912**	**953**	**509**	**1,320**
TDS (mg/L)	-	305	131	306	409	495
Sulphate (mg/L)	187.5*/250^{+}	13.5	6.5	7.56	7.44	27.5
Total TPH (>C6-C40) (ug/l)	-	<0.1	<0.1	<0.1	<0.1	<0.1

(*) S.I. No. 9/2010 – Groundwater Regulations
($^{+}$) S.I. 99/2023 – Drinking Water Regulations

9.3.10.2 Grid Connection Site

No groundwater sampling was required at the Grid Connection Site. Effects on groundwater quality will not occur as the Prospective Development does not include any works at the Grid Connection Site.

9.3.10.3 BMEP Site

No groundwater sampling was required at the BMEP Site due to the shallow nature of the works. Effects on groundwater quality will not occur.

9.3.11 Water Framework Directive Water Body Status & Objectives

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("WFD"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003).

The Water Action Plan 2024 was published in September 2023 and is Ireland's 3rd River Basin Management Plan. Its objectives include the following:

- Ensure full compliance with relevant EU legislation;
- Build on the achievements of the 2nd Cycle;
- Prevent deterioration and maintain a 'high' status where it already exists;

- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at restoring impacted waters and protecting waters from deterioration.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all. Furthermore, any development must not in any way prevent a waterbody from achieving at least good status by 2027.

9.3.11.1 Groundwater Body Status

Local Groundwater Body (GWB) and Surface water Body (SWB) status information is available from (www.catchments.ie).

The Castlederg and Donegal South GWBs, which underlie the Site, achieved 'Good' status in the 3 no. most recent WFD cycles (2013-2018, 2016-2021 and 2019-2024). The status is defined based on the quantitative status and chemical status of the GWB. These GWBs have been deemed to be 'not at risk' of failing to meet their respective WFD objectives. Furthermore, no significant pressures have been identified on these GWBs.

Summary WFD information for these GWBs is presented in **Table 9-18** below.

Table 9-18: WFD Groundwater Body Status

GWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	3rd Cycle Risk Status	WFD Pressures
Castlederg	Good	Good	Good	Not at risk	None
Donegal South	Good	Good	Good	Not at risk	None

9.3.11.2 Surface Water Body Status

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) in the vicinity and downstream of the Site are shown in **Table 9-19** below.

Within the Foyle surface water catchment, the Mourne Beg_010 SWB in the vicinity of the Wind Farm Site achieved 'Poor' status in the 3 no. most recent WFD cycles (2013-2018, 2016-2021 and 2019-2024). Meanwhile, the status of the Bunadaowen_010 SWB improved from 'Moderate' to 'Good' status in the latest WFD cycle (2019-2024). The east of the Wind Farm Site and the BMEP Site are drained by the Mourne Beg River (Derrygoonan) SWB which experienced a deterioration from 'Moderate' to 'Poor' status in the most recent WFD cycle. The status of the Glendergan River has improved from 'Poor' to 'Moderate'. Downstream of the Wind Farm Site the Mourne Beg River (Lisnacloone) and the Derg River (Milbrook) SWBs are of 'Moderate' and 'Poor' status respectively.

The majority of SWBs in the vicinity and downstream of the Wind Farm Site within the Foyle catchment have been deemed to be 'at risk' of failing to meet their respective WFD objectives.

The 3rd Cycle Foyle Catchment Report (EPA, 2024) states that the significant pressure affecting the greatest number of waterbodies in this catchment is agriculture. The significant pressures impacting the SWBs in the vicinity and downstream of the Wind Farm Site are as follows:

- Agriculture is only listed as a significant pressure on the Derg River (Millbrook).
- Forestry is a significant pressure on the Mourne Beg_010, Bunadaowen_010 and Mourne Beg River (Derrygoonan) SWBs in the vicinity of the Wind Farm Site. The catchment report states that the significant issues are arising primarily as a result from clear felling and associated operations, which results in nutrient loads, acidification and sediment loads.
- Abstraction for the Lough Mourne Public Water Supply (PWS) was identified as a significant pressure on the Mourne Beg_010 SWB with habitat alternation due to hydrological changes identified as the issue.
- Abstraction is also listed as a significant pressure on the Mourne Beg River (Derrygoonan) SWB. According to the DAERA mapping this abstraction is for hydro power.
- Peat drainage and peat extraction have been identified as a significant pressure on the Mourne Beg River (Derrygoonan) and the Derg River (Millbrook).
- Unknown anthropogenic pressures are also listed to be impacted several SWBs including the Mourne Beg River (Derrygoonan) SWB.

Within the Donegal Bay North surface water catchment, the Lowerymore_010 and _020 SWBs in the vicinity and downstream of the Site achieved 'High' status in the latest 3 no. WFD cycles. Further downstream, the Eske_010 SWB and the Eske lake waterbody are of 'Good' status. With regard to risk status, the status of the Eske lake waterbody is currently under review while the Lowerymore River is 'not at risk'. No significant pressures have been identified on these SWBs.

A full WFD Compliance Assessment is attached as Appendix 9-3 of this EIAR.

Table 9-19: WFD Surface Waterbody Status

SWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	3rd Cycle Risk Status	WFD Pressures
Foyle Catchment					
Mourne Beg_010	Poor	Poor	Poor	At risk	Forestry & abstractions
Bunadaowen_010	Poor	Moderate	Good	At risk	Forestry
Mourne Beg River (Derrygoonan)	Moderate	Moderate	Poor	At risk	Forestry, peat, abstraction & unknown
Glendergan River	Moderate	Poor	Moderate	Under review	None
Mourne Beg River (Lisnacloone)	Moderate	Moderate	Moderate	At risk	Unknown
Derg River (Millbrook)	Moderate	Moderate	Poor	At risk	Unknown, agriculture & peat
Donegal Bay North Catchment					
Lowerymore_020	High	High	High	Not at risk	None
Lowerymore_030	High	High	High	Not at risk	None
Eske_010	Good	Good	Good	Not at risk	None
Lough Eske	Good	Good	Good	Under review	None

9.3.12 Designated Sites and Habitats

9.3.12.1 Wind Farm Site

Within the Republic of Ireland, designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). Within Northern Ireland designates sites include Special Areas of Conservation (SACs), Areas of Special Scientific Interest (ASSIs), Local Nature Reserves (LNRs) and National Natures Reserves (NNRs). A designated site map for the area is shown as **Figure 9-13**.

The Prospective Development is not located within any designated conservation site, however, there are designated sites within the Wind Farm Site boundary and in close proximity to some elements of the Prospective Development. Small sections of Croaghonagh Bog SAC/pNHA (Site Code: 000129) and Cashelnavean Bog NHA (Site Code: 000122) are located within Wind Farm Site. The Wind Farm Site is also hydrologically connected to some downstream designated sites including the Lough Eske and

Ardnamona Wood SAC (Site Code: 000163) along the Lowerymore River and the River Finn SAC along the Mourne Beg River.

The connectivity of all local designated sites to the Wind Farm Site are assessed as follows:

- Croaghonagh Bog SAC/pNHA (Site Code: 000129) is located immediately to the east of the Wind Farm Site entrance road. This area of the Wind Farm Site is located in the catchment of the Lowerymore River. The SAC/pNHA is located upstream of the main Wind Farm Site entrance road and the works areas, therefore limiting the potential for effects to occur. However, the SAC/pNHA are predominantly located in the catchment of Mary Breen's Burn and is therefore hydrologically connected to other elements of the Wind Farm which are drained by this watercourse, although with an increased separation distance.
- Cashelnavean Bog NHA (Site Code: 000122) is located to the west of the Wind Farm Site entrance and to the west of the N15 National Road. No direct hydrological connections exist between the Prospective Development and this NHA.
- Barnesmore Bog NHA (Site Code: 002375) is located ~400m west of the Wind Farm Site. This NHA is located upstream of the Wind Farm. Therefore, there is no potential hydrological and hydrogeological connectivity.
- Lough Eske and Ardnamona Wood SAC/pNHA (Site Code: 000163) are located ~5km southwest of the Wind Farm Site. The Lowerymore River provides a direct hydrological connection between the Site and this SAC.
- The River Finn SAC (Site Code: 002301) is located downstream of the Wind Farm Site along the Mourne Beg River. The works areas associated with the Prospective Development are hydrologically connected to this SAC.

Meanwhile designated sites within Northern Ireland were identified using the Northern Ireland Environment Agency (NIEA) Catchment Map viewer. Designated sites within Northern Ireland and in close proximity to the Wind Farm Site include:

- The River Foyle and Tributaries SAC (Site Code: UK0030320) is located downstream of the Wind Farm Site along the Mourne Beg River and the Glendergan River.
- Croagh Bog ASSI (ASSI378) is located downstream of the Wind Farm Site and along the lower reaches of the Shruhanagarve Stream. This ASSI is located in close proximity to the BMEP Site.
- The River Foyle and Tributaries ASSI (ASSI229) is located downstream of the Wind Farm Site along the Mourne Beg River and the Glendergan River.
- Killeter Forest Bogs and Lakes ASSI is located ~1km to the south of the Wind Farm Site. The Glendergan River acts as a hydraulic barrier between the Wind Farm Site and this ASSI.

9.3.12.2 Grid Connection Site

A small section of the N15 National Road, including the Grid Connection Site, overlaps with the mapped extent of the Cashelnavean Bog NHA. The Grid Connection Site runs in close proximity to the Barnesmore Bog NHA which is located topographically upgradient of the Grid Connection Site. Lough Eske and Ardnamona Wood SAC are located immediately downstream of the Grid Connection Site at Keadew Bridge.

9.3.12.3 BMEP Site

The River Finn SAC (Site Code: 002301) and the River Foyle and Tributaries SAC (Site Code: UK0030320) are located in close proximity to and downstream of the BMEP Site along the Mourne Beg River. The works areas associated with the Prospective Development are hydrologically connected to these protected areas. The Croagh Bog ASSI is located to the south and in close proximity to the

BMEP Site. Meanwhile, the River Foyle and Tributaries ASSI (ASSI229) is located downstream of the BMEP Site along the Mourne Beg River.

A map of designated sites in relation to the Site is shown as **Figure 9-13**.

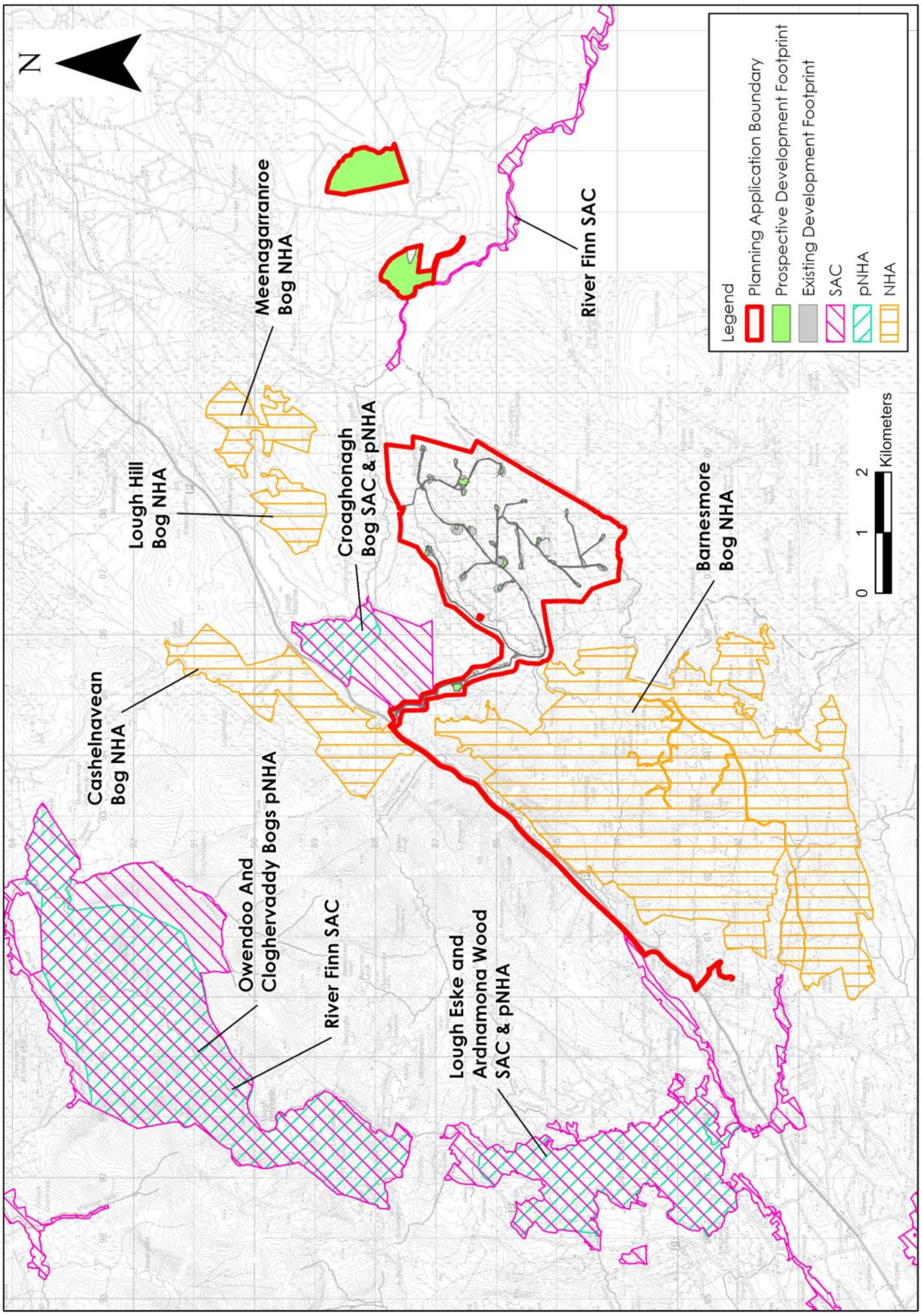


Figure 9-13: Designated Sites Map

9.3.13 Water Resources

9.3.13.1 Groundwater Resources

The GSI do not map the presence of any National Federation registered Group Water Schemes (GWS) or Public Water Schemes (PWS) or an associated Source Protection Area (SPA) within the Site or in the surrounding lands.

A search of private well locations (accuracy of 1 – 50m only) was undertaken using the GSI well database (www.gsi.ie). The GSI database does not record any wells in the vicinity of the Wind Farm Site. The closest mapped groundwater wells are located ~2km northeast of the Wind Farm Site and are reported as having a poor yield class.

An information request was submitted to Uisce Éireann to identify any additional water resources within a 5km buffer of the Wind Farm Site. No additional groundwater resources were identified.

The impact assessment on local groundwater well supplies, presented in Section 9.5.2.12, is conservative by assuming that all private dwellings in the local areas contain a groundwater well supply. There are 4 no. houses (three inhabited, one derelict) located within one kilometre of the proposed turbine locations. The closest occupiable dwelling is a holiday cottage located 750 metres northwest of the nearest proposed turbine location.

A map of nearby mapped groundwater wells is included as **Figure 9-14**.

9.3.13.2 Surface Water Resources

There are no mapped Drinking Water Protected Areas (DWPA) within or immediately downstream of the Site. The closest DWPA is Lough Mourne located upstream of the Wind Farm Site. However, Uisce Éireann abstract water from the Bunadowen River within the Wind Farm Site and pump it to Lough Mourne Reservoir, ~1.7km to the north. This abstraction is currently not mapped on the online WFD database (www.catchments.ie).

In the Donegal Bay North Catchment, the Eske_020 SWB upstream of Donegal Town and downstream of Lough Eske is listed as a DWPA.

An information request was submitted to Uisce Éireann to identify any additional water resources within a 5km buffer of the Wind Farm Site. No additional surface water resources were identified. The only abstraction location identified was from Lough Mourne upstream of the Wind Farm Site.

Within Northern Ireland, the Derg/Strule catchment is identified as a DWPA.

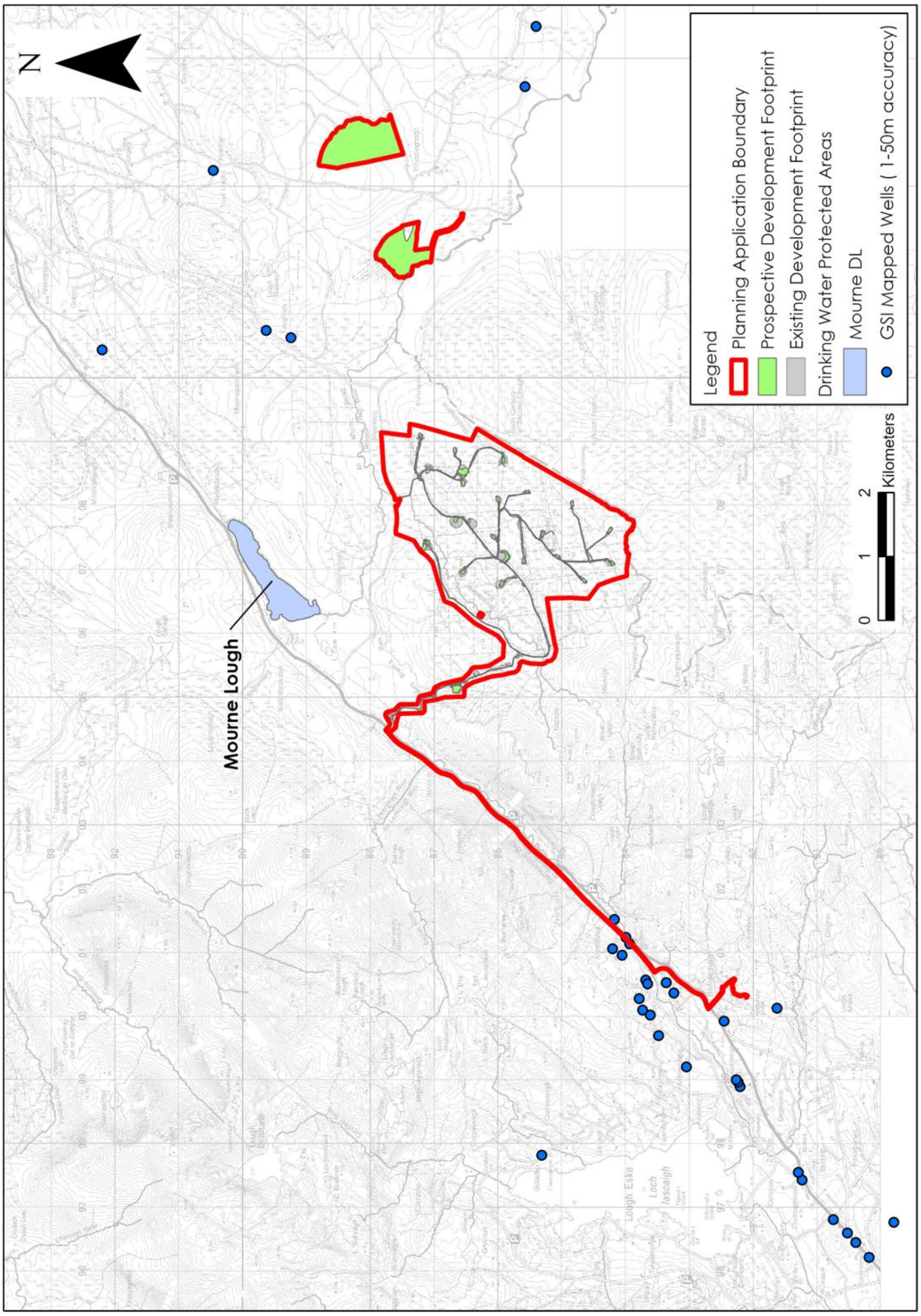


Figure 9-14: Ground Water Resource Map

9.3.14 Receptor Sensitivity

Due to the nature of wind farm developments being near surface construction activities (i.e. shallow excavations and foundations), effects on groundwater quality and quantity are generally negligible and surface water is generally the main sensitive receptor assessed during water impact assessments.

Based on the criteria set out in **Table 9-3** above, the Poor Bedrock Aquifers underlying the Site can be classed as being of Low Importance. The primary risks to groundwater during construction works would be from hydrocarbon spillage and leakages from construction plant. The Site is largely covered in cutover peat which in turn is underlain by lacustrine clay and/or silt dominated glacial deposits and these layers act as a protective cover to the underlying low permeability bedrock aquifers. Due to the presence of the peat and silt/clay layers (which have low permeability and act as a barrier to infiltration), any contaminants which may be accidentally released on-site are more likely to travel to nearby streams within surface runoff.

For the purposes of a conservative assessment the following groundwater receptors are included in the impact assessment:

- Groundwater quality in the Boor Bedrock Aquifers underlying the Wind Farm Site and the BMEP Site;
- The WFD status of the Castlederg and Donegal South GWBs; and,
- All private groundwater well supplies in the lands surrounding the Wind Farm Site and the BMEP Site.

Surface waters are the main sensitive receptors associated with the Prospective Development due to the local hydrogeological regime which is characterised by low rates of groundwater recharge and high rates of surface water runoff. The quantification of flow volumes presented in Section 9.3.4 indicates that the surface watercourses in the immediate vicinity of the Site will be most susceptible to potential effects. Further downstream, the watercourses will be less susceptible to potential effects due to increasing flow volumes which will provide a greater dilution effect. It is worth nothing that the construction of the Prospective Development does not in any way rely upon the dilution/assimilative capacity of any downstream watercourse. The mitigation measures detailed in this EIAR, and the emergency response measures outlined in the CEMP (Appendix 4-3 of this EIAR), are designed to ensure the protection of all downstream watercourses.

The following surface water receptors are identified for impact assessment:

- All watercourses within and downstream of the Wind Farm Site including Mary Breen's Burn, Shruhanagarve Stream, Bunadowen River, Glendergan River, Mourne Beg River and Lowerymore River. Based on the recent Q-monitoring and the criteria detailed in **Table 9-2**, Mary Breen's Burn, the Bunadowen River, and sections of the Mourne Beg River can be considered to be the Medium Important. The Shruhanagarve River is of High Important whilst downstream of the Wind Farm Site the Mourne Beg River is of Very High Importance. The Lowerymore River and its tributaries are also considered to be of Very High Importance;
- All watercourses within and downstream of the BMEP Site including the Trusk and Tievecloghoge streams, the Corraffrin River and the Mourne Beg River.
- The WFD status of all SWBs downstream of the Wind Farm Site and the BMEP Site; and
- The Lough Mourne DWPA which is partly sourced from the Bunadowen River.

In terms of designated sites, only those designated sites which are hydrologically/hydrogeologically linked with the Wind Farm Site and the BMEP Site have been included in the impact assessment. These are the only designated sites which have the potential to be impacted by the Prospective Development and include the:

- Lough Eske and Ardnamona Wood SAC/pNHA (Site Code: 000163) and the River Finn SAC (Site Code: 002301). Based on the criteria detailed in **Table 9-2**, these sites can be considered to be of Extremely High Importance. The River Finn SAC is most susceptible to potential effects, as the vast majority of the Prospective Development is located within the upstream catchment of the Finn River.
- Croaghonagh Bog SAC/pNHA (Site Code: 00129) can also be considered to be of Extremely High Importance. This designated site is located downstream of the Prospective Development.
- River Foyle and Tributaries SAC / ASSI which are located downstream of the Wind Farm Site along the Mourne Beg and Glendergan rivers.
- Croagh Bog ASSI (ASSI378) is located downstream of the Wind Farm Site and along the lower reaches of the Shruhanagarve Stream.

Note that the Prospective Development does not include any works at the Grid Connection Site. Therefore, the water environment in the vicinity and downstream of the Grid Connection Site has been screened out of the impact assessment. Similarly, the designated sites in the vicinity and downstream of the Grid Connection Site have been screened out of the impact assessment.

9.4 Characteristics of the Prospective Development

The Prospective Development comprises the works to complete the construction, operation and decommissioning of the Meenbog Wind Farm.

The Prospective Development is described in full in Chapter 4 of this EIAR. It is worth noting that the works are relatively minor in nature and do not require extensive groundworks, as the majority of the wind farm civil works have been completed under the Existing Development.

The main characteristics of the Prospective Development that could affect the hydrological and hydrogeological environment are:

- 19 no. wind turbines, with an overall tip height of 156.5m, rotor diameter of 133m, and wind turbine hub height of 90m, and 1 no. meteorological mast with a height of 80m, and subsequent decommissioning of the wind turbines and meteorological mast, following a twenty five-year operational period from the date of full commissioning of the wind farm;
- The completion of upgraded access junctions, tracks and roads, and construction of new site access roads;
- The completion of construction of all 19 no. wind turbine foundations and hardstand areas, and the construction of a meteorological mast foundation;
- Completion of internal wind farm underground ducting and cabling;
- Continued use of and upgrade of 2 no. temporary construction compounds;
- Continued use and extraction at the 3 no. borrow pits;
- Peat and spoil management, including site landscaping;
- Forestry felling;
- Site drainage and sediment control measures;
- Biodiversity enhancement measures (including peatland habitat restoration and Hen Harrier habitat areas);
- Recreation and amenity works (including carpark, play, picnic & amenity areas and pedestrian access paths to the wind farm roads);
- Operational stage site signage; and
- All associated site development works.

9.4.1 Proposed Drainage Management

The protection of groundwater and surface water within and surrounding the Site, and downstream catchments that they feed has been of utmost importance in considering the most appropriate drainage proposals for the Site.

The Prospective Development drainage design has therefore been proposed specifically and ensures minimal impact with regards the existing flow regime across the Site, in particular having no negative impact on the water quality of the Site and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Prospective Development. Turbine locations and associated roadways were originally selected to avoid natural watercourses. Existing roads are to be used wherever possible as part of the Prospective Development. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows or into existing field drains.

Two distinct methods will be employed to manage drainage water within the Site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the Site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the Site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Run-off from any construction area will be isolated from natural clean run-off.

The drainage measures associated with the Prospective Development are proportionate to the scale and nature of the proposed works. Much of the existing wind farm drainage infrastructure remains effects in protecting downstream water quality and will continue to perform this function during the construction of the Prospective Development. More significant drainage measures are proposed in locations where the more substantial works are proposed (i.e. BP2, BP3, access track to T18, T18, access track to T2, T2 and T11).

The Prospective Development drainage strategy replicates the proven approach which was successfully implemented for the Existing Development including the use of interceptor/collector drains, silt fencing, silt traps, settlement ponds and routing treated drainage downstream via the existing forestry drainage network.

Chapter 9 of the rEIAR for the Existing Development demonstrates that the construction activities did not result in any significant effects on surface water (quality and flows) and groundwater (quality and quantity), with the exception of the November 2020 Peat Slide which resulted in a at worst, short-term significant effect. The drainage measures proposed for the Prospective Development are comparable to those successfully employed previously and are proportionate to the scale of the proposed works. Therefore, the proposed drainage measures are considered effective in protecting the hydrological and hydrogeological environment.

Full details are provided in the drainage drawings included as Appendix 4-4 of this EIAR.

9.5 Likely Significant Effects and Associated Mitigation Measures

9.5.1 Do -Nothing Scenario

The 'Do-Nothing' alternative is an alternative scenario to retaining and regularising the Existing Development. In this scenario, the Existing Development will remain in-situ as an unauthorised and partially completed wind farm, which is, in effect, the "Do-Nothing" alternative insofar as it represents the current situation as at the date of the application for substitute consent.

There would be no direct negative environmental effects as a result of implementing the "Do-Nothing" alternative. However, by implementing this 'Do-Nothing' alternative, the opportunity to capture a significant part of the country's renewable energy resource by completing the Meenbog Wind Farm (subject to appropriate planning consents) would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment, local authority development contributions, rates and investment in the local area would also be lost. Furthermore, the opportunity to implement the proposed biodiversity enhancement measures would be lost. Please see Appendix 6-4 Biodiversity Management and Enhancement Plan for details. Under the "Do-Nothing" alternative the opportunity to put in place the community benefit scheme proposed as part of the Prospective Development would also be lost.

9.5.2 Construction Phase - Likely Significant Effects and Mitigation Measures

The likely significant effects of the construction phase of the Prospective Development and mitigation measures that will be put in place to eliminate or reduce them are shown in this section. It should be noted that the main potential effects on the hydrological and hydrogeological environment will occur during the construction phase.

It is also worth noting that the works associated with the Prospective Development are relatively minor in terms of renewable energy developments. Given the nature of the construction phase of the Prospective Development (which comprises of the works required for the completion of the construction of Meenbog Wind Farm, of which the majority of the significant earthworks have already been completed), the potential for effects on the hydrological and hydrogeological environment is reduced due to the small scale of the proposed earthworks and the limited construction time in comparison to larger projects. Many of the Wind Farm Site roads and tracks, hardstand areas, turbine foundations required for the Meenbog Wind Farm have already been completed as part of the Existing Development.

The impact assessment presented below relates to the works which will be completed at the Wind Farm Site and the BMEP Site (Section 9.5.2.14). Note that the construction of Grid Connection and the onsite 110kV substation have already been completed as part of the Existing Development. The Prospective Development does not include any construction works along the Grid Connection Site.

9.5.2.1 Potential Effects from Earthworks Resulting in Suspended Solids Entrainment in Surface Waters

Construction phase activities including the completion of turbine foundations and turbine hardstands, upgrade of existing site roads and the construction of new site roads, the excavation of material from the existing onsite borrow pits and the lateral expansion of borrow pit BP3, completion of internal cabling network, construction of the met mast, extension of a temporary construction compound, tree felling and emplacement of the Prospective Development drainage network will require varying degrees of earthworks resulting in excavation of peat and mineral subsoil where present.

Note that much of the works associated with the Prospective Development are minor in nature. 14 no. turbine foundations and 18 no. turbine hardstands have been completed and/or partially completed as part of the Existing Development. In addition, many of the Wind Farm Site roads have also been constructed. The minor works associated with the Prospective Development at these locations will require backfilling of foundations, capping of hardstands and the grading and/laying of surface dressings on the existing site roads. These works would have limited potential for effects.

The more significant works with greater potential for effects include the completion of the turbine foundations at 5 no. locations (T2, T7, T16, T18 and T19), construction of the turbine hardstand at T7, the construction of crane pads, blade fingers and at hardstand locations, and the construction of new site roads and the upgrade and widening of existing roads, the construction of the met mast, the construction of a stabilising berm downslope of the floating road at T01 and T02/T04 junction, expansion of the TCC and expansion of BP3. Note that the effects associated with tree felling and the habitat enhancement are addressed separately in Section 9.5.2.2 and Section 9.5.2.14 respectively.

It is estimated that construction works for the Prospective Development will require the excavation of approximately 71,580m^3 of peat and 7,500m^3 of non-peat materials which will be a significant potential source of sediment laden water. Potential sources of sediment-laden water include:

- Drainage and seepage water resulting from excavations; and,
- Erosion of sediment from emplaced site drainage channels.

These activities can result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Potential effects on all watercourses downstream of the Wind Farm Site could be significant if not mitigated against.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Potential Pre-Mitigation Effect: Negative, significant, indirect, temporary, likely effect on downstream watercourses and water-dependent ecosystems. In the absence of mitigation measures there is the potential for significant effects.

Proposed Mitigation Measures:

<u>Mitigation by Avoidance</u>

The key mitigation measure to be implemented during the construction phase is the avoidance of sensitive hydrological features where possible, by application of suitable buffer zones (i.e. 50m to main watercourses).

The majority of the Prospective Development is located outside of the delineated 50m natural watercourse (river and stream) buffer zones. Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the hydrological buffer zones. The silt fences will be installed as single, double or triple silt fences depending on the space available and the anticipated loading. Further details on silt fences are included in the CEMP (Appendix 4-3 of this EIAR).

The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage (river/stream banks and river/stream beds) to watercourses and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone (where possible) and allowing percolation across the vegetation of the buffer zone.

<u>Mitigation by Design</u>:

The drainage measures associated with the Prospective Development are proportionate to the works that are intended in each area. This is because much of the existing wind farm drainage network is sufficient to protect downstream water quality. More significant drainage infrastructure is proposed in areas where the main additional works are proposed (i.e. BP2, BP3, access track to T18, T18, access track to T2, T2 and T11). The Prospective Development drainage replicates what works well from the Existing Development drainage layout i.e. use of interceptor/collector drains, silt fencing, silt traps, settlement ponds and routing treated drainage downstream via the existing forestry drainage network.

- The Prospective Development drainage strategy replicates the proven approach which was successfully implemented for the Existing Development. Chapter 9 of the rEIAR for the Existing Development demonstrates that the construction activities did not result in any significant effects on surface water (quality and flows) and groundwater (quality and quantity), with the exception of the November 2020 Peat Slide which resulted in a at worst, short-term significant effect. The drainage measures proposed for the Prospective Development are comparable to those successfully employed previously and are proportionate to the scale of the proposed works. Source controls:
    - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems.
    - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas.
- In-Line controls:
    - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, flow limiters, weirs, baffles, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.
- Treatment systems:
    - Temporary sumps and ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted that for the Prospective Development, an extensive network of forestry and agricultural drains already exist, and these will be integrated and enhanced as required and used within the Prospective Development drainage system. The integration of the existing forestry drainage network and the Prospective Development drainage network is relatively simple. The key elements being the upgrading and improvements to existing water treatment elements, such as in line controls and treatment systems, including silt traps, settlement ponds and buffered outfalls.

The main elements of interaction with existing drains will be as follows:

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the Wind Farm Site drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works / tree felling is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area;
- Runoff from individual turbine hardstanding areas will be not discharged into the existing drain network but discharged locally at each turbine location through settlement ponds and buffered outfalls onto vegetated surfaces; and,
- The treated runoff will be discharged into the existing downstream forestry drain network or re-distributed over natural ground

Pre-commencement Temporary Drainage Works

Prior to the commencement of construction works (new road/hardstand, turbine foundation installs or upgrade of existing roads) the following key temporary drainage measures will be installed:

- All existing land and forestry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using forestry check dams/silt traps;
- Clean water interceptor drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing that have surface water flows; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

Silt Fences:

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids such as those present in the subsoils/sandstone tills that overlie the site. This will act to prevent entry to water courses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be placed within drains down-gradient of all construction areas inside the hydrological buffer zones.

Silt Bags:

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, the majority of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats Sediment entrapment mats, consisting of coir or jute matting, will be placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

Settlement Ponds:

The Prospective Development footprint has been divided into drainage catchments (based on topography, outfall locations, catchment size) and stormwater runoff rates based on the 10-year return period rainfall event were calculated for each catchment. These flows were then used to design settlement ponds for each drainage catchment. The settlement ponds are designed for 11hr or 24hr retention times used to settle out medium silt (0.006mm) and fine silt (0.004mm) respectively (EPA, 2006)[3]. Settlement ponds at the borrow pit are designed to allow 24hr retention and settlement ponds along access roads and at turbine hardstands will have 11hr retention as there is additional in-line drainage controls proposed along access tracks and at hardstands.

The supporting design calculations for all settlement ponds are included on Drawing D501 included in Appendix 4-4 of this EIAR.

Pre-emptive Site Drainage Management

The works programme for the entire construction stage of the Prospective Development will also take account of weather forecasts, and predicted rainfall in particular. Large excavations and movements of soil/subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available to be used on a daily basis at the Site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

[3] *Environmental Protection Agency (2006): Environmental Management in the Extractive Industry (Non-Scheduled Minerals).*

Prior to works being suspended the following control measures will be completed:

- All active excavations will be secured and sealed off;
- Temporary or emergency drainage will be installed to prevent back-up of surface runoff; and,
- No works will be completed during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

Timing of Site Construction Works:

Construction of the Site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period will also ensure that attenuation features associated with the drainage system will be in place and operational for all subsequent construction works.

Monitoring:

An inspection and maintenance plan for the on-site construction drainage system will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.

Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. Checks will be carried out on a daily basis.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and Environmental Quality Standards (EQSs) will be undertaken for each primary watercourse, and specifically following heavy rainfall events (as per the CEMP included in Appendix 4-3 of this EIAR).

Allowance for Climate Change

Climate change rainfall projections are typically for a mid-century (2050) timeline. The projected effects of climate change on rainfall are therefore modelled towards the end of the life cycle of the Prospective Development, as the turbines have a life span of 35 years. It is likely that the long-term effects of climate change on rainfall patterns will not be observed during the lifetime of the Meenbog Wind Farm. As outlined in the above sections we have designed settlement ponds for a 1 in 10-year return flow. This approach is conservative given that the Prospective Development will likely be built over a much shorter period (12-18 months), and therefore this in-built redundancy in the drainage design more than accounts for any potential short term climate change rainfall effects.

However, the settlement ponds are designed for 1 in 10 years flows with built in redundancy (+20%) to account for climate change effects on rainfall.

Residual Effects: With the implementation of the prescribed mitigation measures the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality and aquatic habitats.

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on downstream surface water quality will occur.

9.5.2.2 Potential Effects from Tree Felling

Permanent tree felling (~8.273ha) will be required for the construction of the Prospective Development within the Site. Note that the felling associated with the BMEP Site, and associated works, are assessed separately in Section 9.5.2.14 below.

Felling of coniferous plantations required as part of the Prospective Development will be the subject of a Felling Licence application to the Forest Service, in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments.

Potential effects during tree felling occurs mainly from:

- Exposure of soil and subsoils due to vehicle tracking, and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff and enter surface watercourses;
- Entrainment of suspended sediment in watercourses due to vehicle tracking through watercourses;
- Damage to roads resulting in a source of suspended sediment which can become entrained in surface water runoff and enter surface watercourses;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

These effects have the potential to affect the water quality and fish stocks of downstream water bodies. Potential effects on all watercourses downstream could be significant if not mitigated.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Indirect, negative, significant, temporary, likely effect on surface watercourse and associated water-dependent ecosystems. In the absence of mitigation measures there is the potential for significant effects on surface water quality.

Proposed Mitigation Measures:

Tree felling operations will conform to current best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte and DAFM guidance documents, including the specific guidelines listed below, to ensure that felling, planting and other forestry operations result in minimal potential negative effects to the receiving environment.

- Forestry Standards Manual (Forest Service, 2015)
- Forest Protection Guidelines (Forest Service, 2002)
- Forest Operations and Water Protection Guidelines (Coillte, 2013)
- Forestry and Water Quality Guidelines (Forest Service, 2000b)
- Forestry and the Landscape Guidelines (Forest Service, 2000c)
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018)
- Coillte Planting Guideline SOP
- Code of Best Forest Practice (Forest Service, 2000)

Mitigation by Avoidance:

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" are shown in **Table 9-20**.

The setback distance from sensitive hydrological features means that adequate room is maintained for the proposed mitigation measures (discussed below) to be properly installed and operate effectively. The buffer/setback zone will:

- Avoid physical damage (river/stream banks and river/stream beds) to watercourses and the associated release of sediment;
- Avoid soil disturbance and compaction within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from works into watercourses; and,
- Avoid the entry of suspended sediment from the drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

Table 9-20: Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

In addition to the application of buffer/setback zones, the following supplementary mitigation measures will be employed during felling works:

Mitigation by Design:

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which are set out as follows:

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- All machinery will be operated by suitably qualified personnel;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Machines will traverse the Site along specified off-road routes (referred to as racks);
- The location of racks will be chosen to avoid wet and potentially sensitive areas;
- Brash mats will be placed on the racks to support the vehicles on soft ground, reducing mineral soil disturbance and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Silt fences will be installed at the outfalls of existing drains downstream of felling areas. No direct discharge of such drains to watercourses will occur. Sediment traps

and silt fences will be installed in advance of any felling works and will provide surface water settlement for runoff from work areas and will prevent sediment from entering downstream watercourses. Accumulated sediment will be carefully disposed of at pre-selected spoil repository areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;

- In areas particularly sensitive to erosion it will be necessary to install double or triple sediment traps and increase buffer zone width. These measures will be reviewed on Site during construction;
- Double silt fencing will also be put down slope of felling areas which are located in close proximity to streams and/or relevant watercourses;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded;
- Timber will be stacked in dry areas, and outside watercourse buffer zones. Check dams and silt traps will be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water runoff;
- Refuelling or maintenance of machinery will not occur within 50m of an aquatic zone or within 20m of any other hydrological feature. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; and,
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

Silt Traps:

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time, and allow settling of silt in a controlled manner.

Pre-emptive Site Drainage Management :

The works programme for the felling operations will also take account of weather forecasts and predicted rainfall in particular. Operations will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The forecasting systems listed in Section 9.5.2.1 will be used on a daily/weekly basis, as required, to allow for the felling activities to be planned.

Timing of Prospective Development Felling Works:

Felling will only be carried out during periods of no or low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

Drain Inspection and Maintenance:

The following items will be carried out during pre-felling inspections and after:

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;

- Inspection of main drainage ditches and outfalls. During pre-felling inspections the main drainage ditches will be identified. Ideally the pre-felling inspection will be carried out during rainfall;
- Following tree felling all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the Site, if impeded by silt or debris, will be unblocked; and,
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring:

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4 weeks of the felling activity commencing, preferably in medium to high water flow conditions. The "during" sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown).

Criteria for the selection of water sampling points include the following:

- Avoid man-made ditches and drains, or watercourses that do not have year round flows, i.e. avoid ephemeral ditches, drains or watercourses;
- Select sampling points upstream and downstream of the forestry activities;
- It is advantageous if the upstream location is outside/above the forest in order to evaluate the impact of land-uses other than forestry;
- Downstream locations will be selected: one immediately below the forestry activity, the second at exit from the forest, and the third some distance from the second (this allows demonstration of no impact through dilution effect or contamination by other land-uses where impact increases at third downstream location relative to second downstream location); and,
- The above sampling strategy will be undertaken for all on-site sub-catchments streams where tree felling is proposed.

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection.

Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be negative, imperceptible, indirect, temporary, likely effect on downstream watercourses and associated water-dependent ecosystems.

Significance of Effects: For the reasons outlined above, no significant effects on the surface water quality will occur.

9.5.2.3 Potential Effects on Surface Water Quality from Excavation Dewatering

Some groundwater/surface water seepages will likely occur in turbine foundation excavations, sections of the internal cabling trenches and the continued borrow pit excavations and lateral expansion of BP3, and this will create additional volumes of water to be treated by the runoff management system.

However, groundwater inflows will likely be small. Walkover surveys of the existing borrow pits have not revealed any significant groundwater inflows and the borrow pits are above the local groundwater levels. No deepening of any of the existing borrow pits is proposed.

All works at the BEMP Site are shallow and will not require any dewatering of excavations.

Pathway: Overland flow and site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Indirect, negative, slight, temporary, unlikely effect on surface water quality and water-dependent ecosystems. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures:

Management of groundwater seepages and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the Site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by the Environmental Clerk of Works will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

Residual Effect: With the implementation of the prescribed mitigation measures the residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on local surface watercourses and associated water-dependent ecosystems.

Significance of the Effects: For the reasons outlined above, no significant effects on the surface water quality will occur.

9.5.2.4 Potential Effects on Groundwater Levels During Excavation Works

The Prospective Development includes the continued use of 3 no. onsite borrow pits. No expansion is proposed at BP1 or BP2 with continued extraction proposed within the existing footprint of these borrow pits. Meanwhile, a lateral expansion of BP3 is proposed to the west and south (proposed extension area of 6,204m^3). However, no deepening of any existing borrow pit is proposed. The floor of the existing borrow pits are above the local groundwater table and surface water inflows are the main source of water requiring treatment. The continued use of the borrow pits, and the lateral expansion of BP3, has no potential to result in significant effects on local groundwater levels.

Furthermore, small-scale temporary dewatering may occur at some excavations (i.e. cable trenches), and these also have the potential to affect local groundwater levels. However, temporary reductions in groundwater levels by temporary dewatering will be very localised and of small magnitude due to the nature and permeability of the local peat and subsoil geology, which are of low permeability.

The construction of the foundations for 5 no. turbines (T2, T7, T16, T18 and T19) and met mast may also require temporary dewatering of excavations.

Pathway: Groundwater flow paths.

Receptor: Groundwater levels within the underlying Castlederg GWB.

Potential Pre-Mitigation Effect: Imperceptible, direct, negative, temporary, unlikely effects on local groundwater levels. In the absence of mitigation measures there would be no potential for significant effects.

Impact Assessment:

The Wind Farm Site is underlain by bedrock that has been classified as a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl).

During the construction of the Existing Development, dewatering of the deeper excavations was achieved through the intermittent use of pumping, indicating very low levels of groundwater incursion. This was supported by observations made during inspections of the on-site borrow pits. Therefore, the hydrogeological setting means that no significant groundwater dewatering will occur.

Furthermore:

- There are large separation distances between the borrow pits and local houses, and any potential associated groundwater wells. All local houses are remote, in excess of 1km from the borrow pit locations;
- There are large separation distances between the proposed turbine locations (5 no. turbine foundations to be constructed as part of the Prospective Development) and local houses. All local houses are remote, and in excess of 880m, from the proposed turbine locations;
- Similarly, main streams and rivers are at least 150-500m away from any turbine and mast bases, and at these distances potential effects will be imperceptible; and,
- The proposed underground cabling is designed to be shallow and will only be approximately 1.2m in depth. At this depth, it will only potentially interact with shallow perched water within the peat profile. No interaction with deeper regional groundwater will occur. Therefore, no effects on the local groundwater table or flows will occur from this element of the Prospective Development.

It is also noted that no issues in local wells have been reported as a result of the Existing Development. Similarly, no effects would be anticipated as a result of the Prospective Development.

Residual Effects: Due to large separation distances between proposed works and potential groundwater wells and local streams and rivers, and the relatively shallow nature of the proposed works, and also the prevailing geology of the Wind Farm Site, the potential for water level drawdown impacts at receptor locations are considered negligible. The residual effect is considered to be an imperceptible, direct, temporary, unlikely effects on local groundwater levels.

Significance of Effects: For the reasons given above, no significant effects on groundwater levels will occur.

9.5.2.5 Potential Effects Associated with Leakages or Spillages of Hydrocarbons

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

The potential release of hydrocarbons can occur during the works within the Wind Farm Site.

Whilst no oils are around the cables, a lubricant will be used during cable pulling. The lubricant to be used is Techlude PHD which is a pourable, non-flammable, non-toxic and substantially biodegradable water-based product that does not pose a threat to the environment (Techlube PHD Technical Information Datasheet: https://www.socomore.com/en/waterbased-lubricant-techlube-phd-20l-p-bk1.html).

Pathway: Groundwater flowpaths and Site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Negative, indirect, slight, short-term, unlikely effect on local groundwater quality below the Wind Farm Site. Indirect, negative, significant, short term, unlikely effect on surface water quality downstream of the Wind Farm Site. In the absence of mitigation measures there is the potential for significant effects on surface water quality.

Proposed Mitigation Measures:

Mitigation measures proposed to avoid release of hydrocarbons at the Site are as follows:

- All plant will be inspected and certified to ensure that they are leak free and in good working order prior to use at the Site.
- On-site refuelling of machinery will be carried out at designated refuelling areas at various locations throughout the Site.
- Heavy plant and machinery will be refuelled on-site by a fuel truck, with spill kits kept onboard, that will come to the Site as required on a scheduled and organised basis.
- Other refuelling will be carried out using mobile double skinned fuel bowser. The fuel bowser will be parked on a level area in the construction compound when not in use;
- Only designated trained operatives will be authorised to refuel plant on-site;
- Refuelling or maintenance of machinery will not occur within 50m of a watercourse;
- Fuels stored on Site will be minimised;
- Any diesel or fuel oils stored at the temporary construction compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction and Environmental Management Plan

(Appendix 4-3 of this EIAR). Spill kits will be available to deal with accidental spillages.

Residual Effect: Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on local groundwater quality, and a negative, imperceptible, indirect, short term, unlikely effect on surface water quality.

Significance of Effects: For the reasons outlined above, no significant effects on surface water or groundwater quality will occur.

9.5.2.6 Potential Effects Associated with the Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293/1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of $\pm$ 0.5 of a pH unit. Entry of cement-based products into the Site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to the aquatic environment.

Batching of wet concrete at the Wind Farm Site and the washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution. Placed concrete in foundations (5 no. turbine foundations and the foundation for the met mast) and the use of leanmix concrete along the underground cabling route can also have minor local effects on groundwater quality over time. However, due to the contained shuttering that concrete pours are put in, and the limited surface area of exposed concrete, the anoxic conditions below ground, and the higher rate of wider groundwater recharge and flow relative to the small volumes of shallow groundwater that would come in contact with the cured concrete, the potential for impacts are low.

It is also worth noting that concrete pours have been completed at 14 of the 19 no. turbines. As part of the Prospective Development concrete pours will be completed at T2 (in the catchment to the Glendergan River), T7 (in the catchment to the Shruhanagarve Stream), T16, T18 and T19 (in the catchment of the Bunadowen River).

Pathway: Site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Bunadowen River, Shruhanagarve Stream, the Glendergan River and the Mourne Beg River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Indirect, negative, moderate, short term, likely effect to surface watercourses and water-dependent ecosystems and local groundwater quality. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures:

- No batching of wet-concrete products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse

will be allowed. Chute cleaning water will be undertaken at lined concrete washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event; and,
- At turbine foundations, sand blinding, DPM, and lean-mix blinding are used to vertically contain the concrete. While the concrete is contained laterally by temporary/permanent shuttering. The concrete cures within 72 hrs.

Residual Effect: Proven and effective measures to mitigate the risk of releases of cement-based products or cement truck wash water have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on surface and groundwater quality.

Significance of the Effect: For the reasons outlined above, no significant effects on surface water quality will occur.

9.5.2.7 Potential Effects from Wastewater Disposal

Release of effluent from on-site temporary wastewater treatment systems has the potential to impact on groundwater and surface water quality if site conditions are not suitable for an on-site percolation unit. Welfare facilities will be located at the proposed temporary construction compounds at the Wind Farm Site. Wastewater during the construction phase will be stored at the temporary construction compound located along the access track to the south of T10. This compound is located in the catchment to the Bunadowen River. Impacts on surface water quality could affect fish stocks and aquatic habitats.

Pathway: Groundwater flowpaths and site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Bunadowen and Mourne Beg rivers and the associated water-dependant ecosystems.

Pre-mitigation Effect: Negative, significant, indirect, temporary, unlikely effect to surface water quality. Negative, slight, indirect, temporary, unlikely effect on local groundwater quality. In the absence of mitigation measures there is the potential for significant effects on surface water quality.

Proposed Mitigation Measures:

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at each of the Wind Farm Site construction compounds, maintained by the providing contractor, and removed from site on completion of the construction works;
- Welfare facilities are also present at the existing onsite 110kV substation (constructed as part of the Existing Development). Wastewater is stored in an underground tank and is removed by a licenced contractor. These facilities will also be used during the construction of the Prospective Development;
- Water supply for the site office and other sanitation will be brought to the Wind Farm Site and removed after use from the Wind Farm Site to be discharged at a suitable off-site treatment location; and,
- No water or wastewater will be sourced on the Wind Farm Site, nor discharged to the Site.

Residual Effects: Proven and effective measures to mitigate the release of wastewater on the Wind Farm Site have been proposed above and will break the pathway between the potential source and each receptor. The residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on surface water or groundwater quality.

Significance of Effects: For the reasons outlined above, no significant effects on surface water or groundwater quality will occur.

9.5.2.8 Potential Effects from Morphological Changes to Watercourses

There are a total of 18 no. crossings located over EPA mapped watercourses within the Wind Farm Site. 14 of these crossings were upgraded/constructed as part of the Existing Development and no works will be required at these locations other than the minor upgrades to the existing roads.

More significant works are required at the following watercourse crossings:

- More substantial road upgrades and works are located on the road towards T18 and this section of road is mapped to cross 3 no. EPA mapped watercourses (unnamed tributaries of the Bunadaowen River). Existing culverts already exist at these locations and the Prospective Development includes the upgrades of these culverts (these crossings are labelled as NR 102 (EC18), NR 14 (EC12) and NR15 (EC19) on the drainage drawings – Appendix 4-4 of this EIAR)
- It is proposed to upgrade an existing culvert on the road to T14 with a new box culvert (labelled as NR. 48 (PC2) on the drainage drawings);
- The proposed amenity track is mapped to cross the Bunadaowen River in the north of the Wind Farm Site.
- A culvert extension may also be required on the EPA mapped watercourse located to the east of the temporary construction compound to the south of T10 where it is proposed to extend the hardstand. Note that the watercourse is already culverted beneath the existing hardstand (labelled as NR. 37 (EC8) on the drainage drawings).

Works at these locations would have the potential to impact downstream surface water quality.

In addition, there is a high density of manmade forestry drains at the Site. Culverts already exist at these locations and no works will be required at these locations.

Pathway: Site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Negative, moderate, direct, long-term, likely effect on surface water flows, local stream morphology and surface water quality. In the absence of mitigation measures, there is no potential for significant effects.

Proposed Mitigation Measures:

Mitigation measures for the new proposed steel and timber footbridge crossing associated with the amenity proposals are detailed below:

- The proposed crossing will comprise a clear-span steel and timber footbridge. No permanent structures will be located within the watercourse channel and the existing bed and banks will remain undisturbed;
- All drainage and sediment-control measures will be installed prior to commencement of works in the vicinity of the watercourse;
- Construction activities will be undertaken from the banks where practicable and no plant or machinery will enter the watercourse;
- Plant and equipment will not be permitted to track across the channel;

- Access to the opposite bank will be required that avoids disturbance of the bed and banks;
- Any excavated material will be stored outside the watercourse buffer and protected from erosion.
- Appropriate sediment-control measures, including silt fencing will be installed down-gradient of works areas.
- Refuelling, plant maintenance and material storage will be undertaken in designated areas away from the watercourse.
- Spill kits will be maintained on site and emergency response procedures implemented in the event of an accidental release.

The following mitigation measures will be implemented with respect to upgrade of the crossing at T14 and the new box culvert:

- In-stream works will be undertaken during low-flow conditions and during the time period as recommended by IFI;
- Where required, the works area will be isolated from the watercourse using over-pumping, fluming or other appropriate flow management measures;
- Temporary flow management measures will be monitored throughout the works to ensure uninterrupted downstream flow and to prevent scour, erosion or sediment mobilisation;
- Where the box culvert is installed in sections, the joint will be sealed to prevent granular material entering the watercourse;
- Sediment and erosion control measures will be installed prior to commencement of works and maintained throughout construction;
- Excavated material and stockpiles will be stored away from the watercourse and protected from runoff;
- Refuelling, plant maintenance, and chemical storage will be undertaken in designated areas away from the watercourse;
- Spill kits will be available on-site and all personnel will be trained in spill response procedures.
- Plant and machinery entering the Wind Farm Site will be inspected to ensure they are free from leaks and in good working order;
- Concrete works will be managed to prevent cementitious material or wash water entering the watercourse;
- Disturbed channel banks and riparian areas will be reinstated and stabilised immediately following completion of works;
- Regular environmental inspections will be undertaken to ensure compliance with water quality protection measures; and,
- Any pollution incident will be reported and remedial action implemented immediately.

Meanwhile, all new proposed culverts and proposed culvert upgrades at field drain crossings required for the Prospective Development will be suitably sized for the expected peak flows in the relevant drain. Some culverts may be installed to manage drainage waters from works areas of the Prospective Development, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In all cases, culverts will be oversized to allow mammals to pass through the culvert. All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

All culvert upgrades and new culverts will be designed and constructed in accordance with OPW Guidance.

Residual Effect: Proven and effective measures to protect water quality have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect will be a negative, imperceptible, direct, long-term, unlikely effect on downstream water quality and aquatic habitats.

Significance of Effects: For the reasons outlined above, no significant effects on stream morphology or stream water quality will occur at watercourse crossing locations.

9.5.2.9 Potential Effects from the Use of Siltbuster

Siltbusters are regularly used to remove suspended sediments on construction sites by means of chemical dosing and sedimentation (i.e. use of coagulants and flocculants to accelerate the settlement process). The benefits of using enhanced settlement systems on downstream surface water quality are widely known and provide a positive effect. However, potential overdosing with chemical agents means there is a perceived risk of chemical carryover in post treatment water which could result in negative effects on downstream water quality.

Wind farm construction water (i.e. surface water runoff or pumped groundwater) has sometimes very fine particles, particularly clays and peat, with slow settling velocities which do not settle out efficiently, even in a lamella clarifier at normal flow rates. In these cases, chemical dosing can be used to aggregate the particles (i.e. force them to combine and become heavier), increasing the particle settling rate and cleaning the water via gravity separation techniques. Agents commonly used include poly aluminium chloride (PAC), aluminium sulphate, ferric iron and ferrous iron. These agents are commonly used in drinking water treatment plants. So, their use is widespread, and there is significant scientific knowledge around their use and control.

The benefits of using a Siltbuster system in emergency scenarios where all other water treatment systems have proven ineffective are considerable. An example of treatment capability of siltbuster systems from northwest Mayo is provided in **Figure 9-15**. This is a duration curve of downstream water quality data post siltbuster treatment. The system was set up so that any water not meeting discharge criteria was recycled back to the settlement ponds. The graph shows all data, and only 24 data points out of 1194 records were above 20 mg/L (i.e. recycling, and repeat treatment occurred at these times to ensure compliance at the discharge location).

Note that the Siltbuster system will not be used under normal conditions during the construction phase. The mitigation proposed to protect water quality is already outlined above in Section 9.5.2.1 to 9.5.2.7.

The use of Siltbuster is only proposed as an emergency back up in the event of failure of all other proposed water treatment mitigation measures, e.g. in the event of landslide failure. The Siltbuster system is a proven and effective method of water quality treatment during these events. It is extremely unlikely that the Siltbuster system will be utilised.

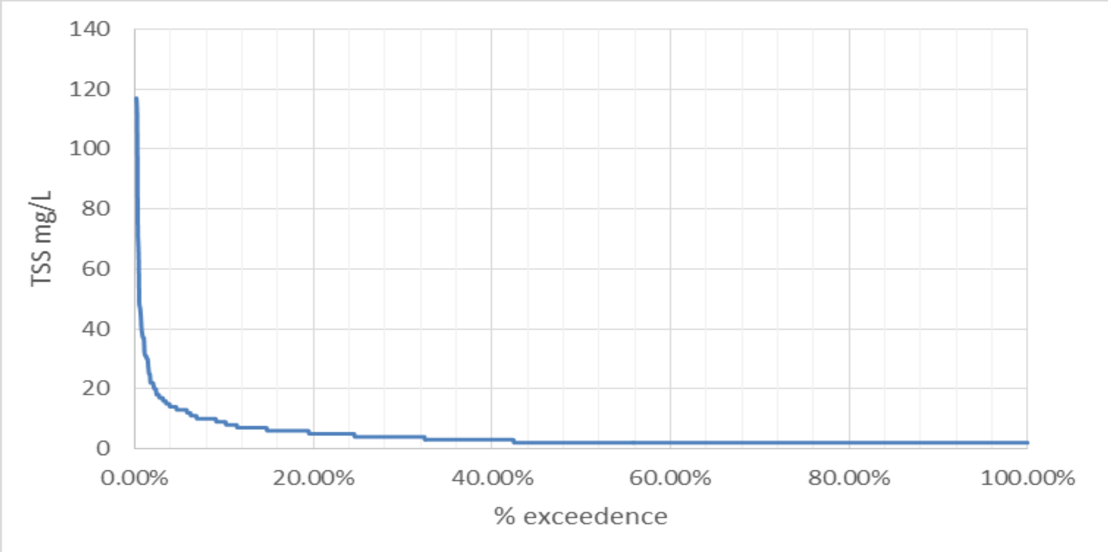


Figure 9-15: TSS treatment data using Siltbuster systems (with chemical dosing)

Pathways: Drainage and surface water discharge routes.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effects: Negative, slight, indirect, temporary, unlikely effect on downgradient water quality. In the absence of mitigation measures there is no potential for significant effects.

Mitigation Measures:

Measures employed to prevent overdosing and potential chemical carryover:

- The siltbuster system comprises an electronic in-line dosing system which provides an accurate means of adding reagents, so overdosing cannot occur;
- Continued monitoring and water analysis of pre and post treated water by means of an in-house lab and dedicated staff, means the correct amount of chemical is added by the dosing system;
- Dosing rates of chemical to initiate settlement is small, being in the order of 2-10 mg/L and the vast majority of the chemical is removed in the deposited sediment;
- Final effluent not meeting the discharge criteria is recycled and retreated, which has a secondary positive effect of reducing carryover; and,
- Use of biodegradable chemical agents can be used at very sensitive sites (i.e. adjacent to SACs).

Residual Effects: With the implementation of the dosing technology and the continual monitoring of pre and post treatment water, the appropriate volume of chemical agent can be added to ensure that chemical carryover concentrations are present only in tiny trace amounts which will not cause any effects to receiving waters or associated aquatic ecology. The residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality.

Significance of Effects: For the reasons outlined above, no significant effects on the surface water quality will not occur. In fact, it is considered that the use of siltbuster systems has a significant positive effect in respect of protected surface water quality.

9.5.2.10 Potential Effects on Hydrologically Connected Designated Sites

The majority of the Wind Farm Site drains to the Mourne Beg River and the Derg River (within Northern Ireland) which also forms part of the River Foyle and Tributaries ASSI and SAC designated site. Croagh Bog ASSI (ASSI378) is located downstream of the Wind Farm Site and along the lower reaches of the Shruhanagarve Stream. A small area in the northwest of the Wind Farm Site is drained by the Lowerymore River which drains to Lough Eske which is a designated SAC (Lough Eske and Ardnamona Wood SAC/pNHA). Furthermore, an area in the northwest of the Wind Farm Site, and directly downstream of the Mary Breen's Burn, forms part of the Croaghonagh Bog SAC/pNHA.

Effects on water quality and the water-dependent aspects of these designated could have been significant in the absence of mitigation.

There is no potential for the Prospective Development to impact any other designated site.

Pathway: Surface water flowpaths and groundwater flowpaths.

Receptor: Down-gradient water quality and designated sites.

Potential Pre-Mitigation Effect: Negative, slight, indirect, short-term, likely effect on downstream designated sites. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures:

Mitigation measures in relation to the protection of downstream surface water quality detailed in the preceding sections as follows:

- Mitigation measures for sediment control are detailed in Section 9.5.2.1 (earthworks) and 9.5.2.3 (excavation dewatering).
- Mitigation measures in relation to felling are prescribed in Section 9.5.2.2.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6.
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.7.
- Mitigation measures in relation to watercourse crossings are prescribed in Section 9.5.2.8

Implementation of these mitigation measures will ensure the protection of water quality in receiving waters.

Furthermore, groundwater from below the Wind Farm Site may also discharge as baseflow, via shallow groundwater flowpaths, to the local rivers and tributaries of the Mourne Beg River, thus entering the downstream designated sites. Groundwater quality and quantity will not be affected by the Prospective Development. Mitigation measures with respect to groundwater quality are prescribed in the preceding sections as follows:

- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5;
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6; and,
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.7.

Residual Effects: Construction activities at the Wind Farm Site pose a threat to designated sites hydrologically linked with the Prospective Development. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff will be equivalent to baseline conditions and will therefore have no significant effect on downstream water quality. No significant adverse effects are anticipated on hydrologically connected designated sites. The residual effect will be a negative, imperceptible, indirect, short-term, unlikely effect on downstream designated sites.

Significance of Effects: For the reasons provided above, and with the implementation of the listed mitigation measures, no significant effects on downstream designated sites will occur.

9.5.2.11 Potential Effects on the Lough Mourne Surface Water Drinking Supply

Donegal Uisce Éireann abstracts surface water from the Bunadowen River and pumps it to Lough Mourne Reservoir.

The Wind Farm Site is located in the catchment of the Bunadowen River. Any deterioration in surface water quality associated with the Prospective Development at the Wind Farm Site could have had a negative effect on the Lough Mourne drinking water supply.

Pathways: Surface water flowpaths.

Receptors: Down-gradient water quality and the Lough Mourne Supply.

Pre-Mitigation Effect: Negative, slight, indirect, short-term, likely effect on the Lough Mourne Supply. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures:

Mitigation measures in relation to the protection of downstream surface water quality detailed in the preceding sections as follows:

- Mitigation measures for sediment control are detailed in Section 9.5.2.1 (earthworks) and 9.5.2.3 (excavation dewatering).
- Mitigation measures in relation to felling are prescribed in Section 9.5.2.2.
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5.
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6.
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.7.
- Mitigation measures in relation to watercourse crossings are prescribed in Section 9.5.2.8

Implementation of these mitigation measures will ensure the protection of water quality in the Bunadowen River.

Residual Effects: Construction activities at the Wind Farm Site pose a threat to the Lough Mourne PWS which abstracts water from the Bunadowen River. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the Wind Farm Site will be equivalent to baseline conditions and will therefore have no effect on downstream water quality. The residual effect will be a negative, slight, indirect, short-term, unlikely effect on the Lough Mourne Supply.

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on the Lough Mourne Supply will occur.

9.5.2.12 Potential Effects on Local Private Groundwater Abstractions

The biggest risk to groundwater wells is potential groundwater contamination associated with any accidental release of hydrocarbons and cement-based products as a result of construction activities within the Wind Farm Site.

No effects are groundwater levels / quantity will occur due to the elevated nature of the Wind Farm Site and the low permeability of the underlying bedrock aquifer. No significant dewatering works will be required.

There are no downgradient public or group scheme groundwater supplies which may have been impacted by the Prospective Development at the Wind Farm Site.

An assessment of private wells within 1km of the Wind Farm Site has been completed, following the assumption that all dwellings are likely to have a private groundwater well. There are 4 no. houses (three inhabited, one derelict) located within one kilometre of the proposed turbine locations. The closest occupiable dwelling is a holiday cottage located 750 metres northwest of the nearest proposed turbine location The potential for effects at this distance are negligible given the local hydrogeological regime which is characterized by low rates of groundwater recharge and high rates of runoff as a result of the low permeability subsoils and the Poor Bedrock Aquifer. Groundwater flowpaths are short and will discharge locally into nearby surface water features.

Pathway: Groundwater flowpaths.

Receptor: Down-gradient groundwater supplies (groundwater wells).

Potential Pre-Mitigation Effect: Imperceptible, direct, negative, temporary, unlikely effects on local groundwater well supplies. In the absence of mitigation measures there would be no potential for significant effects. In the absence of mitigation measures there is no potential for effects on local private groundwater well supplies.

Proposed Mitigation Measures:

Mitigation measures for the protection of groundwater quality have been detailed above:

- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5;
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6; and,
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.7.

Residual Effects: For the reasons outlined in the impact assessment above (separation distances, and prevailing geology, topography and short groundwater flowpaths), and with the implementation of the prescribed mitigation measures, the residual effect will be no effects on local groundwater well supplies.

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on groundwater abstractions will occur.

9.5.2.13 Potential Effects on WFD Status and Objectives

The EU Water Framework Directive (2000/60/EC) requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the Directive is not compromised.

The WFD status for GWBs and SWBs underlying and downstream of the Prospective Development are defined in Section 9.3.11.1 and Section 9.3.11.2 respectively.

A detailed WFD Compliance Assessment Report has been completed in combination with this EIAR Chapter and is included in Appendix 9-3 of this EIAR.

Pathways: Surface water flowpaths and groundwater flowpaths.

Receptors: WFD status of underlying GWBs and downstream SWBs.

Potential Pre-mitigation Effect: Indirect, negative, moderate, temporary, unlikely effect on downstream SWBs. Indirect, negative, slight, temporary, unlikely effect on the underlying GWBs. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures:

Mitigation measures in relation to the protection of downstream surface water quality detailed in the preceding sections as follows:

- Mitigation measures for sediment control are detailed in Section 9.5.2.1 (earthworks) and 9.5.2.3 (excavation dewatering);
- Mitigation measures in relation to felling are prescribed in Section 9.5.2.2;
- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5;
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6;
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.7; and,
- Mitigation measures in relation to watercourse crossings are prescribed in Section 9.5.2.8

Furthermore, groundwater from below the Wind Farm Site may also discharge as baseflow, via shallow groundwater flowpaths, to the local rivers and tributaries of the Mourne Beg River, thus entering the downstream designated sites. Groundwater quality and quantity will not be affected by the Prospective Development. Mitigation measures with respect to groundwater quality are prescribed in the preceding sections as follows:

- Mitigation measures for the control of hydrocarbons during construction works are detailed in Section 9.5.2.5;
- Mitigation measures for the control of cement-based products during construction works are detailed in Section 9.5.2.6; and,
- Mitigation measures in relation to wastewater are detailed in Section 9.5.2.7.

We summarise that there will be no significant effects on GWB or SWB WFD status for the following reasons:

- The small footprint (22.9ha) of the Prospective Development in relation to the scale of the underlying Castlederg GWB (total area of ~13,925ha);
- The Prospective Development does not involve any significant alteration of drainage patterns, therefore, the quantitative status of the receiving surface and groundwaters will remain unaltered;
- There will be no direct discharge from the Prospective Development to receiving waters; and,
- Mitigation measures for the protection of surface and groundwater water quality will be implemented during the construction phase of the Prospective Development to ensure that there is no deterioration in local or downstream water quality. These mitigation measures will ensure the qualitative status of the receiving waterbodies remains unaltered by the Prospective Development.

Residual Effects: Mitigation for the protection of surface and groundwater during the construction phase of the Prospective Development will ensure the qualitative and quantitative status of the receiving waters will not be altered by the Prospective Development.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Prospective Development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration.

The residual effect on GWBs is considered to be - No residual effect.

The residual effect on SWBs is considered to be - No residual effect.

Significance of Effects: For the reasons outlined above, no significant effects on WFD GWBs and SWBs status, risk or future objectives will occur as a result of the Prospective Development.

9.5.2.14 Potential Effects from works at the BMEP Site

The works proposed at the BMEP Site includes the upgrade of existing access road and the permanent felling of ~108ha of coniferous forestry to create wet heath, scrub and bog habitats for Hen Harrier and for peatland habitat enhancement. The potential effects of suspended solids entrainment in surface waters and felling are the same as those described in Section 9.5.2.1 and 9.5.2.2 above, and would have the potential to release nutrients and suspended solids into nearby watercourses which will have a potential negative short-term effect on surface water quality.

The works will also pose a risk of contamination from hydrocarbons and wastewater. Meanwhile, no cement-based products will be used at the BMEP Site and works will be shallow and there will be no requirement for excavation dewatering.

The works have no potential for significant effects on local groundwater quality/quantity due to the local hydrogeological regime which is characterised by high rates of surface water runoff and low rates of groundwater recharge, and the shallow nature of the proposed enhancement works.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface water quality in rivers and streams draining the proposed BMEP Site including the Mourne Beg River, the Corraffrin River and the Trusk and Tievecloghoge streams, and associated dependent ecosystems.

Pre-Mitigation Potential Effect: Negative, significant, indirect, temporary, likely effect on surface water quality and dependent aquatic ecosystems.

Proposed Mitigation Measures/Impact Assessment:

The proposed mitigation measures in relation to suspended solids and felling will be the same as those prescribed in Section 9.5.2.1 and 9.5.2.2. These best practice measures will help protect surface water quality however nutrient release is an unavoidable consequence of deforestation. The mitigation measures with respect to hydrocarbons (Section 9.5.2.5) and wastewater (Section 9.5.2.7) will also be implemented at the BMEP Site.

The mitigation measures set out above will not completely prevent the release of nutrients to downstream watercourses. The release of phosphate into the environment is an unavoidable consequence of deforestation. However, the proposed BMEP Site, will remove a significant source of nutrients (i.e. the existing commercial forestry). The proposed BMEP works only includes 1 no. round of deforestation in comparison to the Do-Nothing Scenario in which the BMEP Site would be felled and replanted several times. This will have a positive long-term effect with regards to nutrient concentrations in local and adjacent watercourses.

Residual Effects: With the implementation of the prescribed mitigation measures the short-term residual effect is considered to be - negative, indirect, slight to moderate, likely effect on downstream water quality and aquatic habitats. The long-term residual effect is considered to be - positive, indirect, moderate, likely effect on downstream water quality and aquatic habitats.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures, no significant effects on the surface water quality will occur.

9.5.2.15 Potential Effects on Groundwater Quality due to Blasting

Baseline nitrate recorded in groundwater is low (Section 9.3.10). Nitrate can occur in groundwater from various sources including land spreading (organic N) and use of fertilizers (inorganic N).

The extraction of bedrock from the borrow pits may be achieved through blasting in order to break the rock into pieces suitable for crushing. Blasting activities typically involve the drilling of holes behind the existing rock face and the placement of explosives within these holes. The explosives are then detonated to dislodge the bedrock. The use of explosives has the potential to effect local groundwater quality at the Wind Farm Site.

Common explosives used at borrow pits, such as Ammonium Nitrate, often contain large percentages of nitrogen compounds. It has been found that small percentages of nitrogen compounds remain as residual coating on the rock following blasting. The ammonium nitrate has the potential to be dissolved when it comes into contact with water. The study that is most referenced was completed by Environment Canada in 1988 (Ferguson and Leak, 1988). This study outlines a procedure for determining the residual nitrogen compounds for carious mine site types. The stepwise procedure in the 1988 study for predicting aqueous concentrations of nitrogen, as outlined by Morin and Hutt (2009) is:

1. Calculate the annual leached nitrogen loading (kg/year) for the entire site based upon annual explosives mass usage and residual nitrogen fraction associated with the explosive type;
2. Separate the leached nitrogen loading among quarry components (e.g. entering water and remaining on the extracted rock);
3. Separate into loadings of nitrogen compounds (nitrate, nitrite and ammonia) and,
4. Calculate the flow concentration.

The concentration of nitrogen species in groundwater at the Wind Farm Site are calculated using this procedure. The highest residual is for nitrate (99%), and upper limit of the range is used in all cases to determine the concentration of nitrogen species in the water. The calculation also assumes that 100% of the residual nitrogen is dissolved in water and subsequently enters the underlying regional groundwater system.

Having used conservative values in the approach the resulting nitrogen species concentration are small and below all relevant EQS values.

A worked example for NH_4-N is as follows:

- Total Annual Explosive Mass: 19,781kg/yr
- Ammonium Nitrate Fraction: 19,781*0.94 = 18,594kg/yr
- Nitrogen Fraction: 18,594*0.35 = 6,508kg/yr
- Residual Nitrogen Fraction (6%): 6,508*0.06 = 390kg/yr
- Residual NH4-N Fraction (24%): 390*0.24 = 94kg/yr
- Annual GW Recharge Volume: 11,228,715m3/yr *1000 – 1,1228,715,000L/yr
- Conversion NH4-N mass to mg: 94kg*1,000,000 = 94,000,000mg
- Theoretical GW Concentration: (94,000,000/11,228,715,000) = 0.08mg/L

Blasting has been completed as part of the Existing Development. No significant effects associated with the blasting as part of the Existing Development were recorded. The future blasting practices will not differ from those which were implemented as part of the Existing Development.

Table 9-21: Potential Nitrogen Compound Concentrations from Blasting Explosives

Explosive Mass Balance		
Combined Borrow Pit Area (ha)	51.39	
Extraction Volumes (m^3)	74,180	
Explosive Mass required for m^3 (kg/m^3)	0.4	
Explosive Mass (kg)	29,672	
Quarry Life (years/months)	1.5 (18)	
Explosive Mass per year (kg/year)	19,781	
Nitrogen Mass Balance		
% Explosive mass as Ammonium Nitrate	94%	
% Ammonium Nitrate as N	35%	
Mass of N (kg)	6,508	
Residual Fraction (1-6%)	0.06	
Residual N (kg)	390	
N Compounds		
Residual NO_3 (75-99%)	0.99 (conservative)	387
Residual NH_4 (0.5-24%)	0.24 (conservative)	94
Residual NO_2 (0-6%)	0.06 (conservative)	23
Water Balance		
Average Annual Rainfall (mm/yr)	2,185	
Recharge Coefficient	1.0 (no runoff in quarry void)	

Explosive Mass Balance	
Total Borrow Pit Area (ha)	51.39
Average Annual Recharge (m^3/year)	11,228,715
Average Daily Recharge (m^3/day)	30,763
Nitrogen Compound Concentrations	
Residual NO_3 (mg/L)	0.03
Residual NH_4 (mg/L)	0.008
Residual NO_2 (mg/L)	0.002

Receptor: Groundwater quality.

Pathway: Detonation of explosives and groundwater flowpaths.

Potential Pre-mitigation Effect:

Indirect, negative, slight, long-term, unlikely effect on groundwater quality.

Mitigation Measures:

The extraction of bedrock at the proposed borrow pits will follow the current international best practice. This protocol will be employed to mitigate the potential effects of explosives on groundwater quality during blasting operations.

It is noted that no elevated concentrations of nitrate have been detected during the groundwater sampling completed at the Wind Farm Site.

Residual Effects: The residual effects will be a negative, indirect, imperceptible, long-term, likely effect on groundwater quality.

Significance of Effects: For the reasons outlined above, no significant effects on groundwater quality will occur.

9.5.3 Operational Phase - Likely Significant Effects and Mitigation Measures

9.5.3.1 Potential Effects from the Progressive Replacement of Natural Surface with Lower Permeability Surfaces

Progressive replacement of the vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the Site and increase flood risk downstream of the Prospective Development. For the purposes of assessment, it is conservatively assumed that the Prospective Development footprint, including access roads and hardstands are impermeable. The assessed Prospective Development footprint (22.9ha). During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems.

Pathway: Site drainage network.

Receptor: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Negative, slight, direct, permanent, likely effect on all downstream surface water bodies. In the absence of mitigation measures there is no potential for significant effects.

Effect Assessment:

The emplacement of the Prospective Development footprint, as described in Chapter 4 of the EIAR, (assuming emplacement of impermeable materials as a worst-case scenario) could result in an average total site increase in surface water runoff of approximately 2,806m^3/month. Given the variable low rates of groundwater recharge rates across the Wind Farm Site, and given the nature of the soils/subsoils encountered during the site investigations, an overall average of 4% groundwater recharge was taken for the overall Wind Farm Site. The assessment shows a potential increase of approximately 0.13% in the average daily/monthly volume of runoff from the Wind Farm Site area in comparison to the baseline runoff conditions (**Table 9-22**). This is a very small increase in average runoff and results from the naturally high surface water runoff rates and the relatively small area of the Site being developed, the proposed total Prospective Development footprint being approximately 22.9ha, representing approximately 2.6% of the Wind Farm Site Boundary area of 892ha.

Table 9-22: Baseline Site Runoff V Development Runoff

Site Baseline Runoff/month (m^3)	Baseline Runoff/day (m^3)	Prospective Development Footprint (m^2)	Hardstanding Area 100% Runoff (m^3)	Hardstanding Area 96% Runoff (m^3)	Net Increase/month (m^3)	Net Increase/day (m3)	% Increase from Baseline Conditions (m^3)
2,200,742	70,991	273,000	70,161	67,354	2,806	90.5	0.13

The additional volume is low due to the fact that the runoff potential across the majority of the Wind Farm Site is naturally high. Also, the calculation assumes that all hardstanding areas will be impermeable which will not be the case as access tracks will be constructed of permeable stone aggregate. The increase in runoff from the Prospective Development will, therefore, be negligible. This is even before mitigation measures will be put in place.

Proposed Mitigation by Design:

The operational phase drainage system of the Wind Farm Site will have been installed and constructed in conjunction with the road and hardstanding construction work as described below and as shown on the Drainage drawings submitted with this planning application (Appendix 4-4 of this EIAR):

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can outfall to the existing drainage network or be re-distributed over natural ground;

- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the Site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds have been designed in consideration of the greenfield runoff rate.

As described above the proposed integration of the Prospective Development drainage with the Existing Development drainage is a key component of the proposed drainage management. By integration we mean maintaining surface water flowpaths where they already exist, avoid creation of new or altered surface water flowpaths, and maintaining the drainage regime (i.e. normal flow) within the agricultural lands and forested areas. Critically, there will be no alteration of the catchment size contributing to each of the main downstream watercourses. All wind farm drainage water captured within individual site sub-catchments will be attenuated and released within the same sub-catchments that it was captured.

Residual Effect: Proven and effective measures to attenuate runoff and mitigate the risk of flooding will be employed. The residual effect will be a neutral, indirect, long term, likely effect on down gradient streams/rivers.

Significance of Effects: No significant effects on downstream flood risk will occur during the operational phase of the Prospective Development.

9.5.3.2 Potential Effects from Suspended Solids Entrainment in Surface Waters

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads, hardstand areas and amenity pathways. Maintenance works may also be required at the BMEP Site which could include tracking machinery over ground. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works

These minor activities could, however, result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Potential effects could be significant if not mitigated against.

During such maintenance works there is a small risk associated with release of hydrocarbons from site vehicles, although it is not envisaged that any significant refuelling works will be undertaken on site during the operational phase.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Potential Pre-Mitigation Effect: Negative, slight, indirect, temporary, unlikely effect on downstream surface water quality. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures:

Mitigation measures for sediment control are the same as those outlined in Section 9.5.2.1.

Mitigation measures for control of hydrocarbons during maintenance works are similar to those outlined in Section 9.5.2.5.

Residual Effects: With the implementation of the prescribed mitigation measures the residual effects will be a negative, imperceptible, indirect, temporary, unlikely effect on surface water quality in the down gradient rivers.

Significance of Effects: For the reasons outlined above, no significant effects on the surface water quality will occur.

9.5.3.3 Potential Effects from the Release of Cement-Based Products

Placed concrete in turbine bases and foundations can also have minor local effects on groundwater quality over time. However, due to the limited surface area of exposed concrete, the anoxic conditions below ground, and the high rate of dilution from the wider groundwater system relative to the small volumes of groundwater that would come in contact with the concrete, the potential for impacts considered to be imperceptible.

Pathways: Wind Farm Site drainage network and groundwater flows.

Receptors: Peat water hydrochemistry and surface water quality in watercourses in the vicinity and downstream of the Wind Farm Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadowen River, Shruhanagarve Stream), the Glendergan River and the Lowerymore River and the associated water-dependant ecosystems.

Potential Pre-Mitigation Effect: Negative, imperceptible, indirect, short-term, likely effect to surface water quality. Negative, imperceptible, indirect, short-term, likely effect on peat water hydrochemistry. In the absence of mitigation measures there is no potential for significant effects.

Proposed Mitigation Measures:

None required. The concrete in turbine bases sets within 3 days of concrete pour.

Residual Effect: Negative, imperceptible, indirect, short-term, likely effect to surface water quality. Negative, imperceptible, indirect, short-term, likely effect on peat water hydrochemistry.

Significance of Effects: For the reasons given above, no significant effects on the surface water or groundwater quality will occur.

9.5.3.4 Potential Effects from the Release of Wastewater

During the operational phase the wind farm control building, included in the onsite 110kV substation compound, will include staff welfare facilities. The substation control building, which is already constructed, is located in the catchment of the Bunadowen River.

Pathways: Groundwater flowpaths and site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Wind Farm Site including the Bunadowen and Mourne Beg rivers and the associated water-dependant ecosystems.

Pre-mitigation Effects: Negative, significant, indirect, temporary, unlikely effect on surface water quality. Negative, slight, indirect, temporary, unlikely effect on local groundwater. In the absence of mitigation measures there is the potential for significant effects.

Impact Assessment / Mitigation Measures:

A sealed underground holding tank for effluent (wastewater) from the substation building has been installed. The tank shall be routinely emptied by a licensed contractor. A level sensor has been installed in the tank which shall be linked to the on-site SCADA system. If the level of the tank contents rise to a predetermined 'high' level a warning shall appear on the overall SCADA system for the wind farm and automatic notification shall be sent to the facility manager. A suitably permitted waste contractor will be engaged, in relation to the servicing and de-sludging of the wastewater holding tank on site. There will be no discharge of wastewater to ground at the Site, and therefore there is no potential to impact groundwater or surface water quality.

Residual Effects: The residual effect is considered to be a negative, imperceptible, indirect, short term, unlikely effect on surface water or groundwater quality.

Significance of Effects: For the reasons given above, and with the implementation of the listed mitigation measures, no significant effects on surface water or groundwater quality will occur.

9.5.3.5 Potential Effects from the Proposed Water Supply at Onsite Substation

The water supply for the operational phase will be sourced from a rainwater harvesting system. Bottled potable drinking water will be brought to the Wind Farm Site as required. There will be no abstraction of surface or groundwater at the Wind Farm Site and there is no potential for effects.

Pathway: Groundwater flowpaths

Receptor: Groundwater levels

Potential Pre-Mitigation Effect: No effect.

Impact Assessment

No mitigation required.

Residual Effects: There will be no residual effect.

Significance of Effects: There will be no significant effects on surface water quality or quantity, or groundwater quality will occur.

9.5.3.6 Potential Effects on WFD Status and Objectives

There is no direct discharge from the Site to downstream receiving waters. Mitigation for the protection of surface water during the operational phase of the Prospective Development will ensure the qualitative status of the receiving SWBs will not be altered by the Prospective Development.

Similarly, there is no direct discharge to groundwaters associated with the Prospective Development. Mitigation for the protection of groundwater during the operational phase of the Prospective Development will ensure that the qualitative status of the receiving GWB will not be altered by the Prospective Development.

A full assessment of the potential effects of the operational phase of the Prospective Development on the status of the receiving waterbodies is included in WFD Compliance Assessment Report attached as Appendix 9-3 of this EIAR.

9.5.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

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

The wind turbines proposed as part of the Prospective Development are expected to operate for a period of 25 years. At the end of this period, the operation of the wind farm may be extended, or the equipment may be replaced with a new technology, subject to planning permission being obtained, or the turbines and associated above ground components of the wind farm may be decommissioned.

Upon decommissioning of the Prospective Development, the wind turbines will be disassembled in reverse order to how they were erected. The turbines will be disassembled with a similar model of crane that was used for their erection. The turbine components will be separated and removed offsite. The turbine materials will be transferred to a suitable recycling or recovery facility. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in unnecessary environment emissions.

The underground electrical cabling connecting the turbines to the onsite 110kV substation will be removed from the cable ducts. The cabling will be pulled from the cable ducts using a mechanical winch which will extract the cable and re-roll it on to a cable drum. This will be undertaken at the original cable jointing pits which will be excavated using a mechanical excavator and will be fully re-instated once the cables are removed. The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance. The cable materials will be transferred to a suitable recycling or recovery facility.

Site roadways will be in use for purposes other than the operation of the Prospective Development by the decommissioning phase of the Prospective Development, and therefore it will be more appropriate to leave the Wind Farm Site roads in situ for future use. It is envisaged that the roads will serve as agricultural or forestry access roads for local landowners.

The Grid Connection underground cabling route and onsite 110kV substation will remain in place as it will be under the ownership and control of the ESB and Eirgrid.

A Decommissioning Plan has been prepared (Appendix 4-6 of this EIAR) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will be agreed with the competent authority at that time.

As noted in the Scottish Natural Heritage report (SNH) *Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms* (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the Prospective Development, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".

No significant effects on the hydrological and hydrogeological environment are envisaged during the decommissioning phase of the Prospective Development.

9.5.5 Risk of Major Accidents and Disasters

The main risk of major accidents and disasters (MADs) at peatland sites is related to peat stability. A Peat Stability Assessment Report (Appendix 8-1 of this EIAR) has been completed for the Prospective Development and it concludes that with the implementation of the proposed mitigation measures that the risk of a peat failure at the Site is Low.

Flooding can also result in downstream MADs. However, the Wind Farm Site drainage will be designed to greenfield runoff rates and will ensure that there is no increase in surface water runoff rates from the Wind Farm Site. This will ensure that the Prospective Development does not increase the downstream flood risk.

9.5.6 Assessment of Potential Health Effects

Potential health effects arise mainly through the potential for surface and groundwater contamination which may have negative effects on public and private water supplies. There are no mapped public or group water scheme groundwater protection zones in the area of the Site. Furthermore, no private wells are located in close proximity to the Prospective Development. Notwithstanding this, the Prospective Development design and mitigation measures ensure that the potential for effects on the hydrogeological will not be significant.

The Lough Mourne surface water abstraction is located within the Site and the assessment of effects is presented in Section 9.5.2.11 above. Notwithstanding this, the Prospective Development design and mitigation measures have ensured that no significant effects have or will occur on the water environment.

Flooding of property can cause inundation with contaminated flood water. Flood waters can carry waterborne disease and contamination/effluent. Exposure to such flood waters can cause temporary health issues. A detailed Flood Risk Assessment has also shown that the risk of the Prospective Development contributing to downstream flooding is very low, as the long-term plan for the Site is to retain and slow down drainage water within the Site. On-site drainage control measures will ensure no downstream increase in flood risk.

9.5.7 Cumulative Effects – Prospective Development

9.5.7.1 Construction Phase

This section presents an assessment of the cumulative effects associated with the construction phase of the Prospective Development and other developments (existing and/or proposed) on the hydrological and hydrogeological environment.

The main likelihood of cumulative effects during the construction phase is related to the hydrological environment (surface water) rather than the hydrogeological (groundwater) environment. Due to the hydrogeological setting of the Prospective Development site (i.e. low permeability peat overlying a Poor Bedrock Aquifer) and the near surface nature of construction activities, cumulative effects with regard groundwater quality or quantity arising from the Prospective Development are assessed as not likely.

The cumulative hydrological study area includes:

- The catchment of the Mourne Beg River downstream as far as its confluence with the River Derg;
- The catchment of the Glendergan River downstream as far as its confluence with the River Derg; and,
- The Lowerymore River downstream as far as Lough Eske.

9.5.7.2 Cumulative Effects with Forestry

The Prospective Development site and the wider hydrological cumulative study area includes coniferous forestry plantations.

The most common water quality problems arising from forestry relate to the release of sediment and nutrients to the aquatic environment and impacts from acidification. Forestry felling may also give rise to modified stream flow regimes caused by associated land drainage.

Given the occurrence of several forestry blocks within the Prospective Development site and in the surrounding lands, and given that they drain to the Mourne Beg, Glendergan an Lowerymore rivers, the potential cumulative effects on downstream water quality and quantity need to be assessed.

However, the mitigation measures detailed above in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Prospective Development will ensure the protection of downstream surface water quality.

For these reasons it is considered that there will not be a significant cumulative effect associated with commercial forestry activities.

9.5.7.3 Cumulative Effects with Agriculture

The delineated cumulative study areas contained agricultural lands at lower elevations downstream of the Prospective Development site within the catchments of the Mourne Beg, Glendergan and Lowerymore rivers.

Agriculture is the largest pressure on water quality in Ireland. Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative impact on local and downstream surface water quality.

The Prospective Development was assessed for its potential to interact cumulatively with existing agricultural activities, which may contribute to elevated concentrations of suspended solids and ammonia in downstream surface waters

However, the mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Prospective Development will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with agricultural activities.

9.5.7.4 Cumulative Effects with Turbary Peat Cutting

The delineated cumulative study areas contained peatlands within the catchments of the Mourne Beg, Glendergan and Lowerymore rivers. There may be small private peat cutting activities in some of these peatland areas.

The construction phase of the Prospective Development may interact with these turbary activities and result in a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However, the areas of private peat cutting will be infinitely small, significantly limiting the potential for cumulative effects to arise with the Prospective Development. Nevertheless, the mitigation measures detailed in Section 9.5.2, 9.5.3 and 9.5.4 for the construction, operation and decommissioning phases of the Prospective Development will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with turbary activities.

9.5.7.5 Cumulative Effects with Other Wind Farm Developments

A total of 10 no. existing, permitted and/or proposed wind farms have been identified within the cumulative hydrological study area.

- The existing Seegroan Wind Farm (9 no. turbines);
- The existing Tievenamenta Wind Farm (15 no. turbines);
- The existing Crighshane Wind Farm (14 no. turbines);
- The existing Church Hill Wind Farm (8 no. turbines) and a permitted additional turbine at Church Hill Wind Farm;
- The permitted repowering of Barnesmore Wind Farm (13 no. turbines);
- The existing Gronan Wind Farm (4 no. turbines);
- The proposed Meenakeeran Wind Farm (4 no. turbines);
- The proposed Meenamullan Wind Farm (6 no. turbines);
- The proposed Pullyteam Wind Farm (6 no. turbines); and,
- The existing Slieveglass Wind Farm (3 no. turbines).

The greatest potential for cumulative effects to occur would be if the construction phase of the proposed wind farms and the Prospective Development overlapped. However, even in an unmitigated scenario, thee potential for cumulative effects is limited given the nature of the works associated with the Prospective Development.

Furthermore, the EIARs for the above proposed wind farm developments will detail potential hydrological and hydrogeological issues relating to the construction, operation and decommissioning phases of these developments and propose a suite of best practice mitigation measures designed to ensure that the developments do not in any way have a negative effect on downstream surface water quality and quantity. Similarly, the mitigation and best practice measures proposed in this EIAR chapter will ensure that the Prospective Development does not have the potential to result in significant effects on the hydrological/hydrogeological environment.

Therefore, with the implementation of the proposed mitigation measures (both for the Prospective Development and for the other wind farms) there will be no cumulative effects associated with the construction, operational or decommissioning phases of the Prospective Development and other wind farms within the cumulative study area.

9.5.8 Assessment of Potential In-Cumulation Effects

This section addresses the potential cumulative effects of the Prospective Development combined with the Existing Development and assesses the effects of the Subject Development on the hydrological and hydrogeological environment. An assessment of the In-Cumulation effects of the Subject Development are presented in **Table 9-23** below.

As detailed in this chapter, with the implementation of the prescribed mitigation measures the Prospective Development will not result in any significant effects on the hydrological and hydrogeological environment.

The rEIAR concluded that the Existing Development did not have any long-term significant effects on the receiving hydrological and hydrogeological environment. The Existing Development did result in some significant, short-term effects on downstream surface water quality and designated sites as a consequence of the November 2020 Peat Slide. However, the rEIAR states that water quality has since returned to baseline levels. Therefore, there is no potential for significant In-Cumulation effects from the Subject Development.

Table 9-23: Assessment of Potential In-Cumulation Effects of the Subject Development

Assessment Heading	Prospective Development	Existing Development	Subject Development
Effects from Earthworks	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality and aquatic habitats. There will be no significant effects.	The rEIAR concluded that the residual effect on surface water quality was at worst, a negative, indirect, imperceptible and temporary effect. There were no significant effects.	The effects on surface water quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects from Tree Felling	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, temporary, likely effect on downstream watercourses and associated water-dependent ecosystems. There will be no significant effects.	The rEIAR concluded that the residual effect on surface water quality was, at worst, a negative, indirect, imperceptible and temporary effect. There were no significant effects.	The effects on surface water quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects from Excavation Dewatering	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on local surface watercourses and associated water-dependent ecosystems. There will be no significant effects.	The rEIAR concluded that the residual effect on surface water quality was, worst, a negative, indirect, imperceptible and brief effect. There were no significant effects.	The effects on surface water quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.

Assessment Heading	Prospective Development	Existing Development	Subject Development
Effects on Groundwater Levels	With the implementation of the prescribed mitigation measures, the residual effect will be an imperceptible, direct, temporary, unlikely effects on local groundwater levels. There will be no significant effects.	The rEIAR concluded that the residual effect on groundwater levels was, at worst, a localised, short term, imperceptible, and of negative effect. There were no significant effects.	The effects on groundwater levels from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects from Contamination due to Hydrocarbons	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on local groundwater quality, and a negative, imperceptible, indirect, short term, unlikely effect on surface water quality. There will be no significant effects.	The rEIAR concluded that the residual effect on surface or groundwater quality was, at worst, a negative, indirect, imperceptible and short-term effect. There were no significant effects.	The effects on surface water and groundwater quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects from Contamination due to Wastewater	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on surface water or groundwater quality. There will be no significant effects.	The rEIAR concluded that the residual effect on surface or groundwater quality surface or groundwater quality was, at worst, a negative, indirect, imperceptible and short-term effect. There were no significant effects.	The effects on surface water and groundwater quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.

Assessment Heading	Prospective Development	Existing Development	Subject Development
Effects from contamination due to cement-based products	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on surface and groundwater quality. There will be no significant effects.	The rEIAR concluded that the residual effect on surface or groundwater quality was, at worst, a negative, indirect, imperceptible and short-term effect. There were no significant effects.	The effects on surface water and groundwater quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects on Watercourse Morphology	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, direct, long-term, unlikely effect on downstream water quality and aquatic habitats. There will be no significant effects.	The rEIAR concluded that the residual effect due to the construction or upgrade of watercourse crossings was, at worst, a negative, indirect, imperceptible and brief effect. There were no significant effects.	The effects on watercourse morphology from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects from the Use of Siltbuster	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality. There will be no significant effects.	Siltbuster was not used as part of the Existing Development.	The effects on surface water quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.

Assessment Heading	Prospective Development	Existing Development	Subject Development
Effects on Designated Sites	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, imperceptible, indirect, short-term, unlikely effect on downstream designated sites. There will be no significant effects.	The rEIAR concluded that the residual effect was, at worst, a negative, indirect, significant and short-term effect. Short-term significant effects occurred due to the November 2020 Peat Slide.	The effects on downstream designated sites from the Prospective Development will not significant. The Existing Development resulted in short-term significant effects due to the November 2020 Peat Slide and water quality has since returned to baseline levels. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects on Lough Mourne Abstraction	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, slight, indirect, short-term, unlikely effect on the Lough Mourne Supply. There will be no significant effects.	The rEIAR concluded that the residual effect was a negative, imperceptible, indirect, short–term effect on water quality. There were no significant effects.	The effects on the Lough Mourne abstraction from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects on Local Private Wells	With the implementation of the prescribed mitigation measures, there will be no residual effects on local groundwater well supplies. There will be no significant effects.	The rEIAR concluded that there were no residual effects on local private groundwater wells. There were no significant effects.	The effects on local private groundwater wells from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.

Assessment Heading	Prospective Development	Existing Development	Subject Development
Effects on WFD Status and Objectives	With the implementation of the prescribed mitigation measures, there will be no residual effect on SWB or GWB status. There will be no significant effects.	The rEIAR concluded that there were no residual effects on WFD status and objectives. There were no significant effects.	The effects on WFD status from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects due to Biodiversity Enhancement	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, indirect, slight to moderate, likely short-term effect on downstream water quality and a positive, indirect, moderate, likely, long-term effect on downstream water quality. There will be no significant effects.	No biodiversity enhancement was completed as part of the Existing Development.	The effects on surface water quality from both the Prospective Development is considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.
Effects due to Blasting	With the implementation of the prescribed mitigation measures, the residual effect will be a negative, indirect, imperceptible, long-term, likely effect on groundwater quality. There will be no significant effects.	The rEIAR concluded that there were no residual effects on local groundwater quality. There were no significant effects.	The effects on groundwater quality from both the Prospective Development and the Existing Development are considered to be not significant. There is no potential for significant In-Cumulation effects from the Subject Development.

Assessment Heading	Prospective Development	Existing Development	Subject Development
Effects due to November 2020 Peat Slide and Emergency Works	Not applicable. The PSRA (FT, 2026) for the Prospective Development concluded that the Site is appropriate for the development and that with the implementation of the prescribed mitigation measures the risk of peat instability is low. There will be no significant effects.	The rEIAR concluded that the residual effect on surface water quality was, at worst, a negative, direct, significant and short-term effect. The residual effect on stream morphology was, at worst, a negative, significant, direct, short-term effect. Short-term significant effects occurred due to the November 2020 Peat Slide. Meanwhile, the emergency response works had a long-term, positive, direct effect on surface water quality.	The Existing Development resulted in short-term significant effects due to the November 2020 Peat Slide and water quality has since returned to baseline levels. There is no potential for significant In-Cumulation effects from the Subject Development.

9.5.9 Cumulative Effects – Subject Development

This section assesses the potential for cumulative effects between the Subject Development (Existing Development and the Prospective Development) on the water environment. The study area for this assessment is the same as that described in Section 9.5.7 above.

9.5.9.1 Cumulative Effects with Forestry

The Site of the Subject Development and the wider hydrological cumulative study area includes coniferous forestry plantations.

The most common water quality problems arising from forestry relate to the release of sediment and nutrients to the aquatic environment and impacts from acidification. Forestry felling may also give rise to modified stream flow regimes caused by associated land drainage.

Given the occurrence of several forestry blocks within the Site of the Subject Development and in the surrounding lands, and given that they drain to the Mourne Beg, Glendergan an Lowerymore rivers, the potential cumulative effects on downstream water quality and quantity need to be assessed.

However, the mitigation measures detailed above for the Existing Development and the mitigation measures prescribed in the EIAR for the Prospective Development will ensure the protection of downstream surface water quality.

For these reasons it is considered that there will not be a significant cumulative effect associated with commercial forestry activities.

9.5.9.2 Cumulative Effects with Agriculture

The delineated cumulative study areas contained agricultural lands at lower elevations downstream of the Site of the Subject Development within the catchments of the Mourne Beg, Glendergan and Lowerymore rivers.

Agriculture is the largest pressure on water quality in Ireland. Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative impact on local and downstream surface water quality.

The Subject Development would have the potential to interact with these agricultural activities and contribute to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

However, the mitigation measures detailed in this EIAR for the Prospective Development and the mitigation measures prescribed in the rEIAR will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with agricultural activities.

9.5.9.3 Cumulative Effects with Turbary Peat Cutting

The delineated cumulative study areas contained peatlands within the catchments of the Mourne Beg, Glendergan and Lowerymore rivers. There may be small private peat cutting activities in some of these peatland areas.

As part of the assessment, consideration was given to the potential for interactions between turbary activities and the Subject Development. In the absence of appropriate controls and mitigation measures, such activities have the potential to contribute to localised increase in suspended solids in receiving waters.

However, the areas of private peat cutting will be infinitely small, significantly limiting the potential for cumulative effects to arise with the Subject Development. Nevertheless, the mitigation measures detailed in this EIAR for the Prospective Development and the mitigation measures prescribed in the rEIAR will ensure the protection of downstream surface water quality.

For these reasons outlined above we consider that there will not be a significant cumulative effect associated with turbary activities.

9.5.9.4 Cumulative Effects with Other Wind Farm Developments

A total of 10 no. existing, permitted and/or proposed wind farms have been identified within the cumulative hydrological study area:

- The existing Seegroan Wind Farm (9 no. turbines);
- The existing Tievenamenta Wind Farm (15 no. turbines);
- The existing Crighshane Wind Farm (14 no. turbines);
- The existing Church Hill Wind Farm (8 no. turbines) and a permitted additional turbine at Church Hill Wind Farm;
- The permitted repowering of Barnesmore Wind Farm (13 no. turbines);
- The existing Gronan Wind Farm (4 no. turbines);
- The proposed Meenakeeran Wind Farm (4 no. turbines);
- The proposed Meenamullan Wind Farm (6 no. turbines);
- The proposed Pullyteam Wind Farm (6 no. turbines); and,
- The existing Slieveglass Wind Farm (3 no. turbines).

The greatest potential for cumulative effects to occur would be if the construction phase of the proposed wind farms and the Subject Development overlapped. However, even in an unmitigated scenario, the potential for cumulative effects is limited as the majority of works associated with the Subject Development have already been completed. This EIAR chapter demonstrates that with the implementation of the prescribed mitigation measures there will be no significant effects on the surface or groundwater environments.

Furthermore, the EIARs for the above proposed wind farm developments will detail potential hydrological and hydrogeological issues relating to the construction, operation and decommissioning phases of these developments and propose a suite of best practice mitigation measures designed to ensure that the developments do not in any way have a negative effect on downstream surface water quality and quantity.

Therefore, with the implementation of the proposed mitigation measures (both for the Subject Development and for the other wind farms) there will be no cumulative effects associated with the Subject Development and other wind farms within the cumulative study area.

9.5.9.5 Cumulative Effects with other Non-Wind Farm Related Developments

A review of other developments, projects and plans within the cumulative study area has been completed. The Site of the Subject Development is located in a largely rural area and the proposed developments largely comprise of farm and agricultural buildings and houses/dwellings.

Furthermore, the potential for the Subject Development to result in significant cumulative effects is limited as the majority of the works have already been completed as part of the Existing Development.

The rEIAR demonstrated that there has been no long-term significant effects on the hydrological or hydrogeological environments. This EIAR prescribes tried and tested mitigation measures for the protection of the surface and groundwater environment. With the implementation of these measures there is no potential for significant cumulative effects.

9.5.10 Assessment of Potential Transboundary Effects

This section addresses the potential transboundary effects of the Prospective Development on the hydrological and hydrogeological environment. An assessment of the potential transboundary effects are presented in **Table 9-24** below.

As detailed in this chapter, with the implementation of the prescribed mitigation measures the Prospective Development will not result in any significant effects on the hydrological and hydrogeological environment.

The prescribed mitigation measures will ensure that there is no potential for the Prospective Development to result in any transboundary effects with other developments in Northern Ireland. The mitigation measures will ensure the protection of all watercourses within the Wind Farm Site, therefore, protecting downstream watercourses within Northern Ireland. With the implementation of mitigation measures there is no potential for significant transboundary effects.

Furthermore, the rEIAR completed for the Existing Development demonstrates that there was no significant long-term effect on the hydrological and hydrogeological environments. A short-term significant negative effect occurred as a result of the November 2020 Peat Slide, however monitoring has shown that water quality has since returned to baseline / pre-construction levels. Therefore, the only significant transboundary effects were of a short duration and were associated with the November 2020 Peat Slide. Therefore, with the implementation of the mitigation measures prescribed in this EIAR chapter, the Subject Development will not result in any significant transboundary effects.

9.5.11 Post Consent Monitoring

The monitoring programme during the course of construction works (unless otherwise specified by any required planning condition) will include:

- One baseline monitoring visit (in advance of construction), including upstream and downstream biological Q value sampling and reporting.
- Monthly grab sampling by site EM at locations SW1-SW4, M-Beg 1 and M-Beg 2, with an additional sampling point to be established on the Shruhanagarve Stream. Analysis suite will include suspended solids, BOD, nitrite, nitrate, ammonia, orthophosphate and chloride.
- Monthly inspections and grab sampling during post construction for 6 months.
- Annual upstream and downstream biological Q value sampling and reporting, including one post construction event.

The Site Environmental Manager (EM) will have a stop works authority. Weekly site meeting will include for scheduling of works according to weather forecast. Suitable locations (further downstream) for biological Q-Value sampling will be identified by Site EM.

Table 9-24: Assessment of Potential Transboundary Effects of the Prospective Development

Assessment Heading	Prospective Development	Transboundary Effects
Effects from Earthworks	The impact assessment presented in Section 9.5.2.1 above concludes that the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on surface water quality.	There will be no potential for significant Transboundary Effects on surface water quality as a result of the Prospective Development.
Effects from Tree Felling	The impact assessment presented in Section 9.5.2.2 concludes that the residual effect will be a negative, imperceptible, indirect, temporary, likely effect on surface water quality.	There will be no potential for significant Transboundary Effects on surface water quality as a result of the Prospective Development.
Effects from Excavation Dewatering	The impact assessment presented in Section 9.5.2.3 concludes that the residual effect will be a negative, imperceptible, indirect, temporary, likely effect on surface water quality.	There will be no potential for significant Transboundary Effects on surface water quality as a result of the Prospective Development.
Effects on Groundwater Levels	The impact assessment presented in Section 9.5.2.4 concludes that the residual effect will be an imperceptible, direct, temporary, unlikely effects on local groundwater levels.	There will be no potential for significant Transboundary Effects on groundwater levels as a result of the Prospective Development
Effects from Contamination due to Hydrocarbons	The impact assessment presented in Section 9.5.2.5 concludes that the residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on local groundwater quality, and a negative, imperceptible, indirect, short term, unlikely effect on surface water quality.	There will be no potential for significant Transboundary Effects on surface water or groundwater quality as a result of the Prospective Development
Effects from Contamination due to Wastewater	The impact assessment presented in Section 9.5.2.7 concludes that the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on surface water or groundwater quality.	There will be no potential for significant Transboundary Effects on surface water or groundwater quality as a result of the Prospective Development

Assessment Heading	Prospective Development	Transboundary Effects
Effects from contamination due to cement-based products	The impact assessment presented in Section 9.5.2.6 concludes that the residual effect will be a negative, imperceptible, indirect, short term, unlikely effect on surface and groundwater quality.	There will be no potential for significant Transboundary Effects on surface water or groundwater quality as a result of the Prospective Development
Effects on Watercourse Morphology	The impact assessment presented in Section 9.5.2.8 concludes that the residual effect will be a negative, imperceptible, direct, long-term, unlikely effect on downstream water quality and aquatic habitats.	There will be no potential for significant Transboundary Effects on surface water morphology as a result of the Prospective Development
Effects from the Use of Siltbuster	The impact assessment presented in Section 9.5.2.9 concludes that the residual effect will be a negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality.	There will be no potential for significant Transboundary Effects on surface water quality as a result of the Prospective Development
Effects on Designated Sites	The impact assessment presented in Section 9.5.2.10 concludes that the residual effect will be a negative, imperceptible, indirect, short-term, unlikely effect on downstream designated sites.	There will be no potential for significant Transboundary Effects on downstream designated sites as a result of the Prospective Development
Effects on Lough Mourne Abstraction	The impact assessment presented in Section 9.5.2.11 concludes that the residual effect will be a negative, slight, indirect, short-term, unlikely effect on the Lough Mourne Supply.	There will be no potential for significant Transboundary Effects on the Lough Moruen abstraction as a result of the Prospective Development
Effects on Local Private Wells	The impact assessment presented in Section 9.5.2.12 concludes that there will be no residual effects on local groundwater well supplies.	There will be no potential for significant Transboundary Effects on local groundwater well supplies as a result of the Prospective Development
Effects on WFD Status and Objectives	The impact assessment presented in Section 9.5.2.13 concludes that there will be no residual effects on WFD status.	There will be no potential for significant Transboundary Effects on WFD status as a result of the Prospective Development
Effects due to Biodiversity Enhancement	The impact assessment presented in Section 9.5.2.14 concludes that the residual effect will be a negative, indirect, slight to moderate, likely short-term effect on downstream water quality and a positive, indirect, moderate, likely, long-term effect on downstream water quality.	There will be no potential for significant Transboundary Effects on surface water quality as a result of the Prospective Development

Assessment Heading	Prospective Development	Transboundary Effects
Effects due to Blasting	The impact assessment presented in Section 9.5.2.15 concludes that the residual effect will be a negative, indirect, imperceptible, long-term, likely effect on groundwater quality.	There will be no potential for significant Transboundary Effects on groundwater quality as a result of the Prospective Development