

**WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT
PROPOSED WIND FARM AND GRID CONNECTION, COOLOO, CO. GALWAY**

FINAL REPORT

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Author:	MICHAEL GILL DAVID BRODERICK NITESH DALAL
Signed:	 Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services
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TABLE OF CONTENTS

1. INTRODUCTION	4
1.1 BACKGROUND	4
1.2 STATEMENT OF AUTHORITY	4
1.3 WATER FRAMEWORK DIRECTIVE	5
2. WATERBODY IDENTIFICATION CLASSIFICATION	6
2.1 INTRODUCTION	6
2.2 SURFACE WATERBODY IDENTIFICATION	6
2.3 SURFACE WATER BODY CLASSIFICATION	9
2.4 GROUNDWATER BODY IDENTIFICATION	14
2.5 GROUNDWATER BODY CLASSIFICATION	14
2.6 PROTECTED AREA IDENTIFICATION	14
2.6.1 Nature Conservation Designations	14
2.6.2 Bathing Waters	15
2.6.3 Nutrient Sensitive Areas	15
2.6.4 Shellfish Areas	15
2.6.5 Salmonid Waters	16
2.6.6 Drinking Water Protected Areas	16
3. WFD SCREENING	17
3.1 SURFACE WATER BODIES	17
3.2 GROUNDWATER BODIES	17
3.3 PROTECTED AREAS	17
3.4 WFD SCREENING SUMMARY	18
4. WFD COMPLIANCE ASSESSMENT	22
4.1 PROPOSED PROJECT	22
4.2 POTENTIAL EFFECTS	23
4.2.1 Construction Phase (Unmitigated)	23
4.2.2 Operational Phase (Unmitigated)	26
4.3 MITIGATION MEASURES	28
4.3.1 Construction Phase	29
4.3.2 Operational Phase	35
4.3.3 Decommissioning Phase	36
4.3.4 Potential Effects with the Implementation of Mitigation	37
4.4 CUMULATIVE EFFECTS	38
5. SUMMARY AND CONCLUSION	39

FIGURES (IN TEXT)

Figure A: Local and Regional Hydrology Map	8
Figure B: SWB and GWB status for the 2016-2021 WFD Cycle	11

TABLES IN TEXT

Table A: Upstream Catchment Size for River Waterbodies	6
Table B: Summary WFD Information for Surface Water Bodies	12
Table C: Summary WFD Information for Groundwater Bodies	14
Table D: Screening of WFD water bodies located within the study area	19
Table E: Surface Water Quality Impacts during Proposed Wind Farm Construction Phase (Unmitigated)	24
Table F: Groundwater Quality Impacts during Construction Phase (Unmitigated)	25
Table G: Surface Water Quality Impacts during Proposed Grid Connection Construction Phase (Unmitigated)	25
Table H: Potential Impact on Surface Water Flows during Operational Phase (Unmitigated)	27
Table I: Surface Water Quality Impacts during Operational Phase (Unmitigated)	28
Table J: Summary of Drainage Mitigation & their Application	29
Table K: Summary of WFD Status for Unmitigated and Mitigated Scenarios	37

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by MKO to complete a Water Framework Directive (WFD) Compliance Assessment for the Proposed Wind Farm and Proposed Grid Connection (Proposed Project), at Cooloo and adjacent townlands, Co. Galway.

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 and includes both the Proposed Wind Farm site and Proposed Grid Connection.

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 and protected areas 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 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 Michael Gill, David Broderick and Nitesh Dalal.

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

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, karst hydrology 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 worked on the EIS/EIARs for Ardderroe Wind Farm, Clonberne Wind Farm, and Oweninny Wind Farm, and over 60 other wind farm related projects across the country.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. 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).

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 2027¹. 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,
- 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.

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.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

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

2.2 SURFACE WATERBODY IDENTIFICATION

Regionally, the Proposed Project is located in the Corrib WFD catchment in Hydrometric Area 30 of Western River Basin District.

The northern portion of the Proposed Wind Farm Site is situated within the Clare [Galway]_SC_040 WFD sub-catchment (Grange River) and the southern portion within the Clare [Galway]_SC_050 WFD sub-catchment (Abbert River). On a more local scale, the northern portion of the Proposed Wind Farm Site is located within the Grange (Galway)_010 river sub basin and the southern portion within the Abbert_030 river sub basin.

The Proposed Grid Connection passes through both the Clare[Galway]_SC_040 (for 7.5km) and Clare[Galway]_SC_050 (for 13.4km) sub-catchments, while the Substation element is located entirely in the Clare[Galway]_SC_050 sub-catchment at the Proposed Wind farm site.

The proposed Substation element of the Proposed Grid Connection is also located in the Abbert_030 sub-basin. On leaving the Proposed Wind Farm site, the Proposed Grid Connection cable route passes through the Abbert_030, Feagh_East_010, Grange (Galway)_040, Clare (Galway)_070 until the termination of the cable route in the Clare (Galway)_060 sub-basin south of Tuam town.

The TDR accommodation works on the N63/R332 junction and adjacent to the R332 at the proposed construction Site entrance are located in the Clare[Galway]_SC_050 (i.e. the Abbert River catchment).

A local and regional hydrology map of the study area is shown as **Figure A** below.

All river watercourses in the immediate vicinity of the Site have current WFD Status classifications (2016-2021).

Table A Presents the total upstream sub-catchment area that drains the Site, and the total sub-catchment area of the rivers downstream from the Site as far as the Corrib Lower lake body. The total upstream catchment area to Lough Corrib is 1,137km². Therefore, the river waterbodies which are located in close proximity to the Site that have relatively smaller catchment areas (i.e. Grange and Abbert) will be more susceptible to water quality impacts as a result of the Proposed Project in comparison to the downstream river and lake bodies, located downstream of the Site.

Table A: Upstream Catchment Size for River Waterbodies

WFD River Sub-Basin	Total Upstream Catchment Area (km ²)
Grange (Galway)_010	~24
Grange (Galway)_020	~94
Grange (Galway)_030	~111
Grange (Galway)_040	~128
Abbert_030	~162
Abbert_040	~198
Feagh_East_010	~11
Clare (Galway)_060	~705

Clare (Galway)_070	~942
Clare (Galway)_080	~987
Clare (Galway)_090	~1041
Clare (Galway)_100	~1137
Corrib_010	~3117
Corrib_020	~3125

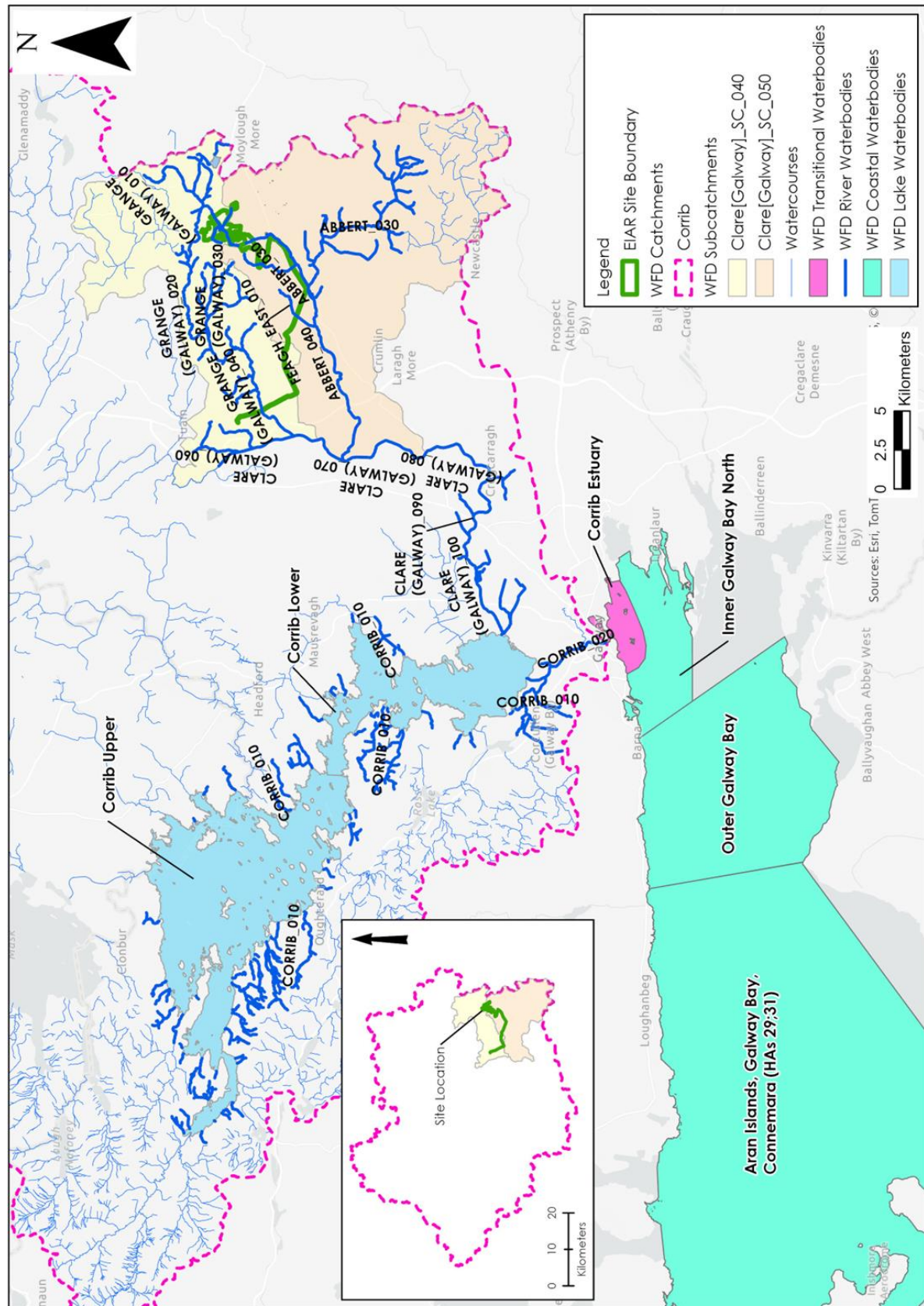


Figure A: Local and Regional Hydrology Map

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).

As stated above the northern portion of the Proposed Wind Farm site is located in the Grange (Galway)_010 WFD river sub basin. The Grange (Galway)_010 SWB achieved "Good Status" in the latest WFD cycle (2016-2021). The Grange (Galway)_010 SWB has been classified as being "not at risk" of failing to meet its WFD objectives in the future.

The remaining lower reaches of the Grange (Galway) River downstream of the Proposed Project (Grange (Galway)_020, Grange (Galway)_030 and Grange (Galway)_040 river segments) have all achieved "Good" status in the latest WFD cycle. The Grange (Galway)_030 and Grange (Galway)_040 SWB's have been deemed to be "not at risk" whereas the Grange (Galway)_020 SWB has been classified as "at risk" of failing to meet its WFD objectives. Agricultural activities have been identified as a significant pressure on the Grange (Galway)_020 SWB.

The Abbert_030 SWB drains the southern portion of the Proposed Wind Farm site and Proposed Grid Connection. Both the Abbert_030 and the downstream Abbert_040 SWB's achieved "Good" status in the 2016-2021 WFD cycle. The Abbert_030 SWB in the vicinity of the Site has been classified as "not at risk", however, the downstream Abbert_040 SWB has been deemed to be "at risk" of failing to meet its WFD objectives. Significant pressures on the Abbert_040 SWB include agriculture, domestic wastewater, and hydromorphology.

Both the Grange (Galway) and Abbert Rivers discharge into the Clare (Galway) River downstream of the Proposed Project. The Grange (Galway) River drains into the Clare (Galway)_060 SWB which achieved "Poor" status in the latest WFD cycle and is "at risk". Hydromorphology is listed as the significant pressure effecting the Clare (Galway)_060 SWB. Further downstream the Abbert River discharges into the Clare (Galway)_070 SWB which achieved "Good" status and is "not at risk" with regards its WFD objectives.

The remaining lower reaches of the Clare River (Clare (Galway)_080, Clare (Galway)_090 and Clare (Galway)_100) all achieved "Moderate" WFD status. Both the Clare (Galway)_080 and Clare (Galway)_090 SWB's have been deemed to be "at risk" with hydromorphology listed as being a significant pressure on each of the SWB's. The Clare (Galway)_100 SWB is "not at risk".

The Clare (Galway) River discharges into the Corrib Lower Lake waterbody approximately ~43km downstream from the Proposed Wind Farm site. The Corrib Lower Lake waterbody achieved "Good" status in the latest WFD cycle and is classified as "not at risk".

Outflowing from the very southern end of the Corrib Lower Lake waterbody is the Corrib River. The Corrib_010 and Corrib_020 SWB's achieved "Good" status and are "not at risk" of failing to meet their WFD objectives in the future.

The Corrib River then discharges into the Corrib Estuary transitional waterbody which achieved "Moderate" status and is deemed to be "not at risk".

Coastal waterbodies downstream of the Proposed Project are as follows; the Inner Galway Bay North, the Outer Galway Bay and the Aran Islands, Galway Bay, Connemara (HAs 29;31) which are classified as "Good", "High" and "High" status respectively.

Both the Inner Galway Bay North and the Outer Galway Bay coastal waterbodies are classified as “not at risk”, whereas the Aran Islands, Galway Bay, Connemara (HAs 29;31) coastal waterbody is currently under “review” with regards its risk status.

The SWB and GWB status for the 2016-2021 WFD cycle are shown on **Figure B** below.

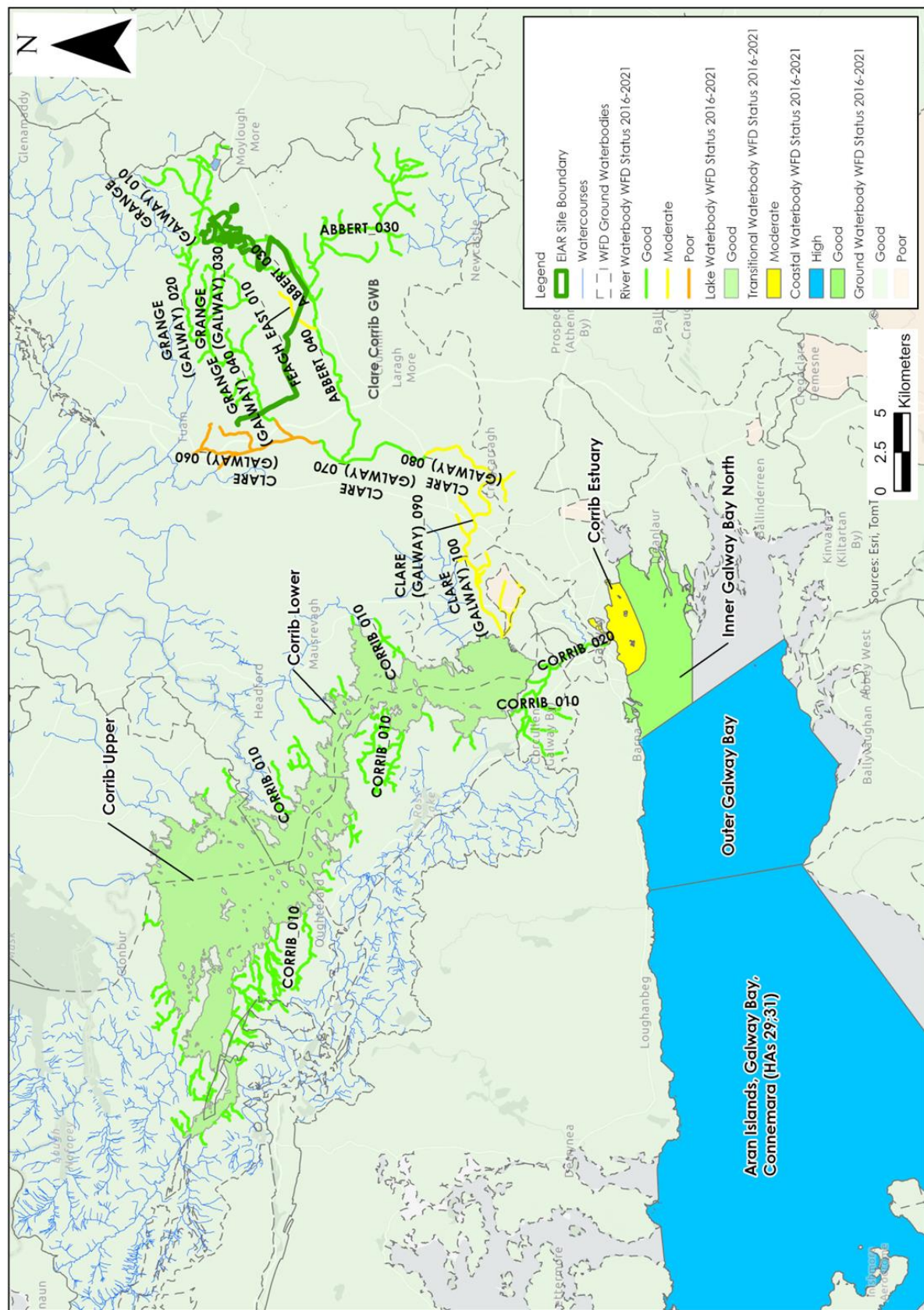


Figure B: SWB and GWB status for the 2016-2021 WFD Cycle

Table B: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3 rd Cycle)	Pressures
Grange (Galway)_010	Good	Good	Good	Not at risk	-
Grange (Galway)_020	Good	Moderate	Good	At risk	Agriculture
Grange (Galway)_030	Good	Good	Good	Not at risk	-
Grange (Galway)_040	Good	Good	Good	Not at risk	-
Abbert_030	Moderate	Good	Good	Not at risk	-
Abbert_040	Moderate	Moderate	Good	At risk	Agriculture, domestic wastewater & hydromorphology
Feagh_East_010	Unassigned	Good	Moderate	Review	-
Clare (Galway)_060	Moderate	Moderate	Poor	At risk	Hydromorphology
Clare (Galway)_070	Good	Good	Good	Not at risk	-
Clare (Galway)_080	Moderate	Moderate	Moderate	At risk	Hydromorphology
Clare (Galway)_090	Moderate	Moderate	Moderate	At risk	Hydromorphology
Clare (Galway)_100	Unassigned	Unassigned	Moderate	Not at risk	-
Corrib Lower	Moderate	Good	Good	Not at risk	-
Corrib_010	Unassigned	Unassigned	Good	Not at risk	-
Corrib_020	Good	Good	Good	Not at risk	-
Corrib Estuary	Good	Good	Moderate	Not at risk	-
Inner Galway Bay North	Good	Good	Good	Not at risk	-
Outer Galway Bay	High	High	High	Not at risk	-

Aran Islands, Galway Bay, Connemara (HAs 29;31)	Unassigned	High	High	Under review	-
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2.4 GROUNDWATER BODY IDENTIFICATION

The Proposed Project is located in the Clare-Corrib Groundwater Body (GWB) (IE_WE_G_0020) which has a mapped surface area of 1,344km². According to WFD mapping this GWB is karstic in nature.

The bedrock hydrostratigraphic rock unit group type of the Clare-Corrib GWB is predominantly Dinantian Pure Bedded Limestone, which according to GSI mapping, is the lithology of the mapped bedrock formations that underlie the Site (i.e. Croghan Formation, the Burren Formation and Visean Limestones (undifferentiated)).

Dinantian Pure Bedded Limestone is classified by the GSI as a Regionally Important Karstified Aquifer which is dominated by conduit flow (Rkc).

2.5 GROUNDWATER BODY CLASSIFICATION

The Clare Corrib 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.

The GWB status for the 2016-2021 WFD cycles are shown on **Figure B** above.

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3 rd Cycle)	Pressures
Clare Corrib GWB	Good	Good	Good	Not at risk	-

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), shellfish areas and drinking water protected area's (DWPA) are looked at 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.

The Proposed Project site is not located within or adjacent to any designated conservation site.

The closest designated site to the Proposed Project site is Lough Corrib SAC (Site Code: 000297) which includes sections of the Grange River and Abbert River downstream of the Site. Downstream distance from the Proposed Wind Farm site to Lough Corrib SAC in the Grange River is 3km and 5.5km in the Abbert River.

The Proposed Grid Connection cable route briefly intercepts Lough Corrib SAC where it crosses over the Grange River via an existing bridge on the R347 approximately 9km to the west of the Proposed Wind Farm site.

Derrinlough Bog SAC (Site Code: 002197) is located approximately 3.5km to the northeast of the Proposed Wind Farm site, while Levally Lough SAC (Site Code: 000295) is located 3.5km to the northwest.

Both Derrinlough Bog SAC and Levally Lough SAC are located upstream of the Proposed Project site in the Grange River catchment and therefore no hydrological pathway/connection is present. Given that the dominant groundwater flow direction in the Lough Corrib GWB is to the southwest, the Proposed Project site is also located downstream of both SACs with regard to groundwater flow.

Killaclogher Bog NHA is located approximately 4km to the southeast of the Proposed Wind Farm site where it is located upstream of the Site in the Abbert River catchment and therefore no hydrological pathway/connection is present. The south-westerly groundwater flow in the Lough Corrib GWB means it's also at an up-gradient position with regard groundwater flowpaths.

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 3 no. designated bathing waters located downstream of the Proposed Project site.

- Ballyloughane Beach (PA3_0132)
- Grattan Road Beach (PA3_0133)
- Salthill Beach (PA3_0071)

The designated bathing waters are located ~31km, 33.8km, and 35.1km respectively downstream of the Proposed Project site, within the Corrib Estuary transitional SWB. The Ballyloughane Beach (PA3_0132) achieved "Excellent" bathing water quality in 2023. This is an improvement from the "Good" water quality status achieved in 2022. The Grattan Road Beach (PA3_0133) achieved "Good" water quality in 2023, which is in line with the "Good" status it achieved in 2022. The Salthill Beach (PA3_0071) achieved "Excellent" water quality in 2023, which it has achieved for four consecutive years.

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 NSA's mapped within the Corrib WFD Catchment, therefore there are no NSAs mapped downstream of the Proposed Project.

2.6.4 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 areas mapped downstream of the Proposed Project site. The nearest Shellfish areas is Clarinbridge/Kinvara Bay, located ~30.6km southwest of the Proposed Wind Farm Site (as the crow flies).

2.6.5 Salmonid Waters

The Salmonid Regulations (S.I. 293 / 1988) identifies the protected river that are designated as Designated Salmonid Waters under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations 1988, 14th August 1988. The Council Directive 78/659/EEC of 18 July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life and the Council Directive 92/42/EEC of the 21st May 1992 on the conservation of natural habitats and of wild fauna and flora was transposed into Irish law under the Fish Directive S.I. 293/1988 and Habitats Directive S.I. 477/2011.

The Corrib_010 and Corrib_020 are mapped as designated Salmonid Waters downstream of the Proposed Project.

2.6.6 Drinking Water Protected Areas

The 3rd Cycle Corrib Catchment Report (EPA, 2021) states that there are 9 no. SWBs in the catchment which have been identified as Drinking Water Protected Areas (DWPAs). There are 2 no. DWPAs mapped downstream of the Proposed Project; the Corrib Lower Lake (IE_WE_30_666a) and the Corrib_020 SWB (IE_WE_30C020600). The Proposed Project is hydrologically connected to these DWPAs via the Clare (Galway) River.

Also, the most southerly portion (approximately 50ha) of the Proposed Project site is located in the Mid Galway Public Water Supply (PWS) Source Protection Area/Zone (SPA/Z). SPA mapping is available online and documented in the EPA report 'Establishment of Groundwater Source Protection Zones - Mid Galway Public Water Supply Scheme' (May, 2012).

Proposed Project infrastructure elements of the Proposed Wind Farm site inside the SPA include 2 no. turbines locations (T1 and T2) and the proposed temporary construction compound. In addition, approximately 3.8km of the Proposed Grid Connection cable route is located inside the SPA, with the majority of the proposed cable route being along the carriageway of the R332 and N63 roads.

The Barnaderg GWS source springs and borehole is located in close proximity to the Mid Galway PWS and share the same groundwater zone of contribution.

Meanwhile all GWB's in Ireland are considered as Drinking water protected areas. The Clare-Corrib (IE_WE_G_0020) GWB underlie the Proposed Wind Farm Site and the Proposed Grid Connection Route.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 14 no. river water bodies that are located in the vicinity or downstream of the Proposed Project. In addition, there is 1 no. lake waterbody, 1 no. transitional waterbody and 3 no. coastal waterbodies located downstream. Furthermore, the Proposed Project is underlain by 1 no. groundwater body.

3.1 SURFACE WATER BODIES

As shown in **Figure A** above, there are 15 no. SWBs (river and lake) located in the vicinity or downstream of the Proposed Project.

With consideration for the construction, operational and decommissioning phases of the Proposed Project, all surface water downstream of the Site as far as Lough Corrib are carried through into the WFD Impact Assessment.

The Corrib Lower Lake waterbody has been screened out due to the large volume of water passing through it owing to its very large catchment area, making it less susceptible to perceptible potential water quality impacts associated with the Proposed Project.

Further downstream the Corrib River (Corrib_010 and Corrib_020) has also been screened out due to its distal location from the proposed works and location downstream of Lough Corrib. The Proposed Project has no potential to cause a deterioration in status of these SWBs and/or jeopardise the attainment of good surface water status in the future.

The Corrib Estuary transitional waterbody has also been screened out due to the large volumes of water within the SWB and the saline nature of these tidal flux waters. The Proposed Project has no potential to cause a deterioration in status of these SWBs and/or jeopardise the attainment of good surface water status in the future.

The Inner Galway Bay North, the Outer Galway Bay and the Aran Islands, Galway Bay, Connemara (HAs 29;31) coastal waterbodies have also been screened out due to the large volumes of water within these SWBs and the saline nature of these tidal waters. The Proposed Project has no potential to cause a deterioration in status of these SWBs and/or jeopardise the attainment of good surface water status in the future.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Clare - Corrib GWB has been screened in due to its location directly underlying the Proposed Project 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

Lough Corrib SAC is located downstream of the Proposed Project site, and thus the Lough Corrib SAC has been screened in for further assessment.

Derrinlough Bog SAC and Levally Lough SAC are located upstream of the Proposed Project site in the Grange River catchment and therefore no hydrological pathway/connection is present. Given that the dominant groundwater flow direction in the Lough Corrib GWB is to the southwest, the Proposed Project site is also located downstream of both SACs with regard to groundwater flow and therefore both SACs are screen out for further assessment.

Killaclogher Bog NHA is located approximately 4km to the southeast of the Proposed Wind Farm site where it is located upstream of the Site in the Abbert River catchment and therefore no hydrological pathway/connection is present. The south-westerly groundwater flow direction in the Lough Corrib GWB means the Site is also at an up-gradient position with regard groundwater flowpaths and therefore Killaclogher Bog NHA is screened out for further assessment.

The Ballyloughane Beach, Grattan Road Beach, and Salthill Beach bathing waters have been screened out due to their distal location (~31km, 33.8km, and 35.1km downstream respectively), intervening lands, and increasing volumes of water within the Corrib Estuary. The proposed works have no potential to cause a deterioration in the status of these bathing waters.

The Corrib Lower and Corrib_020DWPA's have been screened out due to their distal location downstream (28km and ~31.6km downstream respectively), intervening lands, and increasing volumes of water within the Corrib Lake and River Corrib. The proposed works have no potential to cause a deterioration in the status of these DWPA's.

The Corrib_010 and Corrib_20 Salmonid Waters have been screened out due to its distal location from the Proposed Project site and the increasing volume of water within the River Corrib.

Mid Galway PWS and Barnaderg GWS sources are screened in for further assessment due to elements of the Proposed Project being within the mapped groundwater source protection areas.

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	Grange (Galway)_010	Yes	The northern portion of the Proposed Project site including 7 no. of turbines, are mapped within the Grange (Galway)_010 river sub-basin. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Grange (Galway)_020	Yes	The Grange (Galway)_020 SWB is in close proximity to the Proposed Project and is located directly downstream of the Grange (Galway)_010 SWB. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Grange (Galway)_030	Yes	The Grange (Galway)_030 SWB is in close proximity to the Proposed Project and is located directly downstream of the Grange (Galway)_020 SWB. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Grange (Galway)_040	Yes	The Grange (Galway)_040 SWB is in close proximity to the Proposed Project and is located directly downstream of the Grange (Galway)_030 SWB. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Feagh East_010	Yes	The Feagh East_010 SWB is downstream of the Proposed Grid Connection only. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Abbert_030	Yes	The southern portion of the Proposed Project site including 2 no. of turbines and a section of the Proposed Grid Connection, are mapped within the catchment area of the Abbert_030 SWB. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Abbert_040	Yes	The Abbert_040 SWB is in close proximity to the Proposed Project and is located directly downstream of the Abbert_030 SWB. An assessment is required to consider the potential impacts of the Proposed Project on this SWB.
	River	Clare (Galway)_060	Yes	The Clare (Galway)_060 SWB has been screened in due to its location downstream of the Proposed Project
	River	Clare (Galway)_070	Yes	The Clare (Galway)_070 SWB has been screened in due to its location downstream of the Proposed Project.
	River	Clare (Galway)_080	Yes	The Clare (Galway)_080 SWB has been screened in due to its location downstream of the Proposed Project.
	River	Clare (Galway)_090	Yes	The Clare (Galway)_090 SWB has been screened in due to its location downstream of the Proposed Project.
	River	Clare (Galway)_100	Yes	The Clare (Galway)_100 SWB has been screened in due to its location downstream of the Proposed Project.
	Lake	Lough Corrib Lower	No	Corrib Lower Lake waterbody has been screened out due to its distal location from the Proposed Project and the large volume of water passing through the Lake and large surface water catchment. The Proposed Project has very low potential to impact the status of this SWB.

	River	Corrib_010	No	The Corrib_010 SWB has been screened out due to its distal location from the Proposed Project site and the increasing volume of water downstream of Lough Corrib.
	River	Corrib_020	No	The Corrib_020 SWB has been screened out due to its distal location from the Proposed Project site and the increasing volume of water downstream of Lough Corrib.
	Transitional	Corrib Estuary	No	The Corrib Estuary transitional waterbody has been screened out due to its distal location from the Proposed Project site, the large volumes of water within the surface waterbody and the saline nature of its tidal water.
	Coastal	Inner Galway Bay North	No	The Inner Galway Bay North coastal waterbody has been screened out due to its distal location from the Proposed Project site, the large volumes of water within the surface waterbody and the saline nature of its tidal water.
	Coastal	Outer Galway Bay	No	The Outer Galway Bay coastal waterbody has been screened out due to its distal location from the Proposed Project site, the large volumes of water within the surface waterbody and the saline nature of its tidal water.
	Coastal	Aran Islands, Galway Bay, Connemara (HAs 29;31)	No	The Aran Islands, Galway Bay, Connemara (HAs 29;31) coastal waterbody has been screened out due to its distal location from the Proposed Project site, the large volumes of water within the surface waterbody and the saline nature of its tidal water.
Groundwater Body	Groundwater	Clare – Corrib GWB	Yes	The Clare - Corrib GWB underlies the Proposed Project. An assessment is required to consider potential impacts of the Proposed Project on this GWB.
Protected Areas	Nature Conservation Designations	Lough Corrib SAC	Yes	The Lough Corrib SAC has been screened into the assessment as it includes sections of the Grange River and Abbert River immediately downstream of the Site.
		Derrynagran Bog and Esker NHA	No	Derrynagran Bog and Esker NHA are scoped out as there is no hydrological/hydrogeological connectivity with the Proposed Project.
		Summerville Lough pNHA	No	Summerville Lough pNHA is scoped out as there is no hydrological/hydrogeological connectivity with the Proposed Project
		Derrinlough Bog NHA	No	The Derrinlough Bog NHA is scoped out as there is no hydrological/hydrogeological connectivity with the Proposed Project.
		Derrinlough (Cloonkeenleananode) Bog SAC	No	The Derrinlough (Cloonkeenleananode) Bog SAC is scoped out as there is no hydrological/hydrogeological connectivity with the Proposed Project.
		Richmond Esker Nature Reserve pNHA	No	The Richmond Esker Nature Reserve pNHA is scoped out as there is no hydrological/hydrogeological connectivity with the Proposed Project.

		Levally Lough SAC/pNHA	No	The Levally Lough SAC/pNHA is scoped out as there is no hydrological/hydrogeological connectivity with the Proposed Project.
		Killaclogher Bog NHA	No	The Killaclogher Bog NHA is is scoped out as there is no hydrological/hydrogeological connectivity with the Proposed Project.
	Bathing Waters	Ballyloughane Beach	No	The Ballyloughane Beach Bathing Waters have been screened out due to its distal location from the Proposed Project site and increasing volumes of water within the Corrib Estuary.
		Grattan Road Beach	No	The Grattan Road Beach Bathing Waters have been screened out due to its distal location from the Proposed Project site and increasing volumes of water within the Corrib Estuary.
		Salthill Beach	No	The Salthill Beach Bathing Waters have been screened out due to its distal location from the Proposed Project site and increasing volumes of water within the Corrib Estuary.
	Shellfish Area	Clarinbridge/Kinvara Bay	No	The Clarinbridge/Kinvara Bay shellfish area has been screened out due to its distant location and there is no hydrological connection between this Shellfish area and the Proposed Project.
	Salmonid Water	Corrib_010 and Corrib_020	No	The Corrib_010 and Corrib_20 Salmonid Waters have been screened out due to its distal location from the Proposed Project and the increasing volume of water within the River Corrib.
	Drinking Water Protected Areas	Corrib Lower	No	The Corrib Lower DWPA has been screened out due to its distal location downstream (~28km), intervening lands, and increasing volumes of water within Lough Corrib.
		Corrib_020	No	The Corrib_020 DWPA has been screened out due to its distal location downstream (~31.6km), intervening lands, and increasing volumes of water within the River Corrib.
		Mid-Galway PWS	Yes	The southern portion of the Wind Farm Site, including 2 no. turbines, and ~3.8km of the Proposed Grid connection route is mapped inside the Mid-Galway PWS SPA. An assessment is required to consider the potential impacts of the Proposed Project on this source.
		Feigh East and West GWS	No	The Proposed Project is not located inside the Feigh East and West GWS SPA and is therefore scoped out for further assessment.
		Barnaderg GWS	Yes	The southern portion of the Wind Farm Site, including 2 no. turbines, and ~3.8km of the Proposed Grid connection route is mapped inside the Barnaderg GWS SPA. An assessment is required to consider the potential impacts of the Proposed Project on this source.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSED PROJECT

Due to the nature of wind energy developments (and associated grid connections and TDR works), being near surface construction activities, impacts on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risks to groundwater will be chemical pollution of groundwater from cementitious materials, hydrocarbon spillage and leakages.

The primary risk to surface waters will be entrained suspended sediments (peat and soil particles) in site runoff during earthworks and tree felling along with release cement-based compounds and/or hydrocarbons. The Proposed Project may also result in changes to surface water runoff volumes and flow patterns.

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

- Establishment of 1 no. temporary construction compounds, which will involve minor regrading of soil/subsoil and the emplacement of hardstand. 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, however, the floating technique will also be used. This will involve the use of aggregate imported from local quarries where required;
- 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 material will also be reinstated during decommissioning;
- 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;
- Cabling between turbine locations and the on-site substation will involve the excavation of a shallow trench (approximately 1.2m deep), placement of ducting and backfilling;
- Construction of 5 no. new watercourse crossing (clear span bridge design);
- Tree felling (0.7ha) for the purposes of turbine and access road construction clearance which will be carried out under felling licence;
- Establishment of 4 no. peat repositories and 5 no. spoil repository area;
- Construction of approximately 0.6km of floating access road on intact raised bog to provide access to proposed turbine location T7; and,
- Turbine haul route upgrade works at the R332/N63 road junction and at the R332 at the proposed Site entrance.

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

- Approximately 21km of an underground cabling route between the proposed 110kV substation and the existing Cloon 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);

- Construction of the on-site 110kV substation with a subsoil bearing foundation. Welfare facilities will be provided at the substation along with a temporary construction compound;
- Construction of a Battery Energy Storage System (BESS) and Control Building at the proposed Substation location; and,
- 4 no. existing watercourse bridge/culvert crossings along the public road section of the cable route with the cable being placed in the bridge/culvert decking or by means of Horizontal Directional Drilling (no in-stream are proposed at any existing crossing location).

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 including tree felling, site levelling, roadway construction and turbine/substation foundation excavation 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 bare soil/peat and spoil/peat storage areas 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.

Clear felling of coniferous forestry plantations is also proposed over ~1.7ha. Potential surface water quality effects from felling include the release of elevated concentrations of suspended solids and nutrient release which has the potential to effect downstream surface water quality.

The construction of 5 no. new watercourse crossing (clearspan bridge design) will be required to facilitate the Proposed Wind Farm site development infrastructure.

New watercourse crossings (i.e. bridges/culverts) or upgrade of existing crossings will only be required at the Wind Farm site and not the Grid Connection.

Establishment of 4 no. peat repositories and 5 no. spoil repository area as well as biodiversity enhancement measures are also proposed.

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.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the Proposed Wind Farm in the unmitigated scenario are outlined in **Table E**.

Table E: Surface Water Quality Impacts during Proposed Wind Farm Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Grange (Galway)_010	IE_WE_30G020200	Good	Moderate
Grange (Galway)_020	IE_WE_30G020400	Good	Moderate
Grange (Galway)_030	IE_WE_30G020500	Good	Moderate
Grange (Galway)_040	IE_WE_30G020700	Good	Moderate
Abbert_030	IE_WE_30A010300	Good	Moderate
Abbert_040	IE_WE_30A010500	Good	Moderate
Clare (Galway)_060	IE_WE_30C010800	Poor	Poor
Clare (Galway)_070	IE_WE_30C011000	Good	Moderate
Clare (Galway)_080	IE_WE_30C011100	Moderate	Moderate
Clare (Galway)_090	IE_WE_30C011200	Moderate	Moderate
Clare (Galway)_0100	IE_WE_30C011300	Moderate	Moderate

4.2.1.2 Potential Groundwater Quality/Quantity Effects within the Proposed Wind Farm Site and the Proposed Grid Connection Route

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 Project site.

It is acknowledged that the Site is underlain by a Regionally Important Karstified Aquifer, however due to the basin peat geological setting, the groundwater recharge rates are low. This is because the majority of the Site is covered by low permeability peat as well as glacial deposits, which acts as a protective cover to the underlying aquifer. The bedrock comprises impure limestone and mudstone with reduces aquifer productivity and flow path distance.

Any contaminants which may be accidentally released on-site are more likely to travel to nearby streams within surface runoff. The deep and relatively low permeability of the glacial deposits means contaminants are unlikely to reach the bedrock and will instead disperse with the glacial deposits and would remain localised to the source or would be removed as runoff during wet periods.

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 (turbine bases etc) may drawdown the local groundwater table.

Nevertheless, groundwater level impacts due to the Proposed Project are not anticipated to be significant due to the local hydrogeological regime. No groundwater level impacts are predicted from the construction of the collector cabling trench, access roads, substation, compound or met mast due to the relatively shallow nature of the excavation (i.e. 0 --3m).

The Proposed Grid Connection and TDR works are also located in the Clare-Corrib GWB. However, due to the shallow, short-term and transient nature of the proposed 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 during the construction phase of the Proposed Project in the unmitigated scenario are outlined in **Table F**.

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

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

4.2.1.3 Potential Surface Water Quality Effects along the Proposed Grid Connection

The Proposed Grid Connection comprises a proposed 110kV on-site substation, BESS, approximately ~21km of underground cabling route, 4 no. existing watercourse bridge/culvert crossings along the public road section of the cable route with the cable being placed in the bridge/culvert decking or by means of Horizontal Directional Drilling (no in-stream are proposed at any existing crossing location).

Due to the close proximity of local waterbodies to the 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 along the Proposed Grid Connection cable route 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 Grid Connection to alter the overall status of a SWB.

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 in the unmitigated scenario are outlined in **Table G**.

Table G: Surface Water Quality Impacts during Proposed Grid Connection Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Status Change	Potential
Grange (Galway)_040	IE_WE_30G020700	Good	Good	
Abbert_030	IE_WE_30A010300	Good	Good	
Feagh East_010	IE_WE_30F170810	Moderate	Moderate	
Clare (Galway)_060	IE_WE_30C010800	Poor	Poor	
Clare (Galway)_070	IE_WE_30C011000	Good	Good	

4.2.1.4 Potential Protected Area Impacts

The hydrological and hydrogeological water connections from the Proposed Project could transfer poor quality surface water that may affect the conservation objectives of these Protected Areas.

Protected Areas included in this assessment and deemed to be hydrologically or hydrogeologically connected to the Proposed Project include:

Lough Corrib SAC: This SAC is located immediately downstream of the Proposed Wind Farm site, the Proposed Grid Connection. Any potential deterioration in surface water quality has the potential to affect this SAC. Effects could be significant in the pre-mitigated scenario during the construction phase.

Mid-Galway PWS and Barnaderg GWS: Elements of the Proposed Project are located inside the mapped groundwater SPAs to these sources. Please refer to Section 9.5.2.1 of Chapter 9 of the EIAR (Hydrology/Hydrogeology) for a detailed impact assessment relating to these sources. Due to the hydrological and hydrogeological setting of the Proposed Project site (as explained in Chapter 9), no significant effects are expected to occur on these sources in the pre-mitigation scenario during the construction phase.

4.2.2 Operational Phase (Unmitigated)

Potential effects associated with the operational phase of the Proposed Project will be much reduced in comparison to the construction phase. Any effects will occur at the Site and will be associated with minor maintenance works or changes in runoff volumes associated with the footprint of the Proposed Project.

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

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 Site and increase flood risk downstream of the Site.

As stated in the EIAR the emplacement of the Proposed Project infrastructure could result in an average total increase in surface water runoff of 1,655m³/month. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and causing hydromorphological effects. This represents a potential increase of approximately 0.41% 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 Proposed Project site being developed. Specifically, the Proposed Project footprint is approximately 10.6ha, representing 3% of the total EIAR Study Area of 355ha.

The additional volume is low due to the fact that the runoff potential from the Site is naturally high (85%). 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. This water balance assessment demonstrates that even in the

absence of mitigation, the potential to alter the water balance of the Site or downstream hydrology/morphology is imperceptible.

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 H**.

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Grange (Galway)_010	IE_WE_30G020200	Good	Good
Grange (Galway)_020	IE_WE_30G020400	Good	Good
Grange (Galway)_030	IE_WE_30G020500	Good	Good
Grange (Galway)_040	IE_WE_30G020700	Good	Good
Abbert_030	IE_WE_30A010300	Good	Good
Abbert_040	IE_WE_30A010500	Good	Good
Clare (Galway)_060	IE_WE_30C010800	Poor	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)_0100	IE_WE_30C011300	Moderate	Moderate

4.2.2.2 Surface Water Quality Impacts from Operational 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 I**.

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

SWB	WFD Code	Current Status	Assessed Status Change
Grange (Galway)_010	IE_WE_30G020200	Good	Good
Grange (Galway)_020	IE_WE_30G020400	Good	Good
Grange (Galway)_030	IE_WE_30G020500	Good	Good
Grange (Galway)_040	IE_WE_30G020700	Good	Good
Abbert_030	IE_WE_30A010300	Good	Good
Abbert_040	IE_WE_30A010500	Good	Good
Clare (Galway)_060	IE_WE_30C010800	Poor	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)_0100	IE_WE_30C011300	Moderate	Moderate

4.2.2.3 Potential Protected Area Impacts

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.

Therefore, the risk of any operational phase activities that may affect the conservation objectives of the protected areas is greatly reduced.

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 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:	- Application of buffer zones to natural watercourses where possible to avoid excavations in close proximity to watercourses and avoid the release of suspended sediment into watercourses; - Using small working areas; and, - Working in appropriate weather and suspending certain work activities in advance of forecasted wet weather.	Construction work areas where sediment is being generated.
Source Controls:	Use of upstream interceptor drains and downstream collector drains, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment is being generated.
	- Using small working areas; - Covering stockpiles; - Weathering off / 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: - sand bags; - oyster bags filled with gravel; - filter fabrics; - straw bales; - flow limiters; - weirs or baffles; - and/or other similar/equivalent or appropriate systems. - Silt fences, filter fabrics; - Collection sumps, temporary sumps, pumping systems; - Attenuation lagoons; - Sediment traps, stilling / settlement ponds.	Interceptor and collection drainage systems
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

Each element of the Proposed Project will have an array of drainage control measures to ensure protection of downstream watercourses. Each drainage control element is not stand alone but occurs as part of a treatment train of control systems (i.e., check dams, silt traps, settlement ponds etc).

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 site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by 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 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 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 Wind Farm site and along the Grid Connection 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 refuelling truck will also carry fuel absorbent material and pads in the event of any accidental spillages;
- 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 on site will be minimized and will be appropriately banded;
- 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 Wind Farm site include:

- It is proposed to manage wastewater from the staff welfare facilities in the control buildings/substation 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.

4.3.1.5 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 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 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:

- All proposed new stream crossings at the Proposed Wind Farm site will be bottomless or clear span culverts 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 Ireland² 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; and,

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

- 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.

4.3.1.7 Mitigation Measures to Prevent Water Quality Effect to surface Watercourses along the Proposed Grid Connection

Prior to the commencement of substation, BESS and cable trenching works the following key temporary drainage measures will be installed:

- All existing roadside drains (where present) that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Culverts, manholes and other drainage inlets (where present) will also be temporarily blocked; and,
- A double silt fence perimeter will be placed along the road verge on the down-slope side of works areas that are located inside Mid Galway PWS and Barnaderg GWS SPA.

The following mitigation measures are proposed for the underground cabling watercourse crossing works:

- No stock-piling of construction materials will take place along the grid route;
- No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works will not take place at periods of high rainfall, and will be scaled back or suspended if heavy rain is forecast;
- Local road drainage, culverts and manholes will be temporarily blocked during the works;
- Machinery deliveries will be arranged using existing structures along the public road;
- All machinery operations will take place away from the stream and ditch banks, apart from where crossings occur. Although no instream works are proposed or will occur;
- Any excess construction material will be immediately removed from the area and sent to a licenced waste facility;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits will be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.
- The area around the Clear Bore™ (or similar alternative) batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- One or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility; and,
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

4.3.1.8 Mitigation Measures for Clear-Felling

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, to ensure that felling, planting and other forestry operations result in minimal potential negative effects to the receiving environment.

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" will be adhered to during felling operations. The

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

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 will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance. The harvester and the forwarder are designed specifically for the forest environment and are low ground pressure machines;
- All machinery will be operated by suitably qualified personnel;
- Checking and maintenance of roads and culverts will be on-going through any felling operations. 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;
- These machines will traverse the Site along specified off-road routes (referred to as racks);
- The location of racks will be chosen to avoid wet and potentially sensitive areas;
- Brash mats will be placed on the racks to support the vehicles on soft ground, reducing peat and mineral soil disturbance and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Silt fences will be installed at the outfalls of existing drains downstream of felling areas. No direct discharge of such drains to watercourses will occur. Sediment traps and silt fences will be installed in advance of any felling works and will provide surface water settlement for runoff from work areas and will prevent sediment from entering downstream watercourses. Accumulated sediment will be carefully disposed of at pre-selected peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion it will be necessary to install double or triple sediment traps and increase buffer zone width. These measures will be reviewed on site during construction;
- Double silt fencing will also be put down slope of felling areas which are located in close proximity to streams and/or relevant watercourses;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded;
- Timber will be stacked in dry areas, and outside watercourse buffer zones. 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 runoff;
- Refuelling or maintenance of machinery will not occur within 100m of an aquatic zone or any other hydrological feature. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; and,
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

In addition felling works will only be completed during periods of low rainfall and all drains will be inspected and maintained before, during and after the proposed felling works.

4.3.1.9 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.

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

Proposed Mitigation Measures:

- All works are minor and localised and cover very small areas;
- These works are distributed over a wide area;
- All works are temporary in nature; and,
- Application of the Pre-Construction Drainage Measures for surface water quality protection.

4.3.1.11 Construction Phase Mitigation Measures to Protect Water Quality at the Mid Galway PWS and Barnaderg GWS Sources

- No storage of fuels, oils, cements, or chemicals will be permitted within the SPA;
- Refuelling of mobile plant (i.e. diggers, dumpers etc) will only be permitted outside the SPA;
- Refuelling of large immobile plant (i.e. cranes) will only be carried out with a refuelling truck that will be removed from SPA immediately after use;
- Spill kit stations will be present at each turbine location (T1 & T2), temporary construction compound and along the Proposed Grid Connection cable route works areas;
- There are no proposed peat or spoil repositories within the SPA as part of design mitigation;
- A geotextile liner will be placed below the founding layer (lean mix concrete) where concrete is to be poured. These both prevent vertical loss of wet concrete at turbine bases;
- Use of perimeter shuttering at turbine basis to prevent lateral loss of wet concrete;
- All temporary cement washout lagoons will be located outside the SPA;
- Works inside the Lecarrow Stream 50m watercourse buffer limited to 1 no. proposed watercourse crossing culvert which will be clear spanning;
- No wind farm drainage will be released inside the 50m watercourse buffer on the Lecarrow 30 Stream;
- No wind farm drainage will be released inside the 30m buffer for the 1 no. potential enclosed depression/doline mapped inside the SPA at the Proposed Wind Farm site
- Drainage control measures at works areas along the Proposed Grid Connection (Refer to Section 4.3.1.7 above); and,
- There will be clear signage in place inside the refined SPA to remind construction workers that the area is inside a drinking water protection area.

4.3.1.12 Mitigation Measures for Protected Areas

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.

It can be concluded that with best practice methods adhered to during the operation phase of the Proposed Project, the potential for the project to impact upon the qualifying interests of the local designated sites is not significant.

4.3.2 Operational Phase

4.3.2.1 Increased Site Runoff and Hydromorphology Effects

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:

- 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 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 have been designed in consideration of the greenfield runoff rate.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

The mitigation measures outlined in Section 4.3.2.1 above will ensure all surface water runoff from upgraded roads and new road surfaces (including hardstand and turbine base areas) will be captured and treated prior to discharge/release. Settlement ponds, checks dams and buffered outfalls will prevent roads acting as preferential flowpaths by providing attenuation and water quality treatment.

It is proposed that bedrock from off-site sources will be used to construct the sub-base layer of proposed upgraded and new access roads, hardstand areas and turbine base areas. Once installed the subbase layer will be overlain by a clean capping layer of high-grade stone material which will be sourced from local quarries also.

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 wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

4.3.2.4 Mitigation Measures for Protected Areas

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 4.3.2.1 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.

It can be concluded that with best practice methods adhered to during the operation phase of the Proposed Project, the potential for the project to impact upon the qualifying interests of the local designated sites is not significant.

4.3.2.5 Mitigation Measure to Protect Mid Galway PWS & Barnaderg GWS Source

- During the operational phase of the Proposed Project, the only regular plant which will be required on site will be maintenance/inspection vehicles (jeeps/vans/quads) and these will not be refuelled on-site;
- Any hydrocarbons (oil) present within the turbine generator and gear box will be enclosed within a bund with 110% capacity;
- There will be no storage of fuels, oils and chemicals inside any of the turbines;
- Automated oil leak detectors will be placed in each of the turbines which will allow early detection of even the smallest leaks of oil or hydraulic fluid that may arise from components such as the transformer or gearbox; and,
- The automated detection system will then rapidly notify the wind farm operator by cloud-based systems. This early detection system will prevent large leaks of oil or hydraulic fluid.

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.

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 Proposed Wind Farm 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 Wind Farm 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 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
Surface Water Bodies				
Grange (Galway)_010	IE_WE_30G020200	Good	Moderate	Good
Grange (Galway)_020	IE_WE_30G020400	Good	Moderate	Good
Grange (Galway)_030	IE_WE_30G020500	Good	Moderate	Good
Grange (Galway)_040	IE_WE_30G020700	Good	Moderate	Good
Abbert_030	IE_WE_30A010300	Good	Moderate	Good
Abbert_040	IE_WE_30A010500	Good	Moderate	Good
Feagh East_010	IE_WE_30F170810	Moderate	Moderate	Moderate
Clare (Galway)_060	IE_WE_30C010800	Poor	Poor	Poor
Clare (Galway)_070	IE_WE_30C011000	Good	Moderate	Good
Clare (Galway)_080	IE_WE_30C011100	Moderate	Moderate	Moderate
Clare (Galway)_090	IE_WE_30C011200	Moderate	Moderate	Moderate
Clare (Galway)_0100	IE_WE_30C011300	Moderate	Moderate	Moderate
Groundwater Bodies (and associated drinking water protected areas)				
Clare – Corrib GWB	IE_WE_G_0020	Good	Good	Good

4.4 CUMULATIVE EFFECTS

An assessment of potential cumulative effects associated with the Proposed Project and other developments on the hydrological and hydrogeological environment has been completed in the EIAR (Section 9.5.7.1).

Due to the dispersed nature/setback distance of the other wind farm projects along with the implementation of the proposed mitigation measures for the Proposed Project, there will be no cumulative effects associated with the construction, operational or decommissioning phases of the Proposed Project and other developments or land use practices within the cumulative study area (i.e. Clare River catchment).

5. SUMMARY AND CONCLUSION

WFD status for SWBs (Surface Water Bodies), GWBs (Groundwater Bodies) and Protected Areas hydraulically linked to the Proposed Project 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 Project.

There is no direct discharge from the Proposed Project 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.

There is also mitigation proposed to protect groundwater quality within the Proposed Project site during the construction, operational and decommissioning phases of the Proposed Project. 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).

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© **HYDRO-ENVIRONMENTAL SERVICES**

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