APPENDIX 9-4

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 ASSESSMENT
LAURCLAVAGH RENEWABLE ENERGY DEVELOPMENT, CO. GALWAY

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

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Author:	**MICHAEL GILL ADAM KEEGAN JOHN TWOMEY**
Signed:	 **Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services**

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO, to complete a Water Framework Directive (WFD) Compliance Assessment for a planning application for the proposed Laurclavagh Renewable Energy Development. The Proposed Project is situated within a slightly elevated area of ground (~45-60mOD) within a broader area which is generally flat to locally undulating and with elevations generally ~30mOD. The Proposed Wind Farm site land is mainly agricultural improved grassland, primarily used for grazing, with existing road carriageways along the Proposed Grid Connection underground cabling route. The Proposed Project covers an area of approximately 945 hectares, in total, and is divided into two distinct areas: the Proposed Wind Farm Site, and the Proposed Grid Connection.

The Proposed Wind Farm site is situated on agricultural pastures, which are well drained. There are 3 no. roads on the north, east and west sides of the Proposed Wind Farm site that enclose it within a broadly triangular shape. The N83 runs in a northerly direction on the east side of the Proposed Wind Farm site. The 2 no. remaining roads are unmarked rural roads. The Proposed Wind Farm site is situated in the townlands of Laurclavagh, Kilcurrivard, Bunnahevelly More.

The Proposed Wind Farm will connect into the proposed onsite 110kV substation, which is located in the centre-east of the Proposed Wind Farm. This substation will be connected to the existing 110kV Cloon Substation via a 14.3km long underground cabling route. The existing Cloon 110kV Substation is located approximately 6km northeast of the Proposed Wind Farm site. The proposed onsite 110kV Substation, adjacent temporary construction compound and the first c. 2km of the underground cabling route to Cloon Substation are elements of the Proposed Grid Connection which overlap with the Proposed Wind Farm 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 planning application for the Proposed Wind Farm.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist 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 Adam Keegan, Michael Gill and John Twomey.

Adam Keegan PGeo (B.Sc., M.Sc., P. Geo) is a hydrogeologist with 5 years environmental consultancy experience in Ireland. Adam has worked on numerous Environmental Impact Assessments for infrastructure projects, such as wind farms, strategic housing developments and quarries. Adam has experience in intrusive site investigation works within mapped karst environments and experience in trial and production well drilling within areas mapped as Regionally Karstified. Adam has worked on several wind farm EIAR projects, including Seven Hills WF, Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Coole WF.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 18 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 Slievecallan WF, Cahermurphy (Phase I & II) WF, Carrownagowan WF, and Croagh WF and over 100 other wind farm related projects across the country.

John Twomey (BSc) is a recent graduate of Earth and Ocean Science from the University of Galway. He has recently worked on hydrogeological and hydrological impact assessments for quarries, windfarms and industrial developments.

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.

The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the proposed wind farm development, include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

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.

We note that the River Basin Management Plan 2022-2027 is out for public consultation presently, and that closed in March 2023.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

This section identifies those surface water and groundwater bodies with potential to be affected by the Proposed Project and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

On a regional scale, the Proposed Project is located within the Corrib WFD Catchment (HA 30).

On a more local scale, the Proposed Project is located within the Clare (Galway)_SC_060 WFD sub-catchment and the Ballinduff Stream_010 and Clare (Galway)_060 WFD river sub-basins.

The closest surface water body (SWB) to the Proposed Project is the River Clare (EPA Name: Clare [Galway]) located 3.9km to the east of the Proposed Wind Farm site and situated along the route of the Proposed Grid Connection underground cabling route. This is an Order 5 river, having large flow volumes and high flow velocities, which travels 29km to the southwest before discharging into the Lough Corrib. To the west, within the Ballinduff Stream_010 river sub-basin, the closest SWB to the Proposed Wind Farm site is the Ballinduff (Stream) (EPA name), located 1.9km to the west of the Wind Farm site. This SWB then flows in a south-westerly direction for 2.4km before discharging into Lough Corrib.

To the east of the Proposed Wind Farm site and situated along the Proposed Grid Connection underground cabling route, the River Clare travels from the Clare (Galway)_060 river sub-basin through to the Clare (Galway)_100, located adjacent to the Corrib Lower lake body (IE_WE_30_666a). To the west of the Proposed Wind Farm site, the Ballinduff (Stream) flows through the Ballinduff Stream_010 river sub-basin and then into the Corrib Lower lake body.

The Lower Corrib lake body (Lough Corrib) is located within the Corrib_010 WFD river sub-basin, and has an area of 372km^2. The River Corrib (IE_WE_30C020300) flows out of the Lough Corrib and into the Corrib_020 river sub-basin. Here, the River Corrib makes its way south through Galway City, until it discharges into the Corrib Estuary (IE_WE_170_0700).

All river waterbodies in the immediate vicinity of the Site are assigned current WFD Status classifications (2016-2021).

Error! Reference source not found. Presents the total upstream sub-catchment area of the Clare (Galway)_SC_060 that drains the Proposed Project site, and the total catchment area of the rivers downstream from the Site as far as the Corrib Lower lake body. The total upstream catchment area of the Clare (Galway)_SC_060 is 1,137.9km^2. Therefore, the river waterbodies which are located in close proximity to the Proposed Project Site, which have relatively smaller upstream catchment areas (Ballinduff Stream_010), will be more susceptible to water quality impacts as a result of the Proposed Project in comparison to the river and lake bodies located further downstream. However, it is important to note that there are no surface water bodies (streams/rivers) within the Proposed Wind Farm site. All rainfall percolates to ground, without surface water runoff. The Proposed Grid Connection underground cabling route exists within the Clare (Galway)_050 and the Clare (Galway)_060 sub-basins (as seen in **Figure A**). **Figure A** below is a local hydrology map of the area.

Table A: Upstream Catchment Size for River Waterbodies

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Clare (Galway)_SC_060	
Clare (Galway)_050	671.3
Clare (Galway)_060	705.2
Clare (Galway)_070	942.9
Clare (Galway)_080	987.8
Clare (Galway)_090	1041.9
Clare (Galway)_100	1137.9
Ballinduff Stream_010	48.3

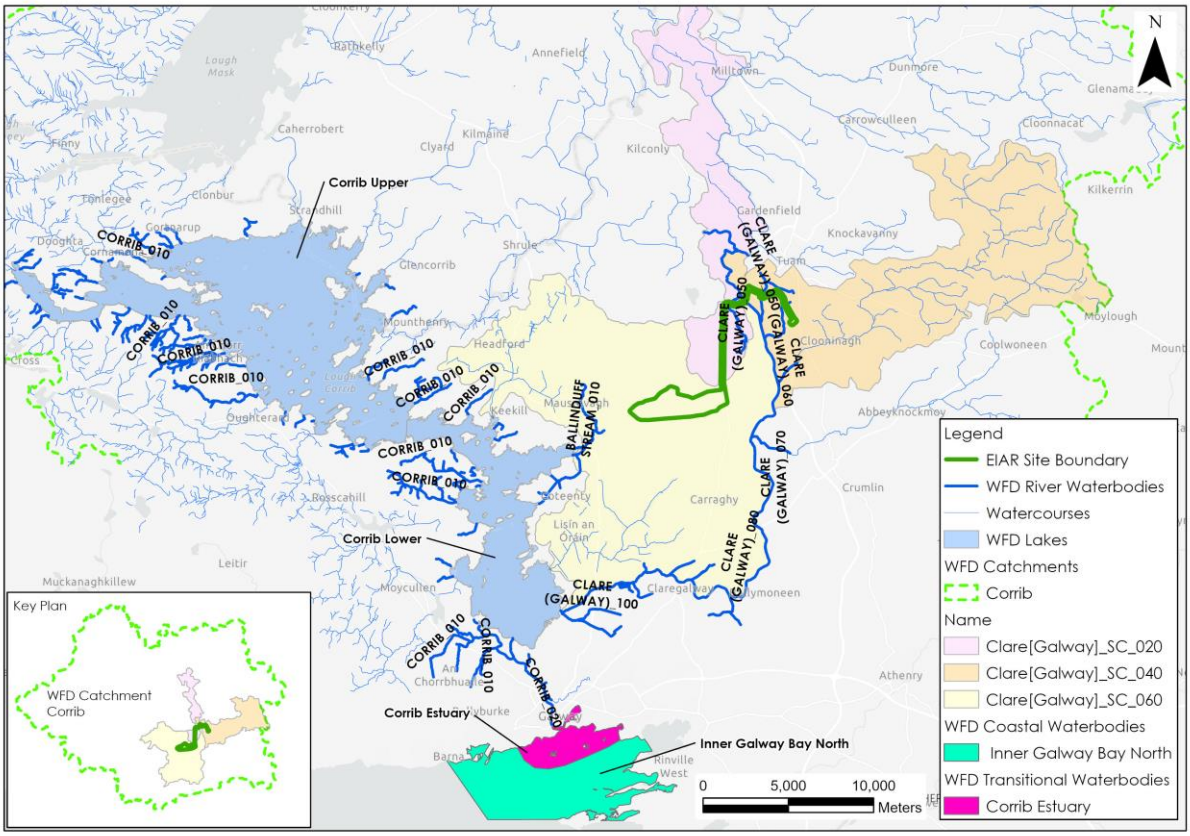

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the Proposed Project are shown in **Table B**. The overall status of SWBs 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).

The Proposed Wind Farm site and the southern section of the Proposed Grid Connection underground cabling route is located in the Ballinduff Stream_010 and the Clare (Galway_060) river sub-basins. The Ballinduff Stream_010 SWB is assigned a 2016-2021 WFD Status of "Good" and is deemed to be "Not at risk" of failing to meet its WFD objectives. The Clare (Galway)_060 SWB is assigned a 2016-2021 Status of "Poor" and is deemed to be "At risk" of not meeting the WFDs 2027 objectives.

The most northern section of the Proposed Grid Connection underground cabling route is situated in the Clare(Galway)_050 river sub-basin. The Clare (Galway)_050 SWB is assigned a WFD 2016-2021 Status of "Moderate" and its risk status is currently "under review".

Further downstream:

- The Clare (Galway)_070 SWB is assigned a WFD 2016-2021 Status of "Good" and is deemed to be "Not at risk" of failing to meet its WFD 2027 objectives.
- The Clare (Galway)_080 SWB is assigned a WFD 2016-2021 Status of "Moderate" and is deemed to be "At risk" of failing to meet its WFD 2027 objectives.
- The Clare (Galway)_090 SWB is assigned a WFD 2016-2021 Status of "Moderate" and is deemed to be "At risk" of failing to meet its WFD 2027 objectives.
- The Clare (Galway)_100 SWB is assigned a WFD 2016-2021 Status of "Moderate" and its risk status is currently "Under Review".
- The Corrib Lower lake body is assigned a WFD 2016-2021 Status of "Good" and is deemed to be "Not at risk" of failing to meet its WFD 2027 objectives.
- The Corrib_010 SWB is assigned a WFD 2016-2021 Status of "Good" and is deemed as being "Not at risk" of failing to meet its WFD objectives.
- The Corrib_020 SWB has a WFD 2016-2021 Status of "Good" also and is deemed to be "Not at risk" of failing to meet its WFD objectives.
- The Corrib Estuary transitional waterbody has a WFD 2016-2021 Status of "Moderate" and its risk status is currently "Under Review".
- The Inner Galway Bay North coastal waterbody has a current WFD 2016-2021 Status of "Good" and is deemed to be "Not at risk" of failing to meet its WFD objectives.

The 3rd Cycle Corrib Catchment Report (EPA, 2021) states that hydromorphology is a significant pressure on the Clare (Galway)_060, _080 and _090 SWBs in the vicinity and downstream of the Proposed Project.

The SWB status for the 2016-2021 WFD cycle are shown on Error! Reference source not found..

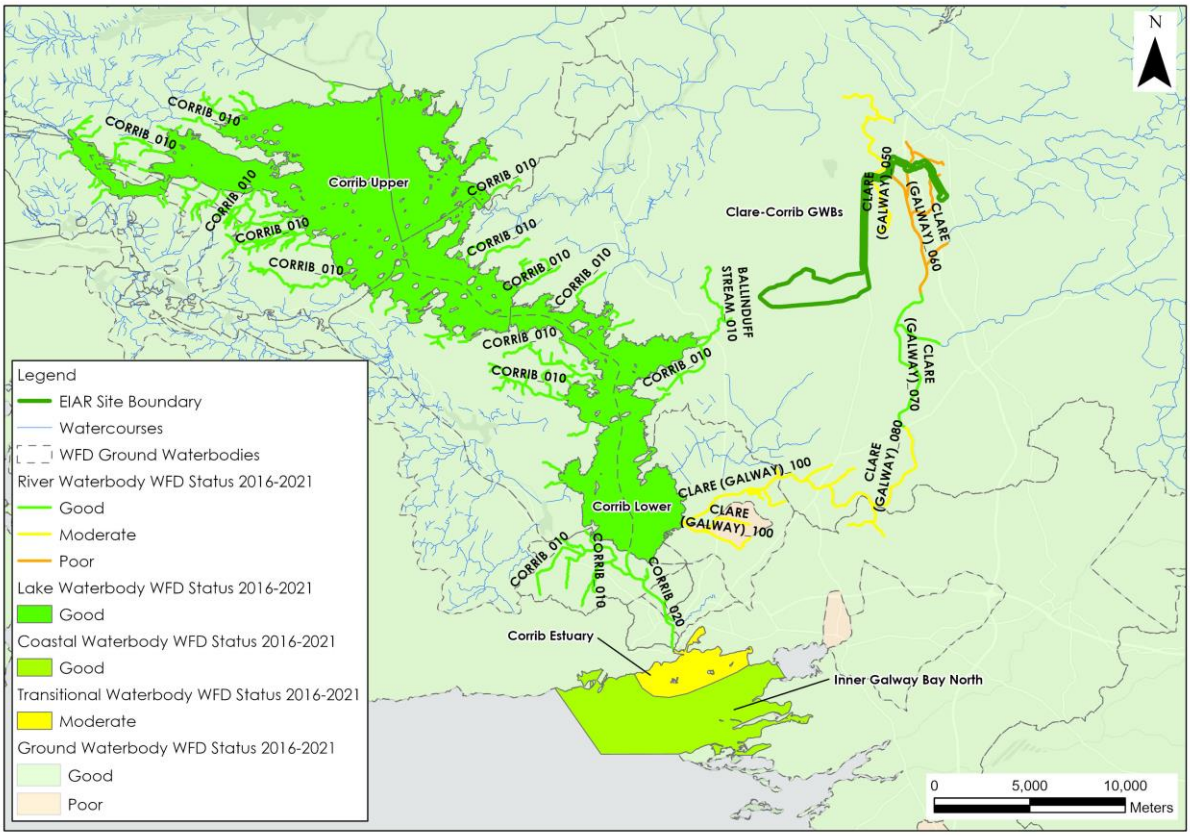

Figure B: WFD Surface Waterbody and Groundwater Body Status (2016-2021)

Table B: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Risk 2nd Cycle	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk 3rd Cycle	Pressures
Ballinduff Stream_010	Not assigned	Not at risk	Good	Good	Not at risk	None
Clare (Galway)_050	Good	Not at risk	Good	Moderate	Under review	None
Clare (Galway)_060	Moderate	At risk	Moderate	Poor	At risk	Hydro
Clare (Galway)_070	Good	Not at risk	Good	Good	Not at risk	None
Clare (Galway)_080	Moderate	At risk	Moderate	Moderate	At risk	Hydro
Clare (Galway)_090	Moderate	At risk	Moderate	Moderate	At risk	Hydro
Clare (Galway)_100	Unassigned	Not at risk	Moderate	Moderate	Under review	None
Corrib Lower	Moderate	At risk	Good	Good	Not at risk	None
Corrib_010	Unassigned	Not at risk	Unassigned	Good	Not at risk	None
Corrib_020	Good	Not at risk	Good	Good	Not at risk	None
Corrib Estuary	Good	Not at risk	Good	Moderate	Review	None
Inner Galway Bay North	Good	Not at risk	Good	Good	Not at risk	None

2.4 GROUNDWATER BODY IDENTIFICATION

The Dinantian Pure Bedded Limestones that are mapped to underlie the Proposed Project Site are classified by the GSI (www.gsi.ie) as a Regionally Important Aquifer – Karstified (conduit).

The Clare-Corrib GWB underlies the Site.

2.5 GROUNDWATER BODY CLASSIFICATION

The Clare-Corrib (IE_WE_G_0020) GWB is currently assigned 'Good Status', which is defined based on the quantitative status and chemical status of the GWB. The Clare-Corrib GWB is "Not at risk" of failing to meet its WFD objectives. No significant pressures have been identified to be impacting this GWB.

The GWB status for the 2016-2021 WFD cycles are given below in **Table C** and shown on **Figure B**.

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Risk 2nd Cycle	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk 3rd Cycle	Pressures
Clare-Corrib	Good	At risk	Good	Good	Not at risk	None

2.6 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's), shellfish protected areas and Drinking Water Protected Area's (DWPA) within the vicinity of the Site are considered as part of the assessment.

2.6.1 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.

To the east of the Site, the River Clare is designated as part of the Lough Corrib SAC (000297). To the west of the Site, the Lower Corrib lake body is designated as the Lough Corrib SAC (000297), the Lough Corrib SPA (004042) and Lough Corrib pNHA.

2.6.2 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 are multiple bathing water areas downstream of the Site within Galway Bay. These include Ballyloughane Beach (IEWEBWT170_0700_0200), Grattan Road Beach (IEWEBWT170_0700_0100) and Salthill Beach (IEWEBWC170_0000_0200).

2.6.3 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.

There are no NSAs within the vicinity of the Site.

2.6.4 Shellfish Waters

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 areas that lie downstream of the Site.

2.6.5 Drinking Water

The Lower Corrib lake body (IE_WE_30_666a) is designated by the EPA (www.epa.ie) as a Drinking Water Protected Area (DWPA) and an Article 7 Abstraction for Drinking Water. Downstream of the Lower Corrib lake body, the Corrib_020 SWB (River Corrib) is also designated as a DWPA.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 7 no. river water bodies that are located in the vicinity or downstream of the Site as far as Lough Corrib. In addition, there is 1 no. lake waterbody downstream of the Site. Furthermore, the Site is underlain by 1 no. GWB.

3.1 SURFACE WATER BODIES

As shown in **Figure A** above, there are 7 no. SWBs located in the vicinity or downstream of the Site.

With consideration for the construction, operational and decommissioning phases of the Proposed Project, it is considered that the 7 no. of river waterbodies, the Ballinduff (Stream)_010SWB to the west and the Clare (Galway)_050 through to the Clare (Galway)_100 SWBs located to the east of the Site will all be included in the WFD Impact Assessment as they are located downstream and in close proximity to the Site.

The Corrib Lower lake waterbody will be screened out of the WFD Impact Assessment due to the large volume of water it holds, which has the potential to dilute possible contaminants that flow downstream from the Site. There is no potential to cause a deterioration in the status of this screened out SWB and/or jeopardise their attainment of good surface water status.

The Corrib_010 and Corrib_020 SWBs will not be included in the WFD Impact Assessment as they lie distally downstream of Lough Corrib and both have large flow volumes and high velocity flows. The flows in these SWBs are magnitudes of orders larger than surface water runoff from the Proposed Grid Connection underground cabling route or groundwater baseflow from the Proposed Wind Farm site (no surface water runoff from Wind Farm site). Therefore, there is no potential to cause a deterioration in the status of this screened out SWB and/or jeopardise their attainment of good surface water status.

The Corrib Estuary transitional waterbody will not be included in the WFD Impact Assessment as there is a large volume of saline water and large tidal currents in this waterbody. The Inner Galway Bay North coastal waterbody will also not be brought through to the WFD Impact Assessment, for the same reasons as given or the Corrib Estuary. There is no potential to cause a deterioration in the status of these screened out SWBs and/or jeopardise their attainment of good surface water status.

3.2 GROUNDWATER BODIES

With respect to GWBs, the Clare-Corrib GWB has been screened in due to its location directly underlying the Site (along the Proposed Grid Connection underground cabling route). The Proposed Project 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

The Lough Corrib SAC (000297) will be brought through to the WFD Impact Assessment as the River Clare, located along the Proposed Grid connection underground cabling route, is mapped as part of this SAC. The Lough Corrib SPA (004042), situated in the Lower Corrib lake body, will be brought through to the WFD Impact Assessment due to the proximal location of the lake to the Proposed Project.

The Bathing Waters located downstream of the Site, within Galway Bay, will not be brought through to the WFD Impact Assessment due to the large amounts of saline water and tidal

currents present at these locations, along with the significant distance involved and the presence of a large lake body (Lough Corrib). Therefore, the Proposed Project has no potential to affect these bathing waters.

The Lower Corrib lake body (IE_WE_30_666a) DWPA will not be brought through to the WFD Impact Assessment as Lough Corrib has a large amount of water that can attenuate any runoff generated upstream, and as such, Lough Corrib's WFD Status will not deteriorate. The Corrib_020 SWB (IE_WE_30C020600) is also deemed a DWPA which lies downstream of the Lower Corrib lake body and the Site. This DWPA will not be brought through to the WFD Impact Assessment due to it being situated downstream of the Lower Corrib lake body as well as the large volume and high velocity flow it has. Therefore, the Proposed Project has no potential to affect these DWPAs.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table D**.

Table D: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	River	Ballinduff (Stream)_010	**Yes**	The Proposed Project is located within the Ballinduff (Stream)_010 river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Project on this SWB.
	River	Clare (Galway)_060	**Yes**	The Proposed Project is located within the Clare (Galway)_050 river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Project on this SWB.
	River	Clare (Galway)_060	**Yes**	The Proposed Project is located within the Clare (Galway)_060 river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Project on this SWB.
	River	Clare (Galway)_070	**Yes**	The Clare (Galway)_070 is located downstream of the Clare (Galway)_060 Therefore, an assessment is required to consider the potential effects of the Proposed Project on this SWB.
	River	Clare (Galway)_080	**Yes**	The Clare (Galway)_080 is located downstream of the Clare (Galway)_070 SWB. Therefore, an assessment is required to consider the potential effects of the Proposed Project on this SWB.
	River	Clare (Galway)_090	**Yes**	The Clare (Galway)_090 is located downstream of the Clare (Galway)_080 SWB. Therefore, an assessment is required to consider the potential effects of the Proposed Project on this SWB.
	River	Clare (Galway)_100	**Yes**	The Clare (Galway)_100 is located downstream of the Clare (Galway)_090 SWB. Therefore, an assessment is required to consider the potential effects of the Proposed Project on this SWB.
	Lake	Lower Corrib	No	The Lower Corrib lake body (Lough Corrib) will not be included into the WFD Impact Assessment due to the large amount of water it holds that has the capability of attenuating runoff that may come downstream from the Site. The Proposed Project has no potential to impact the status of this SWB.
	River	Corrib_010	No	The Corrib_010 is located downstream of Lough Corrib and due to the large amount of water in the lake, there will be no potential for effects. The Proposed Project has no potential to impact the status of this SWB.
	River	Corrib_020	No	The Corrib_020 is located downstream of Lough Corrib and due to the large amount of water in the lake, there will be no potential for effects. The Proposed Project has no potential to impact the status of this SWB
	Transitional	Corrib Estuary	No	The Corrib Estuary has a large amount of saline water and strong tidal currents. There is no possibility of this SWBs WFD Status deteriorating as a result of the Proposed Project and as such it will not be brought through to the WFD Impact Assessment.
	Coastal	Inner Galway Bay North	No	The Inner Galway Bay North has a large amount of saline water and strong tidal

				currents. There is no possibility of this SWBs WFD Status deteriorating as a result of the Proposed Project and as such it will not be brought through to the WFD Impact Assessment.
Ground water Body	Groundwater	Clare-Corrib	**Yes**	The Clare-Corrib GWB underlies the Proposed Project. An assessment is required to consider potential effects of the Proposed Project on this GWB.
Protected Areas	SAC	Lough Corrib	**Yes**	Lough Corrib SAC is located within the Clare River (Clare (Galway_060) SWB) to the east of the Proposed Wind Farm site. Due to its proximal location to the Proposed Project, it will be brought through to the WFD Impact Assessment.
	SPA	Lough Corrib	**Yes**	Lough Corrib SPA is located within the Lower Corrib lake body to the west of the Proposed Project. Due to the regional groundwater flow in this direction (west/southwest *i.e* The Site towards Lough Corrib), it will be brought through to the WFD Impact Assessment.
	pNHA	Lough Corrib	**Yes**	Lough Corrib pNHA is located within the Lower Corrib lake body to the west of the Proposed Project. Due to its proximal location to the Site and groundwater flow direction from it towards Lough Corrib, it will be brought through to the WFD Impact Assessment.
	Bathing Waters	Ballyloughane Beach (IEWEBWT170_0700_0200)	No	These bathing waters will not be brought through to the WFD Impact Assessment due to the large amount of saline water and the tidal currents that will not cause the WFD Status of the Corrib Estuary to deteriorate.
		Grattan Road Beach (IEWEBWT170_0700_0100)	No	These bathing water will not be brought through to the WFD Impact Assessment due to the large amount of saline water and the tidal currents that will not cause the WFD Status of the Corrib Estuary to deteriorate.
		Salthill Beach (IEWEBWC170_0000_0200)	No	This bathing water will not be brought through to the WFD Impact Assessment due to the large amount of saline water and the tidal currents that will not cause the WFD Status of the Corrib Estuary/Inner Galway Bay North coastal waterbody to deteriorate.
	Drinking Water Protected Areas	Lower Corrib	No	The Lower Corrib (Lough Corrib) DWPA will not be brought into the WFD Impact Assessment due to large amount of water that has the capability of attenuating any runoff that may come downstream of the Proposed Project. Therefore, there will be no deterioration in the SWBs status.
		Corrib_020	No	The Corrib_020 SWB DWPA will not be brought into the WFD Impact Assessment due to the fact that it lies downstream of Lough Corrib, and it also has a large amount of water and high velocity flow. Therefore, there will be no deterioration in the SWBs status.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

For the purposes of this EIAR:

- *The 'Proposed Wind Farm' refers to the 8 no. turbines and supporting infrastructure which is the subject of this Section 37E application.*
- *The 'Proposed Grid Connection' refers to the 110kV substation and supporting infrastructure which will be the subject of a separate Section 182A application.*
- *The 'Proposed Project' comprises the Proposed Wind Farm and the Proposed Grid Connection, all of which are located within the EIAR Site Boundary (the 'Site') and assessed together within the EIAR and this accompanying WFD Assessment report.*

A detailed description of the Proposed Project is provided in Chapter 4 of the Laurclavagh Renewable Energy Development EIAR'.

Due to the nature of wind farm developments (and associated grid connection underground cabling), being near surface construction activities, impacts on surface watercourses are normally the primary receptor. However given the lack of surface water features within the Proposed Wind Farm site, there are effectively no pathways to impact on downgradient surface water quality within the Proposed Wind Farm site, while there are existing potential pathways along the Proposed Grid Connection underground cabling route.

The primary risk at the Proposed Wind Farm site is the potential to affect groundwater quality, through alteration of the quality/quantity of recharge to ground.

The primary risk to surface waters with the Site will be entrained suspended sediments (soil particles) in runoff during earthworks along with the use of cement-based compounds.

The primary risks of degradation of groundwaters include:

- Chemical pollution of groundwaters by concrete, oils and fuels.
- Alteration of groundwater recharge patterns.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects from Works within the Proposed Wind Farm Site

Construction phase activities will require earthworks resulting in removal of vegetation cover and excavation of soil and subsoils.

The main risk will be from surface water runoff from bare soil areas during construction works.

Hydrocarbons and cement-based compounds will also be used during the construction phase.

These activities can result in the release of suspended solids and pollutants in runoff water (again, there are no surface water pathways within the Proposed Wind Farm site but there are potential pathways along the Proposed Grid Connection underground cabling route) 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 of downstream water bodies such as the Ballinduff (Stream)_010 SWB and the Clare (Galway)_060 SWB.

These SWBs are relatively distal in relation to the Site (apart from watercourse crossing along the Grid Connection underground cabling route). However, there is the possibility of these contaminants having the potential to cause a deterioration in the overall status of the Ballinduff (Stream)_010 and the Clare (Galway)_060 river waterbodies Further downstream the status of the Clare (Galway)_070 to the Clare (Galway)_100 river waterbodies are unlikely to be impacted even in an unmitigated scenario due to the distant location of the SWB from the Proposed Project and the increasing volumes of water within these rivers. However, they are included into the WFD Impact Assessment as a precautionary measure.

A summary of potential status change to SWBs arising from surface water quality effects from earthworks during the construction phase of the Proposed Wind Farm site in the unmitigated scenario are outlined in

Table E.

Table E: Surface Water Quality Effects during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Ballinduff (Stream)_010	IE_WE_30B050100	Not assigned	Not assigned (potential deterioration in water quality)
Clare (Galway)_050	IE_WE_30C010700	Moderate	Poor
Clare (Galway)_060	IE_WE_30C010800	Moderate	Poor
Clare (Galway)_070	IE_WE_30C011000	Good	Good
Clare (Galway)_080	IE_WE_30C011100	Moderate	Moderate
Clare (Galway)_090	IE_WE_30C011200	Moderate	Moderate
Clare (Galway)_100	IE_WE_30C011300	Unassigned	Unassigned (no change in water quality)

4.2.1.2 Potential Groundwater Quality/Quantity Effects

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. These sources of contamination have the potential to impact on groundwater quality in the underlying GWB in the area of the Proposed Project.

The dewatering excavations such as turbine bases have the potential to impact local groundwater levels. However, groundwater level impacts will not occur due to the local hydrogeological regime. No groundwater level impacts are predicted from the construction of the Grid Connection underground cabling route due to the shallow nature of the excavation (i.e. ~1.3m).

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction phase of the Proposed Project in the unmitigated scenario are outlined in

Table F.

Table F: Groundwater Quality Effects during Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Clare-Corrib	IE_WE_G_0020	Good	Moderate

4.2.1.3 Potential Surface Water Quality Effects along the Turbine Delivery Route / Grid Connection Route

There are no earthworks proposed along the Turbine Delivery route. As such, there will be no impacts on the WFD status or risk of any nearby watercourses.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the Proposed Grid Connection underground cabling route in the unmitigated scenario are outlined in

Table G.

Table G: Surface Water Quality Effects during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Ballinduff (Stream)_010	IE_WE_30B050100	Unassigned	Unassigned (no change)
Clare (Galway)_050	IE_WE_30C010700	Moderate	Moderate – no change
Clare (Galway)_060	IE_WE_30C010800	Moderate	Moderate-No change
Clare (Galway)_070	IE_WE_30C011000	Good	Good – No change
Clare (Galway)_080	IE_WE_30C011100	Moderate	Moderate – no change
Clare (Galway)_090	IE_WE_30C011200	Moderate	Moderate- no change
Clare (Galway)_100	IE_WE_30C011300	Unassigned	Unassigned (no change)

4.2.2 Operational Phase (Unmitigated)

4.2.2.1 Increased Site Runoff and Hydromorphology Effects on River Water Bodies

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 Site and increase flood risk downstream of the development.

As stated in the EIAR there are no surface watercourses within the Proposed Wind Farm site and all rainfall infiltrates to ground.

Along the Grid Connection underground cabling route, the excavated trench for the cabling will be small scale (~1.3m deep) and will be backfilled and re-instated once complete. As such there will be no change in permeability or increased runoff from the Proposed Grid Connection underground cabling route.

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

Table H: Potential Effects on Surface Water Flows during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Ballinduff (Stream)_010	IE_WE_30B050100	Not assigned	Not assigned
Clare (Galway)_050	IE_WE_30C010700	Moderate	Moderate
Clare (Galway)_060	IE_WE_30C010800	Moderate	Moderate
Clare (Galway)_070	IE_WE_30C011000	Good	Good
Clare (Galway)_080	IE_WE_30C011100	Moderate	Moderate
Clare (Galway)_090	IE_WE_30C011200	Moderate	Moderate
Clare (Galway)_100	IE_WE_30C011300	Unassigned	Unassigned

4.2.2.2 Surface Water Quality Effects from Operational Site Drainage

During the operational phase of the Proposed Project, 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. Again, due to the nature of the soil, subsoil and the overall hydrogeological regimen within the Proposed Wind Farm site, there will be no runoff from the Proposed Wind Farm site as all water will infiltrate to ground.

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

Table I.

Table I: Surface Water Quality Effects during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Ballinduff (Stream)_010	IE_WE_30B050100	Unassigned	Unassigned (no change)
Clare (Galway)_050	IE_WE_30C010700	Moderate	Moderate
Clare (Galway)_060	IE_WE_30C010800	Moderate	Moderate

Clare (Galway)_070	IE_WE_30C011000	Good	Good
Clare (Galway)_080	IE_WE_30C011100	Moderate	Moderate
Clare (Galway)_090	IE_WE_30C011200	Moderate	Moderate
Clare (Galway)_100	IE_WE_30C011300	Unassigned	Unassigned (no change)

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, operational and decommissioning phases of the Proposed Project. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Protect Surface Water Quality during Earthworks

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in **Table** J below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls.

Table J: Summary of Drainage Mitigation & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	• Drainage design of Wind Farm site includes the separation of potential clean and dirty water (refer to Drainage design drawings), as well as the routing of any surface water to infiltration areas over small flow paths. • Using small working areas; and, • Working in appropriate weather and suspending certain work activities in advance of forecasted wet weather.	Proposed Wind Farm site and Proposed Grid Connection underground cabling route
Source Controls:	• Use of upstream interceptor drains and downstream collector drains, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment may be generated.
	• Using small working areas; • Covering/ sealing stockpiles and promoting vegetation growth.	Stockpiles areas
In-Line Controls:	• Interceptor drains, vee-drains, oversized swales/collector drains; • Erosion and velocity control measures such as: o sand bags; o oyster bags filled with gravel; o filter fabrics; o straw bales; o flow limiters; o weirs or baffles; o and/or other similar/equivalent or appropriate systems. • Silt fences, filter fabrics; • Collection sumps, temporary sumps, pumping	Interceptor and collection drainage systems

	systems; • Attenuation lagoons; • Sediment traps, stilling / settlement ponds.	
Water Treatment Controls:	• Temporary sumps; • Attenuation ponds; • Temporary storage lagoons; • Sediment traps, Stilling / Settlement ponds, silt bags; • Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.	Surface water treatment locations
Outfall Controls:	• Levelspreaders; • Buffered outfalls; • Vegetation filters; • Silt bags; • Flow limiters and weirs.	Drainage run outfalls and overland discharge points

A site-specific drainage design has been developed for the Proposed Wind Farm site, with the main aims of separating clean water from potential sediment laden water (to reduce volumes of water to manage), as well as the use of infiltration areas to allow any sediment to fall out of suspension within these areas and the water to infiltrate to ground.

4.3.1.2 Mitigation Measures to Water Quality during Excavation Dewatering

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 on-site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit if required;
- 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 should immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment laden 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 a final line of defence if needed.

4.3.1.3 Mitigation Measures to Protect Against the Release of Hydrocarbons

Mitigation measures proposed to avoid the release of hydrocarbons at the Proposed Wind Farm site and along the Proposed Grid Connection underground cabling route include:

- Minimal refuelling or maintenance of vehicles or plant will take place on-site. Off-site refuelling will occur where possible;
- On site re-fuelling of machinery will be carried out using a refuelling truck;
- The fuel truck will be re-filled off site, and will be driven directly to machinery on-site which require refuelling;

- The fuel truck will also carry fuel absorbent material and pads in the event of any accidental spillages;
- The fuel truck will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site;
- Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Onsite refuelling will be carried out by trained personnel only;
- Fuels stored within the Site will be minimized and will be appropriately bunded;
- Surface water runoff from temporary construction compounds will be collected and drained via silt traps and hydrocarbons interceptors prior to recharge to ground;
- A permit to fuel will be put in place;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose;
- An emergency plan for the construction phase to deal with accidental spillages is included within the Construction and Environmental Management Plan; and,
- Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

4.3.1.4 Mitigation Measures to Prevent Groundwater and Surface Water Contamination from Wastewater Disposal

Mitigation measures proposed to avoid the release of wastewater at the Proposed Wind Farm site include:

- It is proposed to manage wastewater during the construction phase from the temporary staff welfare facilities, by means of a sealed storage tank (port-a-loo), with all wastewaters being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site.

4.3.1.5 Mitigation Measures to Prevent the Release of Cement-Based Products

Best practice methods for cement-based compounds:

- No batching of wet-concrete products will occur within the Proposed Wind Farm site or along the Proposed Grid Connection underground cabling route. Ready-mixed supply of wet concrete products 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 concrete contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined concrete washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.6 Mitigation Measures to Prevent Morphological Changes to Surface Water Crossing and Drainage Patterns

The proposed mitigation measures include:

- There are no new stream crossings proposed as part of the Proposed Project;
- No in-stream excavation works are proposed;
- Where the proposed underground cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road;

- 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; and,
- 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.

4.3.1.7 Mitigation Measures to Protect Groundwater Quality

The potential pollution of groundwater during the construction phase will be mitigated by the provision of appropriate controls and working methods. These include best practice methods for storage and handling of fuels and chemicals and wastewater outlined in Sections 4.3.1.3, 4.3.1.4 and 4.3.1.5 above.

4.3.1.8 Mitigation Measures to Protect Water Quality along the Turbine Delivery Route

- There are no proposed works along the Turbine Delivery route which could impact on water quality. No mitigation measures are proposed.

4.3.2 Operational Phase

4.3.2.1 Increased Site Runoff and Hydromorphology Effects

The operational phase drainage system of the Proposed Wind Farm site will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of infiltration areas;
- 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, which will be directed to infiltrate to ground; and,
- 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.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

The mitigation measures to protect against poor quality runoff during the operational phase of the Proposed Project are the same as those outlined in **Section 4.3.1.1** above.

Mitigation measures for oils and fuels during the operational phase of the Proposed Project are the same as those outlines in **Section 4.3.1.3** above.

4.3.2.3 Mitigation Measures to Protect Groundwater Quality

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewaters being tankered off site by permitted waste collector to wastewater treatment plants.

Mitigation measures for oils and fuels during the operational phase of the Proposed Project are the same as those outlines in **Section 4.3.1.3** above.

4.3.1 Decommissioning Phase

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

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 vegetation to encourage vegetation growth and reduce run-off and sedimentation.

The Proposed Wind Farm roadways will be kept and maintained following decommissioning of the Proposed Wind Farm, as these will be utilised by ongoing maintenance works and by other participating landowners.

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.

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 Proposed Wind Farm site.

Other impacts such as possible soil 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. Similar mitigation implemented during the construction phase will be utilised during the decommissioning phase to ensure no impacts of receiving waters.

Some of the potential impacts of water bodies will be avoided by leaving elements of the Proposed Project in place where appropriate. The Proposed Grid Connection (substation & underground cabling) will be retained by EirGrid as a permanent part of the national grid, and therefore it will not be decommissioned. The turbine bases will be rehabilitated by covering with local topsoil 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.

With the implementation of the mitigation measures outlined above no significant effects on the hydrological and hydrogeological environment will occur during the decommissioning phase of the Proposed Project.

4.3.2 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3** will allow all relevant waterbodies to maintain their existing status and meet future WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table K** below.

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

SWB	WFD Code	Current Status	Assessed Potential Status Change- Unmitigated	Assessed Status with Mitigation Measures
Ballinduff (Stream)_010	IE_WE_30B050100	Unassigned	Unassigned (potential deterioration in water quality)	Unassigned (no change)
Clare (Galway)_050	IE_WE_30C010700	Moderate	Poor	Moderate
Clare (Galway)_060	IE_WE_30C010800	Moderate	Poor	Moderate
Clare (Galway)_070	IE_WE_30C011000	Good	Good	Good
Clare (Galway)_080	IE_WE_30C011100	Moderate	Moderate	Moderate
Clare (Galway)_090	IE_WE_30C011200	Moderate	Moderate	Moderate
Clare (Galway)_100	IE_WE_30C011300	Unassigned	Unassigned (no change)	Unassigned (no change)
Clare-Corrib	IE_WE_G_0020	Good	Moderate	Good

5. WFD ASSESSMENT CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the 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, operational and decommissioning phases of the Proposed Project.

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

Mitigation measures will be implemented to protect groundwater quality within the Site 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.

In the event where the current status of the waterbody is Unassigned, Moderate or Poor (i.e. Clare (Galway)_060 river waterbody) the Proposed Project will not prevent these waterbodies from achieving Good Status in the future.

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).

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