APPENDIX 9-3

WFD COMPLIANCE ASSESSMENT

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT

SLIEVEACURRY RENEWABLE ENERGY DEVELOPMENT, CO. CLARE

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT SILEVEACURRY RENEWABLE ENERGY DEVELOPMENT, CO. CLARE**
Issue Date:	**29th April 2026**
Project Number:	**P1159-5**
Project Reporting History:	**P1159-5**
Current Revision No:	**P1159-5_FINAL_F1**
Author:	**MICHAEL GILL DAVID BRODERICK NITESH DALAL**
Signed:	 **Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services**

TABLE OF CONTENTS

FIGURES (IN TEXT)

TABLES IN TEXT

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO to complete a Water Framework Directive (WFD) Compliance Assessment for the proposed Slieveacurry Renewable Energy Development (Proposed Project), Co. Clare.

The Proposed Project (Proposed Wind Farm Site, Proposed Grid Connection Site and Proposed Enhancement Site) is described in full in Chapter 4 of the EIAR.

Where the 'Site' is referred to, this relates to the primary study area for the Proposed Project EIAR, as delineated by the EIAR Site Boundary.

Where the 'Proposed Wind Farm Site' is referred to, this refers to the portion of the Site containing the proposed 9 no. turbines and ancillary infrastructure, excluding the Proposed Grid Connection Site and Proposed Enhancement Site. The 'Proposed Turbines' refers to the 9 no. turbines associated with the Proposed Wind Farm Site as outlined above.

Where the 'Proposed Grid Connection Site' is referred to, this refers to the part of the Site containing the extension to the Slievecallan existing 110kV substation and the 33kV underground cabling route from the Proposed Turbines to the substation at Slievecallan.

Where the 'Proposed Enhancement Site' is referred to, this refers to the portion of the Site containing the proposed biodiversity, ornithology enhancement and management areas, excluding the Proposed Wind Farm Site and Proposed Grid Connection Site.

The purpose of this WFD assessment is to determine if any specific components or activities associated with the Proposed Project will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status.

This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures and determine if the project is in compliance with the objectives of the WFD.

This WFD Assessment is intended to supplement the EIAR submitted as part of the Proposed Project planning application.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including wind farms.

This WFD assessment was prepared by Nitesh Dalal, David Broderick and Michael Gill.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 8 years' experience in environmental consultancy. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

David Broderick (P. Geo., BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with over 19 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has worked on the EIS/EIARs for Booltiagh WF, Cahermurphy WF Cahermurphy West WF, Glenmore WF, Crossmore WF and over 60 other wind farm related projects across the country.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer/Hydrologist with over 24 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Seven Hills Wind Farm, Glenmore Wind Farm, Cahermurphy WF and Slievecallen Wind Farm, and over 100 other wind farm related projects across the country.

1.3 WATER FRAMEWORK DIRECTIVE

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

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021, and the third cycle covers the period from 2022 to 2027[1]. The RBMPs are forward looking.

The Water Action Plan 2024 is Ireland's 3rd River Basin Management Plan (2022 - 2027). The objectives of the Water Action Plan 2024 have been integrated into the design of the Proposed Project and include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration;
- Meet the water standards and objectives for designated protected areas;
- Protect high-status waters; and,

[1] *The WFD RBMP cycles are forward looking plans, so 2009-2015 (1st Cycle), 2016-2021 (2nd Cycle), and 2022-2027 (3rd Cycle) are the plans and they use status from the previous 6 years.*
The EPA updates status every three years, but they also complete an additional assessment mid-RBMP cycle. The mid-cycle status does not get reported to the Commission.
The linkage between the two is that the 2nd Cycle plan uses the 2009-2015 status, the 3rd Cycle plan uses the 2016-2021 status. The 2013-2018 status was not used in the RBMP and the 2019-2024 status will not be used in the next RBMP.

- Implement targeted action and pilot schemes in focus sub-catchments aimed at (i) targeting water bodies close to meeting their objective and (ii) addressing more complex issues that will build knowledge for future cycles.

Our understanding of these objectives is that water bodies, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

This section identifies those Surface Waterbodies (SWBs) and Groundwater Bodies (GWBs) with potential to be affected by the Proposed Project and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

Proposed Wind Farm Site

Regionally, the Proposed Wind Farm Site is located within the Mal Bay surface water catchment within Hydrometric Area No. 28 of the Shannon River Basin District.

More locally, the northeastern part of the Proposed Wind Farm Site is mapped within the Inagh[Ennistymon]_SC_010 river sub-catchment and Inagh (Ennistymon)_040 river sub-basin. Within the Inagh (Ennistymon)_040 river sub-basin, the tributaries of the Inagh (Ennistymon)_040 river originates from the Proposed Wind Farm Site areas and flows northeasterly and drains out into the Inagh (Ennistymon)_050 river which flows northwesterly and drains into the Inagh Estuary transitional waterbody.

The southwestern part is mapped within the Annagh[Clare]_SC_010 river sub-catchment and two river sub-basins, namely the Glendine (Clare)_010 and Kildeema_010 river sub-basins. The Glendine (Clare)_010 river and the Kildeema_010 river drain into the Annagh (Clare)_010 which flows into the Shannon Plume (HAs 27;28) coastal waterbody.

Table A presents the catchment area of each waterbody downstream of the Proposed Wind Farm Site as far as the Inagh Estuary and Shannon Plume (HAs 27;28). The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the rivers. Therefore, those waterbodies which are located in close proximity to the Proposed Wind Farm Site are more susceptible to water quality impacts as a result of activities associated with the Proposed Project. The potential for the Proposed Wind Farm Site to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table A: Catchment Area Downstream of Proposed Wind Farm Site

WFD River Sub-Basin	Total downstream Catchment Area (km²)
Inagh[Ennistymon]_SC_010 river sub-catchment	
Inagh (Ennistymon)_040	~141
Inagh (Ennistymon)_050	~170
Annagh[Clare]_SC_010 river sub-catchment	
Glendine (Clare)_010	~12
Kildeema_010	~14
Annagh (Clare)_010	~50

Proposed Grid Connection Site

Regionally, the majority of the Proposed Grid Connection Site is located within the Mal Bay surface water catchment within Hydrometric Area No. 28 of the Shannon River Basin District. More locally, the majority of the Proposed Grid Connection Site is mapped within the Annagh[Clare]_SC_010 river sub-catchment and Inagh[Ennistymon]_SC_010 river sub-catchment.

Within the Annagh[Clare]_SC_010, the northern part of the Proposed Grid Connection Site is mapped within the Kildeema_010 river sub-basin and the southern portion is mapped within the Annagh (Clare)_010 river sub-basin. The Kildeema_010 river drains into the Annagh (Clare)_010 which flows down into the Shannon Plume (HAs 27;28) coastal waterbody.

Within the Inagh[Ennistymon]_SC_010 river sub-catchment, the Proposed Grid Connection Site is mapped within the Inagh (Ennistymon)_040 river sub-basin which flows northeasterly and drains into the Inagh (Ennistymon)_050 sub-basin which flows northwesterly and into the Inagh Estuary transitional waterbody.

Table B presents the catchment area of each waterbody downstream of the Proposed Grid Connection Site as far as the Inagh Estuary and Shannon Plume (HAs 27;28). The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the rivers. Therefore, those waterbodies which are located in close proximity to the Proposed Grid Connection Site are more susceptible to water quality impacts as a result of activities associated with the Proposed Project. The potential for the Proposed Grid Connection Site to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table B: Catchment Area Downstream of Proposed Grid Connection Site

WFD River Sub-Basin	Total downstream Catchment Area (km²)
Inagh[Ennistymon]_SC_010 river sub-catchment	
Inagh (Ennistymon)_040	~141
Inagh (Ennistymon)_050	~170
Annagh[Clare]_SC_010 river sub-catchment	
Kildeema_010	~14
Annagh (Clare)_010	~50

Proposed Enhancement Site

The Proposed Enhancement Site is mapped within the Mal Bay surface water catchment within Hydrometric Area No. 28 of the Shannon River Basin District. More locally, the Proposed Enhancement Site is mapped within the Inagh[Ennistymon]_SC_010, Annagh[Clare]_SC_010 and Annageeragh_SC_010 river sub-catchments.

Within the Inagh[Ennistymon]_SC_010 river sub-catchment, the Proposed Enhancement Site is mapped within the Inagh (Ennistymon)_040 and Inagh (Ennistymon)_010 river sub-basins. Within the Annagh[Clare]_SC_010 river sub-catchment, the Proposed Enhancement Site is mapped within the Glendine (Clare)_010 and the Kildeema_010 river sub-basin and within the Annageeragh_SC_010 river sub-catchment, its mapped within the Annageeragh_020 river sub-basin.

Table C presents the catchment area of each waterbody downstream of the Proposed Enhancement Site as far as the Inagh Estuary and Shannon Plume (HAs 27;28), into which the Site ultimately drains towards. The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the rivers. Therefore, those waterbodies which are located in close proximity to the Proposed Enhancement Site are more susceptible to water quality impacts as a result of activities associated with the works. The potential for the Proposed Enhancement Site to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Figure A below is a local hydrology map of the area.

Table C: Proposed Enhancement Site

WFD River Sub-Basin	Total downstream Catchment Area (km²)
Inagh[Ennistymon]_SC_010 river sub-catchment	
Inagh (Ennistymon)_010	~20
Inagh (Ennistymon)_020	~65
Inagh (Ennistymon)_030	~83
Inagh (Ennistymon)_040	~141
Inagh (Ennistymon)_050	~170
Annagh[Clare]_SC_010 river sub-catchment	
Glendine (Clare)_010	~12
Kildeema_010	~14
Annagh (Clare)_010	~50
Annageeragh_SC_010 river sub-catchment	
Annageeragh_020	~33
Annageeragh_030	~67

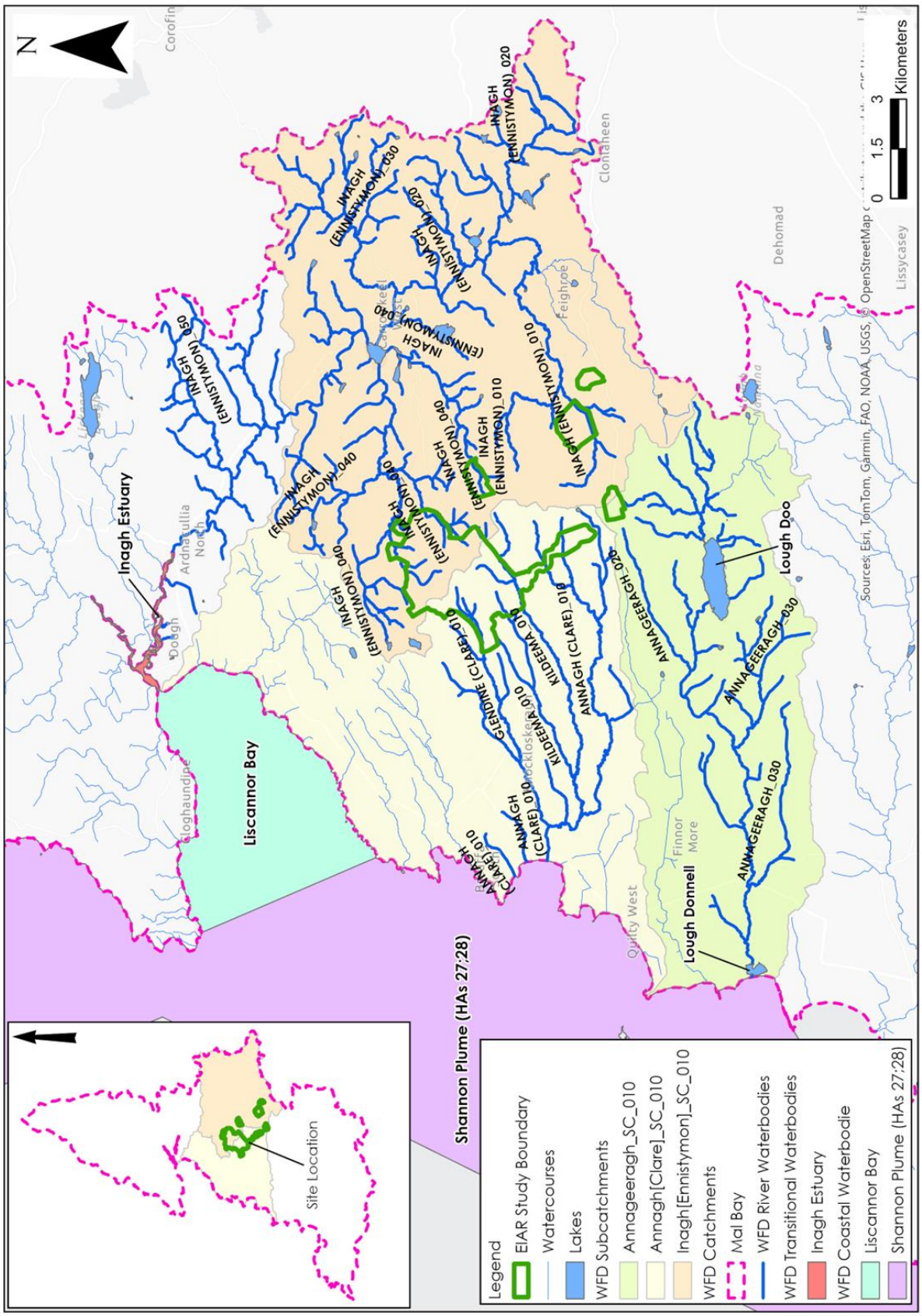

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for SWBs downstream of the Site are shown in **Table D**. The overall status is based on the ecological, chemical and quantitative status of each SWB.

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

Within the Inagh[Ennistymon]_SC_010 river sub-catchment, the Inagh (Ennistymon)_010 and the Inagh (Ennistymon)_030 have achieved a "Good" status in the latest WFD cycle (2019-2024) while the Inagh (Ennistymon)_020, Inagh (Ennistymon)_040 and Inagh (Ennistymon)_050 have achieved a "Moderate" status in the latest WFD cycle. The Inagh (Ennistymon)_010, Inagh (Ennistymon)_020 and Inagh (Ennistymon)_050 are 'not at risk' of failing to achieve its WFD objectives, Inagh (Ennistymon)_040 is 'at risk' of failing to achieve its WFD objectives while the Inagh (Ennistymon)_030 is under review. Forestry, Domestic Wastewater, Anthropogenic and Agriculture are the significant pressures identified on the Inagh (Ennistymon)_040 SWB.

Within the Annagh[Clare]_SC_010 river sub-catchment, the Glendine (Clare)_010 has achieved a "Moderate" status, the Kildeema_010 has achieved a "Good" status while the Annagh (Clare)_010 has achieved a "Bad" status in the latest WFD cycle. The Glendine (Clare)_010 and Annagh (Clare)_010 are 'at risk' of failing to achieve its WFD objectives while the Kildeema_010 is 'not at risk' of failing to achieve its WFD objectives. Hydromorphology, Anthropogenic and Agriculture are the identified significant pressure on the Glendine (Clare)_010 SWB while Domestic Wastewater and Forestry are the identified significant pressure on the Annagh (Clare)_010 SWB.

Within the Annageeragh_SC_010 river sub-catchment, the Annageeragh_020 and Annageeragh_030 have achieved a "Good" status while the Doo Lough CE have achieved a "Moderate" status in the latest WFD cycle. The Annageeragh_020 and the Lough Doo CE are 'at risk' of failing to achieve its WFD objectives while the Annageeragh_030 is 'not at risk'. Forestry is the identified significant pressure on the Annageeragh_020 SWB while Hydromorphology, Forestry and Abstraction are the identified significant pressure on the Lough Doo CE SWB.

In terms of transitional water bodies, the Inagh Estuary transitional water body has achieved a "Moderate" status while the Lough Donnell transitional water body has achieved a "Poor" status in the latest WFD cycle. The Inagh Estuary and the Lough Donnell transitional waterbodies are under review for the risk status of achieving their WFD objectives.

In terms of coastal water bodies, the Liscannor Bay has achieved a "Good" status and the Shannon Plume (HAs 27;28) has achieved a "High" status in the latest WFD cycle. The Liscannor Bay coastal water body is under review while the Shannon Plume (HAs 27;28) coastal water body is 'not at risk' of failing to achieve its WFD objectives.

The SWB status for the 2019-2024 WFD cycle are shown on **Figure B.**

Table D: Summary WFD Information for Surface Water Bodies (Proposed Project)

SWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	Risk Status 3rd Cycle	Pressures
Inagh[Ennistymon]_SC_010 river sub-catchment					
Inagh (Ennistymon)_010	Poor	Good	Good	Not at risk	None
Inagh (Ennistymon)_020	Moderate	Good	Moderate	Not at risk	None
Inagh (Ennistymon)_030	Poor	Good	Good	Under Review	-
Inagh (Ennistymon)_040	Moderate	Moderate	Moderate	At Risk	Forestry, Domestic Wastewater, Anthropogenic and Agriculture
Inagh (Ennistymon)_050	Moderate	Good	Moderate	Not at risk	None
Inagh Estuary	Moderate	Moderate	Moderate	Under Review	-
Liscannor Bay	High	Good	Good	Under Review	
Annagh[Clare]_SC_010 river sub-catchment					
Glendine (Clare)_010	Poor	Moderate	Moderate	At risk	Hydromorphology, Anthropogenic and Agriculture
Kildeema_010	Good	Good	Good	Not at risk	None
Annagh (Clare)_010	Moderate	Bad	Bad	At risk	Domestic Wastewater and Forestry
Shannon Plume (HAs 27;28)	High	High	High	Not at risk	
Annageeragh_SC_010 river sub-catchment					
Annageeragh_020	Poor	Poor	Good	At risk	Forestry
Lough Doo CE	Good	Moderate	Moderate	At risk	Hydromorphology, Forestry and Abstraction
Annageeragh_030	Good	Good	Good	Not at risk	None
Lough Donnell	Poor	Poor	Poor	Under Review	-
Shannon Plume (HAs 27;28)	High	High	High	Not at risk	

2.4 GROUNDWATER BODY IDENTIFICATION

The bedrock geology unit underlying the Site is the Central Clare Group which is described as Sandstone, siltstone & mudstone. This bedrock aquifer is classified as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll).

In terms of Groundwater body (GWB), the Site is underlain by Milltown Malbay GWB (IE_SH_G_167).

The GWB status for the 2019-2024 WFD cycle are shown on **Figure B**

2.5 GROUNDWATER BODY CLASSIFICATION

GWBs are assigned a status based on the assessment of groundwater chemical and quantitative figures. Summary WFD information for the GWB underlying the Site is presented in **Table E**.

The Milltown Malbay GWB (IE_SH_G_167) achieved 'Good' status in the latest WFD cycle and are 'not at risk' of failing to achieve its WFD objectives. There is no significant pressure identified in this GWB.

The GWB status for the 2019-2024 WFD cycles are shown on **Figure B**.

Table E: Summary WFD Information for Groundwater Bodies

GWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	Risk Status 3rd Cycle	Pressures
Milltown Malbay	Good	Good	Good	Not at risk	None

2.6 ZONE OF INFLUENCE

The Zone of Influence (ZoI) to the Site extends to the following SWBs and GWBS:

- River SWBs – Inagh (Ennistymon)_010 to Inagh (Ennistymon)_050, Glendine (Clare)_010, Kildeema_010, Annagh (Clare)_010, Annageeragh_020 and Annageeragh_030 rivers;
- Lake: Doo Lough CE;
- GWB – Milltown Malbay GWB; and,
- Transitional and Coastal Waterbodies – Inagh Estuary, Lough Donnell, Liscannor Bay and Shannon Plume (HAs 27;28).

2.7 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below. Nature conservation designations, bathing waters, nutrient Sensitive areas (NSA), shellfish areas and drinking water protected area's (DWPA) are looked at as part of the assessment.

2.7.1 Nature Conservation Designations

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The closest designated site to the Proposed Project is Slievecallan Mountain Bog NHA (Site Code: 002397) which exists approximately 2.5km to the southeast of the Proposed Wind Farm Site and approximately 0.5km east of the Proposed Grid Connection Site. The Proposed Project has no hydrological connectivity with the Slievecallan Mountain Bog NHA.

The Inagh River Estuary SAC (Site Code: 00036) is located approximately 22km downstream of the Site near the town of Ennistymon.

The Mid-Clare Coast SPA (Site Code: 004182), which encompasses a coastal area from Spanish Point south to Doonbeg, is located approximately 7.5km downstream of the Site via the Glendine River, Kildeema River and Annagh River.

The Carrowmore Point to Spanish Point and Islands SAC/pNHA (Site Code: 001021), which is largely coincident with the Mid-Clare Coast SPA, is also downstream of the Site via the aforementioned rivers.

Other designated sites within 10km of the Site include:

- Cragnashingaun Bogs NHA (Site Code: 002400) is located ~5km south of the Site. There is no hydrological connection between the Site and this NHA;
- Lough Naminna Bog NHA (Site Code: 002367) is located ~5.4km south of the Site. There is no hydrological connection between the Site and this NHA; and,
- Lough Acrow Bogs NHA (Site Code: 002421) is located ~7.6km south of the Site. There is no hydrological connection between the Site and this NHA.

2.7.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

There is no designated bathing waters located in the vicinity or immediately downstream of the Site. The nearest bathing water is Spanish Point (IESHBWC070_0000_0300) mapped ~6.5km west of the Site.

2.7.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

Within the Mal Bay WFD catchment, there are no NSA in the vicinity or downstream of the Site.

2.7.4 Shellfish Areas

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

There are no Shellfish protected area sites mapped in the vicinity or downstream of the Site.

2.7.5 Salmonid Waters

There is no Salmonid Waters mapped in the vicinity or downstream of the Site.

2.7.6 Drinking Water Protected Areas

Doo Lough CE is mapped DWPA located downstream of the Proposed Enhancement Site only. West Clare Regional Water Supply abstracts from Doo Lough.

Meanwhile all GWB's in Ireland are considered as Drinking water protected areas. The Milltown Malbay GWB (IE_SH_G_167) underlie the Site.

No Public Water Supply (PWS) or Group Water Scheme (GWS) supply groundwater protection areas overlap the Site.

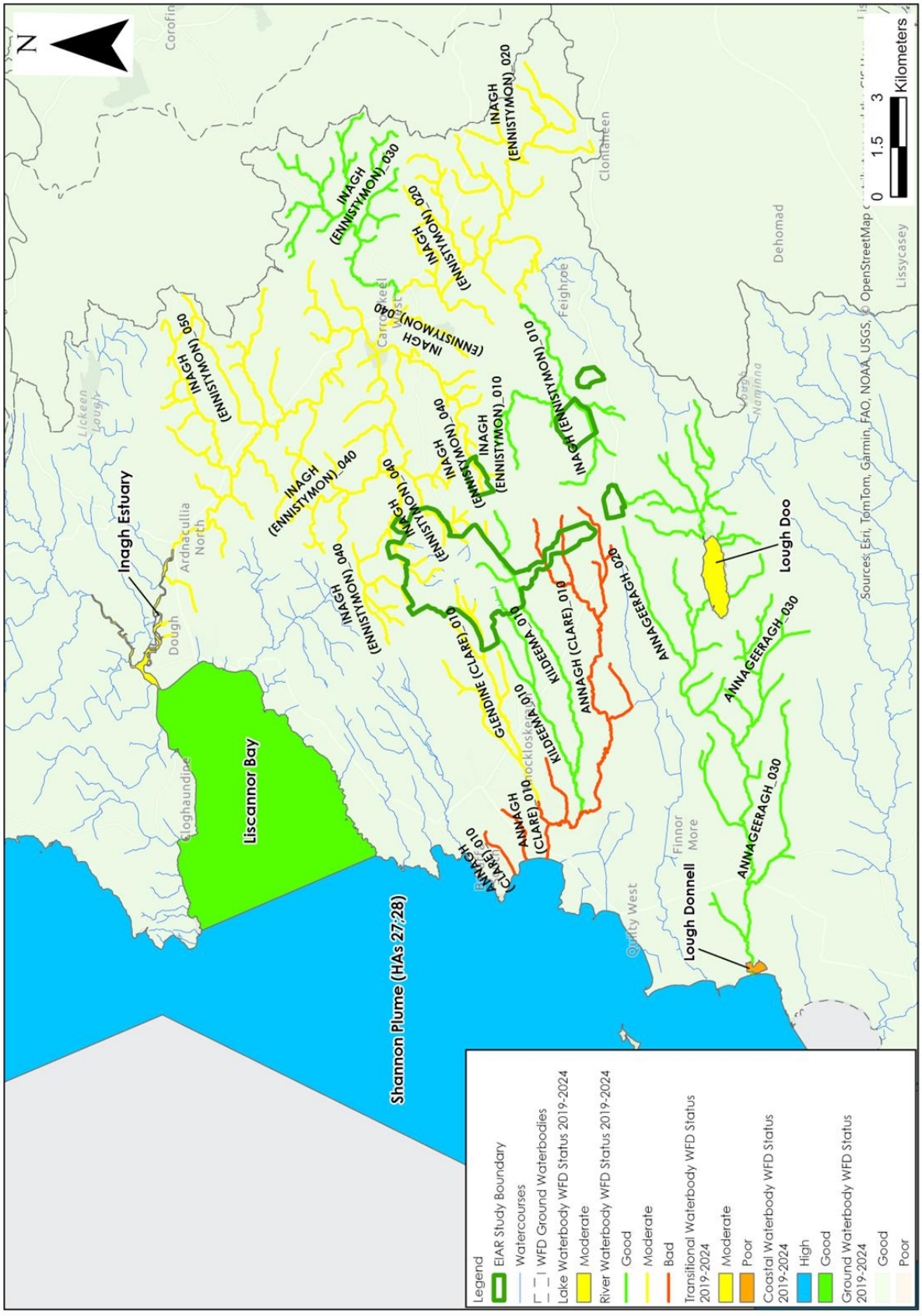

Figure B: WFD Groundwater and Surface Waterbody Status (2019-2024)

3. WFD SCREENING

As discussed in **Section 2,** there are a total of 15 no. SWBs which includes 10 no. river water bodies, 1 no. lake water body, 2 no. transitional water body and 2 no. coastal water bodies that are located in the vicinity or downstream of the Site. Furthermore, the Site is underlain by 1 no. groundwater body.

3.1 SURFACE WATER BODIES

The river waterbodies in the immediate vicinity and downstream of the Site are shown in **Figure A** and described in **Section 2.2** above.

With consideration for the construction, operational and decommissioning phases of the Proposed Project, it is considered that the Inagh (Ennistymon)_040, Glendine (Clare)_010, Kildeema_010 and Annagh (Clare)_010 waterbodies within the vicinity and downstream of the Site are carried through into the WFD Impact assessment. These SWBs have been screened in due to their proximity to the Site and the proposed works within these river sub-basins. The Proposed Project must not in any way result in a deterioration in the status of these SWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

The Inagh (Ennistymon)_050 further downstream of the Site is also carried through into the WFD Impact Assessment. The Proposed Project works must not in any way result in a deterioration in the status of these river waterbodies and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

The Inagh (Ennistymon)_010, Inagh (Ennistymon)_020, Inagh (Ennistymon)_030, Inagh, Doo Lough CE, Annageeragh_020 and Annageeragh_030 are all screened out as proposed development within or upstream of these river waterbodies is limited to the Proposed Enhancement Site.

Downstream of these SWBs, the transitional water bodies (Inagh Estuary and Lough Donnell) and the coastal water bodies (Liscannor Bay and Shannon Plume (HAs 27;28)) has been screened out due to distant location from the Site and increased volume of water within the SWB associated with increased upstream catchment area.

3.2 GROUNDWATER BODIES

With respect to GWBs, the Milltown Malbay GWB has been screened in due to its location directly underling the Site. The Proposed Project works must not in any way result in a deterioration in the status of this GWB and/or prevent it from meeting the biological and chemical characteristics for good status in the future.

3.3 PROTECTED AREAS

Doo Lough CE DWPA: The Doo Lough CE DWPA is mapped directly downstream of the Annageeragh_020 river. This DWPA is hydrologically connected to lands associated with the Proposed Enhancement Site. Doo Lough CE DWPA is screened out as proposed works upstream of this waterbody are limited to the Proposed Enhancement Site.

All other designated sites have been screened out due to distant location, increased volume of water within associated SWB or lack of hydrological connection between the designated site and the Proposed Project Site.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening for SWBs and GWBs discussed above is shown in **Table F** below.

Table F: Screening of WFD water bodies located within the Water Study Area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	**Inagh[Ennistymon]_SC_010 river sub-catchment**			
	River	Inagh (Ennistymon)_010	No	Waterbody screened out as proposed development within this river waterbody is limited to the Proposed Enhancement Site.
	River	Inagh (Ennistymon)_020	No	Waterbody screened out as proposed development upstream of this river waterbody is limited to the Proposed Enhancement Site.
	River	Inagh (Ennistymon)_030	No	Waterbody screened out as proposed development upstream of this river waterbody is limited to the Proposed Enhancement Site.
	River	Inagh (Ennistymon)_040	**Yes**	The Proposed Wind Farm Site, Proposed Grid Connection Site and Proposed Enhancement Site are mapped within the Inagh (Ennistymon)_040 river sub-basin. Therefore, an assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Inagh (Ennistymon)_050	**Yes**	The Inagh (Ennistymon)_030 river is mapped directly downstream of the Inagh (Ennistymon)_020 river and hence considered for further assessment. Therefore, an assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	Transitional	Inagh Estuary	No	The Inagh Estuary transitional waterbody has been screened out due to distant location, large volume of water and saline nature of the sea water. The Proposed Project have no potential to impact the status of this SWB.
	Coastal	Liscannor Bay	No	The Liscannor Bay coastal waterbody has been screened out due to distant location, large volume of water and saline nature of the sea water. The Proposed Project have no potential to impact the status of this SWB.
	Annagh[Clare]_SC_010 river sub-catchment			
	River	Glendine (Clare)_010	**Yes**	The Proposed Wind Farm Site and Proposed Enhancement Site are mapped within the Glendine (Clare)_010 river sub-basin. Therefore, an assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Kildeema_010	**Yes**	The Proposed Wind Farm site, the Proposed Grid Connection Site and Proposed Enhancement Site are mapped within the Kildeema_010 river sub-basin. Therefore, an assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Annagh (Clare)_010	**Yes**	The Proposed Grid Connection Site is mapped within the Annagh (Clare)_010 river sub-basin. Therefore, an assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	Coastal	Shannon Plume (HAs 27;28)	No	The Shannon Plume (HAs 27;28) coastal waterbody has been screened out due to distant location, large volume of water and saline nature of the sea water. The Proposed Project has no potential to impact the status of this SWB.
	Annageeragh_SC_010 river sub-catchment			
	River	Annageeragh_020	No	Only a small portion of the Proposed Enhancement Site is located in the Annageeragh River catchment and therefore there will be no potential to negatively effect the WFD status.
	Lake	Lough Doo CE	No	Only a small portion of the Proposed Enhancement Site is located in the Annageeragh River catchment and therefore there will be no potential to negatively effect the WFD status.
	River	Annageeragh_030	No	Only a small portion of the Proposed Enhancement Site is located in the Annageeragh River catchment and therefore there will be no potential to negatively effect the WFD status.
	Transitional	Lough Donnell	No	Only a small portion of the Proposed Enhancement Site is located in the Annageeragh River catchment and therefore there will be no potential to negatively effect the WFD status.
Groundwater Bodies				

Groundwater Body	Groundwater	Milltown Malbay	**Yes**	The Site is located in the Milltown Malbay GWB. An assessment is required to consider the potential impacts of the Proposed Project on this GWB.
Protected Areas				
Protected Areas	Nature Conservation Designations	Slievecallan Mountain Bog NHA	No	The Slievecallan Mountain Bog NHA has been screened out due to lack of any hydrological connection between this NHA and the Site. Therefore, the Proposed Project has no potential to impact the status of this NHA.
		Inagh River Estuary SAC	No	The Inagh River Estuary SAC has been screened out due to distant location and increased volume of water within the associated SWB due it its tidal influence. Therefore, the Proposed Project has no potential to impact the status of this SAC.
		Mid-Clare Coast SPA	No	The Mid-Clare Coast SPA has been screened out due to distant location and increased volume of sea water within the associated SWB. Therefore, the Proposed Project has no potential to impact the status of this SPA.
		Carrowmore Point to Spanish Point and Islands SAC/pNHA	No	The Carrowmore Point to Spanish Point and Islands SAC/pNHA has been screened out due to distant location and increased volume of sea water within the associated SWB. Therefore, the Proposed Project have no potential to impact the status of this SAC/pNHA.
		Cragnashingaun Bogs NHA	No	The Cragnashingaun Bogs NHA has been screened out due lack of hydrological connection between this NHA and the Site. Therefore, the Proposed Project has no potential to impact the status of this NHA.
		Lough Naminna Bog NHA	No	The Lough Naminna Bog NHA has been screened out due lack of hydrological connection between this NHA and the Site. Therefore, the Proposed Project has no potential to impact the status of this NHA.
		Lough Acrow Bogs NHA	No	The Lough Acrow Bogs NHA has been screened out due lack of hydrological connection between this NHA and the Site. Therefore, the Proposed Project have no potential to impact the status of this NHA.
	Bathing Waters	Spanish Point	No	The Spanish Point bathing waters has been screened out due to distant location and increased volume of water within the associated SWB. Therefore, the Proposed Development have no potential to impact the status of these bathing waters.
	Drinking Water Protected Areas	Lough Doo CE	No	Only a small portion of the Proposed Enhancement Site is located in the Annageeragh River catchment and therefore there will be no potential to negatively effect the WFD status of Doo Lough

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

Please refer to Section 4.1 of the EIAR for a description of the Proposed Project (i.e. Proposed Wind Farm Site, Proposed Grid Connection Site and Proposed Enhancement Site).

The main characteristics of the Proposed Wind Farm Site that could impact on hydrology and hydrogeology are:

- Establishment of 2 no. temporary construction compounds, which will involve minor regrading of soil/subsoil and the emplacement of hardstands. Welfare facilities will be provided at the primary temporary construction compounds. Wastewater effluent will be collected in a wastewater holding tank and periodically emptied by a licenced contractor;
- Construction of the site access tracks will predominantly use the excavate and replace technique. This will involve the use of aggregate from 1 no. on-site borrow pit;
- Construction of the 9 no. crane hardstand areas and turbine assemblage areas will utilise ground bearing foundations;
- Settlement ponds where constructed will be volume neutral, i.e. all material excavated will be used to form side bunds and landscaping around the ponds. There will be no excess material from settlement pond construction. The proposed settlement pond locations (refer to Appendix 4-3 drainage plan drawings) have been assessed for peat instability risks;
- Grey water will be supplied by rainwater harvesting at the substation and water tankered to site where required. Bottled water will be used for potable supply;
- Construction of 9 no. turbine foundations, which are expected to be gravity foundation design due to shallow depths to underlying bedrock;
- Underground cabling between Proposed Turbine locations will involve the excavation of a shallow trench (approximately 1.2m deep), placement of ducting and backfilling;
- Construction of 5 no. new (natural) watercourse crossing (clear span bridge design) and upgrade of 1 no. existing (natural) watercourse crossing at the Proposed Wind Farm Site;
- Tree felling (total 144ha) for the purposes of Proposed Wind Farm Site construction and also for the Biodiversity Management and Enhancement Plan;
- Establishment of 5 no. dedicated peat and spoil management areas as well as utilising the 1 no. exhausted borrow pit for permanent peat placement;
- Upgrade of 2.5km of existing access forestry tracks and construction of 5.2km of new access tracks using the excavate and replace method which is most appropriate technique for shallow peat.

The main characteristics of the Proposed Grid Connection Site that could impact on hydrology and hydrogeology are:

- Approximately 7.1km of an underground cabling route between the Proposed Wind Farm Site and the proposed substation extension at the existing Slievecallan 110kV substation involving the excavation of a double shallow trench (approximately 1.2m deep), placement of ducting and backfilling with aggregate, lean-mix concrete, and excavated material, as appropriate (depending on the location of the cable trench);
- The proposed substation extension will be located on an existing cleared and level area where the ground elevation is at approximately 242m OD.
- 15 no. existing watercourse culvert/bridge crossings along the underground cabling routed (4 no. of these are EPA mapped watercourses);
- At all watercourse crossing locations, the cable will be placed either underneath or above the bridge structure or by Horizontal Directional Drilling (HDD); and no in-stream are proposed at any existing crossing location.

The main characteristics of the Proposed Enhancement Site that could impact on hydrology and hydrogeology are:

- A total of 172.7ha of lands are proposed for enhancement under Biodiversity Management and Enhancement Plan (BMEP). The Proposed Enhancement Site comprises areas of Marsh fritillary Enhancement (grazing management) and Hen Harrier Habitat Enhancement (conifer felling areas and grassland management areas).
- There will be no excavations needing spoil management required as part of the enhancement works.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects from Earthworks and Tree Felling within the Proposed Wind Farm Site (Including BMEP Lands)

Construction phase activities including tree felling, site levelling/construction, building turbine foundation excavation, borrow pits and peat management areas will require earthworks resulting in removal of vegetation cover and excavation of peat, soil and subsoils. The main risk will be from surface water runoff from exposed soil/peat, peat management areas and borrow pit drainage during construction works.

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

Release of effluent from wastewater treatment systems also has the potential to impact on surface waters if site conditions are not suitable for an on-site percolation unit.

A total of 144 hectares of forestry will be felled for the Proposed Project. This includes a total of 20.7 hectares to be removed to facilitate the Proposed Wind Farm infrastructure and 123 hectares to be deforested as part of the BMEP. It should be noted that forestry on the Site was originally planted as a commercial crop and will be felled in the future should the Proposed Project proceed or not.

Construction of 5 no. new (natural) watercourse crossing (clear span bridge design) and upgrade of 1 no. existing (natural) watercourse crossing at the Proposed Wind Farm Site. Works have the potential to result in morphological changes to watercourses.

Construction phase activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which in turn could affect the water quality and fish stocks in the downstream SWBs.

The SWB's potentially affected by these activities is the Inagh (Ennistymon)_040, Inagh (Ennistymon)_050, Glendine (Clare)_010, Kildeema_010 and Annagh (Clare)_010. Further downstream, the potential for water quality effects will decrease downstream due to the increasing volumes of water within the respective SWBs.

A summary of potential status change to SWBs arising from works within the Proposed Wind Farm Site during the construction phase of the Proposed Project in the unmitigated scenario are outlined in **Table G**.

Table G: Potential Surface Water Quality Effects Downstream of the Proposed Wind Farm Site during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Inagh[Ennistymon]_SC_010 river sub-catchment			
Inagh (Ennistymon)_040	IE_SH_28I010300	Moderate	Poor
Inagh (Ennistymon)_050	IE_SH_28I010450	Moderate	Poor
Annagh[Clare]_SC_010 river sub-catchment			
Glendine (Clare)_010	IE_SH_28G020200	Moderate	Poor
Kildeema_010	IE_SH_28K010800	Good	Moderate
Annagh (Clare)_010	IE_SH_28A030900	Bad	Bad
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.1.2 Potential Surface Water Quality Effects At the Proposed Grid Connection Site

At the Proposed Grid Connection Site, there are a total of 15 no. existing watercourse culvert/bridge crossings along the underground cabling routed (4 no. of these are EPA mapped watercourses).

At all watercourse crossing locations, the cable will be placed either underneath or above the bridge structure or by Horizontal Directional Drilling (HDD); and no in-stream are proposed at any existing crossing location.

Due to the proximity of local waterbodies at the crossing locations, there is a potential for surface water quality impacts during trench excavation work due to runoff from the road surface. This runoff may contain elevated concentrations of suspended sediment, cementitious runoff and/or hydrocarbons.

Some minor groundwater/surface water seepages will likely occur in trench excavations and substation foundation excavations, and this will create additional volumes of water to be treated by the runoff management system. Inflows will likely require management and treatment to reduce suspended sediments.

Construction activities at the Proposed Grid Connection Site only have the potential for short term effects due to the minor and transient nature of the works. The limits the potential for the Proposed Project to alter the overall status of a SWB.

A summary of potential status change to SWBs arising from works at the Proposed Grid Connection Site during the construction phase of the Proposed Project in the unmitigated scenario are outlined in **Table H.**

Table H: Potential Surface Water Quality Effects along the Proposed Grid Connection during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Inagh[Ennistymon]_SC_010 river sub-catchment			
Inagh (Ennistymon)_040	IE_SH_28I010300	Moderate	Moderate
Inagh (Ennistymon)_050	IE_SH_28I010450	Moderate	Moderate
Annagh[Clare]_SC_010 river sub-catchment			
Kildeema_010	IE_SH_28K010800	Good	Good
Annagh (Clare)_010	IE_SH_28A030900	Bad	Bad

4.2.1.3 Potential Groundwater Quality/Quantity Effects at Proposed Wind Farm Site

The accidental spillage of hydrocarbons, the release of effluent from wastewater treatment systems and the release of cement-based products have the potential to negatively impact on groundwater water quality at the Proposed Wind Farm Site.

In addition, groundwater seepages may occur in turbine base excavations, particularly those on lower elevations and this will create additional volumes of water to be treated by the drainage management system. Furthermore, temporary dewatering of excavations (borrow pit, turbine base etc) may drawdown the local groundwater table.

However, due to the low permeability of the bedrock aquifer and the shallow nature of the proposed works, there is limited potential for the Proposed Project to change the overall status of the underlying GWBs.

A summary of potential status change to GWBs arising from works at the Proposed Wind Farm Site during the construction phase of the Proposed Project in the unmitigated scenario are outlined in **Table I**.

Table I: Potential Groundwater Effects at Proposed Wind Farm during Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Milltown Malbay	IE_SH_G_167	Good	Good

4.2.1.4 Potential Groundwater Quality/Quantity Effects at the Proposed Grid Connection Site

The Proposed Grid Connection Site is also located in Milltown Malbay GWB.

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a major pollution risk to groundwater. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Chemicals such as cement-based compounds also pose a threat to the groundwater environment. Runoff from concrete works can impact on groundwater quality. Release of effluent from site welfare wastewater treatment systems has the potential to impact on groundwater and surface waters.

These sources of contamination have the potential to impact on groundwater quality in the underlying groundwater body.

However, Due to the shallow, short-term and transient nature of the Proposed Grid Connection Site works, there is no potential for any effects during earthworks and excavation works on the GWBs.

A summary of potential status change to GWBs arising from potential groundwater quality impacts at the Proposed Grid Connection Site during the construction phase of the Proposed Project in the unmitigated scenario are outlined in **Table J**.

Table J: Potential Groundwater Effects Along Proposed Grid Connection during Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Milltown Malbay	IE_SH_G_167	Good	Good

4.2.1.5 Potential Effects on Protected Areas

For the reasons provided in **Table F** above, the Proposed Project has no potential to affect the WFD status Protected Areas.

4.2.2 Operational Phase (Unmitigated)

Potential effects associated with the operational phase of the Proposed Project will be significantly reduced in comparison to the construction phase. Any effects will occur at the Proposed Wind Farm Site and will be associated with minor maintenance works.

No maintenance works will be required along the Proposed Grid Connection Site and therefore there is no potential to impact on the status of downstream SWBs or underlying GWBs.

4.2.2.1 Potential Hydromorphological Effects Downstream of Proposed Wind Farm Site due to Increased Runoff

Progressive replacement of the soil or vegetated surfaces with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the Proposed Project and increase flood risk downstream of the development.

Hardstand emplacement will only be required at the Proposed Wind Farm Site and not the Proposed Grid Connection Site. The water balance assessment does not include the Proposed Grid Connection Site cable route as it follows public roads and therefore the underground cabling cannot alter the hydrological regime along the route which is already a hardstand surface.

The emplacement of the proposed permanent development footprint, as described in Chapter 4 of the EIAR, (assuming emplacement of impermeable materials as a worst-case scenario) could result in an average total site increase in surface water runoff of

approximately 1,479m^3/month or 48m^3/day. This represents a potential increase of approximately 0.077% in the average daily/monthly volume of runoff from the site area in comparison to the baseline pre-development site runoff conditions.

This is a very small increase in average runoff and results from a relatively small area of the overall Site being developed. Specifically, the built infrastructure footprint of the Proposed Project is approximately 8.7ha, representing 0.69% of the total area of the Site (1,260ha).

The additional volume is low due to the fact that the runoff potential from the Site is naturally high (90%). Also, this calculation assumes that all hardstanding areas will be impermeable which considered to be a worst-case scenario. The increase in runoff from most of the development catchment will therefore be imperceptible and this is before mitigation measures will be put in place.

A summary of potential status change to SWBs arising from increased runoff during the operation stage of the Proposed Project in the unmitigated scenario are outlined in **Table K**.

Table K: Potential Hydromorphological Effects Downstream of Proposed Wind Farm Site during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Inagh[Ennistymon]_SC_010 river sub-catchment			
Inagh (Ennistymon)_040	IE_SH_28I010300	Moderate	Moderate
Inagh (Ennistymon)_050	IE_SH_28I010450	Moderate	Moderate
Inagh Estuary	IE_SH_100_0100	Moderate	Moderate
Liscannor Bay	IE_SH_100_0000	Good	Good
Annagh[Clare]_SC_010 river sub-catchment			
Glendine (Clare)_010	IE_SH_28G020200	Moderate	Moderate
Kildeema_010	IE_SH_28K010800	Good	Good
Annagh (Clare)_010	IE_SH_28A030900	Bad	Bad
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.2.2 Potential Surface Water Quality Effects from Operational Proposed Wind Farm Site Drainage

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

A summary of potential status change to SWBs arising from surface water quality impacts during the operation stage of the Proposed Project in the unmitigated scenario are outlined in **Table L**.

Table L: Potential Surface Water Quality Effects Downstream of Proposed Wind Farm Site during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Inagh[Ennistymon]_SC_010 river sub-catchment			
Inagh (Ennistymon)_040	IE_SH_28I010300	Moderate	Moderate
Inagh (Ennistymon)_050	IE_SH_28I010450	Moderate	Moderate
Inagh Estuary	IE_SH_100_0100	Moderate	Moderate
Liscannor Bay	IE_SH_100_0000	Good	Good
Annagh[Clare]_SC_010 river sub-catchment			
Glendine (Clare)_010	IE_SH_28G020200	Moderate	Moderate
Kildeema_010	IE_SH_28K010800	Good	Good
Annagh (Clare)_010	IE_SH_28A030900	Bad	Bad
Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High

4.2.2.3 Potential Effects on Protected Areas

For the reasons provided in **Table F** above, the Proposed Project has no potential to affect the WFD status Protected Areas.

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the construction and operational phases of the Proposed Project. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Clear Felling of Coniferous Plantation

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

- Forestry Standards Manual (Forest Service, 2015)
- Environmental Requirements for Afforestation (Forest Service, 2016a)
- Land Types for Afforestation (Forest Service, 2016b)
- Forest Protection Guidelines (Forest Service, 2002)
- Forest Operations and Water Protection Guidelines (Coillte, 2013)
- Forestry and Water Quality Guidelines (Forest Service, 2000b)
- Forestry and the Landscape Guidelines (Forest Service, 2000c)
- Forestry and Archaeology Guidelines (Forest Service, 2000d)
- Forest Biodiversity Guidelines (Forest Service, 2000e)

- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018)
- Coillte Planting Guideline SOP
- A Guide to Forest Tree Species Selection and Silviculture in Ireland (Horgan et al., 2003)
- Management Guidelines for Ireland's Native Woodlands. Jointly published by the National Parks & Wildlife Service (Cross and Collins, 2017)
- Native Woodland Scheme Framework (Forest Service, 2018)
- Code of Best Forest Practice (Forest Service, 2000)

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

Table M: Minimum Buffer Zone Widths (Forest Service, 2000)

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

During the wind turbine construction phase a self-imposed buffer zone of 50 metres will be maintained for all streams where possible. With the exception of proposed new roads, proposed upgrades to existing roads and proposed watercourse crossings all proposed tree felling areas are located outside of imposed buffer zones. Additional mitigation (detailed below) will be carried where tree felling is required inside the buffer zones.

The large distance between the proposed felling areas and sensitive aquatic zones means that potential poor quality (sediment laden) runoff from felling areas will be adequately managed and attenuated prior to even reaching the aquatic buffer zone and primary drainage routes.

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

- Machine combinations (i.e., handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and will avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;

- All drainage channels will taper out before entering the 50m buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside a local 50 metre watercourse buffer. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted;
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Crossing of streams will not be permitted;
- Trees will be cut manually from along streams and using machinery to extract whole tree; and,
- Travel only perpendicular to and away from stream.

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

Drain Inspection and Maintenance:
The following items shall be carried out during pre-felling inspections and after:

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections the main drainage ditches shall be identified. Ideally the pre-felling inspection shall be carried out during rainfall;
- Following tree felling all main drains shall be inspected to ensure that they are functioning;
- Extraction tracks nears drains need to be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site will be unblocked; and,
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring:

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

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

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

Also, daily surface water monitoring forms will also be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection.

4.3.1.2 Mitigation Measures to Earthworks resulting in Suspended Solids Entrainment in Surface Waters

Mitigation by Avoidance:
The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas where possible. All of the key areas of the Proposed Project are actually significantly away from the delineated buffer zones with the exception of sections of proposed upgrades to existing roads, proposed new roads, proposed stream crossings and existing stream crossings requiring upgrading. Additional control measures, which are outlined further on in this section, will be undertaken at these locations.

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

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface water courses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

Mitigation by Design:
- Source controls:
    - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems.
    - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls:
    - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow

limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.

- Treatment systems:
    - Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted for this Site is that an existing network of forestry, bog, field and roadside drains already exists, and these will be integrated and enhanced as required and used within the Proposed Project drainage system. The integration of the existing drainage network and the Proposed Project network is relatively simple. The key elements being the upgrading and improvements to water treatment elements, such as in line controls and treatment systems, including silt traps, stilling ponds and buffered outfalls.

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

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the Proposed Project drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works / tree felling is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area;
- Runoff from individual turbine hardstanding areas will be not discharged into the existing drain network but discharged locally at each turbine location through stilling ponds and buffered outfalls onto vegetated surfaces;
- Buffered outfalls which will be numerous over the site will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site; and,
- Drains running parallel to the existing roads requiring widening will be upgraded, widening will be targeted to the opposite side of the road. Velocity and silt control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction works. Regular buffered outfalls will also be added to these drains to protect downstream surface waters.

Pre-commencement Temporary Drainage Works
Prior to the commencement of road upgrades (or new road/hardstand) the following key temporary drainage measures will be installed:

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

Water Treatment Train:

A final line of defence will be provided by a water treatment train such as a "Siltbuster". If the discharge water from construction areas fails to be of a high quality during regular inspections, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train (sequence of water treatment processes) will be used to filter and treat all

surface discharge water collected in the dirty water drainage system. This will apply for all of the construction phase.

Silt Fences:

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to water courses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be placed within drains down-gradient of all construction areas inside the 50m hydrological buffer zones and at watercourse crossings.

Silt Bags:

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

Settlement Ponds:

The Proposed Wind Farm infrastructure footprint has been divided into drainage catchments (based on topography, outfall locations, and catchment size) and stormwater runoff rates based on the 10-year return period rainfall event were calculated for various catchment areas in order to size the settlement ponds.

The location and dimensions of proposed settlement ponds are shown on the Proposed Wind Farm Site drainage plan drawings (Appendix 4-3 of the EIAR). A Surface Water Management Plan is included as Appendix 4-7 of the EIAR.

Level Spreaders and Vegetation Filters:

Level spreaders and vegetation filters will be implemented at the settlement ponds. The purpose of level spreaders is to release treated drainage flow in a diffuse manner, and to prevent the concentration of flows at any one location thereby avoiding erosion. Level spreaders are not intended to be a primary treatment component for development surface water runoff. They are not stand-alone but occur as part of a treatment train of systems that will reduce the velocity of runoff prior to be released at the level spreader. In the absence of level spreaders, the potential for ground erosion is significantly greater than not using them.

Vegetation filters are essentially end-of-line polishing filters that are located at the end of the treatment train. In fact, vegetation filters are ultimately a positive consequence of not discharging directly into watercourses which is one of the mitigation components of the drainage philosophy. This makes use of the natural vegetation of the Site to provide a polishing filter for the Proposed Wind Farm drainage prior to reaching the downstream watercourses.

Again, vegetation filters are not intended to be a single or primary treatment component for treatment of works area runoff. They are not sand alone but are intended as part of a treatment train of water quality improvement/control systems (i.e. source controls→check dams→silt traps→settlement ponds→level spreaders →silt fences→vegetation filters).

Pre-emptive Site Drainage Management

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

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

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

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

Works will be suspended if forecasting suggests either of the following is likely to occur:
- >10 mm/hr (i.e., high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:
- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

Management of Runoff from Peat and Spoil Management Areas:

It is proposed that excavated spoil and peat will be used for landscaping where required. The excess material will then be placed in 5 no. dedicated peat/spoil management areas as well as placement of peat in the 1 no. proposed borrow pit once the rock is fully extracted.

All proposed peat and spoil management areas including the borrow pit have been thoroughly assessed from a geotechnical and peat stability perspective (refer to Appendix 8-1 of the EIAR for the Geotechnical and Peat Stability Assessment Report).

All proposed 5 no. peat and spoil management areas, including the borrow pit are located outside of 50m watercourse buffer zones.

During the initial construction of peat and spoil management areas, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from works areas.

Where applicable, the vegetative top-soil layer of the peat and spoil management areas will be rolled back to facilitate placement of excavated spoil, following which the vegetative-top soils layer will be reinstated. Where reinstatement is not possible, spoil and peat management areas will be sealed with a digger bucket and seeded as soon possible to reduce sediment entrainment in runoff.

Drainage from peat and spoil storage areas will ultimately be routed to an oversized swale and a number of stilling ponds pond with appropriate storage and settlement designed for a 1 in 10-year return period before being discharged to the on-site drains.

Peat/subsoil reinstatement areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised peat/subsoil reinstatement areas will no longer be a potential source of silt laden runoff.

Therefore, at each stage of the peat and spoil management area development the above mitigation measures will be deployed to ensure protection of downstream water quality.

Timing of Site Construction Works:

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

Monitoring:

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

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

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each primary watercourse and specifically following heavy rainfall events (as per the CEMP is included in Appendix 4-5 of this EIAR).

4.3.1.3 Mitigation Measures to Excavation Dewatering and Impacts on Surface Water Quality

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

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;

- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a silt bags or silt buster;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken;
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be made available at the borrow pit location for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as final line of defence if needed.

4.3.1.4 Mitigation Measures to Prevent Release of Hydrocarbons during Construction and Storage

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

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Where possible, off-site refuelling will occur at a controlled fuelling station;
- On-site re-fuelling will be undertaken using a fuel truck with spill kits kept on site for accidental leakages or spillages;
- Only designated trained operatives will be authorised to refuel plant on-site;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- All fuel storage areas will be bunded appropriately for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuels stored on-site will be minimised. All storage areas will be bunded appropriately for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The transformer within the proposed substation extension will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency response plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (which is contained in Appendix 4-5).

4.3.1.5 Mitigation Measures for Groundwater and Surface Water Contamination from Wastewater Disposal

- It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site.

4.3.1.6 Mitigation Measures to Prevent Release of Cement-Based Products

- No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined cement washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.7 Mitigation Measures to Prevent Morphological and Hydrological Effects due to Natural Watercourse Crossing Works

- New proposed (natural) watercourse crossings will be bottomless or clear span structures and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing location;
- Where the proposed cable route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road;
- All guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland[2] is incorporated into the design of the proposed crossings;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", i.e., May to September inclusive. This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI);
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas;
- All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- All crossings will be designed to accommodate a 100-year design flood with allowance for 300mm freeboard.

The watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

Confirmatory inspections of the proposed new watercourse crossing location will be carried out by the Project Civil/Structural Engineer and the Project Hydrologist prior to the construction of the crossing.

[2] Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters

In relation to the new proposed culverts and proposed culvert upgrades at forestry drain crossings, the culverts will be suitably sized (approx 900mm) for the expected peak flows in the relevant drain. All culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow as necessary.

4.3.2 Operational Phase

4.3.2.1 Mitigation Measures to Removal of Vegetation Cover and Progressive Replacement of Natural Surface with Low Permeability Surfaces

Proposed Mitigation by Design:

The operational phase drainage system of the Proposed Project will be installed and constructed in conjunction with the road and hardstanding construction work as described below and as shown on the drainage drawings submitted with this planning application:

- Interceptor drains will be maintained up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it will be re-distributed over the ground by means of a level spreader;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in consideration of the greenfield runoff rate.

4.3.3 Decommissioning Phase

The potential impacts associated with decommissioning of the Proposed Project will be similar to those associated with construction but of a reduced magnitude, due to the reduced scale of the proposed decommissioning works in comparison to construction phase works. A description of the decommissioning works is contained in Chapter 4 of this EIAR.

During decommissioning, it will be possible to reverse or at least reduce some of the potential effects caused during construction, and to a lesser extent operation, by rehabilitating constructed areas such as turbine bases and hard standing areas. This will be done by covering with peatland vegetation/scraw or poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation.

The Site roadways will be kept and maintained following decommissioning of the turbine infrastructure, as these will be utilised by ongoing forestry works and by local farmers.

The electrical cabling connecting the site infrastructure to the on-site substation will be removed, while the ducting itself will remain in-situ rather than excavating and removing it, as

this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

The turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported off-site along their original delivery route. The disassembly and removal of the turbines will not have an impact on the hydrological/hydrogeological environment at the Site. Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site.

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

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

Some of the impacts will be avoided by leaving elements of the Proposed Project in place where appropriate. The substation will be retained by EirGrid as a permanent part of the national grid. The turbine bases will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

No significant effects on the hydrological and hydrogeological environment are envisaged during the decommissioning stage of the Proposed Project.

4.3.4 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3** are sufficient to meet the WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table N** below.

Table N: Summary of WFD Status for Unmitigated and Mitigated Scenarios

SWB	WFD Code	Current Status	Assessed Status - Unmitigated	Assessed Status with Mitigation Measures
Inagh[Ennistymon]_SC_010 river sub-catchment				
Inagh (Ennistymon)_040	IE_SH_28I010300	Moderate	Poor	Moderate
Inagh (Ennistymon)_050	IE_SH_28I010450	Moderate	Poor	Moderate
Inagh Estuary	IE_SH_100_0100	Moderate	Moderate	Moderate
Liscannor Bay	IE_SH_100_0000	Good	Good	Good
Annagh[Clare]_SC_010 river sub-catchment				
Glendine (Clare)_010	IE_SH_28G020200	Moderate	Poor	Moderate
Kildeema_010	IE_SH_28K010800	Good	Moderate	Good
Annagh (Clare)_010	IE_SH_28A030900	Bad	Bad	Bad

Shannon Plume (HAs 27;28)	IE_SH_070_0000	High	High	High
Groundwater Bodies				
Milltown Malbay	IE_SH_G_167	Good	Good	Good

4.4 CUMULATIVE IMPACTS

The majority of the Proposed Turbines (6 no. of 9 Proposed Turbines) are located in the Inagh River catchment while the majority of the Proposed Grid Connection Site 33kV underground cabling (5.6km of the total 7.1km) and substation extension are located in the Annagh River catchment. The fact the works associated with the Proposed Project are concentrated in separate catchment areas, means no significant hydrological cumulative effects will occur.

Also, the fact that the Proposed Grid Connection Site 33kV underground cabling is mainly along existing private access roads along with the lack of in-stream works, the intermittent and transient nature of the trenching excavations, the Proposed Grid Connection Site is not expected to contribute to hydrological cumulative effects.

A cumulative impact assessment was undertaken regarding other wind farm developments located within the Annagh River and Inagh River catchments.

In terms of the potential impacts of developments on downstream surface water bodies, the biggest risk is during the construction phase of the Proposed Project as this is the phase when earthworks and excavations will be undertaken at the sites.

However, within the Annagh River catchment, the Slievecallan WF is already operational. Therefore, there is no risk of a construction overlap with the operational Slievecallan WF and the Proposed Project. Presently, there is no proposals or permissions for other wind farm development in the Annagh River catchment

Also, within the Inagh River catchment, other wind farm development is limited to 8 no. operational turbines at Slievecallan WF and 4 no. turbines from the future proposed Illaunbaun WF. No significant effects are likely to occur in the event of a construction phase overlap. Refer to Section 9.5.7.3 of the Water Chapter (Chapter 9) for the cumulative impact assessment completed for other wind farm developments.

5. SUMMARY AND CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the Proposed Project site are defined in **Section 2** above.

The Proposed Project does not involve any abstraction of groundwater or alteration of drainage patterns. Therefore, the quantitative status (i.e., the available quantity (volume) of groundwater and surface water locally) to the receiving waters will remain unaltered during the construction and operational phase of the proposed development.

There is no direct discharge from the Proposed Wind Farm Site to downstream receiving waters. Mitigation for the protection of surface water during the construction, operation and decommissioning phases of the development will ensure the qualitative status of the receiving waters will not be altered by the Proposed Project.

There is also mitigation proposed to protect groundwater quality within the Proposed Project scheme during the construction, operational and decommissioning phases of the development. These mitigation measures will ensure the qualitative status of the underlying GWB will not be altered by the Proposed Project.

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

As such, the Proposed Project:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in Section 9.1.4 of EIAR Chapter 9).

* * * * * * * * * * * * * *

22 Lower Main Street, Dungarvan, Co. Waterford, X35 HK11
T: +353-(0)58-441 22 **F:** +353-(0)58-442 44 **E:** info@hydroenvironmental.ie

www.hydroenvironmental.ie