11 HYDROLOGY & HYDROGEOLOGY

11.1 INTRODUCTION

This chapter considers the likely significant effects on the receiving hydrological and hydrogeological environments associated with the construction, operation and Decommissioning of the proposed Kellystown Wind Farm, hereinafter referred to as the 'Proposed Development' (as described in **Chapter 2: Description of the Proposed Development**).

The impacts caused by the construction, operation and Decommissioning phases of the Proposed Development are assessed, and mitigation measures are provided where required. The assessment also identifies where hydrological features may constrain the layout of the Proposed Development.

11.1.1 Supplementary Assessments

This chapter of the EIAR is supported by Figures provided in Volume III and the following Appendices provided in Volume IV of this EIAR:

- **Technical Appendix 11.1:** Flood Risk & Drainage Assessment
- **Technical Appendix 11.2:** Surface Water Management Plan
- **Technical Appendix 11.3:** Consultation Records
- **Technical Appendix 10.1:** Preliminary Site Investigation Report
- **Figures: 11.1 to 11.3**

Reference should be made to **Chapter 1: Introduction** for information regarding detailed construction proposals.

Changes to the hydrological / hydrogeological regime may create resultant effects on ecology within hydrological dependent ecosystems. Therefore, this chapter is further supported by:

- **Chapter 6: Biodiversity; and**
- **Chapter 9: Aquatic Ecology.**

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. This CEMP will be a key construction contract document, which will ensure that all mitigation measures, which are considered necessary to protect the environment, are implemented. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 20.1**.

11.1.2 Statement of Authority

This chapter of the EIAR was prepared by McCloy Consulting Ltd.; an independent environmental consultancy specialising in the water environment, with specialist knowledge of hydrological and hydrogeological assessments.

The staff members involved in the preparation of this assessment are as follows:

- Iain Muir MSc (Catchment Hydrology and Management) CEnv MIEnvSc – Senior Consultant and Chartered Environmentalist with 9 years' experience in Environmental Impact Assessment (EIA) specialising in the water environment, undertaking hydrology, hydrogeology, water quality and flood risk assessments for major infrastructure projects in highland environments, and renewable energy projects in the Ireland and the UK; and
- Kyle Somerville BEng (Hons) (Civil Engineering) CEng MIEI – Director and Chartered Engineer with over 20 years' experience specialising in the fields of hydrology and surface water management for onshore wind farm developments in Ireland and the UK, and has overseen outline and detailed design of surface water management for in excess of thirty large-scale onshore wind farm developments in the UK and Ireland.

11.1.3 Scope of Assessment

This report will assess the effects of the Proposed Development on hydrology and surface water quality, hydrogeology and groundwater quality. The assessment covers the construction, operational, and Decommissioning phases of the Proposed Development.

This assessment identifies the hydrological and hydrogeological constraints within lands that fall within the main section of the proposed Kellystown Wind Farm boundary, herein referred to as 'the Site', the proposed Grid Connection Route (GCR), and the proposed Turbine Delivery Route (TDR), and assesses the potential effects of the following:

- Existing natural and artificial drainage patterns;
- Water quality of surface water and groundwater;
- Surface and groundwater dependent ecosystems;
- Usage of surface water and groundwater including abstractions;
- Groundwater - surface water interactions; and
- Aquifer systems and their vulnerability.

In order to quantifiably assess the preceding, this report:

- Outlines relevant legislation, policy, and guidance relating to the water environment;
- Summarises consultations provided in response to informal scoping requests;
- Provides baseline information and identifies sensitive receptors;
- Identifies potential likely effects to sensitive receptors;

- Assesses the significance of any adverse effects and resulting impacts based on the magnitude of the impact and the sensitivity of the receptors;
- Discusses management of design evolution and details mitigation measures;
- Provides a residual impact assessment; and
- Discusses the cumulative effects of the Proposed Development in conjunction with other proposed and existing developments in the vicinity.

11.2 RELEVANT LEGISLATION AND GUIDANCE

11.2.1 Legislation

This study complies with the EIA Directive (as amended) (as defined in **Chapter 1: Introduction**) which requires Environmental Impact Assessment for certain types of major development before development consent is granted. The EIA Directive as amended is transposed inter alia by the Planning and Development Act 2000 as amended and by the Planning and Development Regulations 2001 as amended.

In addition to this planning legislation, other environmental legislation relevant to hydrological and hydrogeological aspects of the environment were adhered to:

- S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations 1988;
- S.I. No. 477 of 2011 European Communities (Birds and Natural Habitats) 2011 (as amended);
- S.I. No. 41 of 1999: Protection of Groundwater Regulations 1999;
- S.I. No. 439 of 2000: European Communities (Drinking Water) Regulations, 2000;
- S.I. No. 722 of 2003 European Communities (Water Policy) Regulations 2003;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009;
- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009;
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010;
- S.I. No. 122 of 2014 European Union (Drinking Water) (No. 2) Regulations 2014;
- S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018;
- European Union Water Framework Directive (2000/60/EC);
- European Union Directive 2006/44/EC on the quality of fresh waters needing protection or improvement in order to support fish life (The Freshwater Fish (Fishlife) Directive); and

- European Union Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the "Groundwater Directive") and (2006/118/EC) (the "daughter directive").

The Water Framework Directive (WFD), which was passed by the European Union (EU) in 2000, and came into legal effect in December 2015, is wide-reaching legislation which replaces a number of the other water quality directives (for example, those on Water Abstraction) while implementation of others (for example, The Integrated Pollution Prevention and Control and Habitats Directives) will form part of the 'basic measures' for the Water Framework Directive. The fundamental objective of the Water Framework Directive aims at maintaining "high status" of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least "Good" in relation to all waters by 2027.

11.2.2 National, Regional and Local Planning Policy

The Proposed Development has been reviewed in relation to planning policy specific to the water environment. Statutory national, regional and local planning policy frameworks and associated supplementary guidelines pertinent to this chapter and the Proposed Development are outlined below.

11.2.2.1 Relevant National Plans and Programmes

- Project Ireland 2024 – National Planning Framework (NPF) (Department of Housing, Planning and Local Government, 2018);
- National Development Plan (NDP) (Department of Public Expenditure and Reform, 2021);
- Our Sustainable Future – A Framework for Sustainable Development for Ireland (Department of the Environment, Community and Local Government, 2012);
- Ireland's Environment – An Assessment (Environmental Protection Agency, 2016);
- Department of Environment, Heritage and Local Government (2006) Wind Energy Development Guidelines for Planning Authorities;
- Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines;
- Flood mapping and management information developed and published through the National CFRAMS Programme (Office of Public Works, 2009 to present (January 2024));
- River Basin Management Plan for Ireland (Department of Housing, Local Government and Heritage, 2018);

- The Planning System and Flood Risk Management: Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government/Office of Public Works, 2009); and
- The Greater Dublin Strategic Drainage Study (GDSDS) (Dublin City Council, 2005).

11.2.2.2 Relevant Regional Plans and Programmes

- Strategic Environmental Assessment (SEA) Regional Spatial and Economic Strategy for the Eastern & Midland Region (Eastern & Midland Regional Assembly, 2019)

11.2.2.3 Relevant Local Plans

The Proposed Development is located within the jurisdiction of Louth County Council. The relevant local plans applicable to this assessment include:

- County Louth Development Plan 2021-2027;
- Strategic Environmental Assessment (SEA) Statement for the Louth County Development Plan 2021-2027; and
- Strategic Flood Risk Assessment (SFRA) for the Louth County Development Plan 2021-2027.

Policies and objectives pertinent to the water environment set out by Louth County Council within the CLDP include those outlined in:

- Chapter 8 - Natural Heritage, Biodiversity and Green Infrastructure (i.e., NBG5);
- Chapter 10 - Infrastructure & Public Utilities (i.e., IU19, and IU22 to IU35), and
- Chapter 11 - Environment, Natural Resources & the Coast (i.e., ENV15 to ENV23).

11.2.2.4 Industry Guidelines

The assessment is carried out in accordance with guidance listed below:

- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Department of Environment, Heritage and Local Government (DoHLG) (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters;
- National Road Authority (NRA) (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Department of Agriculture, Food and the Marine (DAFM) (2000) Forest Harvesting and the Environment Guidelines;

- Department of Agriculture, Food and the Marine (2000) Forestry and Water Quality Guidelines;
- Department of Agriculture, Food and the Marine (DAFM) (2018) Plan for Forests & Freshwater Pearl Mussel in Ireland;
- DEFRA (2012) Good Agricultural and Environmental Condition (GAEC) Standards – GAEC 1: Good agricultural and environmental condition standards for soil and water management;
- NatureScot (2019) Guidance - Good Practice During Wind Farm Construction;
- Department of Agriculture, Environment and Rural Affairs (DAERA) (2019) Environmental Advice for Planning Practice Guide Wind farms and Groundwater Impacts: A Guide to EIA and Planning Considerations;
- Construction Industry Research and Information Association (CIRIA) (2001) C532 - Control of Water Pollution from Construction Sites;
- CIRIA (2015) C741 - Environmental Good Practice On-Site;
- CIRIA (2015) C753 - The SuDS Manual;
- CIRIA (2019) C786 - Culverts, Screen and Outfall Manual;
- OPW (2022) Construction, Replacement or Alteration of Bridges and Culverts: A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945;
- Northern Ireland Environment Agency (NIEA) (2019) Practice Guide: Wind Farms and Groundwater Impacts;
- National Fire Chiefs Council (UK) (2022) Grid Scale Battery Energy Storage System Planning – Guidance for Fire & Rescue Services;
- Scottish Environment Protection Agency (SEPA) (2017) Planning Guidance on On-Shore Windfarm Developments; and
- Scottish Environment Protection Agency (SEPA) & Northern Ireland Environment Agency (NIEA) (2000-2023) Guidance for Pollution Prevention (GPP) / Pollution Prevention Guidance (PPG) Series.

The guidance relevant in similar adjacent jurisdictions (i.e., Northern Ireland, Scotland, United Kingdom) has been complied with for the purpose of this assessment as there is no equivalent applicable guidance in Ireland. Based on professional judgment and experience, we consider guidance prepared by DAERA, NIEA, SEPA, NatureScot, and DEFRA to represent an appropriate standard of good practice.

11.2.2.5 Scoping Responses and Consultation

Information has been provided by a number of consultee organisations during the assessment, and this is summarised in **Table 11.1**. The response to each point raised by

consultees is also presented within the table, demonstrating where the design of the Proposed Development has addressed responses to specific issues indicated by respective consultees.

Table 11.1: Scoping Responses and Consultation

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Section where Addressed in this Report
EPA	13/02/2023 & 03/03/2023, (email)	• Provided data on abstractions in the vicinity of the site. • Provided links to datasets on licenced activities. • Provided links to datasets on waste, industrial emissions, integrated pollution control and historic waste licensed sites.	11.4.10 and 11.4.13
Louth County Council	01/02/2023 & 25/07/2024 (email)	• Provided information regarding water services infrastructure in the vicinity of the development site. • Provided details on WFD RBMP and actions	11.4.10
Uisce Éireann / Irish Water	31/01/2023 (email)	• Provided data on their wate and sewer networks in the vicinity of the site.	11.4.10
NFGWS	31/07/2024	• Provided details on WFD RBMP and actions	11.4.8

11.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

11.3.1 Baseline Characterisation

This qualitative and quantitative assessment has been undertaken based on experienced professional judgement and assessment in compliance with statutory and industry guidance, including site visits for verification.

11.3.1.1 Study Area

Potential effects were considered within the study area. For purposes of this assessment, the hydrological study area includes the river reaches at and downstream from the Proposed Development, and the surface water catchments draining the Proposed Development as defined by the relevant water management units (refer to **Plate 11.5** and **Plate 11.6**). The hydrogeological study area extends to the underlying aquifer catchments (refer to **Plate 11.10** and **Plate 11.11**).

11.3.2 Desk Study

The desktop study involved collation and assessment of relevant information. All web-based data sources were verified as unchanged on 25/09/2024 comparative to the versions used to inform the assessment. The relevant information was obtained from the following sources:

- EPA Map Viewer (https://gis.epa.ie/EPAMaps/Water);
- EPA HydroNet, Surface water levels, flows and groundwater levels (http://www.epa.ie/hydronet/#Water%20Levels);
- Catchment Data (https://www.catchments.ie);
- NPWS Designations Viewer (https://www.npws.ie/maps-and-data);
- EPA maps (designated sites etc) (https://gis.epa.ie/EPAMaps/);
- Map of Irish Wetlands (https://www.arcgis.com/apps/View/);
- OPW (2018) Flood Risk Management Plan (Neagh Bann River Basin); (https://www.floodinfo.ie/map/floodplans/);
- OPW Flood Plans and Flood Maps (https://www.floodinfo.ie/];
- Arterial Drainage Viewer (https://www.floodinfo.ie/map/drainage_map/);
- GSI Groundwater Body Descriptions (https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/);
- Met Éireann Meteorological Data (https://www.met.ie/climate/available-data/historical-data);
- Department of Housing, Planning and Local Government, National River Basin Management Plan 2018-2021 (https://www.gov.ie/en/publication/429a79);
- Myplan.ie; National Planning Application Map Viewer (https://myplan.ie/national-planning-application-map-viewer);
- EPA Cycle 3: HA 06 Newry, Fane, Glyde and Dee Catchment Report (https://www.catchments.ie/data/#/?_k=2brxch);
- EPA Cycle 3: HA 07 Boyne Catchment Report (https://www.catchments.ie/data/#/?_k=2brxch);
- EPA WFD Cycle 2: Catchment Newry, Fane, Glyde and Dee Sub-catchment Burren_SC_010 (https://www.catchments.ie/data/#/?_k=2brxch);
- EPA WFD Cycle 2: Catchment Newry, Fane, Glyde and Dee Sub-catchment Dee_SC_04 (https://www.catchments.ie/data/#/?_k=2brxch);
- WFD Cycle 2: Catchment Boyne Sub-catchment Boyne_SC_130 (https://www.catchments.ie/data/#/?_k=2brxch);
- Environmental Impact Assessment Report in respect of Proposed Quarry Development at Kilsaran Quarry (Tom Phillips + Associates, 2022) (iDocs Web (louthcoco.ie);
- Sustainable Energy Authority of Ireland (SEAI), Wind Atlas (https://www.seai.ie/technologies/seai-maps/wind-atlas-map/); and
- Department of Housing, Planning and Local Government, EIA Portal (https://www.housing.gov.ie/planning/environmental-assessment/environmental-impact-assessment-eia/eia-portal).

11.3.3 Field Work

Field investigation and hydrological surveys to inform the baseline hydrological conditions of the Site were undertaken by Iain Muir – Senior Consultant (refer to **Section 11.1.2**) on the 3rd February 2023, 2nd August 2023, and 29th February 2024, with the purpose of identifying / verifying existing natural and artificial site drainage characteristics and hydrological features.

The walkover surveys incorporated the lands within the Site, with particular emphasis on areas affected by proposed turbine locations and access track layout and known / mapped watercourses in order to fully assess potential issues with regards to:

- Disruption to watercourses through construction of infrastructure (i.e., roads / hard standing);
- Likelihood of adverse effects on surface water movement / quality due to construction and operation of wind farms; and
- Potential for impact on natural geological conditions and groundwater movement / quality.

11.3.4 Evaluation of Potential Effects

This assessment determines the nature, scale, and significance of the effects of the Proposed Development on the baseline (current) scenario in accordance with a methodology stated within guidance documents outlined in **Section 11.2.2.4**, namely EPA (2022) and NRA (2008).

The potential effect significance is defined by the combination of the sensitivity of the receptor and the magnitude of the effect. Following this, an overall effect significance is determined by considering the potential effect significance and the likelihood of the effect occurring.

The assessment of the magnitude of the predicted effect has taken into account the full range of infrastructure proposed by the application. The range of turbines proposed causes no change to work at or below ground level that would cause a measurable change to the magnitude of any effect to hydrology / hydrogeology.

11.3.4.1 Sensitivity

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed development (EPA, 2022). The EPA provides guidance on the assessment methodology, including defining general descriptive terms in relation to magnitude of impacts however, in terms of qualifying significance of the receiving environment the EPA guidance also states that:

"As surface water and groundwater are part of a constantly moving hydrological cycle, any assessment of significance will require evaluation beyond the development Site boundary." (EPA, 2015)

To facilitate the qualification of hydrological and hydrogeological attributes, guidance specific to hydrology and hydrogeology as set out by National Roads Authority (NRA) 2008, has been used in conjunction with EPA guidance. The following **Table 11.2** presents rated categories and criteria for rating the sensitivity of Site attributes (NRA, 2008).

The scale and sensitivity of the receiving environment (receptor) has been categorised on a scale of "Extremely High" to "Low". The sensitivity criteria used for this assessment presented in **Table 11.2** are based on:

- Vulnerability of a receptor to a particular pressure (degree of environmental response to any particular effect); and
- The importance or 'value' of the receptor (e.g., an area of international importance) should be considered more sensitive to potential effects than an area of little or no conservation value.

Table 11.2: Criteria for Rating Sensitivity of Attributes

Importance	Criteria	Typical Examples
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 Natural Habitats Regulations, the Birds Directive or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988 • 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, significance or value on a regional or national scale	• 'High' overall WFD status • River, wetland or surface water body ecosystem protected by national legislation – NHA status • Quality Class A (Biotic Index Q4, Q5) • Flood plain protecting more than 50 residential or commercial properties from flooding • Nationally important amenity Site for wide range of leisure activities • 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, significance or value on a local scale	• 'Good' overall WFD status • Salmon fishery • Quality Class B (Biotic Index Q3-4)

Importance	Criteria	Typical Examples
		• Flood plain protecting between 5 and 50 residential or commercial properties from flooding • Locally important amenity Site for wide range of leisure activities • 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 • Well drained and/or high fertility soils
Medium	Attribute has a medium quality, significance or value on a local scale	• 'Moderate' overall WFD status • Coarse fishery • Quality Class C (Biotic Index Q3, Q2- 3) • Flood plain protecting between 1 and 5 residential or commercial properties from flooding • Locally Important Aquifer • Local potable water source supplying >50 homes • Outer source protection area for locally important water source • Moderately drained and/or moderate fertility soils
Low	Attribute has a low quality, significance or value on a local scale	• 'Poor / Bad' overall WFD status • Locally important amenity Site for small range of leisure activities • 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 • Poor bedrock aquifer • Local potable water source supplying <50 homes • Poorly drained and/or low fertility soils

11.3.4.2 Magnitude

In terms of hydrology and hydrogeology, magnitude is qualified in line with relevant guidance, as presented in the following tables (NRA, 2008). The magnitude of change / effect is influenced by the timing, scale, size, and duration of the effect; magnitude has been categorised on a scale of "Large Adverse" to "Large Beneficial"; defined in **Table 11.3**.

Magnitude of impact criteria include criteria as set out in Box 5.2 of the NRA guidance (2008) but provides additional criteria / examples to better allow assignation of magnitude of potential impacts. Additional examples have been developed through practice experience specific to onshore windfarm development in Ireland and elsewhere and are routinely accepted in practice.

Table 11.3: Qualifying the Magnitude of Effect on Hydrological Attributes

Magnitude of Impact	Description	Examples
Large Adverse	Results in loss of attribute and/or quality and integrity of attribute	• Loss or extensive change to a waterbody or water dependent habitat / species • Increase in predicted peak flood level >100mm • Extensive loss of fishery (commercial and / or angling) • Extensive reduction in amenity value / utility function • Potential high risk of pollution to surface water changing water quality status • Loss of local water supply or change in quality with respect to drinking water standards (DWS) • Significant and permanent change over large scale i.e. Large changes in erosion and deposition regimes
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Increase in predicted peak flood level >50mm • Partial loss of fishery (commercial and / or angling) • Partial reduction in amenity value / utility function • Potential medium risk of pollution to surface water, changing water quality status • Temporary loss of local water supply or minor change in quality of supply with respect to drinking water standards • Detectable change to river morphology / fluvial geomorphology over a small scale i.e. some changes in erosion and deposition regimes
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Increase in predicted peak flood level >10mm • Minor loss of fishery (commercial and / or angling) • Slight reduction in amenity value / utility function • Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations • No change in pressure or flow to local water supply or minor change in quality of supply with respect to drinking water standards • Minor change to river morphology / fluvial geomorphology
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• No perceptible changes to baseline conditions. No measurable change in water quality. No change in the water feature's capacity to dilute pollutants and waste products • Negligible change in predicted peak flood level • Negligible reduction in amenity value / utility function • No measurable change to a surface water dependent ecosystem or fishery (commercial and / or angling) • Unquantifiable or unqualifiable change to river morphology / fluvial geomorphology
Small Beneficial	Results in minor improvement of attribute quality	• Reduction in predicted peak flood level >10mm • Minor improvement over baseline water quality conditions • Partial improvement to sediment processes at the reach scale, including reduction in siltation and localised recovery of sediment transport processes • Partial improvements including enhancements to in-channel habitat, riparian zone and morphological diversity of the bed and / or banks • Slight improvement on baseline conditions with potential to improve flow processes at the reach scale

Magnitude of Impact	Description	Examples
Moderate Beneficial	Results in moderate improvement of attribute quality	• Reduction in predicted peak flood level >50mm • Moderate improvement over baseline water quality conditions • Reduction in siltation and recovery of sediment transport processes at the reach or multiple reach scale • Partial creation of both in-channel and vegetated riparian habitat. Improvement in morphological diversity of the bed and / or banks at the reach or multiple reach scale. Includes partial or complete removal of structures and/or artificial materials • Notable improvements on baseline conditions and recovery of fluvial processes at the reach or multiple reach scale
Large Beneficial	Results in major improvement of attribute quality	• Reduction in predicted peak flood level >100mm • Major improvement over baseline water quality conditions • Improvement to sediment processes at the catchment scale, including recovery of sediment supply and transport processes • Extensive creation of both in-channel habitat and riparian zone. Morphological diversity of the bed and/ or banks is restored, such as natural planform, varied natural cross-sectional profiles, recovery of fluvial features (e.g. cascades, pools, riffles, bars) expected for river type. Removal of modifications, structures, and artificial materials • Substantial improvement on baseline conditions at catchment scale. Recovery of flow and sediment regime

Table 11.4: Qualifying the Magnitude of Effect on Hydrogeological Attributes

Magnitude of Impact	Description	Example
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	• Removal of large proportion of aquifer • Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems • Potential high risk to groundwater from polluted 9e.g., construction phase) run-off
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Removal of moderate proportion of aquifer • Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems • Potential medium risk to groundwater from polluted (e.g., construction phase) run-off
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Removal of small proportion of aquifer • Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems • Potential low risk to groundwater from polluted (e.g., construction phase) run-off
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Calculated risk of serious pollution incident <0.5% annually • No measurable change in groundwater levels, groundwater flow regime, groundwater quality with regards to drinking water supplies. No change to an aquifer.

The significance of a potential effect on the water feature is a product of the sensitivity of the water feature and the magnitude of the potential effect. Values can range from 'High' to 'Negligible' ('Imperceptible' to 'Profound') and effects may be considered 'Adverse' or 'Beneficial' depending on the sensitivity of the attribute and the magnitude of effect associated with the Proposed Development.

11.3.4.3 Significance Criteria

Considering the above definitions and rating structures associated with sensitivity, attribute importance, and magnitude of potential impacts, rating of significant environmental impacts is carried out in accordance with relevant guidance as presented in the **Table 11.5** below (NRA, 2008).

The magnitude of effect and receptor sensitivity are combined to evaluate and qualify if an effect is of profound, significant, moderate, slight, or imperceptible as outlined in **Table 11.5.**

Table 11.5: Weighted Rating of Significant Environmental Effects

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Negligible (Imperceptible)	Small Adverse (Slight)	Moderate Adverse (Moderate)	Large Adverse (Significant to Profound)
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

The significance of potential effects arising as a product of the Proposed Development are defined in accordance with the criteria provided by the EPA, as presented in **Table 11.6** (EPA, 2022).

Table 11.6: Describing the Significance of Effects

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

11.3.4.4 Likelihood of Occurrence Criteria

The likelihood of the potential effects occurring is assessed based on historical data, quantitative analysis and professional judgement based on relevant experience as shown in **Table 11.7**.

Table 11.7: Evaluation of Likelihood of Occurrence

Likelihood of Occurrence	Criteria
Certain	Likely consequential effect in medium term and inevitable in long term (within the life of the development).
Likely	Possible consequential effect in the short to medium term and / or likely but not inevitable in the long term.
Unlikely	Unlikely that any consequential effect would arise within the lifetime of the development.
Rare	It is unlikely that any consequence would ever arise.

11.3.4.5 Determination of Overall Effect Significance

Potential impact significance (**Table 11.5**) and likelihood of occurrence (**Table 11.7**) are combined to determine an 'overall effect significance' as shown in the matrix in **Table 11.8**.

Table 11.8: Evaluation of Likelihood of Occurrence

Potential Significance	Likelihood of Occurrence			
	Rare	**Unlikely**	**Likely**	**Certain**
Profound / Significant	Minor	**Moderate**	**Major**	**Major**
Moderate	Minor	Minor	**Moderate**	**Major**
Slight	Not Significant	Minor	Minor	**Moderate**
Imperceptible	Not Significant	Not Significant	Minor	**Moderate**

In accordance with EPA EIAR Guidelines (2022), significance is determined by a combination of scientific and subjective concerns. This requires professional judgement of competent experts which can lead to differences in opinion where assessment is, to an extent, of a subjective nature. EIAR lays out the varying degrees of significance attributed to differing factors to provide clarity to the determination of effects.

Effects predicted to be of major or moderate significance are considered to be 'significant' in accordance with the EPA Guidance 2022 and are highlighted in bold on the above table.

11.3.5 Limitations to the Assessment

Louth County Council were unable to provide information regarding registered private water supplies in the vicinity of the Site. However, a screening assessment was undertaken to identify properties potentially served by local, unrecorded water abstractions within the vicinity of the Site based on Uisce Éireann data, and property and occupancy information determined by the Applicant.

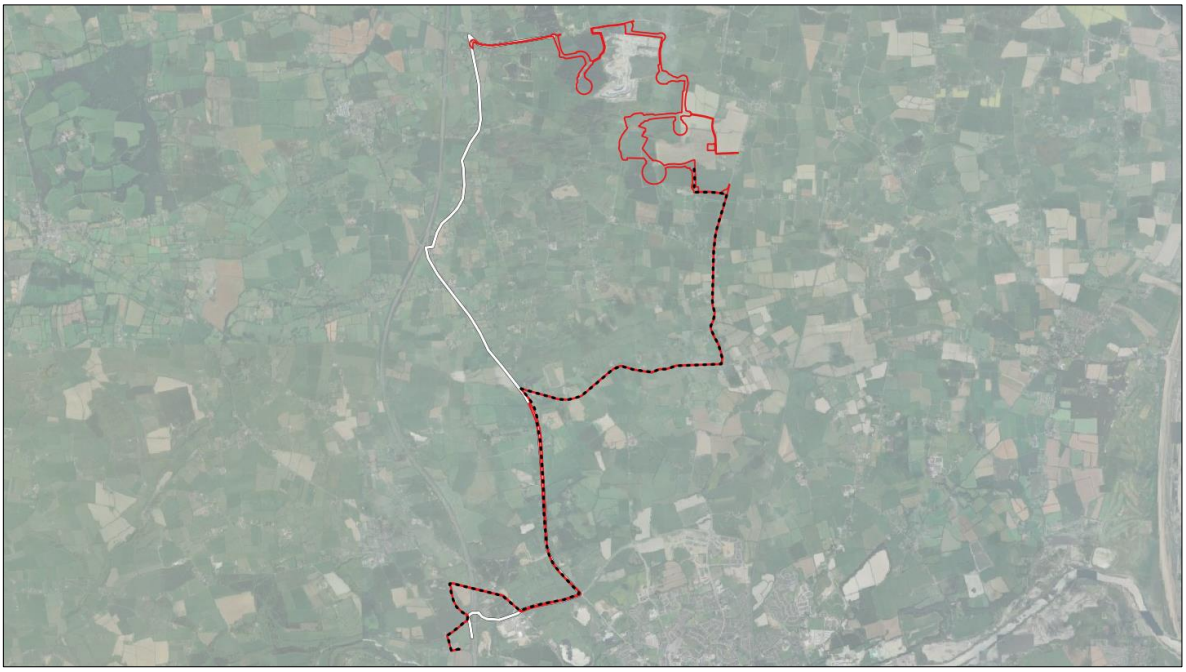
All other aspects of the assessment utilise current publicly available data sources and site-specific surveys which are robust and sufficient to enable this assessment to be completed.

11.4 BASELINE DESCRIPTION

11.4.1 Introduction

Permission is being sought by The Developer for the construction of 5 no. wind turbines, a permanent met mast, a 38kV on-site substation and control building, a Battery Energy Storage System (BESS), all ancillary works and the construction of an underground Grid Connection to Drybridge 110kV Substation, Co. Louth.

The Proposed Development also includes a proposed Grid Connection Route (GCR) that will connect the Site to Drybridge 110 kV substation west of Drogheda and a Turbine Delivery Route (TDR) from Galway port to the Site, following established motorways (



Both the GCR and TDR are described further in **Chapter 2: Description of the Proposed Development**.

11.4.2 Site Description

The Site, as shown in **Figure 1.2 (EIAR Volume III)**, is located within an area of farmland, forestry and scrubland, and is located within the townlands of Brownstown, Cartanstown, Drumshallon, Gallstown, Groom, Kearneystown, Keeverstown, Piperstown, Rokeby, Stonehouse and Swinestown. The Site is located 8.3 km north of Drogheda, 23.6km south of Dundalk and 50km north of Dublin.

The principal land use in the general area consists of a mix of forestry and cattle grazing, pasture farmland, residential properties, and agricultural structures. The Site lies adjacent to the operational Kilsaran Quarry.

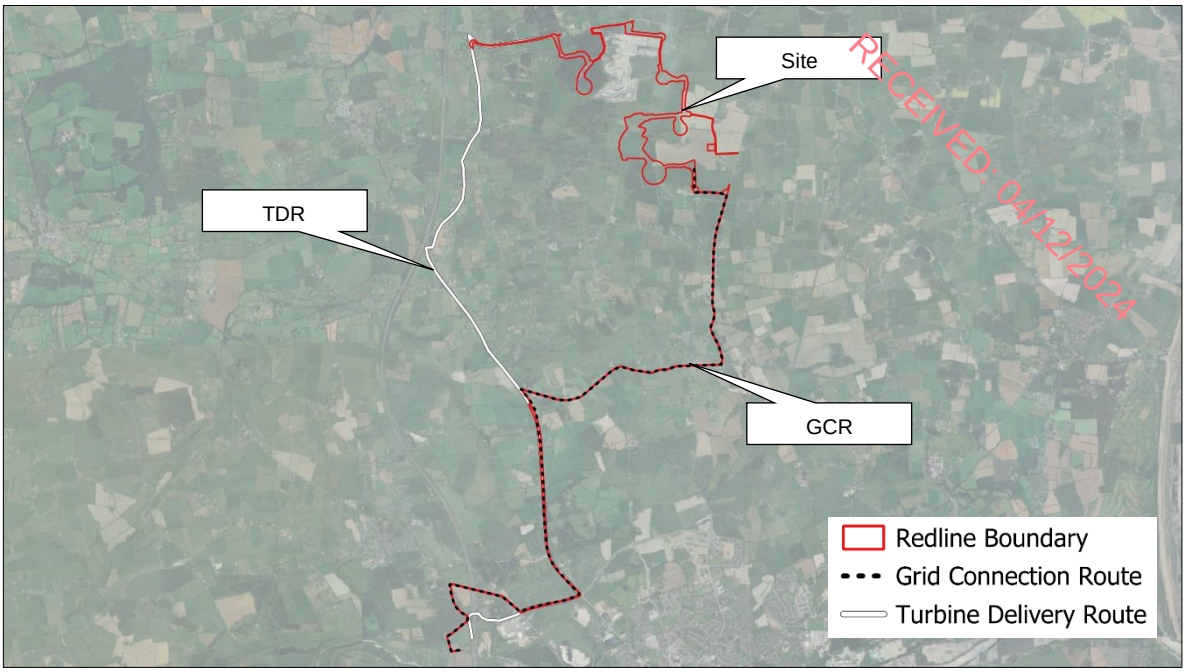


Plate 11.1: Proposed Development

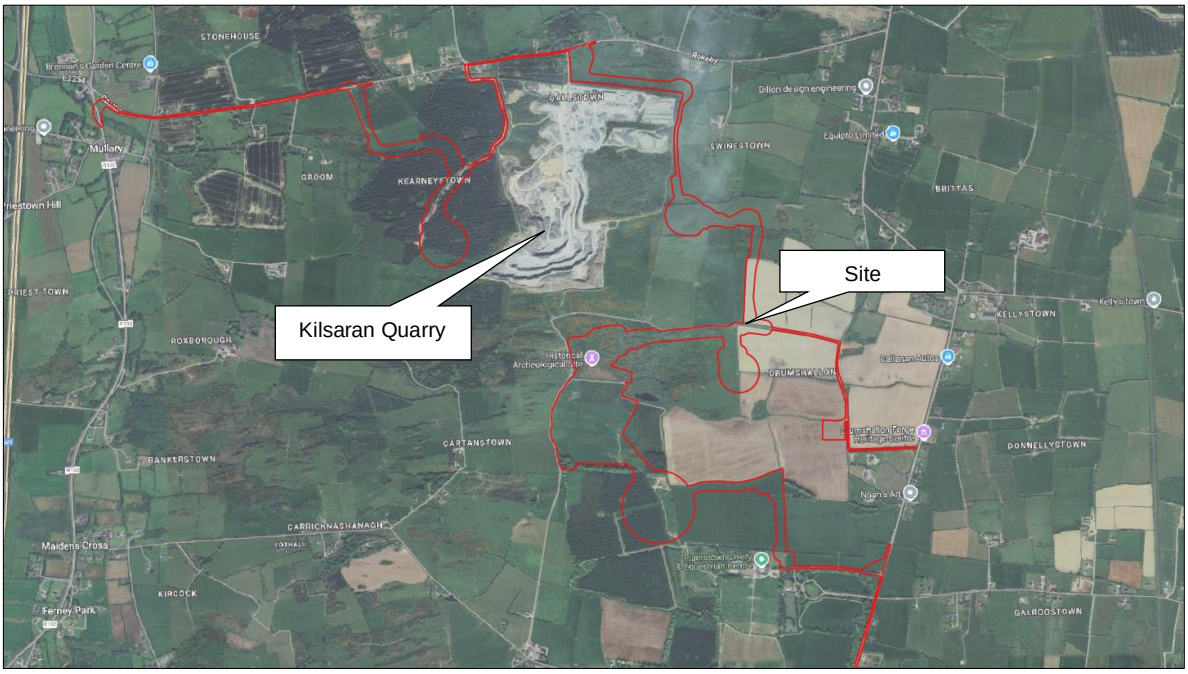


Plate 11.2: Site Context

11.4.3 Topography

The Site is located over undulating lands. Maximum ground levels are on lands in the vicinity of operational quarry (c. 1160 m OD). The lowest ground levels are in the vicinity of the proposed access from the north from the Site (c. 83 m OD).

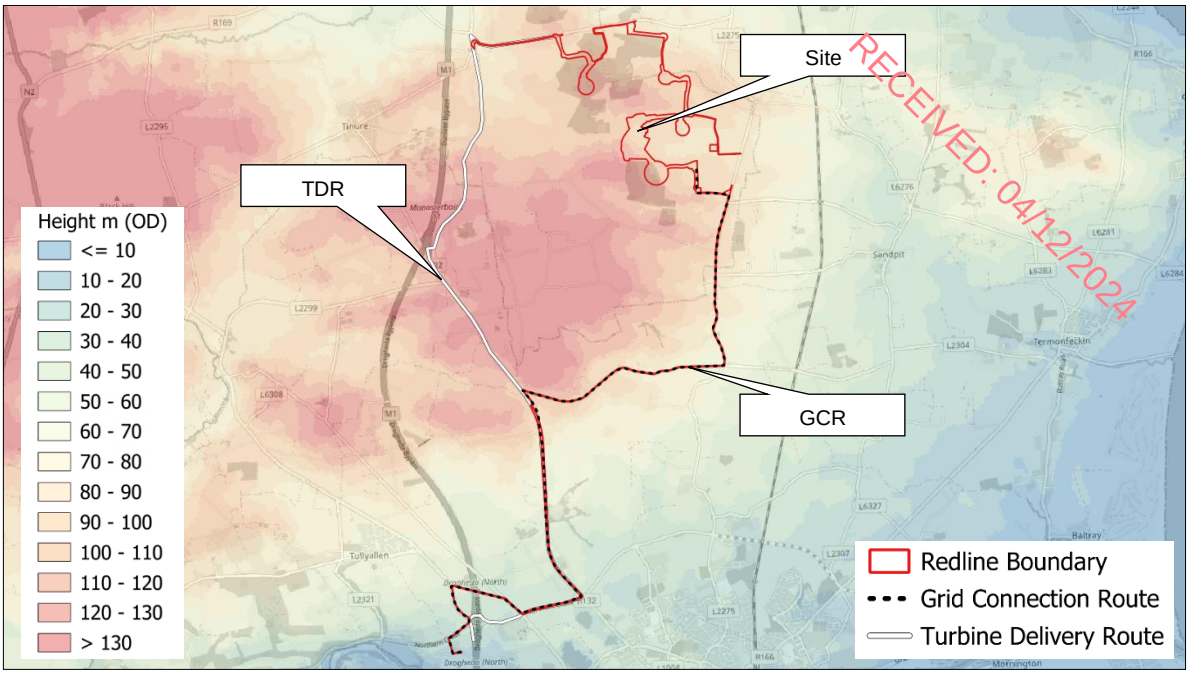


Plate 11.3: Topography (Proposed Development)

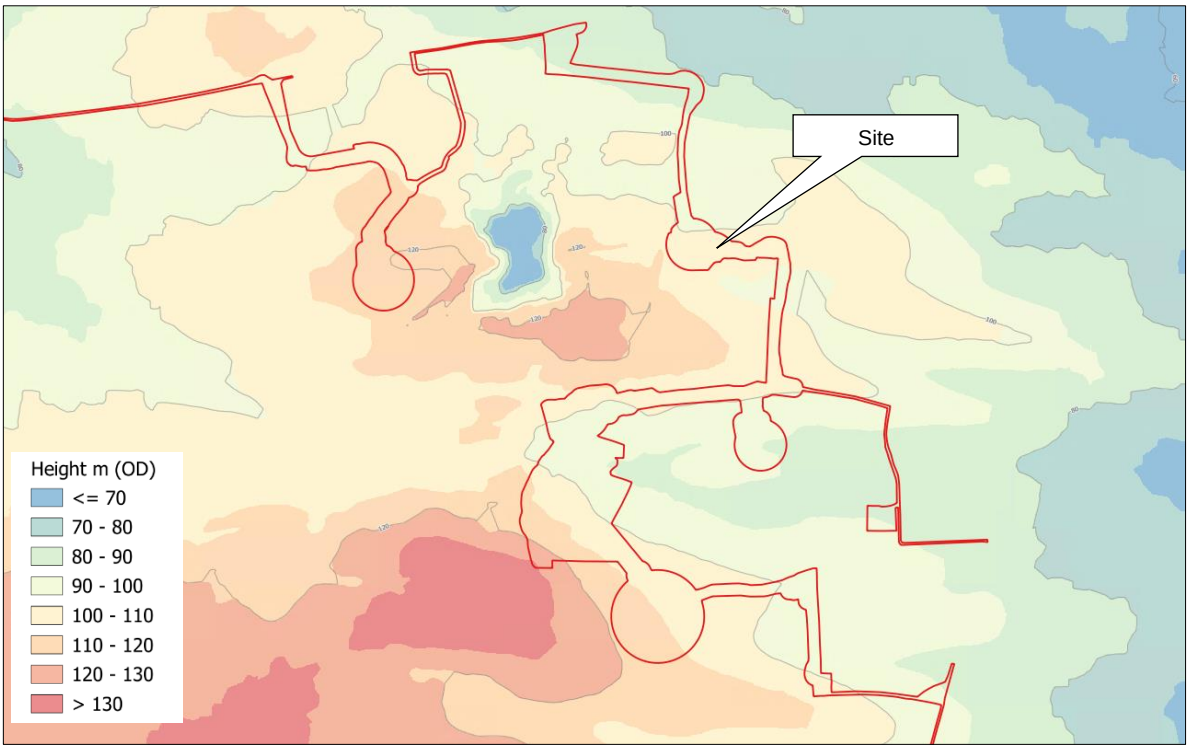


Plate 11.4: Topography (the Site)

11.4.4 Land Cover and Soils

The majority of the land within the Site is underlain by soils categorised as 'fine loamy drift with siliceous stones'. The northern and south-western extents of the Site are bounded by 'fine loamy over shale or slate bedrock' and 'fine loamy drift with siliceous stones'.

Two discrete pockets of 'peat' are identified within the centre of the Site, whilst two linear areas of 'river alluvium' coincide with watercourses of the Teronfeckin_010 catchment (refer to **Section 11.4.6.1**) draining the central and southern sections of the Site.

Further information on land cover and species present within the Site is provided in detail within **Chapter 6: Biodiversity**. Further information on soils is provided in **Chapter 10: Soils and Geology**.

11.4.5 Meteorological Data Summary

Rainfall data from the Dunsany climate station (approx. 28km south south-east from the Site) records a long-term average rainfall total of 869.7 mm during the 1981 – 2010 climatic period.

11.4.6 Hydrology

11.4.6.1 Surface Water Bodies / Catchments

Environmental Protection Agency (EPA) WFD dataset boundaries show that the majority of the Site lies within the Burren_SC_010 WFD river sub-catchment. A section of the western part of the Site, approximately 0.3km^2 in area, lies within the Dee_SC_040 river sub-catchment. The GCR passes through the Boyne_SC_130 and the Burren_SC_010 WFD river sub-catchments. The sub-catchments relevant to the TDR are the Boyne_SC_130, Boyne_SC_120, and the Dee_SC_040 (

).

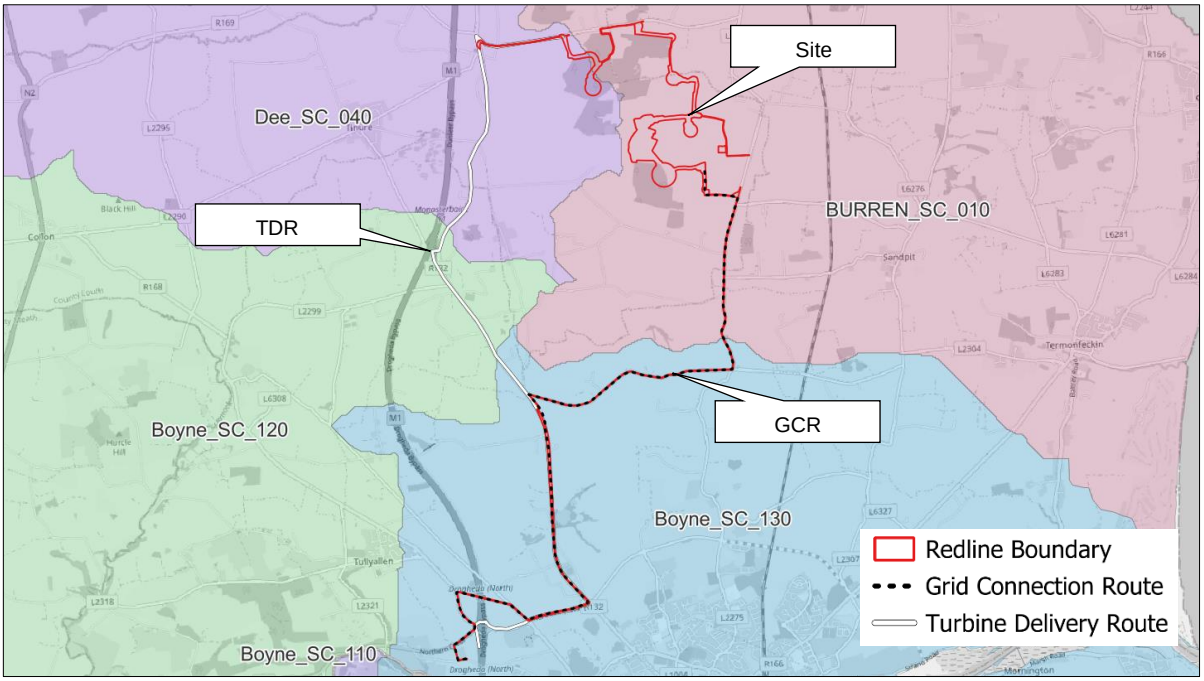


Plate 11.5: WFD Catchments and EPA Waterbodies

For the purposes of WFD classification and assessment the river sub-catchments are further delineated into river 'sub-basins'. The Site is located across three sub-basins; Termonfeckin_010 (IE_NB_06T010250) to the south and east, White (Louth)_010 (IE_NB_06W010100) to the west; and Slieveboy_010 (IE_NB_06S160790) to the north (**Plate 11.6**).

The GCR is located within the Termonfeckin_010, Termonfeckin_020 (IE_NB_06T010400), and Tullyeskar_010 (IE_EA_07T270880) river sub-basins. The TDR passes through the Tullyeskar_010, Mattock_020, White (Louth)_010, and White (Louth)_020 (IE_NB_06W010400) river sub-basins (**Plate 11.6**). Hydrological context is also provided in in **Figure 10.1** (**EIAR Volume III**).

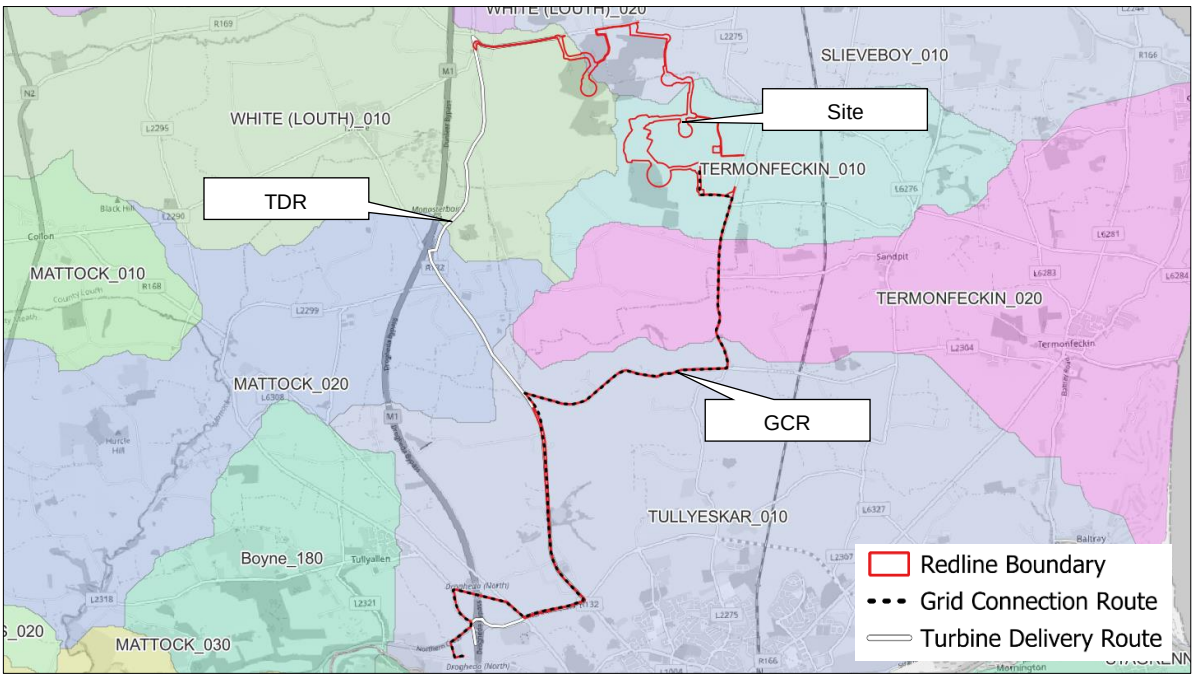


Plate 11.6: WFD River Sub-Basins

11.4.6.2 EPA Watercourses

Watercourses identified by EPA mapping at the Site, along the GCR and associated with the TDR are outlined in **Table 11.9** and shown on **Plate 11.7**.

Table 11.9: EPA Watercourses

Internal Ref & EPA Name / Code	River Sub-Catchment	River Sub-Basin	EPA Code	EPA Segment Code	Stream Order	Section of the Development
Ref: 1 Drumshallon Lough Stream (IE_NB_06T010250)	Burren_SC_010	Termonfeckin_010	06D03	06_372	1	Site
Ref: 2 Piperstown Stream 06	Burren_SC_010	Termonfeckin_010	06P02	06_172	1	Site

Internal Ref & EPA Name / Code	River Sub-Catchment	River Sub-Basin	EPA Code	EPA Segment Code	Stream Order	Section of the Development
(IE_NB_06T010250)						
Ref: 3 Hammondstown 06 (IE_NB_06W010100)	Dee_SC_040	White (Louth)_010	06H05	06_275	1	Site
Ref: 4 Slieveboy 06 (IE_NB_06S160790)	Burren_SC_010	Slieveboy_010	06S16	06_422	1	Site
Ref: 5 Ballymakenny Branch (IE_NB_06T010400)	Burren_SC_010	Termonfeckin_020	06B04	06_379	1	GCR
Ref: 6 N/A (IE_EA_07T270880)	Boyne_SC_130	Tullyeskar_010	-	07_591	1	GCR
Ref: 7 Twenties 07 (IE_EA_07T270880)	Boyne_SC_130	Tullyeskar_010	07T29	07_6	1	GCR & TDR
Ref: 8 Mell (IE_EA_07T270880)	Boyne_SC_130	Tullyeskar_010	07M53	07_1119	2	GCR & TDR
Ref: 8 Mell (IE_EA_07T270880)	Boyne_SC_130	Tullyeskar_010	07M53	07_1902	2	GCR & TDR
Ref: 9 Hall of Rath (IE_EA_07T270880)	Boyne_SC_130	Tullyeskar_010	07H19	07_1124	1	GCR
Ref: 10 Timullen (IE_EA_07M010220)	Boyne_SC_120	Mattock_020	07T26	07_1302	1	TDR
Ref: 3 Hammondstown 06 (IE_NB_06W010100)	Dee_SC_040	White (Louth)_010	06H05	06_174	2	TDR

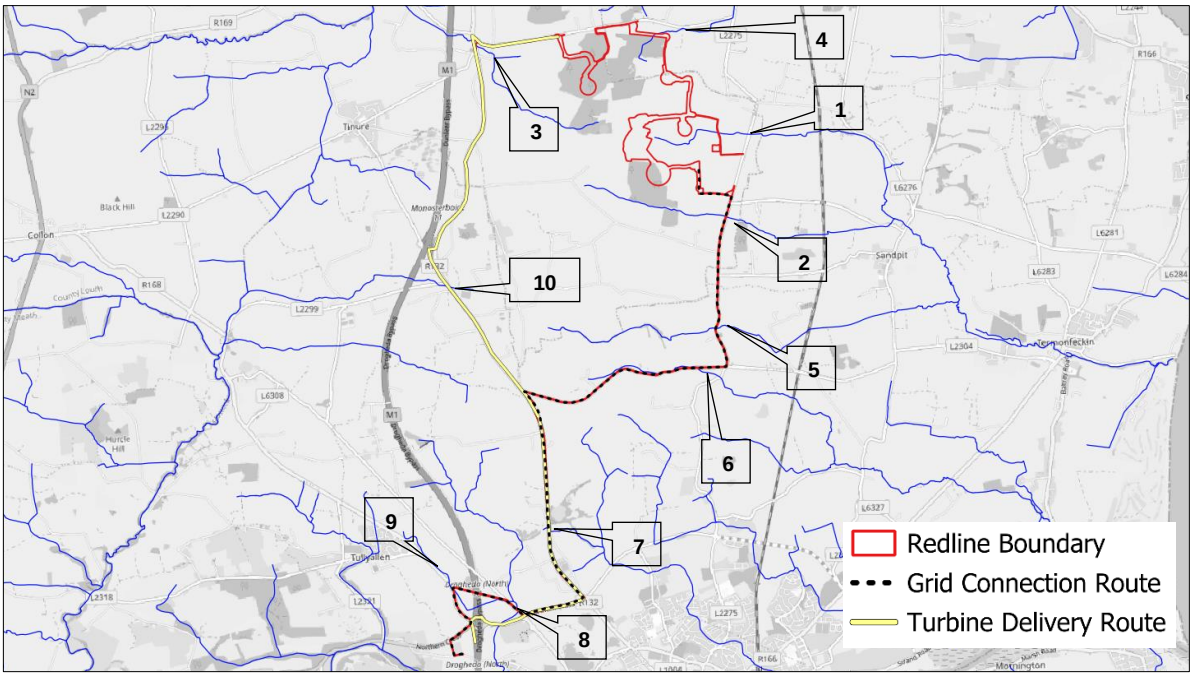


Plate 11.7: EPA Watercourses

11.4.6.3 Site Drainage

Walkover observations indicate that the hydrology at the Site drains to water features consisting of a number of natural streams, man-made agricultural drains and ditches, and natural ephemeral features. At the Site, all water features drain to the Termonfeckin_010 (IE_NB_06T010250); Slieveboy_010 (IE_NB_06S160790); and White (Louth)_010 (IE_NB_06W010100) river sub-basins (**Plate 11.8**).

EPA mapping indicates that the source of the Slieveboy watercourse was originally within the area now occupied by the Kilsaran Quarry. Surface runoff from within the quarry is discharged to the watercourse at a licenced discharge point at the northern extent of the quarry boundary.

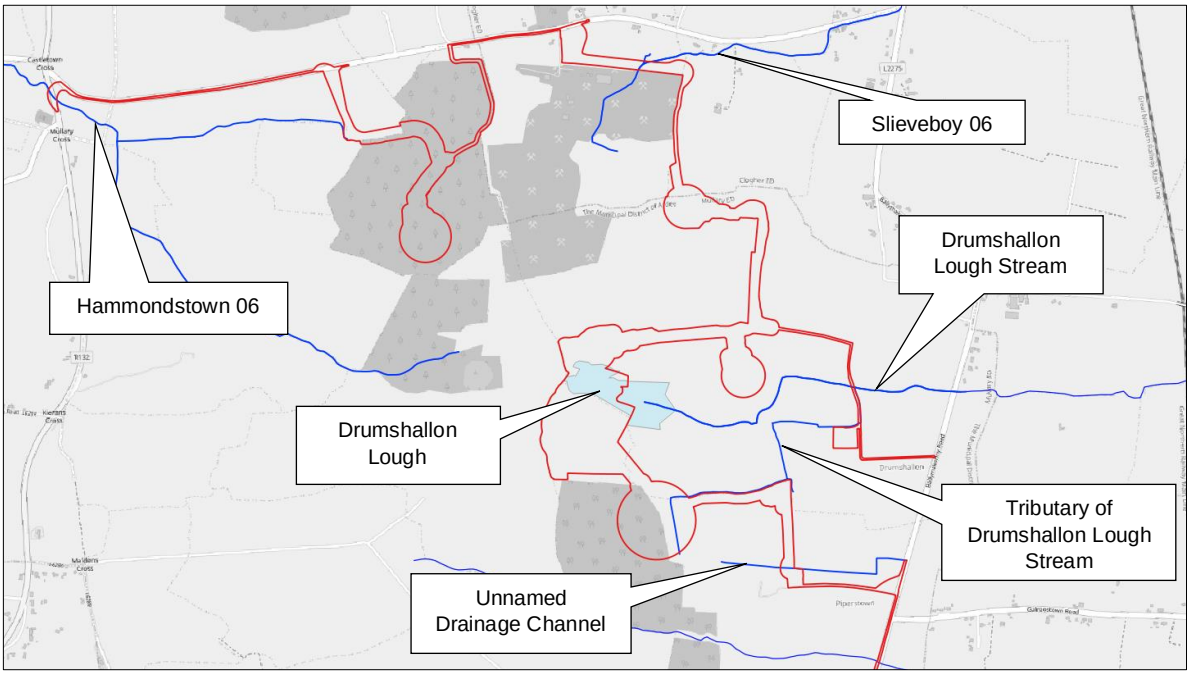


Plate 11.8: Site Drainage (EPA naming)

The hydrological regime of the Site as determined by desktop studies and site walkovers are shown on **Figure 11.1 (EIAR Volume III**).

11.4.6.4 Watercourse Classification

The significance and sensitivity of water features on the site and the associated degree of protection subsequently deemed necessary it is primarily dependent on:

- Environmental designations on the water feature or downstream environment.
- Fisheries or ecological potential in the water feature or in the downstream environment.
- Water feature morphology (natural substrate or artificial channel, soil / ground type);

- Water feature size, capacity to convey water and hydrological potential (flows) – proportionate to the size of the catchment drained by the water feature;
- Nature and topography of the surrounding land, i.e. wet, poorly drained soils and steep slopes (>10°) would require greater protection; and
- Sensitivity of the water feature to particular types of pollution, i.e. silts / nutrient enrichment / chemical pollution.

These attributes are established in the wider hydrological assessment.

The classification of watercourses to establish their hydraulic / hydrological and environmental significance has been determined via a combination of desktop assessments and site surveys (surveys undertaken between February 2023 and February 2024, refer to section 11.3.3), with all channels subject to catchment and flow analysis by geographic information system (GIS) flow-raster accumulation analysis.

"***Major watercourses***" are largely as per OSI close scale vector mapping and were subject to ground truthing within the Site, and are where the catchment draining to the watercourse >0.25 km^2. There is a single major watercourse (Drumshallon Lough Stream) on the Site and it is shown on the following **Plate 11.9**.

Plate 11.9: Major Watercourse

Location	Drumshallon Lough Stream
Grid Ref.	709156, 783399
Photo Ref.	IMG_9248
	

"Minor watercourses" represent tributary channels within the Site where the contrinuting catchment area was less than 0.25 km^2 but where a baseflow is observed. Many minor watercourses are the sources / upper reaches of the more identifiable downstream channels and appear as agricultural drainage ditches. The Tributary of Drumshallon Lough Stream (a minor watercourse) is shown on the following **Plate 11.20**.

Plate 11.10: Minor Watercourse Example

Location	Tributary of Drumshallon Lough Stream
Grid Ref.	709003, 783229
Photo Ref.	IMG_9268
	

All "***other"*** drainage features (mapped or otherwise) comprising; dry or partially dry agricultural ditches, ephemeral drains, dry track drainage, grips or similar, are not sensitive or significant in the context of development hydrology and habitat potential due to their limited capacity to support water dependent habitats, and their limited capacity or potential to convey water.

Major Watercourses, Minor Watercourses, and other drainage are shown at **Figure 11.1: Site Hydrology** and drainage management drawings shown at **Appendix 11.2: Surface Water Management Plan.**

11.4.7 Surface Water Quality

The following section is intended to provide a qualitative appraisal of existing surface water quality of those catchments within which the Proposed Development is located.

Following the publication of the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003), waterbodies are given a classification based on annual average / percentile results from several individual monitoring stations.

The WFD classification is a combination of chemical, biological and hydromorphological elements; whereby, the overall status is the lowest of the combined constituents. The EPA also use the current water quality and trends to highlight waterbodies that are 'At Risk' of failing to meet their WFD objectives by 2027.

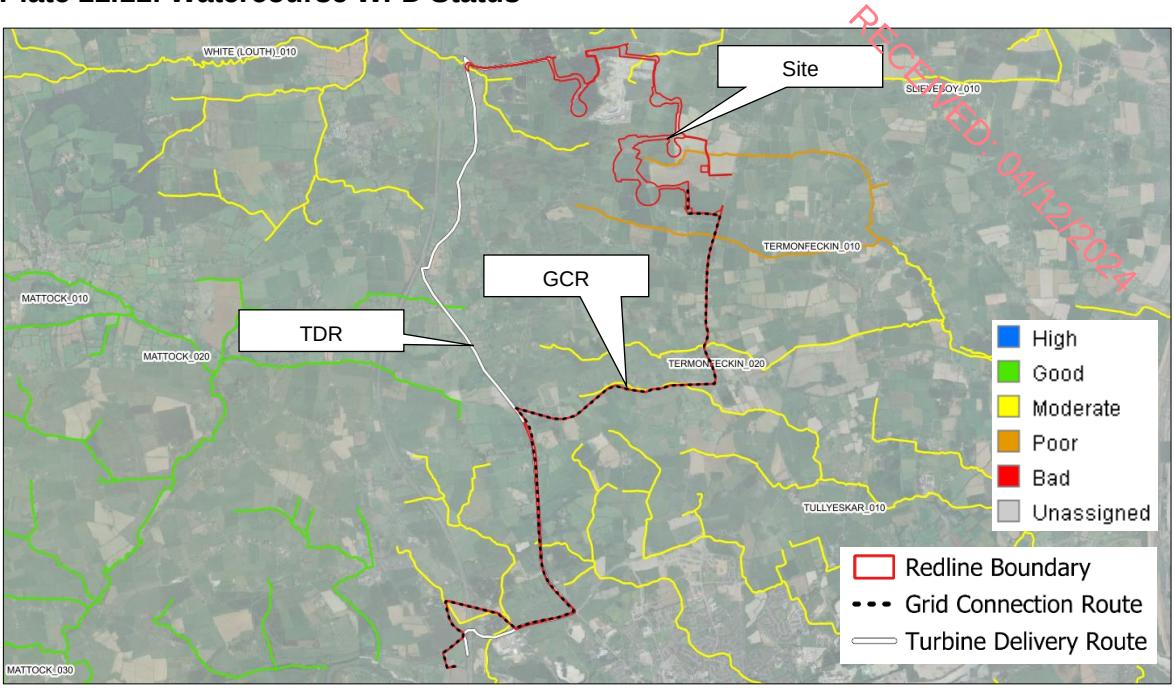
11.4.7.1 River Water Bodies / Water Framework Directive Status

The current / latest status published by the EPA (2016-2021) of the receiving river waterbodies identified is summarised in the table below.

Table 11.10: Summary of River Water Body Status

River Waterbody	2010 – 2015 Status	2013 – 2018 Status	2016 – 2021 Status	Objective	At Risk	High Status (Blue Dot) Objective
Termonfeckin_010 (IE_NB_06T010250)	Unassigned	Poor	Poor	Good	At Risk	No
Slieveboy_010 (IE_NB_06S160790)	Unassigned	Moderate	Moderate	Good	Review	No
White (Louth)_010 (IE_NB_06W010100)	Good	Moderate	Moderate	Good	At Risk	No
Termonfeckin_020 (IE_NB_06T010400)	Poor	Moderate	Moderate	Good	At Risk	No
Tullyeskar_010 (IE_EA_07T270880)	Unassigned	Poor	Moderate	Good	Review	No
White (Louth)_010 (IE_NB_06W010400)	Poor	Moderate	Moderate	Good	At Risk	No
Mattock_020 (IE_EA_07M010220)	Good	Good	Good	Good	Review	No
White (Louth)_020 (IE_NB_06W010400)	Poor	Moderate	Moderate	Good	At Risk	No

Plate 11.11: Watercourse WFD Status



11.4.7.2 Project Specific Water Quality Assessment

In addition to a review of water quality data held by statutory bodies, independent water quality monitoring has been undertaken as part of this assessment to provide baseline water quality standards of water features draining the Site prior to any development.

Sampling was carried out by Iain Muir – Senior Consultant (refer to **section 11.1.2**) on the 13th April 2023. The prevailing weather conditions on the day of sampling were clear and sunny with no rainfall. The baseline assessment collected and assessed 5 no. representative water samples from watercourses draining the Site for a range of physio-chemical parameters. Monitoring locations are shown on **Figure 11.2 (EIAR Volume III)**.

Water quality results were assessed for compliance against key parameter limits outlined in the Water Framework Directive (2000/60/EC), transposed in Ireland European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) and S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009.

In terms of the key indicators of water quality and / or pre-existing pollutants, chemical results obtained in levels were within legislative limits and are provided in **Table 11.11**.

All site-specific water quality sampling results are provided in **Technical Appendix 11.4: Laboratory Certificates (EIAR Volume IV)**. Further water quality sampling was undertaken as part of the aquatic assessment and is detailed in **Chapter 9: Aquatic Ecology**.

Table 11.11: Surface Water Results from Site-Specific Monitoring

Parameter	Sample ID					EC Directive 2006/44/EC		EC Directives 75/440/EEC 79/869/EEC	EC Directive 98/83/EC	EC Directives 2000/60/EC 2008/105/EC	EC Directive 78/659/EEC
	SW01	SW02	SW03	SW04	SW05	Cyprinid Guide Limits	Salmonid Guide Limits	EC (Quality of Surface Water Intended for The Abstraction of Drinking Water) Regulations, 1989	EU Drinking Water Regs 2014	EC Environmental Objectives Surface Water Regulations 2009	EC (Quality of Salmonid Waters) Regulations, 1988
Biochemical Oxygen Demand (mg/L)	1	<1	<1	<1	<1	≤6	≤3	A1 and A2 Waters = 5 A3 Waters =7	-	High ≤ 1.3 mean Good ≤ 1.5 mean	≤5
Total Suspended Solids (mg/L)	<10	<10	<10	<10	<10	≤25	≤25	50	-	-	≤25
Nitrate as NO_3 (mg/L)	16.3	17.7	6.1	17.1	17.3	-	-	50	50	-	-
Nitrite as NO_2 (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	≤0.03	≤0.01	-	0.5	-	≤ 0.05
Ortho-phosphate as PO_4-P (mg/L)	<0.06	<0.06	<0.06	<0.06	<0.06	≤0.4	≤0.2	-	-	High ≤ 0.025 Good ≤ 0.035	-
Ammoniacal N (mg/L)	0.08	<0.03	<0.03	<0.03	<0.03	-	-	-	-	High ≤ 0.04 Good ≤ 0.065	- -

11.4.8 Significant Pressures – Rivers

The EPA use current water quality data and trends to highlight waterbodies that are 'At Risk' of failing to meet their WFD objectives by 2027. The 'Cycle 3' WFD Reports (May 2024) (refer to section 11.3.2) include summaries of local pressures within the catchments that present a risk to waterbodies meeting their WFD objectives. The current (2018) 'Sub-Catchment Assessments' relevant to the Proposed Development (refer to **section 11.3.2**) also provide an evaluation of priority issues within the respective sub-catchments.

Review of the documents relevant to the Site found the significant pressure for both the Termonfeckin_010 and the White (Louth)_010 river sub-basins is considered to be agriculture. The Slieveboy_010 river sub-basin risk status is under review. Impacts from agriculture include nutrient and organic pollution. A significant agricultural pressure can be diffuse and / or point source of pollution. Agricultural pressures are subcategorised into pasture, arable, farmyard and agriculture.

Within the Termonfeckin_010 catchment, the significant issues are noted to be elevated nutrients likely attributable to agricultural activities. Within the White (Louth)_010 catchment, significant issues are noted to be nutrients and other organic sources, and the catchment is 'At Risk' due to its 'Moderate' WFD status as a result of biological and nutrient conditions. Specific locations of pressures within the Termonfeckin_010 and White (Louth)_010 river sub-basins are currently unknown; therefore, a conservative approach assumes all sections have been / are subject to these pressures.

With regards to the GCR and the TDR, significant pressures within the relevant river sub-basins were noted to be: Termonfeckin_020 – agriculture (acidification and nutrients); Tullyeskar_010 – agriculture (pasture) and urban run-off (diffuse sources of run-off); and White (Louth)_020 – agriculture and urban wastewater (nutrients and organic materials). The Mattock_020 river sub-basin is currently under 'review' with regards to meeting its WFD objectives.

11.4.9 Pollution Impact Potential

EPA online mapping provides datasets of Pollution Impact Potential (PIP) for nitrate and phosphorous: 'PIP-N' and 'PIP-P', respectively. The datasets indicate where agricultural measures are needed to restore water quality.

Lands parcels within the eastern sections of the Site are identified as having 'High' nitrate or phosphorous pollution potential, and 'Low' to 'Very High' focused delivery points where PIP-P focused flow paths enter a watercourse.

Within both the Termonfeckin_010 and White (Louth)_010 sub-basins, measures are to target 'point source, nitrate and phosphorus / sediment losses'. Within the Slieveboy_010

sub-basin, agriculture is not identified as a significant pressure and measures to 'protect' water quality are appropriate.

With regards to the GCR and TDR, measures within the Termonfeckin_020 measures are to target 'point source, nitrate and phosphorus / sediment losses', within Tullyeskar_010 river sub-basin they are to 'target risk of nitrate losses', and within Mattock_020 they are to target 'high nitrate'.

11.4.10 Surface Water Abstractions / Water Supplies

EPA provided data generated from their Water Abstraction Registration Database relating to water abstractions of 25 cubic meters (25,000 litres) or more per day that have been registered with the EPA. One (1 no.) abstraction was found to be located in proximity to the Site associated with the Kilsaran / Gallstown Quarry immediately adjacent to the Development (Abstraction Ref: APR000907; Abstraction Purpose: Mining or Quarrying; and Abstraction Type: Reservoir).

No evidence was found of existing private water supplies in or proximal to the Site.

11.4.11 Surface Water Discharges

The adjacent operational Kilsaran Quarry has a licenced discharge point at the northern extent of the quarry (Licence Ref No. 56/03) discharging to the Slieveboy watercourse. The licence limits discharge volumes to 64.8 m^3/hour or 1,600 m^3/day (Tom Phillips + Associates, 2022).

11.4.12 Domestic Discharges

No evidence was found of existing domestic discharges in or proximal to the Site.

11.4.13 EPA Licenced Activities

A review was undertaken of EPA datasets on waste facilities, Industrial Emissions Licensing (IEL) facilities, and Integrated Pollution Control (IPC) sites. One (1 no.) associated with industry (egg production) was identified approximately 1.5 km north-east (downstream) from the Site. The activity is not of a type or in a location that would affect, or be affected by, the Proposed Development.

11.4.14 Habitats and Eco-Hydrology

Consideration has been given to local surface water and groundwater dependent ecosystems and habitats dependent on or prone to change due to variation in surface water and groundwater patterns on the Site. This is assessed fully within the accompanying **Chapter 6: Biodiversity** which should be read as the primary point of reference for assessment of habitats.

11.4.15 Fisheries

Detailed consideration has been given to fisheries on and downstream of the proposed development within **Chapter 9: Aquatic Ecology**. With regards to important ecological receptors (i.e., water quality, macro-invertebrates, and fish and fish habitat), the assessment found 'low' fisheries potential within the Termonfeckin_010, White (Louth)_010, and Slieveboy_010 river sub-basins at the Site.

While not identified as present on the Site, the presence of protected species of fish 5 – 8.5 km downstream means that these populations need to be considered for detailed assessment. Further details, including figures of watercourses downstream of the Site, are included in **Chapter 9: Aquatic Ecology** which should be read as the primary point of reference for assessment of fisheries interests.

11.4.16 Aquaculture

EPA datasets did not identify any aquaculture sites located downstream from the Site.

11.4.17 Wetlands

The Map of Irish Wetlands identifies one wetland area within the Site. Drumshalbon Lough is noted as a nationally important wetland, though it is not a protected site.

Onsite verification and topographic analysis indicate that the actual extent of the wetland that encroaches onto the Site is considerably smaller than that provided on the Map of Irish Wetlands and it does not extend to the area where development is proposed.

Further information on the lough is provided in **Chapter 6: Biodiversity** which should be read as the primary point of reference for assessment to wetlands and water-dependent habitats.

11.4.18 Protected Areas and Designated Sites

Designated sites such as Special Areas of Conservation (SAC), Special Protected Areas (SPA), Ramsar sites, and similarly designated environmental receptors hydrologically connected to the Proposed Development, have been identified as part of this assessment.

Sites were identified utilising the datasets available on the NPWS Designations Viewer, and were screened to identify hydrological sites with sensitivities to the water environment that are connected to the Proposed Development, i.e. sites which lie in the upstream catchment of, or are on downstream streamlines of, the watercourses draining the Site. Only sites meeting these criteria are discussed further in this assessment.

Terrestrial sites with ground or surface water-dependent habitats are considered in **Chapter 6: Biodiversity**. Terrestrial sites with water-related reliance for birds are not considered further within this assessment and are considered in **Chapter 8: Ornithology**.

The Termonfeckin watercourse (Termonfeckin_010) ultimately discharges into the Boyne Coast and Estuary SAC approximately 7 km east (downstream) from the Site; therefore, the Proposed Development is hydrologically connected to the designated site (**Figure 11.3 EIAR Volume III**).

Where the Termonfeckin watercourse discharges to the coast, the receiving waters are also denoted as the 'Seapoint' Bathing Water Area in accordance with S.I. No. 79/2008 and S.I. No. 351/2011 Bathing Water Quality (Amendment) Regulations 2011 (**Figure 11.3 EIAR Volume III**).

Along the GCR, the Termonfeckin_010, Termonfeckin_020, and Tullyeskar_010 river sub-basins drain and are hydrologically connected to the Boyne Coast and Estuary SAC and River Boyne and River Blackwater SAC. The TDR is located within the White (Louth)_010 river sub-basin in the upper reaches of the Dee catchment which is hydrologically connected to the Dundalk Bay SAC approximately 12 km downstream from the TDR.

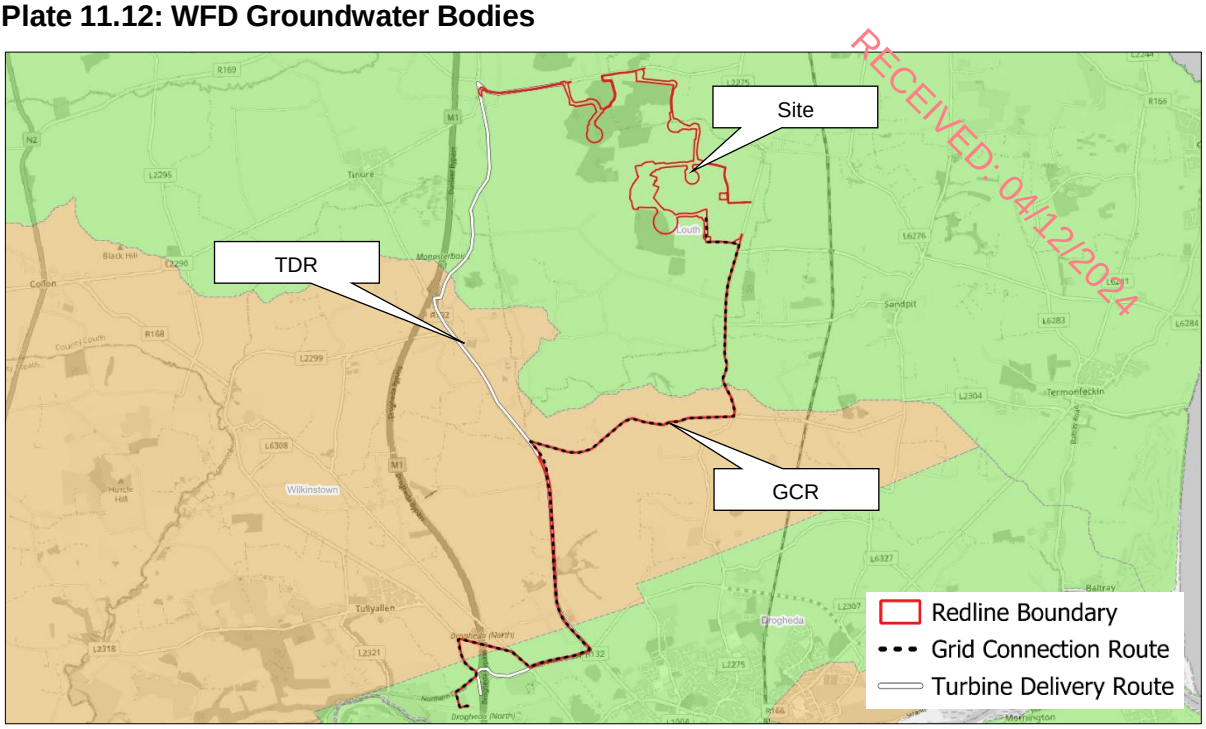
11.4.19 Hydrogeology

11.4.19.1 Groundwater Body

The Site is underlain by the Louth groundwater body (IE_GBNI_NB_G_019). Sections of the GCR and TDR are located within the boundaries of the Louth groundwater body, Wilkinstown groundwater body (IE_EA_G_010), and Drogheda groundwater body (IE_EA_G_025).

The characteristics of the groundwater bodies are summarised in the following sections. Refer to **Chapter 10: Soils and Geology** for further information on geology of the area.

Plate 11.12: WFD Groundwater Bodies



11.4.19.2 Groundwater Quality / Water Framework Directive Status

The European Water Framework Directive (2000/60/EC) (WFD) requires the status of groundwater management units (groundwater bodies) within each river basin to be determined as 'Good' or 'Poor'.

For the period 2016-2021, the Louth groundwater body has overall WFD status of 'Good', the Wilkinstown groundwater body has a status of 'Poor', and the Drogheda groundwater body has a status of 'Good'. The overall status relates to both the quantitative and chemical (water quality) characteristics of a groundwater body. Both groundwater bodies are also delineated as a 'drinking water – groundwater' bodies in accordance with European Communities (Drinking Water) (No. 2) Regulations 2007 (SI no. 278/2007).

Table 11.12: Summary of Groundwater Body Status

Groundwater Body	2010 – 2015 Status	2013 – 2018 Status	2016 – 2021 Status	Objective	At Risk
Louth (IEGBNI_NB_G_019)	Good	Good	Good	Good	Not at Risk
Wilkinstown (IE_EA_G_010)	Good	Good	Poor	Good	At Risk
Drogheda (IE_EA_G_025)	Good	Good	Good	Good	At Risk

11.4.19.3 Significant Pressures – Groundwater

The EPA use current water quality data and trends to highlight waterbodies that are 'At Risk' of failing to meet their WFD objectives by 2027. The status of the Louth groundwater body

is currently 'Not at Risk'. The status of the Wilkinstown and Drogheda groundwater bodies is currently 'At Risk'.

The 'Cycle 3' WFD Reports (May 2024) (refer to **section 11.3.2**) include summaries of local pressures that present a risk to waterbodies meeting their WFD objectives. The current (2018) Sub-Catchment Assessments relevant to the Proposed Development (refer to **section 11.3.2**) also provide an evaluation of priority issues within the respective waterbodies.

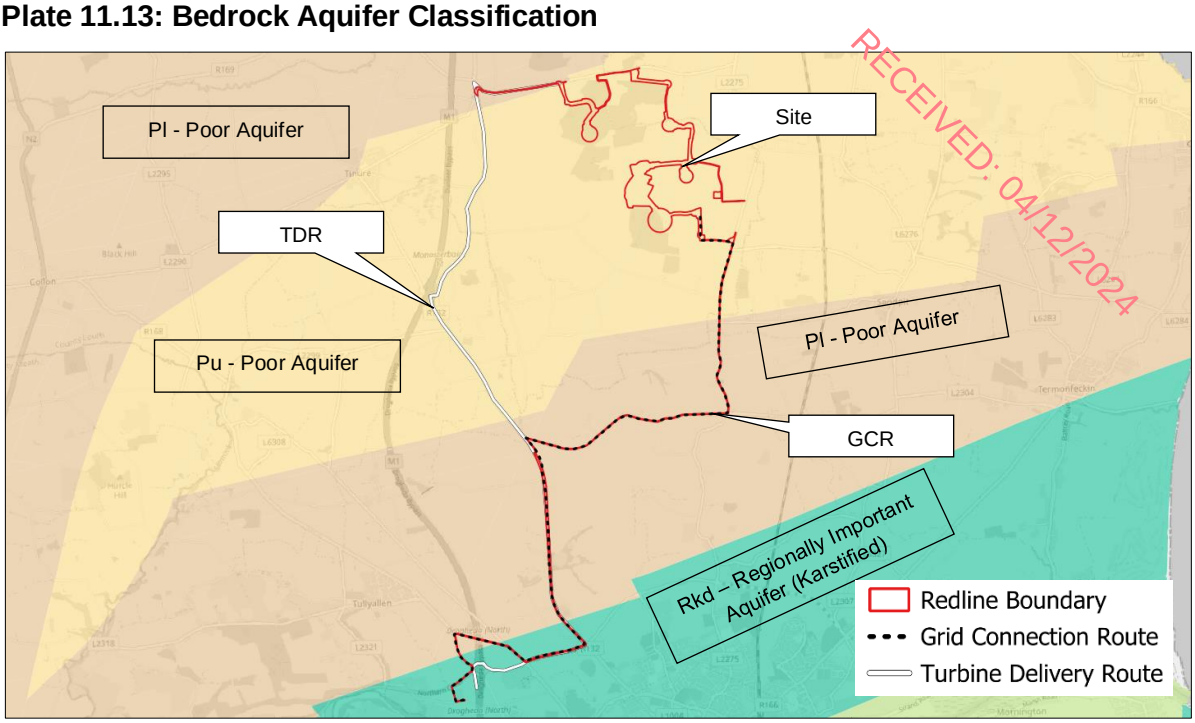
Review of the documents relevant to the Proposed Development found the significant pressure within the Wilkinstown and Drogheda groundwater bodies to be agriculture with the significant issues noted to be 'chemical quality diminution' as a result of nutrients.

11.4.19.4 Aquifer Classifications

A review of the available online GSI data indicates the bedrock aquifer underlying the Site is classified as a 'Poor Aquifer (bedrock which is generally unproductive)'. GSI mapping indicates there are no sand and gravel aquifers in the vicinity of the Proposed Development. While GSI data infers there is no productive groundwater source, other abstraction data (described at sections **11.4.23** and **11.4.24**) tend to indicate that a shallow groundwater resource is supplying commercial non-potable and at least one residential potable supply. The aquifer is likely to be highly localised and characterised as water perched in weathered upper layers of impermeable bedrock.

The GCR and TDR pass through lands underlain by the same aquifer as that noted for the Site, as well as an aquifer classified as 'Poor Aquifer (bedrock which is generally unproductive except for local zones)', and through an area denoted as 'Regionally Important Aquifer - Karstified (diffuse)' for approximately 3.2 km (**Plate 11.11**).

Plate 11.13: Bedrock Aquifer Classification



11.4.19.5 Groundwater Vulnerability

Groundwater vulnerability is a measure of the inherent geological and hydrogeological characteristics which determine the ease at which groundwater may potentially become contaminated via human activities at the surface. The vulnerability of groundwater is dependent upon multiple factors. These include the intrinsic toxicity of the contaminants in question, the quantity of contaminants that can reach the groundwater, the rate at which contaminants can flow to the groundwater and the attenuating capacity of the subsoils and bedrock through which the water travels.

Table 11.13: Groundwater Vulnerability Classes

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil permeability (type) and thickness			Unsaturated zone	Karst features
	High permeability (sand/gravel)	Moderate permeability (e.g. sandy till)	Low permeability (e.g. clayey till, clay, peat)	Sand/gravel aquifers only	(<30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	>3.0m	3.0m – 10.0m	3.0m – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0m – 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Source: Strive Report Series No. 6, Water Framework Directive – Recharge and Groundwater Vulnerability, Environmental Protection Agency, 2008

The GSI Groundwater Vulnerability Map indicates that groundwater within the Site has 'Moderate' to 'Extremely High' vulnerability. Large areas are also identified where rock is at or near the surface. The vulnerability maps are informed by the type and thicknesses of

subsoils (sands, gravels, glacial tills (or boulder clays), peat, lake and alluvial silts and clays), and the presence of karst features.

The GCR and TDR pass through areas with classifications ranging from 'Low' to 'Extremely High' and also in proximity to areas where rock is at or near the surface (**Plate 11.14**).

Plate 11.14: Groundwater Vulnerability (Proposed Development)

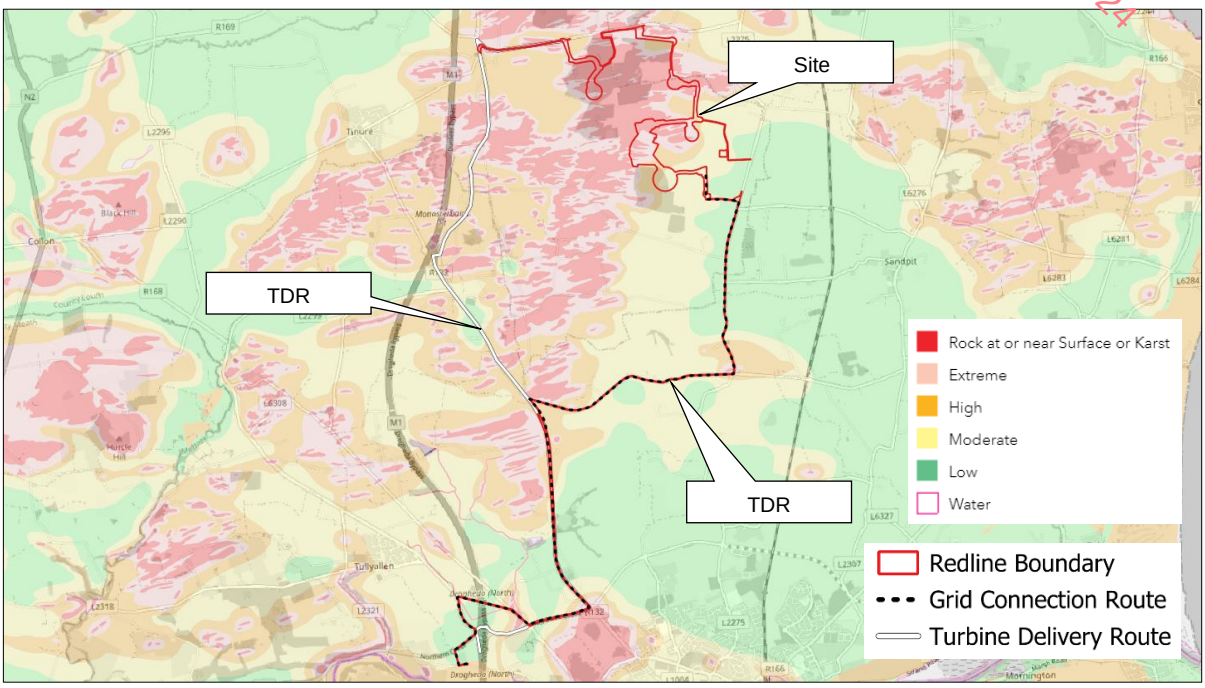
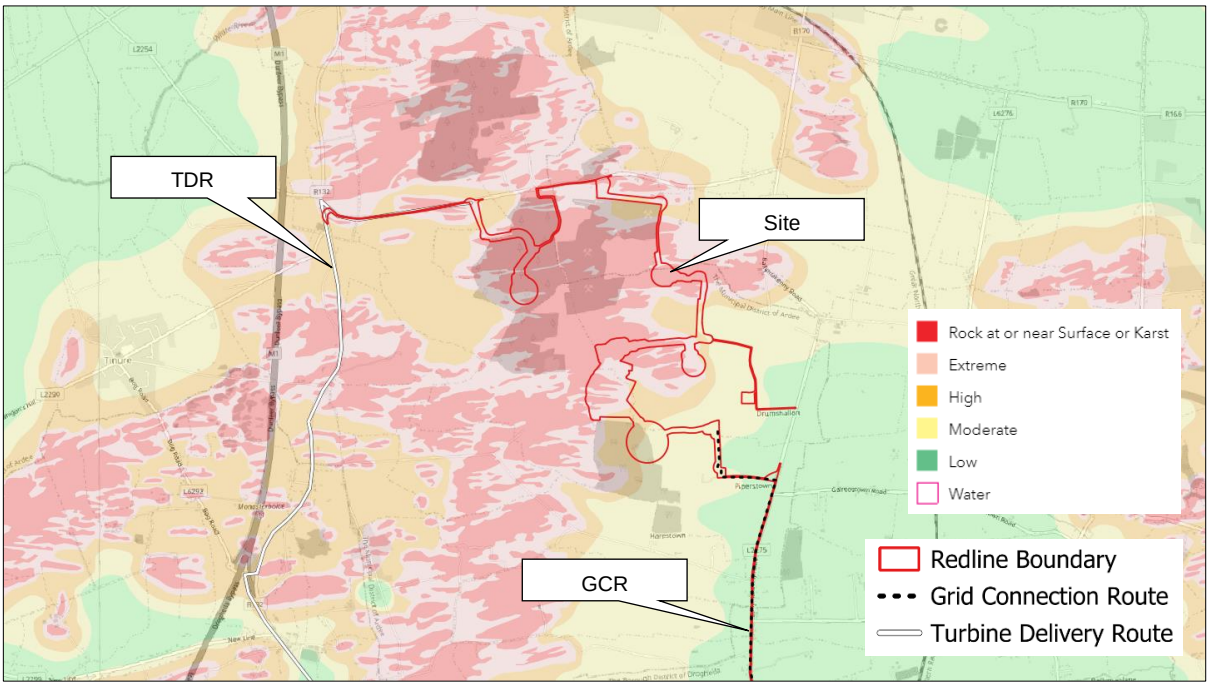


Plate 11.15: Groundwater Vulnerability (Site)



11.4.19.6 Groundwater Recharge

The National Groundwater Recharge map is derived from existing hydrogeological and meteorological spatial datasets and provides an estimate of the average amount of rainwater that percolates down through the subsoils to the water table over a year. GSI information available for each of the groundwater bodies notes the following:

- Louth: diffuse recharge occurs via rainfall percolating through the subsoil and rock outcrops. Due to the low permeability of some subsoil deposits (e.g. thicker till) and the aquifers, a high proportion of the effective rainfall will quickly discharge to the streams in the groundwater body;
- Wilkinstown: water will enter this aquifer by diffuse recharge. The potential recharge will be highest in areas of thin or permeable subsoil e.g. at the tops of the many hills which are present in the area. Not all of the potential recharge will reach the water table, as some will be rejected because the permeability of the rocks is low. The rejected recharge will runoff to the nearest surface water bodies. This accounts for the high drainage density seen in this area; and
- Drogheda: water will enter this aquifer by point and diffuse recharge. In karstic limestone it is possible for large amounts of water to enter the aquifer by point recharge where dissolution of the limestone has opened up fractures in the rock.

11.4.19.7 Groundwater Flow

GSI information provides an overview of groundwater flow conditions and characteristics for the groundwater bodies relevant to the Proposed Development. This is summarised as follows:

- Louth: in the absence of inter-granular permeability, groundwater flow is expected to be concentrated in upper fractured and weathered zones and in the vicinity of fault zones. Available groundwater levels are mainly 0-10 m below ground level (c.50% <5 m bgl). Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to nearby streams and small springs. Water strikes deeper than the estimated interconnected fissure zone suggests a component of deep groundwater flow, however shallow groundwater flow is dominant. Groundwater flow directions are expected to follow topography – overall in an easterly direction;
- Wilkinstown: the majority of groundwater flow in this aquifer is considered to take place in an upper weathered zone. The maximum flow path length the aquifer can maintain is in the region of 500 m. This agrees with the concept of the aquifer as a poor aquifer and that regional flow paths (i.e., in the order of kilometres) do not develop; and
- Drogheda: groundwater flow in the aquifer will be from the main recharges areas, i.e. the areas of thin subsoil, in the west and north towards the discharge areas i.e. River

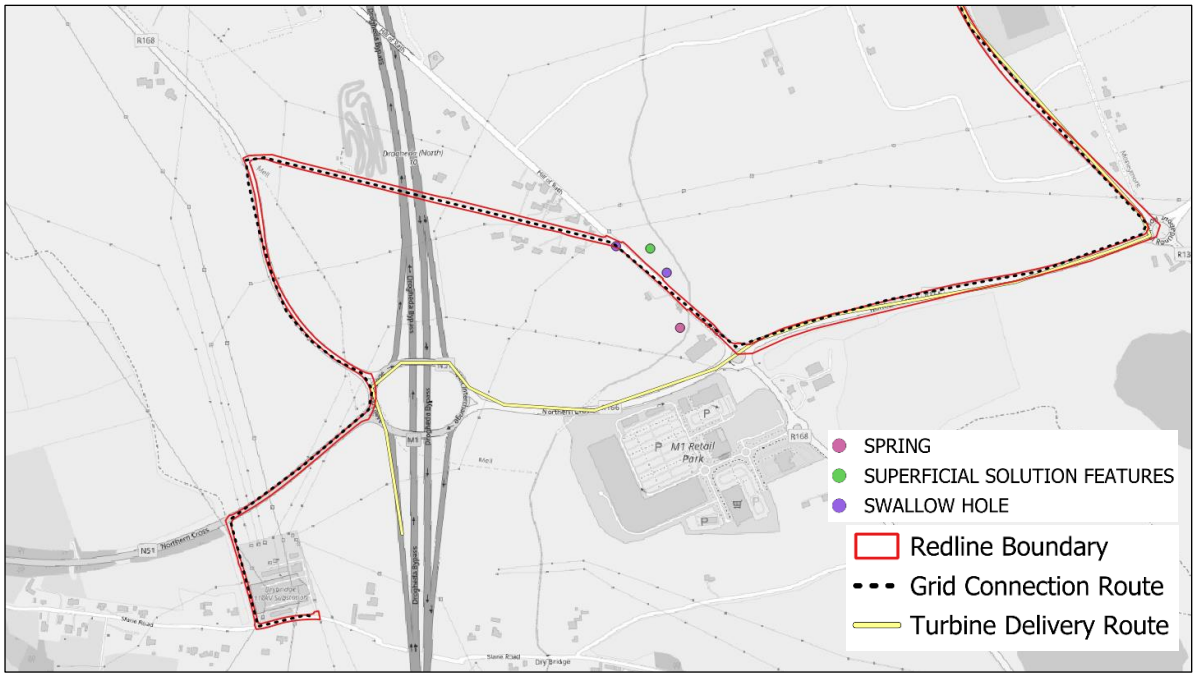
Boyne and the coast. Groundwater flow paths of up to a couple of kilometres can be expected. This is supported by the absence of surface water features in the north and northwest of the area. The nature of groundwater flow will depend on the degree of karstification of the limestone. Where the aquifer is heavily karstified, groundwater flow will be concentrated along a few enlarged conduits. Where the rock is less karstified nature groundwater flow will be though a series of connected fractures and joints.

11.4.20 Karst Features

A review of GSI online datasets did not identify any karst features at, or in the immediate vicinity of the Site.

The datasets identified 4 no. karst features in the vicinity of the GCR near to the Hill of Rath road approximately 6.4 km south-west from the Site. The features were identified as 2 no. swallow holes, 1 no. superficial solution feature, and 1 no. spring – one swallow hole is mapped on the route of the GCR (**Plate 11.14**).

Plate 11.16: Karst Features

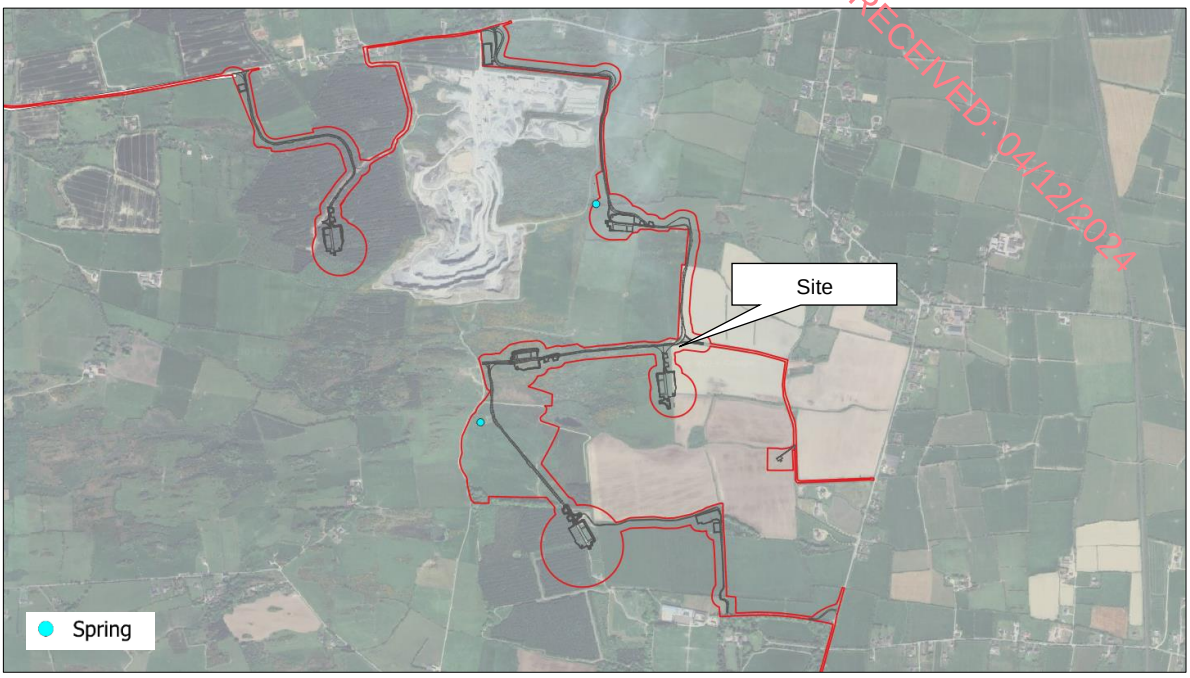


11.4.21 Wells and Springs

A review of GSI online data and information provided by EPA did not identify groundwater wells and springs that may be affected via a hydrological connection to the Site. Landowners party to the Proposed Development provided information regarding 2 no. springs utilised for non-potable usage located within the Site (**Plate 11.15**).

GSI-mapped springs and wells identified along the GCR coincide with the Public Supply Source Protection Areas and Zone of Contribution discussed in **section 11.4.22**.

Plate 11.17: Springs



11.4.22 Groundwater Abstractions (Drinking Water)

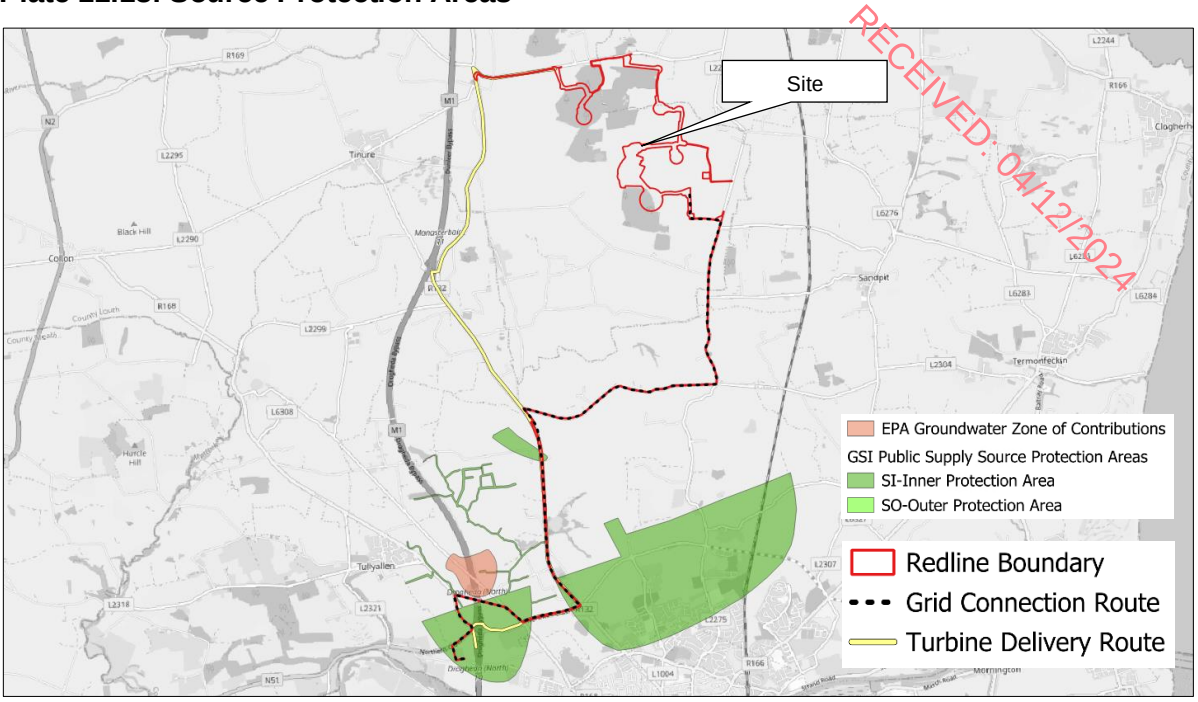
Louth County Council was unable to supply information regarding private water supplies / abstractions located in the vicinity of the Site.

GSI online mapping outlines 'Public Supply Source Protection Areas' (PSSPA) around groundwater abstraction points that are managed by Uisce Éireann / Irish Water to supply Public Water Supply Schemes across Ireland. None are shown to be in the vicinity of the Site. The GCR is noted to pass through the 'inner protection area' of 3 no. PSSPAs:

- Killineer PWS;
- Ballymakenny GWS; and
- Drybridge PWS.

GSI mapping also identifies 'Group Scheme Source Protection Areas' (GSSPA). These delineate 'Zones of Contribution' to groundwater abstraction points that supply Group Water Schemes across Ireland affiliated to the National Federation of Group Water Schemes which supply > 15 people. None are shown to be in the vicinity of the Site. The GCR passes proximal to the 'Drybridge' Zone of Contribution.

Plate 11.18: Source Protection Areas



11.4.23 Unregistered Water Supplies

To ensure a robust assessment, screening has been undertaken to identify properties potentially served by local, unrecorded water abstractions within the vicinity of the Site based on property and occupancy information determined by the Applicant.

DAERA (2019) and SEPA (2017) recommend a 250 m buffer between proposed turbine foundations and 100 m between roads, tracks and cable trenches and any potential drinking water (public or private) supply. A buffer per that guidance was applied to the proposed infrastructure within the Site boundary (where construction work shall be undertaken) to provide the screening extent.

Plate 11.19: Property Screening

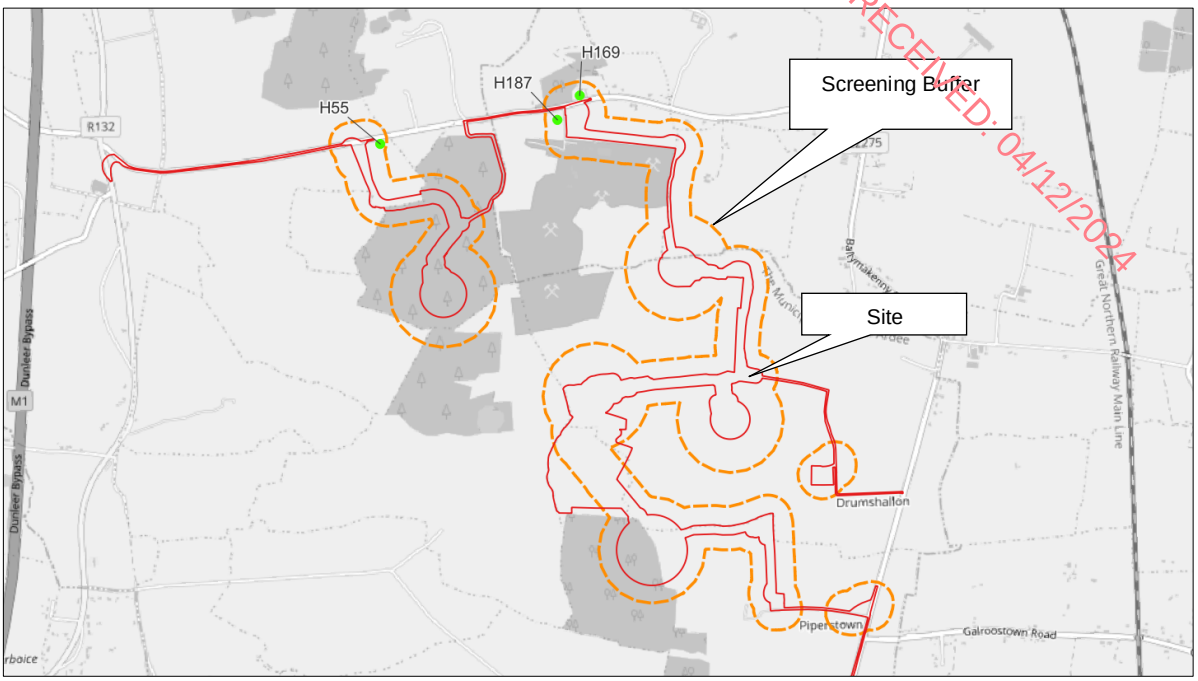


Table 11.14: Summary of Dwellings

Feature ID	Description	Nearest Turbine	Distance to Turbine (m)	Significant and Rational for Scoping In / Out
H55	Occupied Property	1	765	Located approximately 85 m east from the access track from Site Entrance 1.
H169	Occupied Property	2	939	Uisce Éireann main present, unlikely to rely on a private supply
H187	Uninhabited Property	2	917	Uninhabited building, no drinking water requirements.

In total, 3 no. residential properties were identified within the screening area. Uisce Éireann mains supplies are indicated to be located in the eastern extent of the public road proximal and east of Site Entrance 2.

A single potential receptor was identified (H55) and subsequent investigation via public planning files (Louth Co. Co. reference 001004) confirms that the dwelling was planned to be served by a borehole within the dwelling site curtilage. Consideration is given to the dwelling water supply in the assessment of predicted environmental effects.

11.4.24 Kilasaran Quarry

11.4.24.1 Production Wells

The operational Kilsaran Quarry is located adjacent to the Site. There are 4 no. production wells known to be located upgradient from the proposed access track into the Site from the Local Road L6274 (Site Entrance 2).

The wells were installed in 2002 to provide water for ready-mix and concrete block production due to the lack of groundwater inflows into the quarry void.

Water levels within the production wells have previously been assessed by others and found to be approximately 5 m below ground level (bgl) (80 m OD). The maximum pumping water level recorded in the production wells was found to be approximately 12 – 18 m bgl (73 – 67 m OD) (Tom Phillips + Associates, 2022).

Infrastructure proposed proximal to production wells is within a 100 m screening radius of tracks. Consideration is given to the production wells in the assessment of predicted environmental effects.

11.4.24.2 Potable Water Well

A potable water supply well is understood to be located near the office block within the quarry supplying an office and canteen (Tom Phillips + Associates, 2022).

The well is located >100 m from proposed new road, tracks, cable trenches and >250 m from turbines and, therefore, unlikely to be affected by works associated with the Proposed Development.

Plate 11.20: Kilsaran Quarry Wells

11.4.25 Flooding

The Proposed Development was assessed in relation to OPW Flood Maps which provide an indication of predicted Low, Medium, and High probability fluvial flood extents and information on past flood events.

Further information regarding flood risk from various sources is outlined in **Appendix 11.1: Flood Risk and Drainage Assessment** and is summarised in the following sections.

11.4.25.1 Fluvial Flooding

OPW flood mapping indicates that all proposed infrastructure is sited in Flood Zone C (defined in OPW guidelines (2009) as where the probability of flooding from rivers is low i.e., less than 0.1% or 1 in 1000). Fluvial flood extents relative to proposed infrastructure are outlined in figures included in **Appendix 11.1: Flood Risk and Drainage Assessment**.

11.4.25.2 Coastal Flooding

The Site is not in a coastal area and, therefore, does not require further detailed assessment of flooding from this source.

11.4.25.3 Pluvial Flooding

Surface water runoff could potentially flow towards the Site from adjacent areas that lie at higher elevations.

Surface water flooding would not constrain development but would inform design of the infrastructure with a view to ensuring that surface water flow paths are maintained, and a

suitable standard of protection if afforded to any development adjacent to areas predicted to be affected by flooding. Pluvial flooding is further assessed and surface water management measures are further detailed in **Appendix 11.1: Flood Risk & Drainage Assessment** (**EIAR Volume IV**).

11.4.25.4 Urban Drainage Flooding

The Site is not in an urban area and, therefore, does not require further detailed assessment of flooding from this source.

11.4.25.5 Groundwater Flooding

There are no identified karst features at the Site or in the immediate vicinity. Ground cover typically comprises upland agricultural lands. Topography in the areas where development is proposed is not conducive to clear groundwater flooding. GSI groundwater flooding datasets do not indicate the Site to be susceptible to groundwater flooding or identify historic groundwater flooding within the Site. There is no other indicator of flooding and further detailed assessment of flooding from this is source is not required.

11.4.25.6 Historical Flood Extents

OPW Flood Maps indicate 1 no. recorded incident of historic flooding (single flood event) on the 14th November 2014 on Gallstown Road, approximately 200 m north-east from the Site boundary. No other historic flood events are noted within, or in proximity to, the Site.

11.4.25.7 Artificial Sources of Flooding

There are no impoundments or reservoirs in proximity to or that drain towards the Site. Further detailed assessment of flooding from this is source is not required.

11.4.25.8 Arterial Drainage Schemes

Lands adjacent and to the west of the Site from OPW-maintained Arterial Drainage Schemes (ADS) (Ref: C2(7E), part of the Glyde and Dee scheme). No works associated with the Proposed Development are proposed in the vicinity of ADS watercourses.

11.4.26 Baseline Summary and Receptor Sensitivities

The baseline assessment identified the receptors which have the potential to demonstrate sensitivity to the Development; the receptors and their sensitivity / value are summarised within the following table. Sensitivity is based on the baseline assessment and determined in accordance with the rationale previously described.

Table 11.15: Baseline Receptor Sensitivity and Rational

Type	Receptor	Sensitivity	Rationale
The Site			
Hydrological	On-site watercourses draining the **Termonfeckin_010** river sub-basin	Low	Termonfeckin_010 (and its tributaries within the Site) have a WFD 'Poor' classification and low fisheries potential.
	On-site watercourses draining the **White (Louth)_010** river sub-basin	Medium	White (Louth)_010 (and its tributaries within the Site) have a WFD 'Moderate' classification and low fisheries potential.
	On-site watercourses draining the **Slieveboy_010** river sub-basin	Medium	Slieveboy_010 (and its tributaries within the Site) have a WFD 'Moderate' classification and low fisheries potential.
	Off-site designated site (Boyne Coast and Estuary SAC)	Extremely High	Designated site with international importance hydrologically connected to the Site.
	Off-site protected area (Seapoint Bathing Water Area)	High	Protected area as locally important amenity site hydrologically connected to the Site.
Hydro-geological	Bedrock Groundwater / Aquifers	Low	The bedrock aquifer underlying the site is classified as a 'Poor' Aquifer (bedrock which is generally unproductive).
	Abstractions / Non-Potable Supplies within the Site	Low	2 no. springs used for non-potable uses are located within the Site.
	Abstractions / Non-Potable Supplies within the adjacent Kilsaran Quarry	Low	4 no. production wells used for non-potable uses located within the adjacent Kilsaran Quarry site.
	Abstractions / Potable Supply	Low	Single dwelling was served by a borehole within the dwelling site curtilage.
Terrestrial	The Development	Low	Proposed infrastructure prone to damage including potential for water damage of electrical infrastructure in a flood event; potential for structural damage of access infrastructure in the event of hydraulic incapacity.
Grid Connection Route			
Hydrological	Watercourses draining the Termonfeckin_020 river sub-basin	Medium	Termonfeckin_020 (and its tributaries) have a WFD 'Moderate' classification.
	Watercourses draining the Tullyeskar_010	Medium	Tullyeskar_010 (and its tributaries) have a WFD 'Moderate' classification.
	Designated sites (Boyne Coast and Estuary SAC, and River	Extremely High	Designated site with international importance hydrologically connected to the GCR.

Type	Receptor	Sensitivity	Rationale
	Boyne and River Blackwater SAC)		
	Floodplains	Medium	Route in proximity to discrete areas of fluvial floodplain.
Hydro-geological	Bedrock Groundwater / Aquifers	Low	The bedrock aquifer underlying the northern and central sections of the GCR are classified as a 'Poor' Aquifer (bedrock which is generally unproductive / generally unproductive except for local zones)
		High	The bedrock aquifer underlying the southern section of the GCR is classified as 'Regionally Important Aquifer - Karstified (diffuse)'.
	Abstractions / PWS	High	The GCR passes through the 'inner protection area' of 3 no. Public Supply Source Protection Areas (Killineer PWS, Ballymakenny GWS; and Drybridge PWS).
	Karst Features	High	4 no. karst features in the vicinity of the GCR. Karst features with potential to act as direct conduit to groundwater akin to well drained soils.
Turbine Delivery Route			
Hydrological	Watercourses draining the Tullyeskar_010 river sub-basin	Medium	Tullyeskar_010 (and tributaries) have a WFD 'Moderate' classification.
	Watercourses draining the Mattock_020 river sub-basin	High	Mattock_020 (and tributaries) have a WFD 'Good' classification.
	Watercourses draining the White (Louth)_010 river sub-basin	Medium	White (Louth)_010 (and tributaries) have a WFD 'Moderate' classification.
	Watercourses draining the White (Louth)_020 river sub-basin	Medium	White (Louth)_020 and (and tributaries) have a WFD 'Moderate' classification.
	Designated sites (Dundalk Bay SAC)	Very High	Designated site with international importance hydrologically connected to the TDR.
	Floodplains	Medium	Route in proximity to discrete areas of fluvial floodplain.
Hydro-geological	Bedrock Groundwater / Aquifers	Low	The bedrock aquifers underlying the TDR are classified as a 'Poor' Aquifer (bedrock which is generally unproductive / generally unproductive except for local zones) and 'Poor' Aquifer (bedrock which is generally unproductive).

Type	Receptor	Sensitivity	Rationale
		High	The bedrock aquifer underlying the southern section of the TDR is classified as 'Regionally Important Aquifer - Karstified (diffuse)'.

11.5 PREDICTED ENVIRONMENTAL EFFECTS

11.5.1 Do-Nothing Scenario

If the Proposed Development was not constructed, there would be no changes to existing land-use i.e., agricultural operations (pasture farmland) would continue across the majority of the Site, as would eventual commercial forestry felling within the forestry compartments around turbines T1 and T5.

Licence felling operations are managed as per the felling licence(s) granted by the Minister for Agriculture, Food & the Marine under the Forestry Act 2014. Refer to **Appendix 2.2: Forestry Management Report** for further detail on existing forestry pertinent to the Proposed Development.

Any existing potential effects on the water environment from on-going agricultural and commercial forestry operations at the Site would remain unchanged in a Do-Nothing scenario. Continued agricultural use of lands would continue to contribute to WFD water quality pressures (nutrients) within the Termonfeckin_010 and White (Louth)_010 river sub-basins as noted in **section 11.4.8**.

11.5.2 Baseline Evolution

The baseline conditions of the water environment will change over time. Changes likely to occur without the Proposed Development due to either natural variability and / or other factors such as nearby developments or changes in land use.

11.5.2.1 Hydrology, Drainage and Flood Risk

The principal factor concerning the likely evolution of baseline conditions in relation to hydrology / hydrogeology is climate change. The baseline has been assessed with regards to present day rainfall and fluvial flows but predicted effects of climate change have also been considered using the Mid-Range Future Scenario (MRFS) which allows +20% for extreme rainfall and +20% for peak fluvial flood flows.

The MRFS represents a projected future scenario for the end of the century (i.e., 2100). Given the relatively short timeframe between this assessment and proposed commencement of construction works (approx. 10 years) and designed operating life of the Proposed Development (35 years), the MRFS is appropriate for assessing likely evolution

of baseline hydrological conditions. The effects of other proposed and / or consented developments are assessed in **section 11.12**.

11.5.2.2 Surface and Groundwater Quality

This assessment has considered the existing baseline with regard to surface and groundwater quality and the future status / objectives for future years, as defined by the EPA for the relevant river catchments and groundwater bodies.

Changes to baseline conditions in relation to water quality may occur as a result of on-going agricultural and commercial forestry operations, the former noted as a significant pressure at the Site. The Water Framework Directive (WFD) aims at maintaining 'High' status of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least 'Good' in relation to all waters by 2027. To achieve this, 'Areas for Action' have been identified where measures to improve water quality shall be implemented. Whilst the Termonfeckin_010 and White (Louth)_010 river sub-basins are currently noted to be 'At Risk' of failing to achieve their 2027 WFD objectives, a conservative approach assumes the relevant 'actions' will be implemented and there will be improvements to water quality within these catchments.

As noted in the Do-Nothing section (**section 11.5.1**), licenced felling operations are managed as per the felling licence(s) granted by the Minister for Agriculture, Food & the Marine under the Forestry Act 2014. No changes to baseline conditions are, therefore, expected from on-going felling operations. The effects of other proposed and / or consented developments are assessed in **section 11.12**.

11.5.3 Activities Associated with Construction, Operation and Decommissioning

This section describes the potential likely effects on hydrological patterns and water quality that have the potential to arise at and downstream of the Proposed Development in the absence of mitigation, during the following development phases:

- Construction;
- Operation and maintenance; and
- Decommissioning.

During each phase some of the activities undertaken have the potential to modify hydrological regimes and affect water quality on the Site and the downstream environment. Due to the nature of the Site and work undertaken, the hazards and associated effects will be similar for each phase; with an increased likelihood during the construction phase.

11.5.3.1 Components Contributing to Predicted Environmental Effects

During the enabling works, tree felling is required to create access track corridors and space for turbines and other infrastructure. The total area needed to accommodate turbines and associated infrastructure is approximately 13.41 ha. Details in relation to forestry and felling work are included in **Appendix 2.2: Forestry Management Report**.

Felling of trees may result in increased mobilisation and transportation via surface water runoff of dissolved and / or sediment-bound nutrients / phosphate fertilisers from the disturbed soils and breakdown of organic matter (brash etc) into the wider water environment. The tree felling activities required as part of the Proposed Development will be the subject of a Limited Felling Licence (LFL) application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (S.I. 191/2017).

During construction, the Proposed Development comprises construction of infrastructure which would be likely to cause change to local hydrology and water quality, comprising earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with construction of temporary compounds, turbine foundations, building foundations, access tracks, and cable trenches.

The operational phase of the Proposed Development (the designed operating life estimated to be 35 years) would cause runoff from access tracks, turbine bases and hard standings via drainage features, would require onsite welfare facilities with associated waste, includes the provision of battery energy storage systems (BESS), and potentially necessitate storage and use of oils, fuels and lubricants on-site, each with the potential to cause adverse effects on the environment without adequate avoidance, design, or mitigation measures.

Activities associated with the decommissioning phase at the end of the operating design life are generally as per those for the construction phase i.e., earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with removal of turbines, buildings, hard standing areas, and buried structures followed by reinstatement and restoration of ground cover.

11.5.4 Likely Significant Effects

The likely effects of the Proposed Development on the surface and groundwater environment prior to any avoidance, careful design, or additional mitigation are summarised in the following sections.

11.5.4.1 Changes in Runoff and Flow Patterns

New temporary and permanent impermeable surfaces, as well as temporary compaction of soils due to construction phase plant and site traffic movements, may cause increased rate and volume of surface water runoff due to the reduced permeable area on the Site through which rainfall can infiltrate. Impermeable surfaces will cause an increased "flashy" response to rainfall events, with increased water velocities in new and existing drainage features. As a consequence, the effect would be likely to cause temporary or permanent increases in surface water runoff rates and volumes, leading to increased flood risk and increased effects of erosion and scour in downstream watercourses. Similarly, loss of permeable areas is likely to cause reduced potential for groundwater recharge affecting aquifers.

Excavations, and in particular linear works such as access tracks, drainage ditches and cable trenches, are likely to act as barriers to runoff resulting in ponding, or development of preferential flow routes, diverting surface water away from its current route. Consequently, temporarily or permanently redirected surface water flows may starve areas where water currently flows, or cause flooding of areas where water currently does not flow.

Works to existing surface watercourses (such as installation of culverts) have the potential to cause an obstruction to flow and may alter conveyance capacities, potentially causing temporary or permanent restrictions in watercourse channels, affecting upstream water levels and increasing flood risk.

11.5.4.2 Changes to Water Quality (Sediment / Suspended Pollution)

Temporary activities required to construct windfarm infrastructure would require felling, excavations, ground disturbance (due to excavations and plant and vehicle movements), stripping and excavation of peat and soils, and temporary spoil deposition. Exposed soils have potential to release fine sediments in surface water runoff or where excavations come in contact with surface watercourses.

Construction of hardstanding areas and access tracks would require importing, handling and placement of aggregate; which would have the potential to release fine sediments into surface water runoff. The proximity of such works to surface watercourse will increase the risk of pollution to the wider water environment.

Temporary surface water or shallow groundwater gathering in excavations has the potential to be significantly polluted due to contact with excavated surfaces and aggregates. Discharge of intercepted contaminated groundwater during passive or active dewatering has the potential to pollute the wider water environment if not disposed of correctly.

Silt and suspended sediments and debris entering watercourses would have the potential to adversely modify stream morphologies, smother habitats and harm aquatic flora and fauna.

11.5.4.3 Changes to Water Quality (Nutrient Loss)

Felling of trees has the potential to result in increased mobilisation and transportation via surface water runoff of dissolved and / or sediment-bound nutrients / phosphate fertilisers from the disturbed soils into the wider water environment, as well as loss of nutrients to the water environment from decomposed vegetative matter.

Such a potential effect is likely to be realised during and after felling, and during disturbance of soils during earthworks. Nutrient enrichment entering waterbodies has the potential to adversely affect water quality, with associated effects to fish and aquatic ecology.

11.5.4.4 Changes to Water Quality (Chemical Pollution of Surface Water and Groundwater)

Temporary storage and use onsite use of chemicals, fuels and oils associated with construction activities, and use of wet concrete and other cementitious material, may result in potentially harmful substances entering the water environment. Possible pathways to hydrological receptors may include; accidental spillages, improper transport and refuelling, or inappropriate storage and disposal procedures, by gradual leakage or single failure of storage tanks or refuelling mechanisms. Temporary presence of alum-based flocculants (used to remove suspended solids from surface water) has the potential to enter surface waters if unregulated.

During the operational phase of the Proposed Development, the permanent presence of oils and lubricants associated with turbine maintenance has a similar potential to enter and pollute the water environment.

Wastewater effluent from temporary construction phase welfare facilities and permanent substation building welfare facilities has the potential to enter surface water or shallow groundwater.

During the operational phase of the Proposed Development, an accidental loss of control and associated use of water for firefighting or cooling at the BESS facility on site may potentially risk contamination to land and water from release and fallout of gases and particulates.

As a consequence, chemical pollutants from construction activities, storage of materials, or from coliforms from wastewater entering watercourses have the potential to adversely affect water quality, with associated effects to fish and aquatic ecology.

11.5.4.5 Changes to Locally Important Groundwater Abstractions

The baseline assessment has identified non-potable abstractions and 1 potable abstraction from groundwater within a screening buffer that could be influenced by the Proposed Development. Excavations within the zone contributing to the abstractions could affect water quantity, while pollution from leakage or accidental spillage of fuel oils, lubricating oils and hydraulic fluid during the construction phase could affect water quality to the potable supply. Further consideration has been given to the likely significance of these effects.

The Kilsaran Quarry production wells are sited within 25 m of the proposed access track. The groundwater levels are noted as relatively shallow (4-6 m bgl) with production wells abstracting water from a local superficial resource perched in the upper weathered zone of impermeable unproductive bedrock layers. Construction of the development (access track) proximal to the wells would comprise shallow excavations that would not extend significantly into superficial deposits and would not encroach to bedrock. There would be no likely significant effect to the quantity of water available to supply the boreholes. The production wells by their nature are not sensitive to changes in water quality.

The domestic potable abstraction adjacent to (within 100m of) Site Entrance 1. No Site Investigation or other borehole log data is available to allow characterisation of the supply but given that underlying bedrock is generally unproductive it is reasonable to expect that the groundwater source is from a local superficial in locally permeable drift deposits or perched in the upper weathered zone of impermeable unproductive bedrock layers. Construction of the development (access track) proximal to the wells would comprise shallow (<1 m) excavations that would not extend significantly into superficial deposits and would not encroach to bedrock. There would be no likely significant effect to the quantity of water available to supply the borehole. The prevailing topographic gradient is to the south (away from the abstraction well) and potential sources of pollution would likely be transported laterally in drainage in that direction. Vertical migration of pollutants would likely be very gradual and the pollutant types that are likely (oils) would tend to break down in aggregate used to form tracks and in underlying loamy drift cover before it could disperse into a zone from where the borehole is abstracting. Potential for a pollutant causing a significant effect that would affect water quality and useability of the potable source is unlikely.

11.6 MITIGATION MEASURES (EMBEDDED & DESIGN MEASURES)

11.6.1 Embedded Mitigation

The magnitude and significance of those effects determined as being likely to be a consequence of the Proposed Development can be substantially reduced or eliminated

through a proactive design approach. The approach aims to avoid identified sensitive baseline receptors.

This section identifies the embedded mitigation (design) measures imposed and outlines the resulting magnitude and significance of residual effects. Additional mitigation is then specified to further reduce and / or eliminate remaining residual effects.

Detail of the design evolution highlighting considerations made with regards to hydrology, hydrogeology and water quality management is presented in **Chapter 3: Alternatives Considered**.

The Proposed Development layout has evolved so that the design avoids environmental constraints pertinent to the water environment, per the following sections.

11.6.1.1 Avoiding Water Features (Watercourse Buffer Zones)

As a precautionary measure, and in accordance with the guidance adhered to for this wind farm project (set out below), buffer / exclusion zones to 'major' and 'minor' watercourses were adopted as constraints in the design layout, and for incorporation as a construction buffer in relation to construction activities in proximity to watercourses. Watercourses are classified in the baseline assessment at section 11.4.6.4.

Avoidance measures (i.e. buffer or exclusion zones) have been developed in accordance with legislation and industry guidance outlined in this section. Maintaining intact buffer zones between infrastructure and water features allows:

- Protection of water quality by filtering runoff within riparian vegetation before it enters the watercourse;
- Space for natural fluvial processes such as channel shape and planform adjustment, which help restore and maintain the natural dynamic balance of river systems and associated habitats;
- Vegetation to be maintained and further establish to stabilise banks and reduce soil erosion;
- Access for the maintenance and inspection of watercourses and for dealing with any residual risk of pollution incidents; and
- Habitat for plants and animals to form part of a habitat network.

The rationale adopted in relation to water feature buffers is informed by knowledge, understanding and experience of similar developments whereby infill, disturbance, construction activity or storage of materials proximal to watercourses should be avoided.

The following publications include industry guidance around buffer exclusion zones to watercourses. The guidance relied on is relevant and similar in nature to the construction and operational activities for the Proposed Development:

- In relation to works near water, IFI (2016) recommends buffers of at least 5 m from the watercourse, with bridge foundations recommended to be placed at least 2.5 m from riverbanks to prevent silt and other contaminants from entering the riparian habitat;
- Regarding management of sediments and runoff from construction works, concrete/cement mixing, or washing areas, SEPA / NIEA (2018) recommends a buffer of 10 m from any watercourse, surface water drain, rock outcrop, or karstic sinkhole to prevent suspended solids or other pollutants from entering the water environment;
- In relation to on-site storage and construction works, SEPA / NIEA (2018) recommends a buffer of 10 m from a watercourse or flood defence and 50 m from a well, borehole, or spring;
- To mitigate potential impact of wind farm developments such as tracks, foundations, and borrow pits on the water environment, DAERA (2019) recommends buffers zones of 10 m from surface watercourses, 50 m from water features not used for water supplies, and 250 m from designated wetlands and water features used for drinking water;
- In relation to wetlands and groundwater dependent terrestrial ecosystems, SEPA, (2017) recommends a screening distance of 100 m from roads, tracks, and trenches, and 250m from borrow pits and foundations; suitable buffers taking into account ground cover, waterlogging, and slope should be proposed around sensitive receptors;
- In relation to forestry works (in particular on upland and peat sites), DAFM (2023) recommends riparian buffer reflecting stream size, with buffers from 10 – 25 m; and
- Regarding management of sediments and runoff from exposed ground in relation to agriculture, GAEC (2012) recommends buffers of up to 10 m in order to protect surface waters from pollution by suspended solids, and nutrient enrichment by organic / inorganic fertilisers.

The significance classification of watercourses (major / minor / other) is shown on **Figure 11.1: Site Hydrology**. Conservative minimum hydrological buffer zones, bearing in mind the previous guidance documents are implemented in the Proposed Development as shown in **Table 11.16**: Minimum Adopted Hydrological Buffer Zones . Buffers are indicated on Surface Water Management drawings included in **Appendix 11.2: Surface Water Management Plan.**

Table 11.16: Minimum Adopted Hydrological Buffer Zones

Water Features	Width of Adopted Buffer
Significant Watercourses (catchment >0.25 km^2)	**50 m**
Minor Watercourses (catchment <0.25 km^2)	**10 m**
Other Drainage Features	**Managed on-site by diversion / temporary blocking in accordance with GGPs and PPGs.**

New infrastructure is designed to lie outside hydrological buffer zones for major and minor watercourses. This includes those elements of the works associated with earthworks and greatest potential for spillage or leakage of chemical pollutants, i.e.:

- All turbine bases, crane pads and associated working areas;
- Temporary and permanent spoil and peat repositories; and
- Enabling works compound, substation, BESS, and construction compound, fuel and chemical storage areas and any other platforms.

New permanent access tracks are to lie outside of buffer zones; with the exception of locations where proposed site tracks unavoidably cross over watercourses. Careful consideration has been given to the routing of access tracks in order to avoid / limit crossing of watercourses. Where crossings are proposed, appropriate design measures shall be incorporated to control or reduce the potential effect of the Proposed Development on the receiving environment (refer to **section 11.8.1.7** of this chapter and **Appendix 11.2: Surface Water Management Plan** for further detail).

Temporary track infrastructure (such as temporary widening and turning heads) that may encroach into buffers shall be managed through the use of additional surface water management measures, discussed in **section 11.8.1**.

Development located within buffers includes drainage infrastructure due to their requirement to be located at natural low points often coinciding with watercourses. In instances where drainage infrastructure is located within buffers, construction works shall be managed through the use of additional surface water management measures, discussed in **section 11.8.1**.

Protection of other drainage features will be managed during and following construction by means of diversion and / or temporary blocking (with prior settlement features upstream of, and outside, the drainage channel), using filtration check dams or similar, in order to prevent residual indirect potential pollution downstream caused by connectivity to downstream waterways.

11.6.1.2 Abstractions

With regards to known or potential potable water abstractions identified in the previous screening assessment, the proposed infrastructure layout within the Site is such that no turbines and associated significant infrastructure are sited within 250 m of screened locations (refer to **sections 11.4.22** to **11.4.24**).

Additional mitigation during the construction phase for works associated with access track construction within 100 m of non-potable production well abstractions at Kilsaran Quarry and a potable abstraction serving a single dwelling within 100 m of Site Entrance 1 are outlined in **section 11.8**.

11.6.1.3 Springs

The proposed infrastructure layout within the Site is such that no new development is sited within 100 m of springs for non-potable usage (refer to **section 11.4.21**). No further avoidance measure is required.

11.6.1.4 Forestry

The ancillary forestry felling required to facilitate construction and operation of the Proposed Development will be limited to 13.41 ha felling of in the vicinity of turbines T01 and T05. In line with relevant guidelines i.e., 'Forest Harvesting and the Environment Guidelines' (DAFM, 2000) and 'Forestry and Water Quality Guidelines' (DAFM, 2000), a minimum 10 m buffer has been established between areas of felling and watercourses. No further avoidance / design measure is required.

11.6.1.5 Floodplains

All development within the Site is located within Flood Zone C, as defined in the OPW Guidelines (OPW, 2009).

OPW PFRA flood mapping indicates that the Site is not in an area at risk of pluvial flooding.

Drainage infrastructure to be installed (refer to **section 11.8.1.9** and **Appendix 11.1 Flood Risk and Drainage Assessment**) ensures a standard of flood protection from surface water for the 1% AEP / 1 in 100-year rainfall event, including allowance for climate change.

Construction works associated with the GCR (underground cable to a depth of 1.2 m) will follow the route of existing road corridors and cross watercourses either via existing bridges and culverts or via Horizontal Direction Drilling (HDD). The cable route affects no significant fluvial floodplains other than those contiguous with existing road bridges and culverts. The cable route will not further encroach into existing floodplains compared to existing conditions.

Similarly, during the operational phase of the Proposed Development, the cable route would by its nature (buried) have no effect on flooding by causing restrictions or disruption to flood flows.

During decommissioning phase, underground cables will be removed while the ducting will be left in-situ. As such there would be no effect on flooding caused by restrictions or disruption to flood flows.

While risk of flooding given the nature of the GCR is not deemed significant, the Applicant will take a precautionary approach and adopt appropriate measures to avoid earthworks becoming inundated and potentially transporting sediment off-site into the water environment. Measures will comprise:

- Routinely checking weather warnings and planning for adverse weather conditions;
- Storing plant and materials in areas outside areas prone to flooding;
- Implementing temporary drainage systems to alleviate localised surface water flood risk and prevent surface water ingress to the construction working areas; and
- Prevent obstruction of existing surface runoff pathways.

The nature of the GCR (underground cable) and the methods used to cross watercourses (i.e., within existing bridge decks or by directional drilling) would have no potential to affect watercourse morphology, and so potential for effects at watercourse crossings are not considered further.

Further details on the proposed GCR construction methods are provided in **Appendix 2.3: 38kV Grid Connection - Outline Construction Methodology**.

Other effects associated with proposed construction activities for the GCR and TDR would be similar to those described in **section 11.5.4** and would be solely associated with the construction phase. No operational effects are anticipated.

11.6.2 Designed Measures

Standard design measures associated with development of the type proposed are not considered "mitigation" in EIA terms but are important in their effect of controlling or reducing the potential effect of the Proposed Development on the receiving environment. Such measures are outlined in the following sections.

11.6.2.1 Site Drainage Management and SuDS Design

The Proposed Development adopts a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of onsite retention of flows and use of buffers and silt removal techniques. All drainage related mitigation measures will be encompassed by a robust and proven Sustainable Drainage

System (SuDS) design proposed as part of the Proposed Development which will be used to control drainage and silt management on the site.

The proposed on-site drainage is set out in detail at **Appendix 11.2: Surface Water Management Plan** and the accompanying set of drainage drawings. The drainage manages flood risk to the Proposed Development, provides environmental protection and manages water quality and silt / suspended sediment, and avoids unnecessary disruption to existing hydrological patterns by adhering to the following principles:

- Track and hardstanding drainage adopts SuDS principles and ensures that runoff from new track and hardstanding shall be reduced to the pre-development greenfield rate. The drainage system caters for protection for up to a 1 in 100-year / 1% AEP rainfall event including allowance for climate change;
- The drainage plan adopts sub-catchments to manage runoff from the Proposed Development where sub-catchments mimic natural topography to avoid "crossing catchments" which could locally affect flood risk;
- Drainage maintains existing overland flow routes and channels. Existing natural flow paths are maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals;
- Drainage minimises transporting rainfall runoff in long linear drainage swales by providing regular channel "breakouts", whereby water is encouraged to flow overland, thus maintaining existing natural hydrological patterns;
- Drainage reducing surface water flow rates and volumes by attenuating runoff from tracks and hardstands "at source" by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties. This provides an additional layer of protection rather than relying solely on "end of line" attenuation basins; and
- Drainage provides attenuation and settlement ponds at main surface water discharge locations at end of drainage "runs", where runoff from significant new impermeable areas is treated and attenuated before being discharged, either by dispersal overland, or over a riparian zone adjacent to a watercourse.

Drainage design will reduce chemical, silt and other suspended pollutant transport by providing a "treatment train" of two to three stages of pollutant removal to all surface water runoff, nominally by:

- Ensuring that drainage swales are designed to convey flows at a low velocity by using a wide, flat-bottomed drain;
- Providing settlement and filtration features in all linear drainage swales (check dams, filtration dams) to reduce flow velocity and encourage settlement;

- Encouraging appropriate vegetation growth in the base of all linear drainage to provide additional filtration of water;
- Providing settlement ponds at discharge locations in order to provide treatment to contaminated runoff prior to discharge;
- Discharging surface water runoff over undisturbed vegetated ground, hence allowing any remaining silts and other pollutants to drop out of flows before entering the watercourse (having the effect of polishing the runoff); and
- Preventing the discharge of surface water runoff flows directly to existing watercourses or drainage. Discharges will be via SuDS and buffer zones which will act as a filter strip, allowing deposition of suspended solids and other pollutants.

Consideration specific to the proposed infrastructure elements are documented in the detailed site-specific drainage management / SuDS design – refer to **Appendix 11.1 Flood Risk and Drainage Assessment** and accompanying drainage drawings.

11.6.2.2 Drainage at Upgraded Tracks

The Proposed Development design includes the upgrading of sections of existing access track associated with the existing agricultural lands and commercial forestry workings. As such, the proposed upgrade works (maintenance of existing running surface and associated drainage) may encounter current track drainage which is locally significant in terms of drainage function.

In these instances, additional mitigation measures will be deployed including placement of temporary silt barriers (e.g., check dams) within retained and replacement drains. Additional mitigation is discussed further in **section 11.8.1.9**.

11.6.2.3 Watercourse Crossings

As described in **section 11.6.1**, the number of watercourse and drainage crossings has been minimised through the principle of avoidance at the layout design stage. The Proposed Development will result in the crossings of 3 no. minor watercourses:

Crossings are designed to accommodate the track width and minimise length of affected channel. Hydraulic design of crossings has been undertaken as per the guidance and requirements provided in CIRIA C786 "Culverts, Screen and Outfall Manual", with primary parameters as follows:

- Width of the culvert will be greater than the width of the active drainage channel;
- Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow;
- The slope of the culvert will not exceed the slope of the bed of the existing drainage channel;

- Detailed design of crossings will comply with OPW Section 50 guidelines, which will include providing freeboard to design flood levels and ensuring no increase in flood risk elsewhere as a result of the bridge / culvert. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Ireland; and
- Fisheries shall be protected by adopting the guidance stated in 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' as published by Inland Fisheries Ireland (2016).

Hydraulic design of crossings has been undertaken as part of this assessment and details are provided in a 'Watercourse Crossing Schedule' included as part of **Appendix 11.1 Flood Risk and Drainage Assessment**.

The GCR will require the crossing of 5 no. watercourses (3 no. bridges and 2 no. culverts) where there is insufficient cover to install the cable to ESB specification (450 mm cover to the top of ducts). At these locations Horizontal Direction Drilling (HDD) shall be employed.

All other culverts to be traversed using standard 38kV Service / Culvert Crossing details provided in **Appendix 2.3: 38kV Grid Connection - Outline Construction Methodology**.

During decommissioning phase, underground cables will be removed while the ducting will be left in-situ. Therefore, no works within watercourses shall be required during any phase of the Proposed Development.

Further details on the proposed HDD methods are provided in **Appendix 2.3: 38kV Grid Connection - Outline Construction Methodology**.

Consultation and approval will be sought from all relevant stakeholders and regulators in accordance with OPW Section 50 guidelines (OPW, 2022), at the pre-construction detailed design stage for all works in and affecting watercourses and drains.

11.6.2.4 BESS

The battery energy storage systems (BESS) comprise 20 no. lithium-ion battery energy storage containers. The storage containers are designed such that the batteries are within sealed units to ensure that a single cell thermal runaway will not propagate and result in multiple cell thermal runaways.

In the very unlikely event there is loss of control of a battery cell container, the Proposed Development includes allowance for containment of spills including in the event where firefighting water (from an external source) is used to suppress fire or is used to cool adjacent battery containers. The approach is precautionary and presumes that the potential

concentration of contaminants in water could reach a level that could cause potential environmental harm and seeks to entirely omit the potential pollutant pathway.

NIEA / SEPA Pollution Prevention Guidelines (PPG) 18: Managing Firewater and Major Spillages which is adopted as good practice in the absence of Irish-specific guidance sets out requirements for containment of runoff likely to carry firefighting contamination.

Measures adopted prevent vertical and lateral pathways to waterbodies. Runoff in the event of a firefighting event will be stored within the permeable subbase and an adjacent open lagoon/basin, with infiltration to ground prevented by installation of an impermeable liner to the subbase and lagoon, and control of outflows by a pollution control valve. Storage in the BESS subbase (c. 1013 sq. m x 0.5m deep x typical 30% voids, c. 150 cu.m storage), contained to the site by an impermeable membrane, will eventually drain via perforated pipes to a lagoon with a capacity of a further min. 80 cu.m capacity. Total containment storage within the site will exceed the minimum recommended volume (228cu m) required to contain water used for boundary cooling per National Fire Chiefs Council (UK) - Grid Scale Battery Energy Storage System Planning – Guidance for Fire & Rescue Services, which is adopted as the best applicable guidance in the absence of an Irish equivalent.

Where loss of control is limited to a single BESS unit, fire suppression is by a mix of gas and internally supplied coolant by sprinkler which is self-contained.

The drainage system is designed to give sufficient time to contain that water and allow for the arrangement of pumping facilities to remove the contaminated water from the network. Pumped firewater will be removed into suitable lorries which will transport this to a licensed facility for disposal.

The spill containment is reflected on a detailed drainage plan (reference **Drawing SWMP_09**) specific to the BESS area.

11.7 EFFECT OF THE PROPOSED DEVELOPMENT

Magnitude and likelihood of the potential environmental effects have been determined based on criteria outlined within section 11.3 taking into account the effect of avoidance measures and normal designed-in measures proposed and described in preceding sections.

The associated impact significance of these effects on the receptors affected (following the implementation of avoidance and design measures proposed) has been determined in accordance with the rationale described previously and the results are presented in summary **Table 11.17**.

11.7.1 Effect of the Proposed Development (the Site)

Table 11.17: Potential Magnitude and Significance of Impacts to Receptors – Including Effect of Embedded Avoidance & Design

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
On-site watercourses draining the Termonfeckin_010 river sub-basin (Low)	Changes in runoff and flow patterns	Construction, Operational & Decommissioning	**Negligible** No change in the water feature's capacity to dilute pollutants and waste products; Negligible change in predicted peak flood level	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of watercourse crossings on-site when adopting best practice design standards as stated result in a not significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Construction & Decommissioning	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Slight Adverse	**Likely** Possible consequential effect in the short to medium term	**Minor Adverse** Temporary short-term construction activities within watercourses would be likely to cause a temporary but fundamental change in water quality in watercourses on the Site.
		Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Imperceptible	**Likely** Possible consequential effect in the short to medium term.	**Minor Adverse** In the absence of additional mitigation measures e.g., improper maintenance of permanent SuDS drainage features / improper site management, the operation of the Proposed Development would be likely to cause a temporary, small adverse (minor deterioration in water quality) change with regards to sediment / suspended pollution in watercourses within the Proposed Development site.
	Chemical pollution of surface waters	Construction & Decommissioning	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Slight Adverse	**Likely** Possible consequential effect in the short to medium term	**Minor Adverse** Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a temporary but fundamental change in water quality in watercourses on the Site.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
		Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Imperceptible	**Likely** Possible consequential effect in the short to medium term	**Minor Adverse** Accidental spillage / leaks of oils, chemicals, or other materials stored on site arising due to improper site management, would be likely to cause a temporary, small adverse (minor deterioration in water quality) change in watercourses within the Proposed Development site.
On-site watercourses draining the White (Louth)_010 river sub-basin (Medium)	Changes in runoff and flow patterns	Construction, Operational & Decommissioning	**Negligible** No change in the water feature's capacity to dilute pollutants and waste products; Negligible change in predicted peak flood level	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. No crossings are proposed on watercourses within the White (Louth)_010 catchment.
	Silt / suspended solid pollution of surface waters	Construction & Decommissioning	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Moderate Adverse	**Likely** Possible consequential effect in the short to medium term	**Moderate Adverse** Temporary short-term construction activities within watercourses would be likely to cause a temporary but fundamental change in water quality in watercourses on the Site.
		Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Slight Adverse	**Likely** Possible consequential effect in the short to medium term	**Minor Adverse** In the absence of additional mitigation measures e.g., improper maintenance of permanent SuDS drainage features / improper site management, the operation of the Proposed Development would be likely to cause a temporary, small adverse (minor deterioration in water quality) change with regards to sediment / suspended pollution in watercourses within the Proposed Development site.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
	Chemical pollution of surface waters	Construction & Decommissioning	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Moderate Adverse	**Likely** Possible consequential effect in the short to medium term	**Moderate Adverse** Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a temporary but fundamental change in water quality in watercourses on the Site.
		Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Slight Adverse	**Likely** Possible consequential effect in the short to medium term	**Minor Adverse** Accidental spillage / leaks of oils, chemicals, or other materials stored on site arising due to improper site management, would be likely to cause a temporary, small adverse (minor deterioration in water quality) change in watercourses within the Proposed Development site.
On-site watercourses draining the Slieveboy_010 river sub-basin (Medium)	Changes in runoff and flow patterns	Construction, Operational & Decommissioning	**Negligible** No change in the water feature's capacity to dilute pollutants and waste products; Negligible change in predicted peak flood level	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of watercourse crossings on-site when adopting best practice design standards as stated result in a not significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Construction & Decommissioning	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Moderate Adverse	**Likely** Possible consequential effect in the short to medium term	**Moderate Adverse** Temporary short-term construction activities within watercourses would be likely to cause a temporary but fundamental change in water quality in watercourses on the Site.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
	Chemical pollution of surface waters	Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Slight Adverse	**Likely** Possible consequential effect in the short to medium term	**Minor Adverse** In the absence of additional mitigation measures e.g., improper maintenance of permanent SuDS drainage features / improper site management, the operation of the Proposed Development would be likely to cause a temporary, small adverse (minor deterioration in water quality) change with regards to sediment / suspended pollution in watercourses within the Site.
		Construction & Decommissioning	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Moderate Adverse	**Likely** Possible consequential effect in the short to medium term	**Moderate Adverse** Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a temporary but fundamental change in water quality in watercourses on the Site.
		Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Slight Adverse	**Likely** Possible consequential effect in the short to medium term	**Minor Adverse** Accidental spillage / leaks of oils, chemicals, or other materials stored on site arising due to improper site management, would be likely to cause a temporary, small adverse (minor deterioration in water quality) change in watercourses within the Proposed Development site.
Off-site designated site / protected area (Boyne Coast and Estuary SAC / Seapoint Bathing Water Area) (Extremely High / High)	Changes in runoff and flow patterns	Construction, Operational & Decommissioning	**Negligible** No change in the water feature's capacity to dilute pollutants and waste products; Negligible change in predicted peak flood level	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of watercourse crossings on-site when adopting best practice design standards as stated result in a not significant localised effect in terms of restricted capacity that would cause any change to flood risk.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
	Silt / suspended solid pollution of surface waters	Construction & Decommissioning	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Significant	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Moderate Adverse** Riparian buffer zones, avoidance, and control of reduced quality runoff (silt / suspended solids) from the temporary works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations. In the absence of additional mitigation, temporary short-term construction activities within upstream watercourses may cause a small / detectable but temporary change in water quality at the designated site / protected area.
		Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Significant	**Rare** It is unlikely that any consequence would ever arise.	**Minor Adverse** Riparian buffer zones, avoidance, and control of reduced quality runoff (silt / suspended solids) from the permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations. In the absence of additional mitigation measures e.g., improper maintenance of permanent SuDS drainage features / improper site management, the operation of the Proposed Development could cause a temporary, small adverse change (minor deterioration in water quality) with regards to sediment / suspended pollution at the designated site / protected area.
	Chemical pollution of surface waters	Construction & Decommissioning	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Profound	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Moderate Adverse** Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management may cause a temporary but fundamental change in water quality in at the designated site / protected area.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
		Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Significant	**Rare** It is unlikely that any consequence would ever arise.	**Minor Adverse** Accidental spillage / leaks of oils, chemicals, or other materials stored on site arising due to improper site management, could cause a temporary, small adverse (minor deterioration in water quality) at the designated site / protected area.
Bedrock Groundwater / Aquifers (Low)	Alteration of Groundwater	Construction, Operational & Decommissioning	**Negligible** No measurable change in groundwater levels, groundwater flow regime, or groundwater quality. No change to an aquifer.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development	**Not Significant** No significant excavations within the bedrock are expected. Significant dewatering with the potential for affecting groundwater levels is not anticipated.
	Chemical pollution of groundwater	Construction & Decommissioning	**Small Adverse** Potential low risk to groundwater from polluted run-off	Imperceptible	**Likely** Possible consequential effect in the short to medium term.	**Minor Adverse** Spillage of oils, chemicals, or cementitious material associated with temporary construction and / or arising due to improper site management during construction or operational phases would be likely to cause a change in groundwater quality. However, bedrock is expected to be shallow in several areas, with limited thickness of superficial deposits; depth to groundwater is anticipated to be significant and dominated by fracture flow, offering a limited pollution pathway.
		Operational	**Small Adverse** Potential low risk to groundwater from polluted run-off	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development	**Not Significant** Accidental spillage / leaks of oils, chemicals, or other materials are unlikely during the operational phase that would cause a deterioration in water quality in the context of the overall groundwater aquifer.
Non-Potable Water Supplies – Kilsaran Production Wells	Disruption to quantity of supply	Construction, Operational & Decommissioning	**Negligible** No measurable change in groundwater levels,	Imperceptible	**Rare**	**Not Significant** Construction of the proposed track proximal to the boreholes would cause no excavations to a depth

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
(Low)			groundwater flow regime with regards to water supplies.		It is unlikely that any consequence would ever arise.	that would cause disruption or displacement of shallow flow paths serving the well sources which are to 6m deep. The production wells are not sensitive to changes in water quality.
Potable Water Supply - Borehole near Site Entrance 1 (Low)	Disruption to quantity or quality of supply	Construction	**Small Adverse** Potential low risk to groundwater from polluted (e.g., construction phase) run-off	Imperceptible	**Likely** Possible consequential effect in the short to medium term.	**Minor Adverse** Construction of the proposed track proximal to the borehole would not cause any excavations to a depth that would cause disruption or displacement of shallow flow paths serving the well source. A significant accidental spillage of fuel oil or similar could feasibly cause a low risk of pollution to groundwater that could cause a temporary short-term change in water quality.
		Operational & Decommissioning	**Negligible** No measurable change in groundwater quality with regards to drinking water supplies.	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** Accidental spillage / leaks of oils, chemicals, or other materials are unlikely during the operational phase that would cause a deterioration in water quality. During decommissioning phase the site access roads will remain in situ (no proposed works to remove) and will serve ongoing forestry and agriculture activity in the area.
Tracks, turbines and associated building (Low)	Risk to occupants and infrastructure due to identified potential risk of flooding.	Construction, Operational & Decommissioning	**Negligible** Negligible change in predicted peak flood levels	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development	**Not Significant** The Proposed Development has been designed to avoid areas potentially susceptible to pluvial ponding.
Watercourses and Groundwater (Varies up to Medium)	Risk of contamination due to accidental fire at BESS facility.	Operational	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to	Slight Adverse	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** Battery storage containers are sealed to ensure that any potential single cell thermal runaway is contained. The Proposed Development includes design measures at the BESS to prevent discharge, and contain potentially contaminated runoff in an impermeable lined area, up to a volume exceeding

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
			naturally occurring fluctuations			FRS guidance. Stored contaminated runoff will be disposed of offsite. There is no pathway for pollutants.

11.7.2 Effect of the Proposed Development (Grid Connection Route)

Table 11.18: Potential Magnitude and Significance of Impacts to Receptors – Including Effect of Embedded Avoidance & Design

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Grid Connection Route						
Surface Watercourses within Termonfeckin_010; Termonfeckin_020; and Tullyeskar_010; river sub-basins (Low to Medium)	Reduced water quality	Construction	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Imperceptible to Slight Adverse	**Likely** Possible consequential effect in the short to medium term.	**Minor Adverse** All watercourse crossings coincide with existing road crossings and culverts; the cable will be laid within the road deck over the existing culvert, or via horizontal directional drilling (HDD) under the watercourse. Methods will not cause requirement for any in-stream work or work that would directly cause potential for pollution of the watercourse. Other effects associated with typical proposed GCR construction activities would be similar to those described in section 11.5.4.2 (e.g., sediment / suspended pollution or chemical pollution of surface water runoff and groundwater) and would be solely associated with the construction phase.
		Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development	**Not Significant** During the operational phase of the Proposed Development, the cable route would by its nature (buried) and have no effect on water quality. During decommissioning, underground cables will be removed while the ducting will be left in-situ avoiding the need for earthworks.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Grid Connection Route						
	Changes to watercourse morphology	Construction, Operational & Decommissioning	**Negligible** No change to river morphology / fluvial geomorphology	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** All watercourse crossings coincide with existing road crossings and culverts; the cable will be laid within the road deck over the existing culvert, or via horizontal directional drilling (HDD) under the watercourse. Methods will not cause requirement for any in-stream work or work that would directly affect watercourse morphology. Underground cables will be removed while the ducting will be left in-situ.
Floodplains (Medium)	Flood risk to the Proposed Development	Construction, Operational & Decommissioning	**Negligible** No change in predicted peak flood levels	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** The cable route affects no significant fluvial floodplains other than those contiguous with existing road bridges and culverts. The cable route will not further encroach into existing floodplains compared to existing conditions. During decommissioning, underground cables will be removed while the ducting will be left in-situ.
	Increased flood risk elsewhere	Construction, Operational & Decommissioning	**Negligible** No change in predicted peak flood levels	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** Appropriate techniques to manage surface water around working areas during construction would be implemented. The cable route would by its nature (buried) have no effect on flooding by causing restrictions or disruption to flood flows.
Designated Sites (Boyne Coast and Estuary SAC, and River Boyne and River Blackwater SAC) (Extremely High)	Reduced water quality	Construction	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Significant	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Moderate Adverse** All watercourse crossings coincide with existing road crossings and culverts; the cable will be laid within the road deck over the existing culvert, or via horizontal directional drilling (HDD) under the watercourse. Methods will not cause requirement for any in-stream work or work that would directly cause potential for pollution of the watercourse. Other effects associated with typical GCR construction activities would be similar to those described in section 11.5.4.2 (e.g., sediment / suspended pollution or

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Grid Connection Route						
						chemical pollution of surface water runoff and groundwater) and would be solely associated with the construction phase.
		Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** During the operational phase of the Proposed Development, the cable route would by its nature (buried) and have no effect on water quality. During decommissioning, underground cables will be removed while the ducting will be left in-situ avoiding the need for earthworks.
Bedrock Groundwater / Aquifers (Low to High)	Reduced Groundwater Quality	Construction	**Small Adverse** Potential low risk to groundwater from polluted (e.g., construction phase) run-off	Imperceptible to Slight Adverse	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Minor Adverse** Limited potential for short term slight deteriorations in water quality due to excavations that would release sediments; use of mechanical plant with associated fuels and lubricants. **Not Significant** During the operational phase of the Proposed Development, the cable route would by its nature (buried) have no effect on water quality. During decommissioning, underground cables will be removed while the ducting will be left in-situ.
		Operational & Decommissioning	**Negligible** No measurable change in groundwater quality.	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	
	Reduced Groundwater Quantity	Construction, Operational & Decommissioning	**Negligible** No measurable change in groundwater levels, groundwater flow regime, No change to an aquifer.	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** Shallow excavations associated with cable laying would not be anticipated to cause any change in groundwater flow routes.
Public Supply Source Protection Areas (High)	Reduced Groundwater Quality	Construction	**Small Adverse** Potential low risk to groundwater from polluted (e.g.,	Slight Adverse	**Unlikely** Unlikely that any consequential effect would arise	**Minor Adverse** Limited potential for short term slight deteriorations in water quality due to excavations that would release

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Grid Connection Route						
			construction phase) run-off		within the lifetime of the development.	sediments; use of mechanical plant with associated fuels and lubricants.
		Operational & Decommissioning	**Negligible** No measurable change in groundwater quality with regards to drinking water supplies.	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** During the operational phase of the Proposed Development, the cable route would by its nature (buried) have no effect on water quality. During decommissioning, underground cables will be removed while the ducting will be left in-situ.
	Reduced Groundwater Quantity	Construction, Operational & Decommissioning	**Negligible** No measurable change in groundwater levels, groundwater flow regime,	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** Shallow excavations associated with cable laying would not be anticipated to cause any change in groundwater flow routes.
Karst Features (High)	Reduced Groundwater Quality	Construction	**Small Adverse** Potential low risk to groundwater from polluted (e.g., construction phase) run-off	Slight Adverse	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Minor Adverse** Karst features are primarily a geotechnical risk, but they may act as a direct conduit (pathway) for potential pollutants to groundwater receptor.

11.7.3 Effect of the Proposed Development (Turbine Delivery Route)

Table 11.19: Potential Magnitude and Significance of Impacts to Receptors – Including Effect of Embedded Avoidance & Design

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Turbine Delivery Route						
Watercourses draining the Tullyeskar_010 river sub-basin	Reduced Water Quality	Construction	**Negligible** No changes to baseline conditions	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** Works associated with the TDR in this river sub-basin are limited to temporary street sign / street furniture removal and construction of temporary load bearing surfaces, remote from watercourses.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Turbine Delivery Route						
(Medium)		Operational & Decommissioning	**Negligible** No changes to baseline conditions	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** The proposed TDR is applicable only to the construction phase of the Proposed Development.
Watercourses draining the Mattock_020 river sub-basin (High)	Reduced Water Quality	Construction	**Negligible** No changes to baseline conditions	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** No physical works are required within this river sub-basin (traffic management only).
		Operational & Decommissioning	**Negligible** No changes to baseline conditions	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** The proposed TDR is applicable only to the construction phase of the Proposed Development.
Watercourses draining the White (Louth)_010 river sub-basin (Medium)	Reduced Water Quality	Construction	**Moderate Adverse** Potential medium risk of pollution to surface water, changing water quality status	Moderate Adverse	**Likely** Possible consequential effect in the short to medium term.	**Moderate Adverse** A new offline track and embankment reprofiling is required adjacent to the Hammondstown watercourse. Temporary short-term construction activities adjacent to watercourse would be likely to cause a temporary but fundamental change in water quality in the absence of additional mitigation. Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a temporary but fundamental change in water quality.
		Operational & Decommissioning	**Negligible** No changes to baseline conditions	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** Works required to facilitate the turbine delivery shall be temporary during the construction phase only.
Watercourses draining the White (Louth)_020 river sub-basin (Medium)	Reduced Water Quality	Construction	**Negligible** No changes to baseline conditions	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** No physical works are required within this river sub-basin.
		Operational & Decommissioning	**Negligible** No changes to baseline conditions	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** The proposed TDR is applicable only to the construction phase of the Proposed Development.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Turbine Delivery Route						
Designated sites (Dundalk Bay SAC) (Very High)	Reduced Water Quality	Construction	**Small Adverse** Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations	Moderate Adverse	**Likely** Possible consequential effect in the short to medium term.	**Moderate Adverse** Designated site hydrologically connected to the TDR via the White (Louth)_010 river sub-basin. A new offline track and embankment reprofiling is required adjacent to the Hammondstown watercourse (White (Louth)_010). Temporary short-term construction activities adjacent to watercourse would be likely to cause a temporary but fundamental change in water quality in the absence of additional mitigation. Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a temporary but fundamental change in water quality.
		Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** The proposed TDR is applicable only to the construction phase of the Proposed Development.
Floodplains (Medium)	Flood risk to the Proposed Development	Construction	**Negligible** No change in predicted peak flood level	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** The TDR affects no significant fluvial floodplains other than those contiguous with existing roads. The cable route will not further encroach into existing floodplains compared to existing conditions. Appropriate techniques to manage surface water around working areas during construction would be implemented.
		Operational & Decommissioning	**Negligible** No change in predicted peak flood level	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** The proposed TDR is applicable only to the construction phase of the Proposed Development.
	Increased flood risk elsewhere	Construction	**Negligible** No change in predicted peak flood level	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise	**Not Significant** Appropriate techniques to manage surface water around working areas during construction would be implemented.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Turbine Delivery Route						
					within the lifetime of the development.	
		Operational & Decommissioning	**Negligible** No change in predicted peak flood level	Imperceptible	**Rare** It is unlikely that any consequence would ever arise.	**Not Significant** The proposed TDR is applicable only to the construction phase of the Proposed Development.

11.8 ADDITIONAL MITIGATION MEASURES – CONSTRUCTION PHASE

Additional mitigating measures, over and above the designed-in / embedded mitigation previously detailed, are intended to reduce or prevent the residual hazards which may not be fully mitigated by the design evolution and avoidance. Although significant effects are not predicted, these additional mitigation measures will be implemented as part of best practice.

11.8.1 Pollution Prevention Measures

During all phases of the Proposed Development, the site manager will ensure that mitigation measures as identified within this assessment are fully implemented and that activities are carried out in such a manner as to prevent or reduce effects.

To ensure best practice on site and to help avoid pollution release to watercourses, IFI 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' (2016) will be adhered to. The Guidance on Pollution Prevention (GPP) series (SEPA / NIEA, 2022), relevant in similar adjacent jurisdictions, will be consulted and complied with to help avoid pollution release to watercourses. Key requirements for control of chemical pollution risk that will be implemented include those outlined in the following sections.

The following sections should be read in conjunction with the construction management information provided within **Chapter 2: Description of the Proposed Development**, Construction Environmental Management Plan (CEMP) **Appendix 2.1**, and **Appendix 11.2: Surface Water Management Plan**.

11.8.1.1 Storage

All equipment, materials and chemicals required for the Proposed Development will be stored away from any watercourse (i.e. outside previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with GPP2: Above Ground Oil Storage Tanks and within a secured bund of 110% of the storage capacity.

Storage space shall be located within the 3 no. temporary construction compounds (as described in **Chapter 2: Description of the Proposed Development**); the same conditions shall apply where materials are stored at main working areas (e.g. turbine cranepads).

11.8.1.2 Vehicles and Refuelling

Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Spill kits will also be available in designated areas throughout the Site. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, away from any watercourse or drainage ditches (i.e., outside previously stated buffer zones, refer to **section 11.6.1.1**) and will adhere to best practice as detailed in PPG 7.

11.8.1.3 Maintenance

On-site maintenance (outside of construction compounds) to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown. Spill / leak prevention measures (spill kit, drip trays, absorbent booms) will be put in place to avoid spills of oils or fuels prior to carrying out any maintenance works.

11.8.1.4 Cement and Concrete Batching

Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be determined before commencement of works. Concrete contaminated water will be discharged to a lined basin in order that it be contained for authorised disposal off site. Wastewater spillage will be minimised by using settling tanks and recycling water. Spill kits will also be available in designated areas throughout the Site.

11.8.1.5 Mess and Welfare Facilities

Mess and welfare facilities will be required during the construction phase and will be located at the construction compounds. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e., there shall be no emission of treated or untreated foul effluent on the Site).

11.8.1.6 Construction in the Vicinity of Watercourses

The following procedures apply to the general construction activities required either within watercourses or in defined watercourse buffer zones:

- Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water; and
- Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings.

Work in or near water will be limited to construction of drainage outfalls and 3 no. watercourse crossings / culverts.

11.8.1.7 Construction of Watercourse Crossings

Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months) and adhere to working period restrictions imposed.

Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include:

- Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing;
- Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity;
- Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location; and
- Use of over pumping where deemed appropriate.

11.8.1.8 Construction in the Vicinity of Private Water Supplies

There shall be no storage of chemicals, fuels, or other lubricants and no refuelling permitted within 100 m of private water supplies.

A spill kit will be available on site at all times and a team of operatives will be trained in the use of the spill kit. Emergency procedures in the event of a spillage will be displayed on site and communicated to all operatives. All operatives will be made aware that any fuel spillage must be reported to the contractor's office as soon as it happens.

An Emergency Response Plan for dealing with an accidental spillage of chemicals, fuels, or other lubricants shall be prepared prior to works commencing and communicated to all operatives. Emergency response measures shall include the following:

- Establish that there is not an immediate risk of fire, if there is call the Fire Brigade and evacuate the area;
- Stop the source of the leak – i.e. by turning off the tap, plugging the leak or rolling over the drum (if it is safe to do so);
- Contain the spillage by bunding using sandbags, earth banks, absorbent materials etc. Seal any drains to prevent entry of oil and place booms across any receiving watercourses to contain and absorb surface oil;
- If necessary, contact the Emergency Response Team;
- Notify the Environmental Manager or another member of the SHE department. The Environmental Manager/SHE department will assess the requirement to notify other agencies i.e. EPA or the sewage undertaker; and,
- Clean up within the contained area. All contaminated earth and materials arising from the spillage are classifies as hazardous waste and are to be disposed of via a licensed haulier to a licensed recipient in line with approved hazardous waste removal procedures.

11.8.1.9 Temporary SuDS

SuDS, comprising temporary drainage and silt management features will be constructed prior to earthworks (including preliminary or enabling works including felling) proceeding to

construct any linear works (tracks / hardstanding areas / cable routes), turbine bases, and other infrastructure.

Drainage will be provided to temporary earthworks. Permanent drainage will be installed in advance of or in parallel with completion of tracks and hardstanding areas; a planning design for permanent drainage is shown on drawings within **Appendix 11.1: Flood Risk and Drainage Assessment** and **Appendix 11.2: Surface Water Management Plan.**

Temporary measures will include:

- Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. track watercourse crossing locations and areas where tracks lie within watercourse buffer zones;
- Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons in areas where water is to be discharged. Principles and design standards for sizing of treatment are stated in **Appendix 11.2**;
- Upslope temporary cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas;
- Drains, natural flow paths and cut-off drain outlet locations will be identified and charted, in order to ensure that piped crossings can be installed in advance of or adjacent to the track construction;
- Settlement ponds will be constructed in advance of commencing excavations for foundations and at any other locations where dewatering of reduced quality runoff is expected; and
- Trackside drainage swales will be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level.

The prevention measures described above will be in place at all times during the construction phase to prevent the conveyance of silts to receiving watercourses. Further detail on the measures above is elaborated in **Appendix 11.2: Surface Water Management Plan.**

11.8.1.10 Electrical Cable Laying

Cable laying works will be managed and limited in accordance with section 11.8.2 (Responding to Weather) so that execution of the works is undertaken during periods with low rainfall likely to coincide with low superficial groundwater levels in order to reduce the likelihood of runoff entering the excavations.

Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which is included as part of the detailed CEMP at the pre-construction stage.

11.8.1.11 Dewatering of Excavations

The majority of the turbine base foundations will be on bedrock or other hard strata above bedrock (to be confirmed by detailed site investigation prior to detailed design); therefore, deep excavations within bedrock and the associated bedrock aquifer, and dewatering below the bedrock aquifer groundwater table are not anticipated.

Shallow groundwater or rainfall runoff collected in excavations will be discharged via settlement ponds or filter strips prior to entry to the receiving water environment.

Any settlement lagoons or filter strips associated with dewatering will be regularly inspected, particularly after periods of heavy rainfall and prior to periods of forecast heavy rainfall. Maintenance (to clear blockages or remove silt) will be carried out in periods of dry weather where practicable. Maintenance requirements are further considered in **Appendix 11.2: Surface Water Management Plan**.

11.8.1.12 Dust Management

Loose track material generated during the use of access tracks and the construction compound will be prevented from reaching watercourses by surface water drainage systems installed at aggregate based hard standing areas. In dry weather dust suppression methods such as by dust suppression bowser will be employed.

11.8.1.13 Maintenance of Pollution Prevention Measures

All SuDS and additional pollution prevention measures installed will be subject to a regular maintenance regime for the life of the construction phase in order to maintain functionality of all features. This will comprise:

- Unblocking of drains;
- Maintenance of access road and other hard standing surfaces;
- Replacement of filtration features; and
- Removal of silt build-up from settlement and filtration features.

11.8.2 Responding to Weather

The works programme for the construction phase will take account of weather forecasts and predicted rainfall in the region. Monitoring of weather forecasts shall be the responsibility of a suitably qualified Environmental Consultant / Environmental Clerk of Works (ECoW).

Work 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 scale and nature of the work proposed, the proximity to a receiving watercourse, and the amount of rainfall forecast.

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

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

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

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

- Secure all open excavations; and
- Provide temporary or emergency drainage to prevent back-up of surface runoff.

Contractor will avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded. ECoW shall check drainage after rainfall event and prior to recommencement of works.

11.9 MITIGATING MEASURES – OPERATIONAL PHASE

Mitigation of the effects of the Proposed Development will comprise the following:

- Ensure best practice is adhered to on the Site and avoid pollution release to watercourses by incorporating pollution prevention measures (as outlined in **section 11.8.1**) into management policy;
- Permanent welfare facilities will be installed as part of control building / substation facilities. Foul effluent will be disposed of through the use of sealed cesspools or chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on the site); and
- Cyclical maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of access road and other hard standing surfaces, and removal of silt build-up from settlement features. An outline maintenance programme is included in **Appendix 11.2: Surface Water Management Plan**.

11.10 MITIGATING MEASURES – DECOMMISSIONING PHASE

As noted **in section 11.5.3**, activities associated with the decommissioning phase at the end of the operating design life are generally as per those for the construction phase, and

as such, mitigation measures outlined in the construction phase will be followed as appropriate during the decommissioning phase of the Proposed Development.

The Irish Wind Energy Association (IWEA) states that when decommissioning a wind farm "the concrete bases could be removed, but it may be better to leave them under the ground, as this causes less disturbance". As a result, underground cables will be removed while the ducting will be left in-situ. The turbine foundations will remain in-situ, turbine hardstand areas will be remediated to match the existing landscape as closely as possible, and access tracks will be left for use by the relevant landowner(s).

Prior to the decommissioning work, a comprehensive plan will be drawn submitted to the local authority for approval that takes account of the findings of this EIAR and the contemporary legislative requirements at that time, to manage and control the component removal and ground reinstatement.

11.11 WATER QUALITY MONITORING

A water quality monitoring program will be implemented to monitor effects on the surface water quality regime during the infrastructure construction, operational and decommissioning phases of the Proposed Development, in order to:

- Demonstrate that the mitigation measures and surface water management is performing as designed;
- Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment; and
- Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short-term flocculant dosing to suit observed site conditions.

The monitoring would be informed by existing water quality baseline data and baseline monitoring rounds undertaken prior to the commencement of the construction phase.

It is proposed that the water monitoring extent, duration and frequency will be agreed with the local authority or the relevant regulating body post-consent and will nominally consist of physicochemical and biological monitoring. The extent, duration and frequency of the monitoring will be proportionate to the level of activity during each phase of the Proposed Development and the associated perceived risks.

A Water Quality Monitoring Plan is included within the Construction and Environmental Management Plan (CEMP) appended to the EIAR in **Appendix 2.1**.

11.11.1 Mitigated Effects of the Proposed Development (the Site)

Table 11.20: Mitigated Effects

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
On-site watercourses draining the Termonfeckin_010 river sub-basin (Low)	Silt / suspended solid pollution of surface waters	Construction, Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and a not significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Construction & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
		Operational	**Small Beneficial** Minor improvement over baseline water quality conditions	Imperceptible	**Likely** Possible consequential effect in the short to medium term and / or likely but not inevitable in the long term.	**Minor Beneficial** During the operational phase, the change of land use from agriculture within the footprint of the wind farm development will likely have a slight / minor beneficial effect on the receiving water environment compared to existing conditions i.e., water quality (agricultural / nutrient) pressures noted within the on-site Termonfeckin_010 river sub-basin.
On-site watercourses draining the White (Louth)_010 river sub-basin (Medium)	Silt / suspended solid pollution of surface waters	Construction, Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and a not significant temporary change in conditions exceeding natural or pre-existing conditions.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
	Chemical pollution of surface waters	Construction & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
		Operational	**Small Beneficial** Minor improvement over baseline water quality conditions	Slight	**Likely** Possible consequential effect in the short to medium term and / or likely but not inevitable in the long term.	**Minor Beneficial** During the operational phase, the change of land use from agriculture within the footprint of the wind farm development will likely have a slight / minor beneficial effect on the receiving water environment compared to existing conditions i.e., water quality (agricultural / nutrient) pressures noted within the on-site White (Louth)_010 river sub-basin.
On-site watercourses draining the Slieveboy_010 river sub-basin (Medium)	Silt / suspended solid pollution of surface waters	Construction, Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and a not significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Construction, Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Off-site designated site / protected area (Boyne Coast and Estuary SAC / Seapoint Bathing Water Area)	Silt / suspended solid pollution of surface waters	Construction, Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the site to have no effect exceeding normal seasonal or pre-existing fluctuations. Surface water management and pollution control in particular to work in and adjacent to watercourses, is

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
The Site						
(Extremely High / High)						likely to result in no permanent change and a not significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Construction, Operational & Decommissioning	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Bedrock Groundwater / Aquifers (Low)	Chemical pollution of groundwater	Construction, Operational & Decommissioning	**Negligible** No measurable change in groundwater quality. No change to an aquifer.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Bedrock is expected to be shallow in several areas, with limited thickness of superficial deposits; however, depth to groundwater is anticipated to be significant and dominated by fracture flow, offering a limited pollution pathway. Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.
Private Water Supplies (Low)	Disruption to quality of supply	Construction	**Small Adverse** Potential low risk to groundwater from polluted (e.g., construction phase) run-off	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.

11.11.2 Mitigated Effect of the Proposed Development (Grid Connection Route)

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Grid Connection Route						
Surface Watercourses within Termonfeckin_010; Termonfeckin_020; and Tullyeskar_010; river sub-basins (Low to Medium)	Reduced water quality	Construction	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and a not significant temporary change in conditions exceeding natural or pre-existing conditions. Pollution prevention measures proposed to control chemical pollution during construction phase is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Designated Sites (Boyne Coast and Estuary SAC, and River Boyne and River Blackwater SAC) (Extremely High)	Reduced water quality	Construction	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and a not significant temporary change in conditions exceeding natural or pre-existing conditions. Pollution prevention measures proposed to control chemical pollution during construction phase is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Bedrock Groundwater / Aquifers (Low to High)	Reduced Groundwater Quality	Construction	**Negligible** No measurable change in groundwater quality. No change to an aquifer.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution during construction phase is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Grid Connection Route						
Public Supply Source Protection Areas (High)	Reduced Groundwater Quality	Construction	**Negligible** No measurable change in groundwater quality with regards to drinking water supplies.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution during construction phase is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.
Karst Features (High)	Reduced Groundwater Quality	Construction	**Negligible** No measurable change in groundwater quality.	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Pollution prevention measures proposed to control chemical pollution during construction phase is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.

11.11.3 Mitigated Effects of the Proposed Development (Turbine Delivery Route)

Receptor and Sensitivity	Potential Effect	Phase of Development	Magnitude	Potential Effect Significance	Likelihood	Overall Effect Significance and Rationale
Turbine Delivery Route						
Watercourses draining the White (Louth)_010 river sub-basin (Medium)	Reduced Water Quality	Construction	**Negligible** No perceptible changes to baseline conditions. No measurable change in water quality	Imperceptible	**Unlikely** Unlikely that any consequential effect would arise within the lifetime of the development.	**Not Significant** Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and a not significant temporary change in conditions exceeding natural or pre-existing conditions. Pollution prevention measures proposed to control chemical pollution during construction phase is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Designated sites (Dundalk Bay SAC) (Very High)						

11.12 CUMULATIVE EFFECTS

An assessment has been undertaken of the cumulative effect on the water environment of the Proposed Development in conjunction with other known wind farms and other developments that are proposed, in planning, construction, or operation at the time of the application that could give rise to significant cumulative effects.

The assessment aims to determine potential for cumulative impact within the hydrological and hydrogeological setting of the Proposed Development caused by an accumulation of other (similar) developments.

The hydrological and hydrogeological setting for the purposes of the assessment of other developments is the downstream catchments hydrologically connected to the Proposed Development as identified on EPA mapping as described in **section 11.4.6.1** and shown on **Error! Reference source not found.**.

11.12.1 Kilsaran Quarry

The adjacent Kilsaran Quarry has recently been granted planning permission (LCC Reg. Ref. 22109) on the 27th November 2023 to extend the extractive area to include a parcel of land comprising c. 10 ha to a proposed depth of +60 m OD. This area of land is located to the central eastern portion of the Site. The extraction is expected to continue for a period of 25 years.

Within the quarry, all surface water runoff from site hardstanding / yards and pumped discharges from the quarry void sump (comprising mainly rainfall and surface water runoff) are discharged to Slieveboy Stream via a licenced discharge point.

The hydrology and hydrogeology environmental assessment submitted in support of the granted extension notes that there is 'no proposal to amend the existing discharge licence limits in terms of volume or discharge quality.' It concludes that 'no significant effects on the surface water or groundwater environment as a result of the proposed development will occur' also noting that 'monitoring of quarry discharge will continue to ensure no significant effects are occurring on downstream waters.'

A restoration plan is included as part of the permission. It includes proposals to allow the quarry void to naturally flood to form a freshwater lake to provide beneficial ecological habitat for wildlife and an amenity for the wider area. Water levels are to be maintained at 95 m OD by an outfall weir that will flow into an approximately 450 m long constructed stream within the quarry site. It will then discharge to the Slieveboy Stream at the location of the existing licenced discharge point.

The continued operation and subsequent decommissioning of the quarry and implementation of the Proposed Development have potential to interact and cause a cumulative effect in relation to flow rates and potential flooding in the Slieveboy Stream adjacent to the Site. Interactions and potential cumulative effects are addressed as follows:

- The Proposed Development includes a proposed watercourse crossing (culvert) over the Slieveboy Stream to allow an access track crossing. The culvert will be required to be designed to ensure that the proposed access track is flood resilient, and that the culvert does not cause a restriction that could cause flood risk upstream. While the quarry is operational, the hydrology of the stream is highly modified where the majority of the catchment is influenced by the quarry excavation, and discharge is primarily from quarry void sump per the consented discharge rate. When the quarry is decommissioned and restoration plan implemented, inflow hydrology to the Slieveboy Stream will be naturalised but will be highly influenced by the attenuating effect of the quarry lake that will form. The proposed culvert will be designed to accommodate a conservative estimate of flows from a naturalised catchment for the 1% AEP Climate Change design standard, in addition to the artificial pumped discharge rate, which will ensure a precautionary approach.
- The Proposed Development will include discharge of track runoff to the Slieveboy Stream. The discharge will be attenuated and limited to a greenfield equivalent rate (Qbar) to control runoff up to the 1% AEP / 1 in 100-year rainfall event, including allowance for climate change. Where runoff from the Proposed Development is limited in that way then it can cause no change to the existing runoff from the present site conditions, and no new or cumulative effect.

The restoration of the quarry has been considered when evaluating the potential effect of an increased groundwater table caused by filling of the quarry void to form a quarry lake. Aspects of the Proposed Development that could be affected by a change in groundwater table (wind turbine foundations) are to be located > 10 – 20 m above the proposed water levels and would, therefore, not be affected by the proposed restoration plans.

Therefore, no cumulative effects on flows at or downstream from the quarry are likely to occur as a result of the proposals.

11.12.2 Other Developments

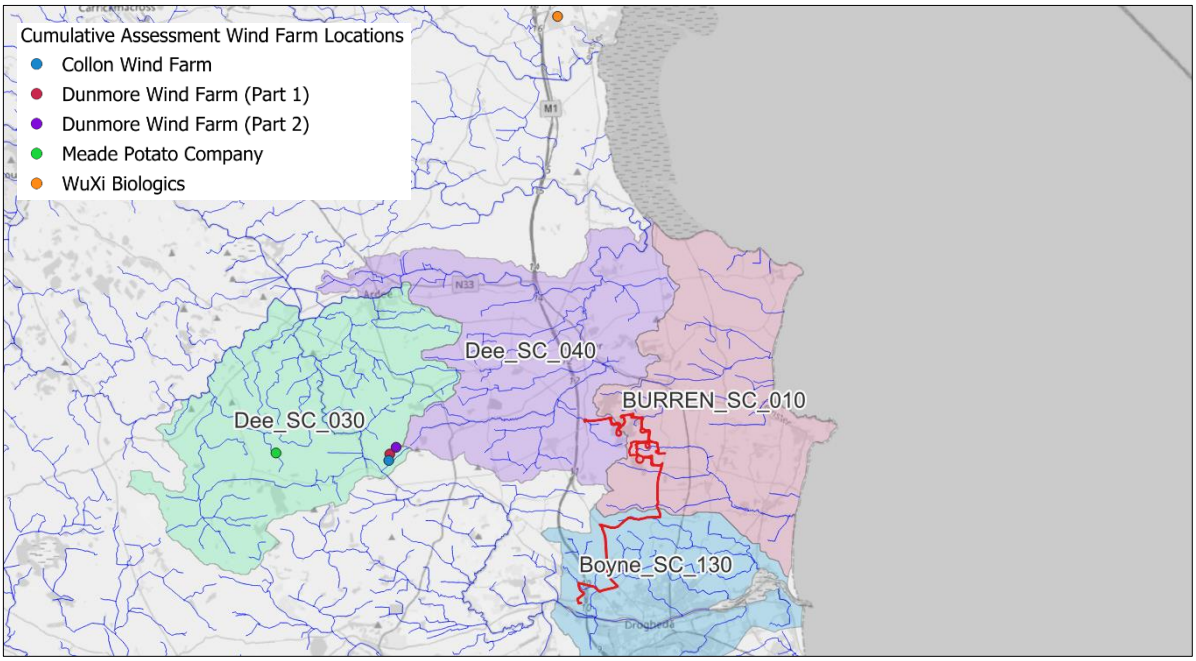
Other developments assessed within the cumulative assessment are outlined in **Table 11.21**. There are 4 no. wind farms within the hydrological and hydrogeological setting of the Site (as described in **section 11.4.6.1** and shown on **Plate 11.21Error! Reference s ource not found.**). All are located to the west and operational, with the closest being 11.7 km away. A single permitted turbine to be located 19.5 km to the north is hydrologically

discrete from the Site and, therefore, is screened out of the cumulative assessment for this chapter.

Table 11.21: Cumulative Assessment

Wind Farm Name	Number of Turbines	Distance and Direction from the Development Site Boundary	Status
Dunmore Wind Farm (Part 1)	2	11.4 km west of the site	Operational
Dunmore Wind Farm (Part 2)	2	11.4 km west of the site	Operational
Collon Wind Farm	1	12.9 km west of the site	Operational
Meade Potato Company	1	17 km west of the site	Operational
WuXi Biologics	1	19.5 km north of the site	Permitted

Plate 11.21: Cumulative Assessment Area & Hydrological Setting



The existing operational wind farms are captured within the baseline conditions assessed in this EIAR and as such the residual effects determined for the Proposed Development are effectively cumulative with those pre-existing developments.

11.12.3 Cumulative Effects Summary

As no likely significant residual water environment effects are predicted arising from the current Proposed Development, there is no potential significant cumulative effect to the water environment in conjunction with any other pre-existing or other proposed / consented development.

11.13 SUMMARY AND CONCLUSION (AND STATEMENT OF SIGNIFICANCE)

This assessment identifies the potential hydrological and hydrogeological impacts, including surface and groundwater quality of the Development. It summarises the relevant legislation

and guidance and provides appropriate baseline information, enabling the potential effects to be identified.

Aspects of the design, construction, operation, and decommissioning of the Development that may potentially affect the receiving water environment have been identified and the pathways for effects assessed.

It has been determined that without mitigation, the Proposed Development has the potential to cause adverse effects to watercourses ranging from "minor" to "moderate" significance primarily driven by the sensitivity (WFD status) of the receiving watercourses and designated site shortly downstream of the Site, and a "minor" adverse effect to groundwater. As such, informed by the baseline assessment and pathways identified, mitigation integrated as part of design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;
- Design of site elements to minimise effects on the water environment;
- A surface water management plan comprising the use of SuDS (drainage) embedded in the design to prevent pathways for pollution; and
- Construction phase pollution prevention procedures (additional mitigation) in accordance with best practice guidance.

Monitoring of the effect of the Proposed Development on the water environment will be provided by the Applicant through physicochemical water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the predicted significance of effect to all receptors to "not significant".

The change of land use within the footprint of the wind farm development will likely have a "slight / minor beneficial" effect during the operational phase on the receiving water environment in the Termonfeckin_010 and White (Louth)_010 river sub-basins compared to existing water quality (agricultural / nutrient) pressures present within these catchments.

As outlined in **section 11.3.4.5**, effects graded below major or moderate significance are not considered to be 'significant' in accordance with the EPA Guidance 2022.

The assessment of the significance of the predicted effect has taken into account the full range of infrastructure proposed by the application. The range of turbines proposed causes no change to work at ground level that would affect the significance of any effect to hydrology. The foundation footprint will remain the same for all turbines within the range and, therefore, there will be no change to the significance of any of the predicted effects on hydrology for all turbines within the proposed range.

As noted in previously (section 11.2.1, section 11.4.7.1, and section 11.4.19.2) a fundamental requirement of the WFD is to attain good ecological status of water bodies and that deterioration in the status of surface water and groundwater bodies is prevented. Any effect that would compromise the achievement of a WFD objective or result in the deterioration in the status of a water body would be a significant adverse effect.

This chapter and assessment outlines embedded and additional mitigation measures specifically in relation to management of water (detailed further in **Appendix 11.2 Surface Water Management Plan**) to prevent deterioration of water quality and quantity. Implementation of the mitigation measures which result in an overall "not significant" effect in EIA terms are also appropriate to ensure that the present WFD status of receiving waterbodies is maintained (i.e., protecting chemical, biological including invertebrate, and general / hydromorphological conditions) and no aspect of the Proposed Development would compromise WFD objectives for improvement.

There is no likelihood of significant cumulative effects over and above any pre-existing effect caused by existing, proposed or consented projects.

11.14 REFERENCES

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