GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Illaunbaun Wind Farm - Environmental Impact Assessment Report

Chapter 10: Hydrology, Water Quality and Flood Risk

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

µS/cm	Microsiemens per centimeter
BOD	Biochemical Oxygen Demand
CDP	County Development Plan
CEMP	Construction Environmental Management Plan
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
EQS	Environmental Quality Standards
EU	European Union
FRA	Flood Risk Assessment
GSI	Geological Survey Ireland
IFI	Inland Fisheries Ireland
IGI	Institute of Geologist of Ireland
ITM	Irish Transverse Mercator (Coordinate Reference System)
mg/l	Milligram per litre
NHA	Natural Heritage Area
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NREAP	National Renewable Energy Action Plan
OPW	Office of Public Works
OSi	Ordnance Survey Ireland
pNHA	Proposed Natural Heritage Area
RES	Renewable Energy Strategy
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
TON	Total Oxidised Nitrogen
WFD	Water Framework Directive

GLOSSARY OF TERMS

Term	Description
Biotic Index (Q-Value)	A biological water quality assessment system used in Ireland that classifies rivers and streams based on the composition of macroinvertebrate communities. Ratings range from Q5 (high quality) to Q1 (poor quality).
Catchment	An area of land where precipitation collects and drains into a common outlet, such as a river, lake or estuary.
Culvert	A structure that allows water to flow under a road, railway, or similar obstruction, typically a pipe or box-shaped conduit.
Geochemical Parameters	Chemical characteristics of water measured to assess quality, such as pH, conductivity, dissolved oxygen, nutrients, and metals.
Hardstanding	An area of ground surfaced with concrete, asphalt or compacted stone to provide a durable, load-bearing surface for construction or operational use.
Hydraulic Conditions	Physical characteristics of water flow in a channel, such as velocity, turbulence, depth and discharge.
Hydrogeology	The branch of geology concerned with the distribution and movement of groundwater in the soil and rocks of the Earth's crust.
Hydromorphology	The physical characteristics of the shape, boundaries, and content of a river or waterbody, including flow regime, sediment transport, and riverbed/bank structure.
Riparian Zone	The interface between land and a river or stream, important for biodiversity and hydrological processes.
Sediment Dynamics	The processes by which sediments are eroded, transported, and deposited within a river system.
Sub-basin	A division of a river catchment used for management and reporting under the Water Framework Directive, generally representing a tributary river system.
Surface Waterbody	A body of surface water such as a river, stream, lake, or reservoir, assessed under the Water Framework Directive for ecological and chemical status.
Suspended Solids	Fine particles of soil, organic matter, or pollutants that remain in water as a suspension, potentially reducing water quality.

Term	Description
Turbidity	The cloudiness or haziness of water caused by suspended particles, which scatter and absorb light. It is a key indicator of water quality as high turbidity can reduce oxygen levels, smother aquatic habitats, and transport pollutants.
Watercourse	A natural or artificial channel through which water flows, including rivers, streams, drains and ditches.
Water Framework Directive (WFD) Status	The ecological and chemical classification of waterbodies under Directive 2000/60/EC, assessed as High, Good, Moderate, Poor, or Bad.

10 HYDROLOGY AND WATER QUALITY

10.1 INTRODUCTION

This chapter of the Environmental Impact Assessment (EIA) Report presents the assessment of the likely significant effects (as per the "EIA Regulations") of the Proposed Development on hydrology and water quality arising from the construction and operation of the Proposed Development, both alone and cumulatively with other plans and projects, and was determined following the issue of the *Illaunbaun Wind Farm - Environmental Impact Assessment Scoping Report* to stakeholders described in Chapter 6: Project Scoping and Consultation.

The primary purpose of this report is to describe the hydrology of the receiving environment and analyse any potential development related effects on it.

This chapter comprises of the following elements:

- Summary of relevant policy and guidance;
- Data sources used to characterise the Study Area;
- Summary of consultations with stakeholders;
- Methodology followed in assessing the impacts of the Proposed Development (such as information of the Study Area and the approach taken in assessing the potential impacts);
- Review of baseline conditions;
- Assessment of likely effects arising from the construction and operation of the Proposed Development;
- Identification of further mitigation measures and/or monitoring requirements (if any) in respect of any significant effects (following the 'mitigation hierarchy' of avoidance, minimisation, restoration and offsets in consecutive order); and
- Summary of residual impact assessment determinations in the case of any additional mitigation measures identified during this process.

10.1.1 RELEVANT LEGISLATION AND GUIDELINES

The following policy, legislation, plans and guidance are considered applicable to this chapter.

10.1.1.1 NATIONAL AND INTERNATIONAL LEGISLATION

- Water Framework Directive (2000/60/EC);
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009);
- European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. No. 77 of 2019);
- European Communities (Quality of Salmonid Waters) Regulations (S.I. No. 293 of 1988);

- Habitats Directive (92/43/EEC);
- European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No. 9 of 2010);
- European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016 (S.I. No. 366 of 2016);
- Local Government (Water Pollution) Act 1977; and
- Local Government (Water Pollution) (Amendment) Act 1990.

10.1.1.2 RELEVANT POLICIES AND PLANS

The Clare County Development Plan 2023-2029 outlines objectives related to water quality, flood risk management and wind energy developments, with which the Proposed Development aligns. These objectives are:

- CDP2.2 - f) To facilitate and support the relevant stakeholders and enterprises in the progression of advancements in climate adaptation solutions and renewable energy generation and technologies.
- CDP2.6 - a) To ensure development proposals have regard to the requirements of the SFRA and Flood Risk Management Guidelines; and where required, are supported by an appropriately detailed hydrological assessment/flood risk assessment.
- CDP2.14 - f) To facilitate the development of energy sources which will achieve low carbon output.
- CDP6.17 - a) To contribute to the economic development and enhanced employment opportunities in the county by:
    - Enabling the development of a self-sustaining, secure, reliable and efficient renewable energy supply and storage for the County in line with CDP Objective 3.3;
    - Facilitating the county to become a leader in the production of sustainable and renewable energy for national and international consumption through research, technology development and innovation; and
    - Supporting on-land and off-shore renewable energy production by a range of appropriate technologies in line with CDP Objective 3.3.
- CDP8.12 - To support the implementation of the National Renewable Energy Action Plan (NREAP), the Clare Wind Energy Strategy and the Clare Renewable Energy Strategy to facilitate the development of renewable energy developments in rural areas to meet national objectives towards achieving a low carbon economy by 2050 subject to the requirement of the RES SEA Environmental Report and the mitigation measures arising from the CDP Appropriate Assessment as contained in Volume 10(a).
- CDP11.47 – c) To support the sustainable development of renewable wind energy (onshore and offshore) at appropriate locations and of its related grid infrastructure in County Clare, in

accordance with all relevant policies, guidance and guidelines pertaining to the protection of the environment and protected habitats and species, and to assess proposals having regard to the Clare Wind Energy Strategy in Volume 6 of this plan and the associated SEA and AA, or any subsequent updated adopted strategy and to National Wind Energy Guidelines.

10.1.1.3 GUIDANCE

- Environmental Protection Agency (EPA) (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- Institute of Geologists of Ireland (IGI) (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.

10.2 ASSESSMENT METHODOLOGY

10.2.1 STUDY AREA AND PROPOSED DEVELOPMENT

The Proposed Development is located across the townlands of Illaunbaun, Tooreen, Slievenalicka, Lackamore and Drumbaun, in west Co. Clare. The site is approximately 3 km inland from the Atlantic Ocean, 5 km south of the town of Lahinch and 3 km northeast of the town of Miltown Malbay. Several watercourses and Lough Keagh are located in the vicinity of the site.

The Proposed Development comprises a wind farm consisting of 6 no. wind turbines and access tracks in Illaunbaun, Slievenalicka, Ballynew and Toreen townlands. The site is a mixture of greenfield, peatland and forestry plantation, and the proposed wind turbines are spread out over an area of over 1.5 km in width from east to west. The proposed access routes extend from Toreen Road and an unnamed local road to the south-southwest and the L1074 to the northwest. The layout of the Proposed Development can be seen in Figure 10-1 below.

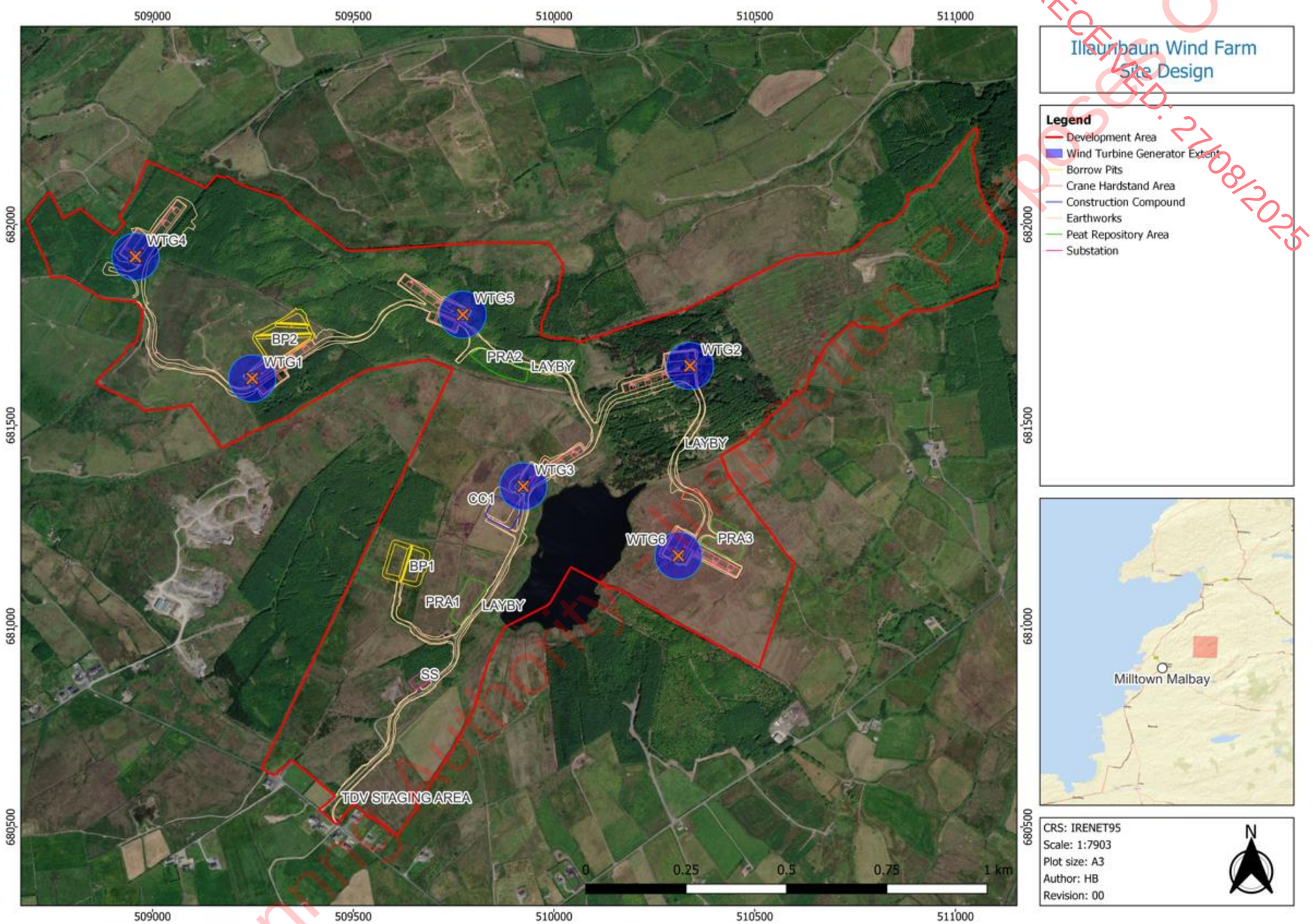


Figure 10-1: Site location

10.2.2 SCALE OF ASSESSMENT

This chapter has considered all possible water sources in the study area across the river sub-basin scale. This includes all surface waterbodies, such as rivers, streams, ditches, drains and the stormwater network, and lake waterbodies, located within the three river sub-basins that encompass the Proposed Development.

Potential impacts were assessed on this river sub-basin scale. The wider context of the surface waters in terms of their designation as part of Water Framework Directive (WFD) waterbodies were also considered where relevant.

10.2.3 SENSITIVITY OF RECEPTORS

The significance/sensitivity of receptors was described following criteria outlined in the EPA Guidelines. The possible rankings are high, medium, low and negligible. In this manner, the sensitivity of each target receptor is evaluated relative to the existing environment.

10.2.4 STATEMENT OF COMPETENCE

Alison Freeley BA MSc - Alison holds a BA in Geography and Geoscience from Trinity College Dublin and an MSc in Risk, Resilience, and Sustainability from University College Dublin. As an Assistant Environmental Scientist, Alison has undertaken numerous Environmental Impact Assessment Screenings and has contributed to the preparation of Environmental Impact Assessment Reports for large-scale flood relief schemes, along with the development of Construction Environmental Management Plans.

Conor O'Neill BA (Mod) MSc Adv Dip - Conor has 5 years of environmental consultancy experience. He has been involved in all aspects of EIAR, from Screening and Scoping to EIAR co-ordination and chapter authoring for numerous projects including the Deansgrange, Castleconnell, and Carrickmines-Shanganagh River Flood Relief Schemes, along with other developments including transport infrastructure, renewable energy, residential, and commercial.

David Casey BSc MSc MCIWEM - David has 14 years of experience in environmental and flood risk assessment, specializing in Strategic Flood Risk Assessments, Flood Risk Assessments, and Environmental Impact Statements, with a focus on Soils & Geology and Hydrology & Hydrogeology. His work on Environmental Impact Statements spans large residential, commercial, and port developments, involving significant collaboration with architects, engineers, and planners.

10.2.5 DATA SOURCES

The following sources of information and references were consulted in the preparation of this report:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022)
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (Institute of Geologists of Ireland, 2013)

- EPAMaps.ie (EPA, 2023)
- OSI.ie – 6" & 25" maps
- Aerial Mapping
- Clare County Development Plan 2023 - 2029

10.2.6 ASSESSMENT OF EFFECTS

To determine the significance of an impact, the description of the effect is compared to the previously mentioned sensitivity of the receiving environment following the matrix shown in Figure 10-2. The significance or sensitivity of each receptor will be ranked, as will the character of the predicted effect.

In accordance with Figure 10-2, for example, a high sensitivity value combined with a high character effect, would result in a "profound" effect; if both were low, the final result would be "slight" or "not significant".

There are seven generalised degrees of effect significance that are commonly used in the EPA guidelines, as it is depicted on the figure: Imperceptible, Not Significant, Slight, Moderate, Significant, Very Significant and Profound.

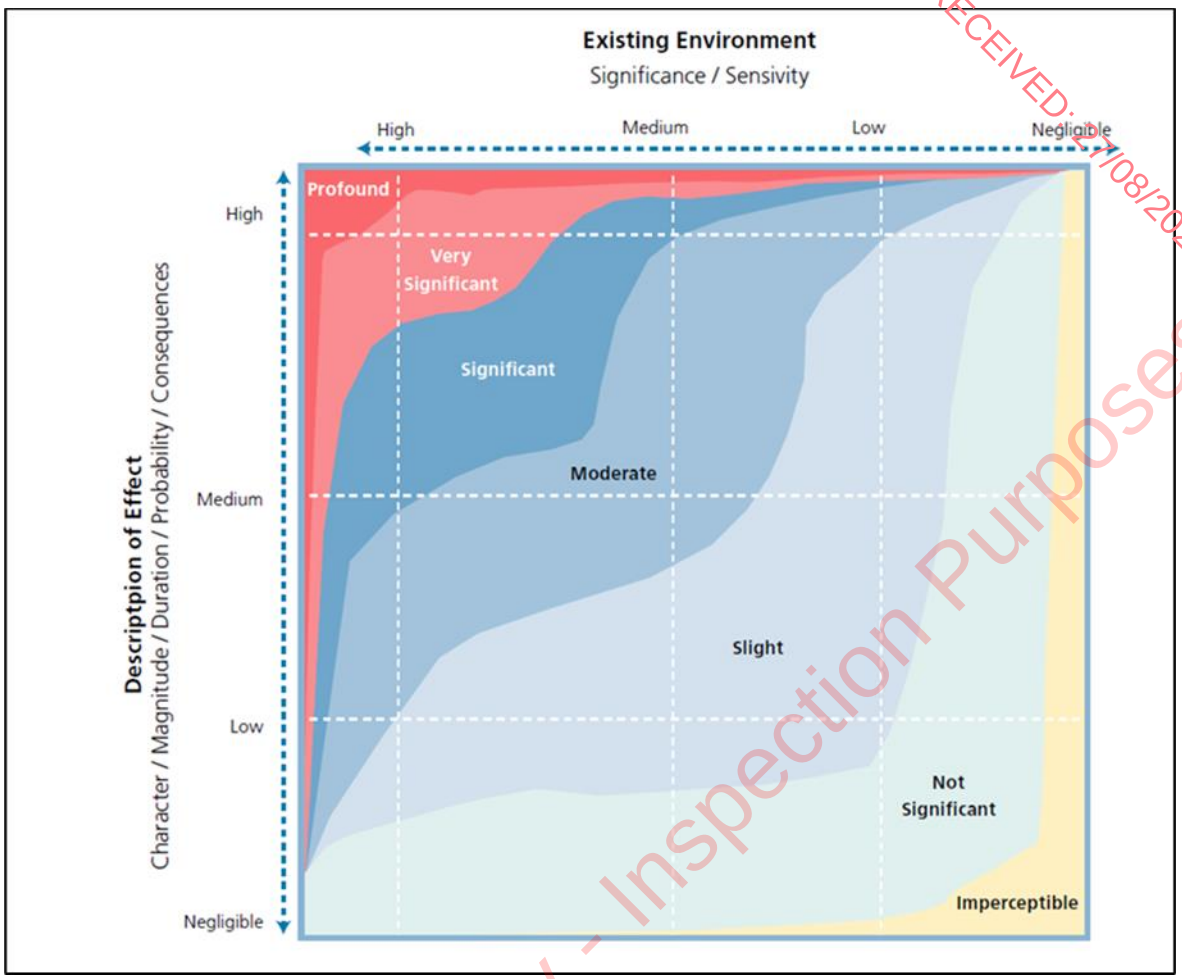


Figure 10-2: Assessment of significance of impacts (EPA, 2022)

In addition to the EPA (2022) Guidelines, the NRA (2009) criteria for assessing the importance of surface water attributes are useful (Table 10-1). These criteria have been used to assist in rating the importance of features, which are then combined with the description of effects as shown in the matrix of significance (Figure 10-2).

Table 10-1: Criteria for rating importance of hydrological attributes (NRA, 2009)

Importane	Criteria	Typical Examples
Extremely high	Attribute has a high quality or value on an international scale	River, wetland or surface waterbody ecosystem protected by EU legislation e.g., 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988
Very high	Attribute has a high quality or value on	River, wetland or surface waterbody ecosystem protected by national legislation - NHA status

Importane	Criteria	Typical Examples
	a regional or national scale	Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

Note: "Extremely high", "very high", and "high" in Table 10-1 all correspond to "high" significance or sensitivity of a feature in the effects significance matrix (EPA, 2022).

10.2.7 LIMITATIONS OF ASSESSMENT

No specific limitations were encountered in this assessment.

10.3 BASELINE: HYDROLOGY AND WATER QUALITY IN RECEIVING ENVIRONMENT

The Proposed Development is situated across several fields, separated by regular field boundaries, and forestry plantations. There are a number of watercourses located around the site, flowing in both north-easterly and south-westerly directions. There is also a lake waterbody, Lough Keagh, which is located within the boundary of the Proposed Development.

10.3.1 HYDROLOGIC ENVIRONMENT

Several watercourses are in the vicinity of the site. These are shown in Figure 10-3.

The Cleedagh River flows past the northwest boundary of the site, flowing in a southwest direction past WTG4 and WTG1.

The Inagh River extends near the northeast boundary of the site adjacent to WTG5 and WTG2, flowing in a northeast direction before draining into Liscannor Bay.

The Glendine River is located approx. 150 m south of the Proposed Development and flows across the site for a proposed cable, in a southwest direction.

A small tributary of the Clooneyogan North Stream is located approx. 1.2 km northeast of the Proposed Development.

Other nearby watercourses include the Freagh River, located approx. 1.6 km northeast of the site, and the Kildeema River, located approx. 1-3 km southeast of the site.

Lough Keagh is located directly adjacent to the Proposed Development, between WTG3 to the west and WTG6 to the east, seen in Figure 10-3.

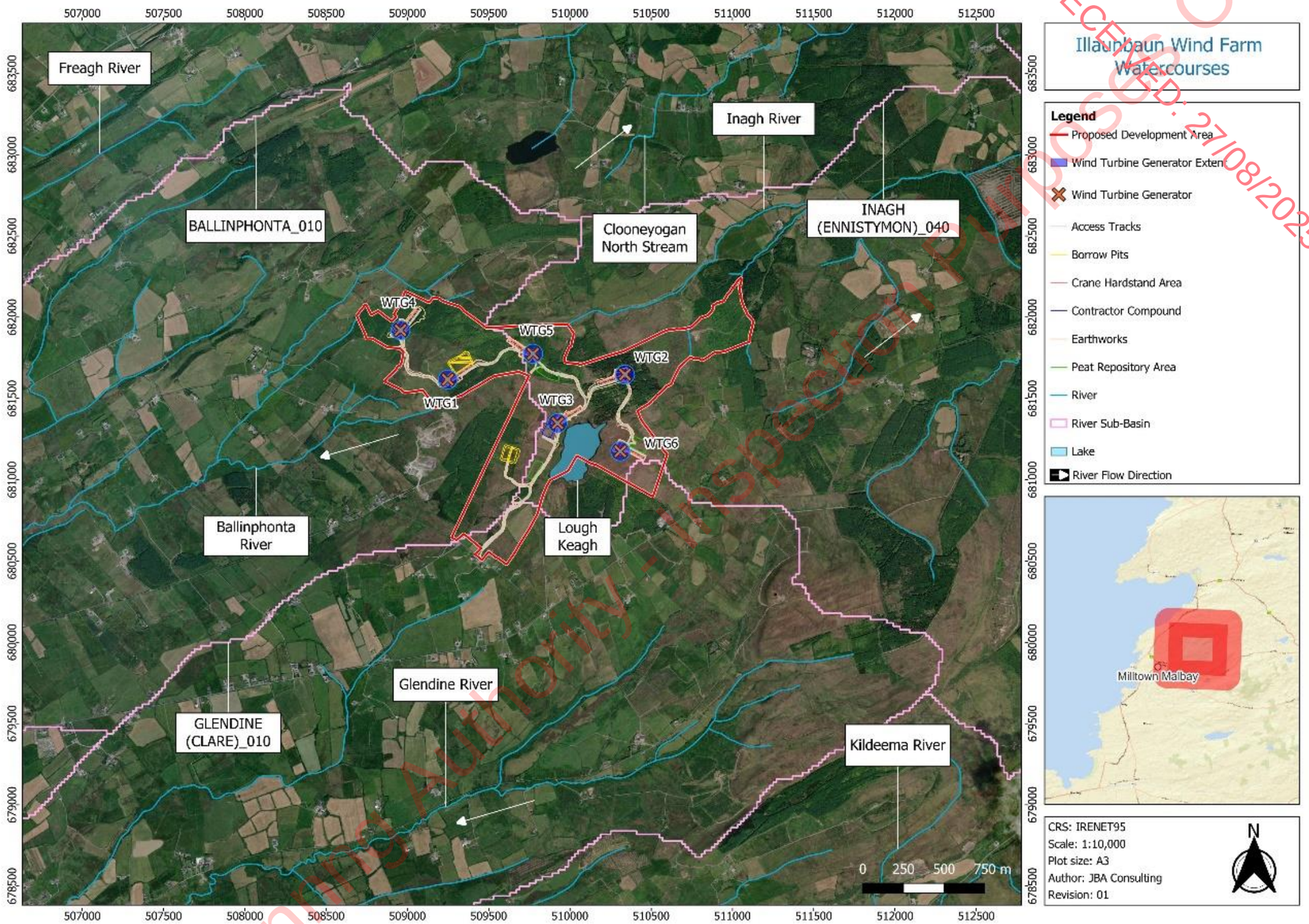


Figure 10-3: Surface waterbodies in the vicinity of the site

10.3.2 WATER FRAMEWORK DIRECTIVE (WFD) STATUS

The site is situated within the Mal Bay Water Framework Directive (WFD) catchment (28). The catchment is 848 km^2 in area (EPA, 2018). The Proposed Development is located across two WFD sub-catchments, the Annagh [Clare]_SC_010 in the west, and the Inagh[Ennistymon]_SC_010 to the east.

WFD sub-catchments are subdivided into river sub-basins, which are the WFD management and reporting divisions. The Proposed Development and surrounding watercourses are situated across three river sub-basins. These are the BALLINPHONTA_010 west of the site, the INAGH (ENNISTYMON)_040 east of the site and the GLENDINE (CLARE)_010 south of the site. The ANNAGH (CLARE)_010 river sub-basin is located downstream of the GLENDINE (CLARE)_010.

There are four WFD river waterbodies adjacent to the project area: BALLINPHONTA_010, CLOONEYOGAN_NORTH_010, INAGH (ENNISTYMON)_040 and the GLENDINE (CLARE)_010.

- The BALLINPHONTA_010 waterbody is at Moderate status under the WFD for 2016-2021 and is At Risk of not meeting its WFD objectives.
- The CLOONEYOGAN_NORTH_010 waterbody is at Good status and its risk status is currently under review.
- The INAGH (ENNISTYMON)_040 waterbody is at Moderate status and is At Risk.
- The GLENDINE (CLARE)_010 waterbody is at Moderate status and is At Risk.

Pressures acting on these rivers include agriculture, forestry, domestic wastewater treatment systems and hydromorphology (EPA, 2023).

10.3.3 SURFACE WATER CHEMISTRY

Surface water sampling was carried out by Gavin and Doherty Geosolutions Ltd on 21st September 2023 to establish the baseline geochemical composition of surface water within the Proposed Development. A summary of the results is included below. Samples were collected from 11 locations which included watercourses within the development boundary, lake bodies and their outflows, existing and planned watercourse crossing points, the proposed cable connection route, and downstream areas receiving drainage from the development. A summary of surface water sampling locations is presented in Table 10-2 below.

Table 10-2: Summary of surface water sampling locations

Sample ID	Watercourse	EPA Code	Location	X ITM	Y ITM
WS_A1	Derrymore River	28D03	Illaunbaun	510235	682012

Sample ID	Watercourse	EPA Code	Location	X ITM	Y ITM
WS_A4	Unnamed stream	N/a	Illaunbaun	510728	681909
WS_A5	Illaunbaun Stream	28I03	Illaunbaun	511085	682020
WS_L1	Lough Keagh	N/A	Slievenalicka and Tooreen	510051	681168
WS_B3	Kilcorcoran Stream	28K11	Ballynew	509568	680425
WS_B4	Kilcorcoran Stream	28K11	Ballynew Bridge	508784	679868
WS_C1	Ballinphonta River	28B03	Drumbaun	509271	681492
WS_C2	Ballinphonta River	28B03	Drumbaun	508558	681320
WS_A9a	Derrymore River	28D03	Illaunbaun	511717	682677
WS_A9b	Fahanlunaghta Beg Stream	28F08	Fahanlunaghta Beg	511750	682663

Surface water sampling was conducted to evaluate the concentrations of key water quality indicators and compare them to the Environmental Quality Standards (EQS) for surface water in Ireland, as outlined in S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations (2019). Laboratory analysis was carried out by Complete Laboratory Solutions (CLS) Ltd, based in Co. Galway. The results are presented in Table 10-3 and Table 10-4 below.

Table 10-3: Geochemical parameters for wind farm surface water quality monitoring (1)

Sample ID	Turbidity (N.T.U)	Total Phosphorus as P (mg/l)	TON as N (mg/l)	Suspended Solids (mg/l)	pH	Orthophosphate as P (mg/l)
*EQS standard**	-	*High status ≤ 0.010 (mean), Good status ≤ 0.025 (mean)*	-	-	*Soft Water 4.5<pH<9.0, Hard Water 6.0<pH<9.0*	*High status ≤0.025 (mean), Good status ≤0.035 (mean)*
WS_A1	3.0	0.038	<0.1	2	6.0	0.006
WS_A4	18.8	0.212	<0.1	40	5.0	0.026
WS_A5	8.3	0.091	0.216	10	7.0	0.036
WS_L1	47.8	0.081	<0.1	189	5.7	0.006
WS_B3	3.0	0.051	<0.1	2	7.2	0.02
WS_B4	4.1	0.101	0.157	2	7.1	0.041
WS_C1	5.7	0.052	<0.1	2	5.3	0.01
WS_C2	13.5	0.081	<0.1	8	6.7	0.012
WS_A9a	3.4	0.044	<0.1	4	6.7	0.012
WS_A9b	4.6	0.067	<0.1	2	7.0	0.02
WS_C4a	5.1	0.111	<0.1	3	6.8	0.023

Table 10-4: Geochemical parameters for wind farm surface water quality monitoring (2)

An analysis of geochemical testing results for surface water quality indicators was conducted, revealing the following trends:

Sample ID	Nitrite as N (mg/l)	Nitrate as N (mg/l)	Iron (mg/l)	Conductivity @ 20°C (µS/cm)	COD (mg/l)	Chloride (mg/l)	BOD (mg/l)	Ammonia as N (mg/l)	Aluminium (mg/l)	Alkalinity (mg/l) CaCO3
*EQS standard**	-	-	-	-	-	-	*High status ≤ 1.3 (mean), Good status ≤ 1.5 (mean)*	*High status ≤ 0.040 (mean), Good status ≤ 0.065 (mean)*	-	-
WS_A1	<0.005	<0.1	1.49	94.4	53	22	<1	0.016	0.176	<10
WS_A4	<0.005	<0.1	11.7	81.6	124	20.8	2	<0.005	0.504	<10
WS_A5	<0.005	0.22	2.45	130	44	17.5	1	0.039	0.430	29
WS_L1	<0.005	<0.1	22.97	84	256	18.2	22	<0.005	0.562	<10
WS_B3	<0.005	<0.1	0.49	132	63	16.2	1	0.016	0.326	39.6
WS_B4	<0.005	0.16	1.69	135	50	19.1	1	0.046	0.284	34.8
WS_C1	<0.005	<0.1	4.17	108	84	26.7	2	0.027	0.343	<10
WS_C2	<0.005	<0.1	2.43	123	64	24.9	1	0.019	0.800	13
WS_A9a	<0.005	<0.1	1.78	99.6	52	20.9	1	0.016	0.271	13.2
WS_A9b	<0.005	<0.1	1.61	106	43	16.7	1	0.02	0.268	22.4
WS_C4a	<0.005	0.0.1	1.48	143	43	26.9	<1	0.034	0.299	16.6

10.3.3.1 BASIC FIELD PARAMETERS

- Biochemical Oxygen Demand (BOD): Levels at the Proposed Development site fall within the "High status" threshold of ≤1.3 for river water quality, as per the Surface Water Regulations (2019).
- Conductivity: Ranges from 81.6 to 143 µS/cm across the site, consistent with expected values for surface waters.
- pH Levels: Generally range from 6.7 to 7.2 for most samples. Slightly acidic values below 6 were noted at WS_A4 and WS_C1.
- Alkalinity: Low across the site, with a maximum of 39.6 mg/l CaCO3 recorded at WS_B3. Alkalinity levels below 10 mg/l CaCO3 at WS_L1 and WS_A1 suggest Lough Keagh and Lough Abullaunduff fall within the low alkalinity lake threshold (<20 mg/l CaCO3) as per the Surface Water Regulations (2019).

10.3.3.2 NUTRIENTS

- Nitrate as N and Nitrite as N: Concentrations are very low, with nearly all samples below the limit of detection.
- Total Phosphorus as P: Does not meet the "Good" status threshold under the Surface Water Regulations (2019). Lough Keagh recorded 0.081 mg/l, exceeding the lake threshold of 0.025 mg/l.
- Ammonia as N: Most samples fall below the "High status" threshold of ≤0.040 mg/l, with all samples meeting the "Good" status threshold of ≤0.065 mg/l.
- Orthophosphate as P: Most samples meet the "Good" status threshold of ≤0.035 mg/l, with slight exceedances at WS_A5 (0.036 mg/l) and WS_B4 (0.041 mg/l).

10.3.3.3 OTHER PARAMETERS

- Iron: Slightly elevated concentrations were observed at Lough Keagh (WS_L1) and WS_A4 but did not exceed 23 mg/l.
- Suspended Solids: A high level of 189 mg/l at WS_L1 is likely due to sampling near the lake shoreline and potential disturbance of lakebed materials. Most other samples returned levels below 10 mg/l, except for WS_A4, which recorded 40 mg/l.

10.3.4 EPA Q RATING

The EPA's biological river water quality classification is based on macroinvertebrate biological sampling at water monitoring stations. The values and their interpretation are shown in Table 10-5.

Table 10-5: Q value ratings and interpretation

Q Rating	WFD Status	Pollution
Q5 or Q4-5	High	Unpolluted
Q4	Good	Unpolluted
Q3-4	Moderate	Slightly Polluted
Q3 or Q2-3	Poor	Moderately Polluted
Q2, Q1-2 or Q1	Bad	Seriously Polluted

There are seventeen EPA water monitoring stations which have Q ratings from 1988 to 2021 downstream of parts of the Proposed Development. The water quality status at the stations varies from high to poor. These are detailed in Table 10-6 below and are shown in Figure 10-4: Q values

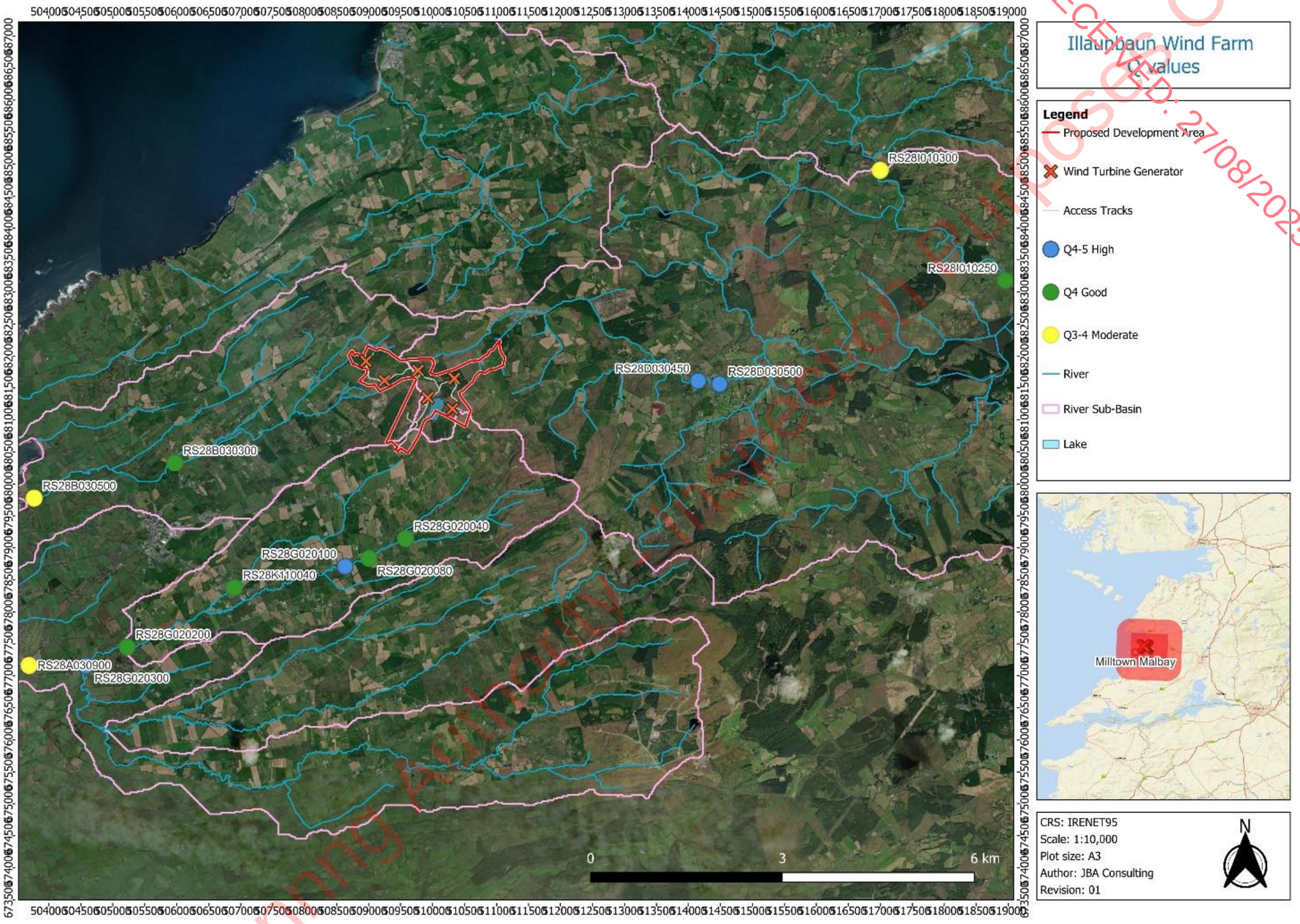


Figure 10-4: Q values

Table 10-6: Q values recorded at nearby stations

Station code	Location and hydrological distance	Year measured	Q rating	Status
BALLINPHONTA_010 River Sub-Basin:				
RS28B030500	Cleedagh Bridge (7.7km d/s proposed site)	2021	3-4	Moderate
RS28B030300	BALLINPHONTA - Bridge S.W. of Ballinphonta (5km d/s proposed site)	2006	4	Good
GLENDINE (CLARE)_010 River Sub-Basin:				
RS28K110040	Br u/s confl with S. Branch (3.6km d/s proposed site)	1991	4	Good
RS28G020200	Knockloskeraun Bridge, S of M (5.6km d/s proposed site)	2021	4	Good
RS28G020100	GLENDINE (CLARE) - Honan's Bridge (2.5km d/s proposed site)	1991	4-5	High
RS28G020080	GLENDINE (CLARE) - Second Bridge u/s Honan's Br (2.1km d/s proposed site)	2006	4	Good
RS28G020040	GLENDINE (CLARE) - Br u/s confl with S. Branch (1km d/s proposed site)	1991	4	Good
ANNAGH (CLARE)_010 River Sub-Basin:				
RS28G020300	GLENDINE (CLARE) - Bridge u/s Annagh River (8.6km d/s proposed site)	1988	4-5	High
RS28A030900	Bridge u/s Mouth of River (9.5km d/s proposed site)	2021	3-4	Moderate
INAGH (ENNISTYMON)_040 River Sub-Basin:				

Station code	Location and hydrological distance	Year measured	Q rating	Status
RS28I010300	Moananagh Bridge (16.7km d/s proposed site)	2021	3-4	Moderate
RS28I010250	INAGH (ENNISTYMON) - Renalicka Bridge (13.1km d/s proposed site)	1991	4	Good
RS28D030500	DERRYMORE - Derrymore Bridge (5.5km d/s proposed site)	1991	5	High
RS28D030450	DERRYMORE - Cloonanaha Br (5.1km d/s proposed site)	1991	4-5	High

10.3.5 LAKE WATERBODIES

Lough Keagh is located directly adjacent to the Proposed Development, located approx. 10 m from a proposed wind turbine. It is approx. 7 ha in size. Based on EPA mapping (EPA, 2023), there are no identified inflow or outflow points. However, satellite imagery indicates a possible connection to a headwater of the INAGH (ENNISTYMON)_040 watercourse through a field drain to the northeast. This connection might be seasonal or related to periods of high rainfall. Lough Keagh is a WFD lake waterbody at Moderate status and is At Risk of not meeting its WFD objectives. Pressures acting on this waterbody include forestry.

Other lakes in the vicinity of the Proposed Development are Lough Abullanduff and Ailbrack Lough. For the purposes of WFD classification, these are part of nearby river waterbodies.

Ailbrack Lough is located approx. 1 km north of the Proposed Development. There is no hydrological connection between the site and Ailbrack Lough. It is visible on satellite imagery, but it is not classified as a WFD lake waterbody.

Lough Abullanduff is shown on historical OSi maps from the 19th and 20th century. The lake appears dry on satellite imagery but its outline is visible, and it is mapped on online sources from Geological Survey Ireland (GSI) and the EPA. The lake is located north of the Proposed Development and is approx. 2.6 ha in size. Satellite imagery reveals vegetation changes at the lake boundary, indicating that the lake's morphology may vary seasonally or during periods of higher precipitation.

10.3.6 FLOOD RISK

A Flood Risk Assessment (FRA) has been prepared for the Proposed Development. The FRA was prepared in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHLG & OPW, 2009). The objectives of the FRA were to:

- Identify potential sources of flood risk;

- Confirm the level of flood risk and identify key hydraulic features;
- Assess the impact that the Proposed Development has on flood risk; and
- Develop appropriate flood risk mitigation and management measures which will allow for the long-term development of the site.

The source of the flood zone data within the closest proximity to the site (NIFM, GSI Winter 2015/2016 Surface Water Flooding mapping and Seasonal Flood Mapping 2020/2021) was considered suitable for the Stage 2 Initial Flood Risk Assessment. This is confirmed by the Stage 2 site specific FRA, after review of the GSI Winter 2015/2016 Surface Water Flooding and Seasonal Flood Mapping 2020/2021. Risk to the site has been managed through the positioning of a minimum distance of a 50 m buffer from surface watercourses, and wind turbines will be located outside of flow paths to ensure there is adequate distance between electrical equipment and water. It was deemed hydrological and hydraulic analysis was not necessary in this instance.

As a result of the analysis undertaken of the available data, and of review of mitigation measures, it is concluded that the development is in compliance with the core principles of the Planning System and Flood Risk Management Guidelines and appropriately manages risk.

10.3.7 PROTECTED ECOLOGICAL ENVIRONMENT

Natura 2000 sites (Special Areas of Conservation (SAC) and Special Protection Areas (SPA), Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA)) in the vicinity of the Proposed Development are shown in Table 10-7. Impacts on the surface water environment could lead to indirect effects on these protected sites.

Table 10-7: Natura 2000 sites within 15km of the Proposed Development

Natura 2000 site	Straight line distance	Hydrological distance (downstream distance)
Cliffs of Moher (SPA, pNHA)	9.4 km	n/a
Mid-Clare Coast (SPA)	6.6 km	7.7 km
Inagh River Estuary (SAC, pNHA)	6 km	23.8 km
Carrowmore Dunes (SAC)	14.3 km	n/a
Carrowmore Point to Spanish Point and Islands (SAC, pNHA)	6.6 km	7.7 km
Lough Naminna Bog (NHA)	10.1 km	n/a

Natura 2000 site	Straight line distance	Hydrological distance (downstream distance)
Slievecallan Mountain Bog (NHA)	3.4 km	n/a
Cragnashingaun Bogs (NHA)	8.7 km	n/a
Lough Acrow Bogs (NHA)	12.1 km	n/a
Lough Goller (pNHA)	14.3 km	n/a
White Strand/Carrowmore Marsh (pNHA)	14.3 km	n/a
Caherkinallia Wood (pNHA)	13.4 km	n/a

10.3.8 ASSESSMENT OF IMPORTANCE OF ATTRIBUTES

The attributes discussed above have been assessed using the criteria outlined in Table 10-1: Criteria for rating importance of hydrological attributes (NRA, 2009) and given the following importance ratings seen in Table 10-8 below.

Table 10-8: Importance ratings for hydrological attributes

Attribute	Importance	Rationale
BALLINPHONTA_010 River Sub-Basin	High	Q values of surface waterbodies within river sub-basin are Q3-4
GLENDINE (CLARE)_010 River Sub-Basin	Very High	Q values of surface waterbodies within river sub-basin are Q4
INAGH (ENNISTYMON)_040 River Sub-Basin	High	Q values of surface waterbodies within river sub-basin are Q3-4
River Cleedagh	High	River of local importance with a Q rating of 3-4 'Moderate' WFD status and 'At Risk'
Inagh River	High	River of local importance with a Q rating of 3-4

Attribute	Importance	Rationale
		'Moderate' WFD status and 'At Risk'
Glendine River	High	River of local importance with a Q rating of 4 'Moderate' WFD status and 'At Risk'
Clooneyogan North Stream	Medium	River of local importance 'Good' WFD status
Lough Keagh	Medium	Lake used locally for fishing 'Moderate' WFD status
Mid-Clare Coast SPA	Extremely High	River ecosystem protected by EU legislation

10.4 ASSESSMENT OF EFFECTS

Predicted impacts during construction and operation of the proposed wind farm, and under a 'Do Nothing' scenario which presents an outline of the evolution of the baseline in the absence of the proposed wind farm, are discussed below. This EIA focused on likely significant effects.

10.4.1 "DO-NOTHING" SCENARIO

If the Proposed Development is not constructed, the existing land use would remain unchanged. Consequently, the hydrology would remain unaffected under this 'Do-Nothing' scenario. The effect on hydrology in the do-nothing scenario is neutral.

10.4.2 CONSTRUCTION PHASE IMPACTS

Construction activities of the wind farm, which have the potential to impact the surface water environment, are listed below:

- Excavation and construction of 3500 m of new founded tracks, 350 m of new floated track, 880m of track upgrade;
- Excavation and construction of six turbine foundations;
- Excavation and construction of six permanent crane hardstandings;
- Cable laying within track verges;
- Internal electrical cable laying circa 3.3 km;
- Installation of temporary construction compounds;
- Storage and use of oils and fuels;
- Extraction of aggregate via borrow pits;
- Backfilling of borrow pits with excavated peat;
- Stockpiling of excavated soils and peat, including permanent peat storage areas;
- Side casting of excavated peat along access tracks;
- Tree felling to create access track corridors and space for turbines and additional structures;
- Installation of cut-off drains;
- Installation of drains, both temporary and permanent;
- Dewatering of excavations and trenches;
- Discharge of surface water and groundwater from excavations;
- Temporary watercourse diversions; and
- Concrete mixing and pouring.

Construction activities are expected to last approximately 12 to 18 months. The potential impacts of these works to the water environment (without mitigation) are discussed below:

10.4.2.1 FINE SEDIMENT POLLUTION

During construction, the water environment is at risk from fine sediment pollution from the following sources:

- Excavation of, or import of, fill material on site that is stored near or adjacent to the river network;
- Ground that is exposed following vegetation clearance adjacent, or near to, the river network;

- Tree felling;
- Installation of watercourse crossings; and
- Interaction between machinery and the riparian environment, such as for excavations required for access tracks or turbine foundations.

There are several potential pathways for fine sediment to be mobilised from these sources to receptors. Surface water runoff during a precipitation event could wash fine sediment from stores or exposed ground into the river network, either directly via surface runoff pathways or indirectly via the stormwater drainage network. During construction, machinery operating within the riparian environment may knock exposed sediment directly into the river channel or move material to a position where, should a precipitation event occur, it would be more vulnerable to mobilisation by surface water runoff (either as sheet flow or slumping of sediment piles into the channel).

Fine sediment pollution refers to both the fine sediment itself and urban pollutants that can be adsorbed onto the fine particles and transported along with them. Once fine sediment enters the water, it can disperse through the water column as suspended sediment. Suspended sediment affects physico-chemical water quality parameters by increasing turbidity and reducing dissolved oxygen. Changes in these conditions, along with toxicity effects associated with adsorbed urban pollutants, can pose a risk to the life of aquatic species. Settlement of fine sediment over instream geomorphic features such as coarse sediment deposits (e.g., riffles and bars) can smother these important physical habitat environments, rendering them unsuitable for aquatic species.

A fine sediment pollution event would be expected to immediately impact the local environment, and to subsequently affect downstream environments as the fine sediment is flushed through the system during flushing flow conditions (e.g., winter high flow events). It may take several years for a single fine sediment event to be flushed through the system, but given flushing is expected, the effect on water quality and instream features is expected to be reversible. The effects of urban pollutants on aquatic life are unclear. While these pollutants are expected to be entering the river network to some degree, a fine sediment pollution event would represent an intensification of that pollution pressure. Taken together, the magnitude of potential impacts on water without mitigation measures in places is high, leading to a *significant, short-term, adverse* impact on the surface water environment due to fine sediment pollution.

10.4.2.2 ACCIDENTAL SPILLS AND LEAKS

During construction, there is a risk of localised accidental pollution incidences from the following sources:

- Spillages or leakage of temporary oils and fuels stored on site;
- Spillages or leakage of oils and fuels from construction machinery or site vehicles;
- Spillage of oil or fuel from refuelling machinery on site; and
- Run-off from concrete and cement during the construction of turbine foundations or crane hardstandings.

There are several potential pathways for these pollutants from their sources to receptors. A direct hydrological link to surface water exists should an accidental spill or leak occur directly into the watercourse during construction, or on land, and be allowed to flow overland to the watercourse. A spill or leak could also discharge to the existing surface water drainage network and subsequently discharge to the river network. During construction, compaction of the soil or subsoil could occur due to the use of heavy machinery in green areas. This could reduce infiltration rates and increase surface water runoff, further acting as a pathway for potential pollutants.

The potential pollutants described above could negatively impact surface water quality if allowed to reach them. Concrete (specifically the cement component) is highly alkaline, and any potential spillages can be detrimental to surface water quality. Changes in pH of the waterbody resulting from spills of concrete material would have a consequent effect on aquatic species. Spillage of oil or other similar contaminants, which are likely to be in use during construction, would similarly negatively impact the water environment.

An accidental spill or leak is likely to be an isolated event if it occurs in a specific geographical area. The entire water environment as described above is therefore not likely to be affected, with effects likely only within one river sub-basin and the immediate area downstream. Taken together, the magnitude of potential impacts on water without mitigation measures in places is high, leading to a *significant, temporary, adverse* impact on the surface water environment due to fine sediment pollution.

10.4.2.3 DRAINAGE WORKS

During construction, there is a risk that drainage works could directly affect both the in-channel and riparian environments in additional ways to the fine sediment pollution discussed in the previous section. A potential source is the installation of culverts for watercourse crossings.

The installation of culverts for the construction of watercourse crossings may create localised changes in hydraulic conditions that alter local sediment dynamics (e.g. promote bankside erosion). This can create additional fine sediment pressures and/or promote undercutting of banks. Vegetation clearance may temporarily reduce localised bank stability depending on the nature of the existing bank material and the stabilising effect of the local specific vegetation.

Changes to the hydromorphology of the river network are likely to be limited in extent and magnitude due to the Proposed Development layout. Direct interactions with watercourses will be limited to required drain crossings, and any impacts on hydromorphology are likely to be temporary as the river will adjust once the works are completed and the pressure removed. Natural sediment dynamics will flush fine sediments through the network gradually, and monitoring will be necessary to observe how quickly the riverbanks will naturally revegetate following the construction of the Proposed Development. The magnitude of potential impacts on water will be medium, leading to a *moderate, short-term, adverse* impact on the surface water environment due to drainage works.

10.4.3 OPERATIONAL PHASE IMPACTS

The potential impacts on the water environment during the operation phase refer to both the static ongoing operation of the proposed wind farm and to any specified maintenance requirements.

10.4.3.1 OPERATIONAL DRAINAGE

The operational drainage design has the potential to cause some impacts; however, it is expected to largely follow the existing overland flow pathways. Culverts will be installed along any drainage channel encountered to further minimise any significant changes to the current drainage patterns and as a result, there will be a *permanent, slight, negative* to *neutral* impact on the surface water environment.

10.4.3.2 MAINTENANCE

During operation, activities associated with the maintenance of the wind farm have the potential to impact water. This includes the ongoing use of the substation, access tracks and storage compound of fuels and hydrocarbons, vehicular use, and the maintenance of turbines, access tracks and cables. As discussed above, potential impacts of these activities on water include fine sediment pollution and accidental spills and leaks, such as fuel leakage from vehicles used to maintain the wind farm. Together, the magnitude of potential impacts on water will be medium, leading to a *moderate, short-term, adverse* impact on the surface water environment due to maintenance works.

10.5 MITIGATION MEASURES FOR HYDROLOGY AND WATER QUALITY

In the impact assessment discussed above, a range of potential effects on water were identified. Mitigation measures in the construction and operational phase of the Proposed Development will be implemented to reduce these adverse effects. Most measures are required during the construction phase as it will pose the greatest level of risks due to the construction activity on site, plant construction and use of construction materials and the soil on site. In the sections below the mitigation measures for the do-nothing scenario, construction phase and operation phase are discussed.

10.5.1 "DO-NOTHING" SCENARIO

In the do-nothing scenario, no mitigation measures will be required.

10.5.2 CONSTRUCTION PHASE MITIGATION MEASURES

Mitigation measures during the construction phase are discussed below. These mitigation measures have been developed with the source-pathway-receptor links above in mind and are designed to break this link either by removing the source or disrupting the pathway for pollution.

10.5.2.1 BEST PRACTICE CONSTRUCTION METHODS

A preliminary Construction Environmental Management Plan (CEMP) has been prepared for the Proposed Development and will be put in place by the appointed contractor. The CEMP will be used by the contractor to prevent and minimise environmental effects during construction. It includes the below to mitigate impacts on water.

10.5.2.2 SURFACE WATER RUNOFF

Surface water generated on site from rainfall will be prevented from flowing across active works areas or materials storage areas. Rainwater that collects in these areas will, prior to being discharged, pass through a settling tank or settlement lagoon.

Temporary storage of soil will be carefully managed to prevent any potential negative effects on the receiving hydrological environment. The material will be stored away from any existing drains or flow pathways within the site. Movement of material will be minimised to reduce degradation of soil structure and generation of dust. Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations.

Weather conditions will be monitored when planning construction activities, to minimise the risk of run-off from the site and the suitable distance of topsoil piles from drainage ditches/sewerage systems will be maintained. In the event of an extended period of dry weather, stockpiles will be dampened using a water spray. The level of spraying will be sufficient to just dampen the soil to avoid dust blow and avoid excessive runoff that could arise during this process. Site roads will also be subject to similar mitigation to avoid dust blow.

10.5.2.3 FINE SEDIMENT POLLUTION

Mitigation for the protection of surface water quality from runoff carrying fine sediments and urban pollutants involves silt control measures. These include proper planning of works, site compound construction, storage management and excavation plans, as follows:

- The CEMP will include the mitigation measures outlined in this EIAR to address sediment control during construction and the potential risk of sediments and various pollutants being release into the local watercourse. This includes silt fencing, runoff control and measures to prevent contaminants from entering the stormwater by proper storage of hazardous materials and waste management practices.
- Planning of works will be conscious of available weather forecasts and avoid working during heavy rain/storm events to minimise the risk of runoff that may be in excess of the capacity of the runoff control measures outlined in this EIAR. If working during precipitation events cannot be avoided, then runoff control measures will be actively monitored during the works to ensure their capacity is not compromised.
- Adherence to best practice guidance for pollution prevention and sediment management measures (e.g., use of oil booms, spill kits, and silt fences etc.) will be applied.
- The contractor will construct a site compound at a location remote from any drains, at a minimum distance of 10m.
- All soil stockpiles will be covered (i.e., with a tarpaulin or vegetated) to minimise the risk of rain/wind erosion. Vegetation will be established as soon as possible on all exposed soils.
- In the event of an extended dry period, stockpiles will be dampened using water to minimise the risk of airborne particles entering watercourses.

- Excavations will remain open for as little time as possible before the placement of fill to minimise the potential of water ingress into excavations.
- Management/Response plans will be implemented to identify mobilisation of soil particles/pollution and initiate the interception and treatment of pollution/silt run-off.
- Silt fencing or other appropriate measures will be put in place downstream of exposed soils or soil stockpiles.

10.5.2.4 ACCIDENTAL SPILLS AND LEAKS

To avoid and manage accidental spills and leaks a series of measures listed below will be implemented. The main contractor and sub-contractors will be responsible for ensuring their implementation:

- An Emergency Plan for the site will be established by the main contractor prior to work commencing at the site. The Emergency Plan will contain contact details for statutory bodies such as the NPWS, Clare County Council and Inland Fisheries Ireland. All site workers will be made aware of the plan and its location in the site offices.
- There will be no refuelling of machinery within or near the watercourses located in the study area. Refuelling will take place at designated locations at distances of greater than 30 metres from the watercourse.
- No vehicles will be left unattended when refuelling, and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel needed to be stored on the site will be stored appropriately and at a location that is set back from the river and lake. All other construction materials will be stored in this compound. The compound will also house the site offices and portable toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.
- All liquids, solids and powder containers will be clearly labelled and stored appropriately in sealable containers. Storage of fuels and oils will be in the main contractor's compound only.
- Spill protection equipment such as spill kits, absorbent mats, oil booms, and sand will be available for use in the event of an accidental spill. These will be disposed of correctly if used and replaced with new ones immediately. Disposal records for used absorbent materials will be retained by the Site Manager.
- The contractor will implement measures for the regular inspection of bunds and emptying of rainwater (when uncontaminated). Bunding must have a minimum capacity of 110% of the volume of the largest tank or 25% of the total storage capacity, whichever is greater. Bunding will be impermeable to the substance that is being stored in the tank.
- The use of settling lagoons, settling tanks, or equivalent, with outflow control measures will be used for the interception of surface water pumped from an active working area.

- The Contractor will clean equipment prior to delivery to the site. The Contractor will avoid using equipment which leaks fuel, hydraulic oil or lubricant. The Contractor will maintain equipment to ensure efficiency and to minimise emissions.
- Management/Response plans will be implemented to identify mobilisation of soil particles/pollution and initiate the interception and treatment of pollution/silt runoff.
- Precast concrete elements should be maximised to avoid wet concreting in close proximity to water.

10.5.2.5 DRAINAGE WORKS

To reduce the potential impacts from drainage works the following mitigation measures are proposed:

- All drainage works will be supervised by an Ecological Clerk of Works (ECoW), and safe concreting measures during construction will be implemented.

10.5.3 OPERATIONAL PHASE MITIGATION MEASURES

During the operational phase, the operator of the wind farm will put the mitigation measures outlined in Section 10.5.2 in place during maintenance works. In addition, the proposed surface water drainage network design includes the following mitigation measures. Dirty water relief drains, spaced at 200mm intervals along the access tracks, will collect and divert runoff with sediments. Filtration check dams will be installed to slow down the water flow, reduce erosion, and help sediments settle. Swales and clean water cross drains will channel clean water across the site, preventing it from mixing with runoff containing sediment. Additionally, scour protection measures will be implemented to prevent erosion and maintain the integrity of the clean water channels.

10.6 ASSESSMENT OF RESIDUAL EFFECTS

Following the implementation of the recommended mitigation measures and the final design and layout of the scheme, the magnitude and significance of the residual effects is discussed in the following sections.

10.6.1 CONSTRUCTION PHASE

With mitigation measures in place during the construction phase of the proposed wind farm, the residual effects to surface water will be reduced to slight, temporary, adverse, and not significant.

10.6.2 OPERATIONAL PHASE

During the operation phase of the Proposed Development, due to the maintenance requirements of the wind farm, the residual effects will be slight, long-term, adverse, and not significant.

10.7 MONITORING

Monitoring will ensure the proper implementation of mitigation measures during construction, set out in this EIAR. The frequency and reporting procedures should be agreed with the NPWS and IFI

before commencement of the work. All monitoring records should be maintained by the Project Manager or their nominated assistant. The monitoring will include:

- Records of regular inspection, on bunds, vehicles, and oil storage on site according to the CEMP
- Records of silt fencing conditions and placement
- Records of any water ingress during excavation

Monitoring of surface water on quantitative and qualitative parameters during construction will be carried out. As a minimum, the following parameters will be recorded in surface waters: pH, conductivity, chemical oxygen demand, suspended solids and total dissolved solids. If monitored levels exceed the threshold levels outlined in S.I. No 77/2019 European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019, mitigation measures to protect surface water will be reviewed by the environmental manager acting on behalf of the contractor. On-going water quality monitoring across the three river sub-basins in the study area will identify the success of the mitigation measures/operating practices installed.

10.8 INTERACTIONS

Impacts to surface water have the potential to interact with the following environmental factors.

10.8.1 BIODIVERSITY

A river network serves as a valuable ecological corridor, providing habitats for a number of significant and protected species. Impacts on waterbodies within such networks can affect aquatic habitats and the species they support. Key potential impacts include accidental sediment release, pollution from spills or leaks, and disruption to habitats caused by instream or bank-side activities. Mitigation measures included in the Water chapter and the Biodiversity chapter will ensure that no significant interactive effects occur.

10.8.2 LAND AND SOIL

Hydrogeology is linked with surface water networks. Surface water run-off can directly affect soil quality and condition through deposition or withdrawal of chemicals, suspended solids, and nutrients. During construction, eroded material can enter surface water, causing an influx of sediments. This has the potential to increase suspended sediments. Through implementation of mitigation measures outlined in the Land and Soil and Water chapters of the EIAR, the potential impact through interaction is reduced to *short-term, slight, negative*.

10.9 CUMULATIVE IMPACTS

Several wind farm developments are located near the Proposed Development, predominantly clustered 10–15 km to the south-southeast. These include Booltiagh Wind Farm, Glenmore Wind Farm, Boolynagleragh Wind Farm, Lissycasey Wind Farm, Kiltumper Wind Farm, and Cahermurphy Wind Farm. The distance between these wind farms and the Proposed Development is considered sufficient to avoid any cumulative effects on the receiving environment.

10.10 SUMMARY

Table 10-9: Summary of effects

Potential Effect	Construction / Operation	Beneficial / Adverse/ Neutral	Extent (Site/Local/ National / Transboundary)	Short term/ Long term	Direct/ Indirect	Permanent / Temporary	Reversible / Irreversible	Significance of Effect (according to defined criteria)	Proposed mitigation	Residual Effects (according to defined criteria)
Fine sediment pollution	Construction	Adverse	Local	Short-term	Direct	Temporary	Reversible	Significant	Silt control measures	Not significant
Accidental spills and leaks	Construction	Adverse	Local	Short-term	Direct	Temporary	Reversible	Significant	Fuel management measures	Not significant
Drainage works	Construction	Adverse	Local	Short-term	Direct	Temporary	Irreversible	Moderate	ECoW present for all instream works	Not significant
Operational drainage	Operation	Negative to neutral	Site	Long-term	Indirect	Permanent	Irreversible	Slight	Follow existing drainage pattern	Not significant
Maintenance	Operation	Adverse	Local	Short-term	Direct	Temporary	Reversible	Moderate	Silt control and fuel management measures	Not significant

10.11 REFERENCES

Clare County Council. (2023). Clare County Development Plan 2023–2029. Ennis, Ireland: Clare County Council.

https://www.clarecoco.ie/services/planning/plans/clarecountydevelopmentplan23-2029/

Department of the Environment, Heritage and Local Government (DoEHLG), & Office of Public Works (OPW). (2009). *The planning system and flood risk management: Guidelines for planning authorities*. Dublin: DoEHLG and OPW.

the-planning-system-and-flood-risk-management-guidelines-for-planning-authorities-nov-.pdf

Environmental Protection Agency (EPA). (2018). *Water quality in Ireland 2013–2018*. Johnstown Castle, Co. Wexford: EPA.

https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/Water-Quality-in-Ireland-2013-2018-(web).pdf

Environmental Protection Agency (EPA). (2022). *Guidelines on the information to be contained in Environmental Impact Assessment Reports*. Johnstown Castle, Co. Wexford: EPA. https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf

Environmental Protection Agency (EPA). (2023). *EPA maps and water quality data portal*. Johnstown Castle, Co. Wexford: EPA.

https://gis.epa.ie/EPAMaps/

Geological Survey Ireland (GSI). (2016). Winter 2015/2016 surface water flooding mapping. Dublin: GSI.

https://www.gsi.ie/en-ie/data-and-maps/Pages/Flood-Maps.aspx

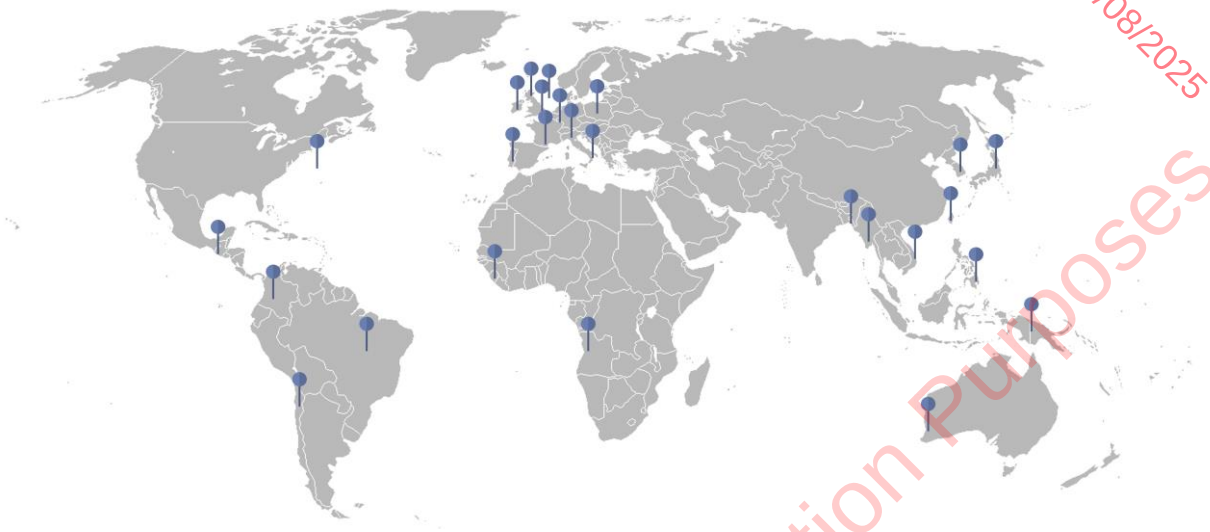
Geological Survey Ireland (GSI). (2021). Seasonal flood mapping 2020/2021. Dublin: GSI. https://www.gsi.ie/en-ie/data-and-maps/Pages/Flood-Maps.aspx

Institute of Geologists of Ireland (IGI). (2013). *Guidelines for the preparation of soils, geology and hydrogeology chapters of Environmental Impact Statements*. Dublin: IGI. https://igi.ie/assets/files/Codes%20and%20Guidelines/IGI%20Enviro%20Impact%202013.pdf

National Roads Authority (NRA). (2009). *Guidelines for the assessment of ecological impacts of national road schemes*. Dublin: NRA.

https://www.tii.ie/media/kzldoawo/guidelines-for-assessment-of-ecological-impacts-of-national-road-schemes.pdf

Global Project Reach



Offices

Dublin (Head Office)
Gavin & Doherty Geosolutions
Unit A2, Nutgrove Office Park
Rathfarnham
Dublin 14, D14 X627
Phone: +353 1 207 1000

Cork
Gavin & Doherty Geosolutions
First Floor, 12 South Mall
Cork
T12 RD43

London
Gavin & Doherty Geosolutions (UK) Limited
85 Great Portland Street, First Floor
London
W1W 7LT

Utrecht
Gavin & Doherty Geosolutions
WTC Utrecht, Stadsplateau 7
3521 AZ Utrecht
The Netherlands

Belfast
Gavin & Doherty Geosolutions (UK) Limited
Scottish Provident Building
7 Donegall Square West
Belfast
BT1 6JH

Edinburgh
Gavin & Doherty Geosolutions (UK) Limited
22 Northumberland Street SW Lane
Edinburgh
EH3 6JD

Rhode Island
Gavin & Doherty Geosolutions Inc.
225 Dyer St, 2nd Floor
Providence, RI 02903
USA

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Website: www.gdgeo.com
Email: info@gdgeo.com

A Venterra Group Plc
Member Company