

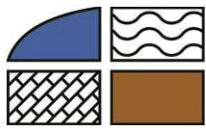


Islandmore Wind Farm

Environmental Impact Assessment
Report

Annex 7.4: Water Framework
Directive Compliance Assessment

Islandmore Wind Farm Limited



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**WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT
ISLANDMORE WIND FARM, CO. ROSCOMMON**

FINAL REPORT

Prepared for:
ISLANDMORE WIND FARM LIMITED

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HYDRO-ENVIRONMENTAL SERVICES

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by Islandmore Wind Farm Limited to undertake a Water Framework Directive (WFD) Compliance Assessment for the proposed Islandmore Wind Farm and underground electricity line ('the project') near Ballaghaderreen, Co. Roscommon. The project is described at **Chapter 3** of the accompanying EIAR.

The purpose of this WFD assessment is to determine if any specific components or activities associated with the 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 affected, describe the proposed mitigation measures (if required) 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 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 and grid connections.

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

Michael Gill (P.Geo, BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 26-years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Glenard Wind Farm, Cloncreen Wind Farm, and Seven Hills Wind Farm, 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 20-years' experience in both the public and private sectors. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into Environmental Impact Assessment Reports/Environmental Impact Statements (EIAR/EIS) for a range of commercial developments. For example, David has worked on the EIS/EIAR for Drumlins Park Wind Farm, Cush Wind Farm, White Hill Wind Farm, Arderroo Wind Farm and Yellow River Wind Farm, and over 80 no. other wind farm related projects across the country.

1.3 WATER FRAMEWORK DIRECTIVE

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

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

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021, and the third cycle covers the period from 2022 to 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 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 those surface water bodies, groundwater bodies and protected areas with potential to be affected by the project and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

On a regional scale, the project site is mapped within 2 no. WFD Catchments. The northern portion of the project site, including 6 no. turbines (T1–T6), are located in the regional Moy and Killala Bay Catchment (HA: 34) and within the Moy_SC_030 sub catchment.

The southern section of the project site, including 4 no. turbines (T7 - T10), is mapped in the Upper Shannon Catchment (HA: 26B) and within Lung_SC_020 sub catchment.

The underground electricity line is located entirely in the Upper Shannon Catchment and within the Lung_SC_020 sub catchment. The electricity substation location sits on the surface water catchment divide between the two regional catchments, with most of the substation footprint draining south into the Upper Shannon Catchment.

On a more local hydrology scale, the northern portion of the project site (within the Moy regional catchment) is located in the Owengarve River catchment and within the Owengarve (Sligo)_010 river sub basin. The Owengarve River flows in a north-westerly direction for approximately 25km before entering the River Moy.

The southern portion of the project site (within the regional Upper Shannon Catchment) lies within the Lung River catchment (Lung_050 river sub basin). This portion of the project site is drained by 3 no. tributaries of the Lung River that flow in a southerly direction for c. 2.5 to 3km towards the main channel of the Lung River which flows to the south of the project site.

From this point the Lung River flows northeasterly for approximately 4.5km, where it discharges to the Lough Gara middle lake (6km downstream of the project site). Lough Gara comprises 3 no. separate lake waterbodies (upper, middle and lower) that drain in a northerly direction into the Boyle River.

Table A presents the catchment area of each waterbody downstream of the project as far as the River Moy and Lough Gara. The Moy_SC_030 sub-catchment has an area of 242km² and extends c. 25km downstream of the project site. Further downstream of this point, no likely indirect effects are likely due to large catchment size and increasing flows in the River Moy itself.

The Lung_SC_010 and Lung_SC_020 have a combined area of 233km² and extend downstream as far as Lough Gara, c. 6km downstream of the project site. Downstream of Lough Gara (i.e. Boyle River), no indirect effects or effects are likely due to the large Lough Gara catchment (i.e. 484km²) and the large storage/attenuation capacity afforded by the Lough Gara waterbody.

Therefore, those waterbodies which are located in close proximity to the project site are more susceptible to water quality impacts as a result of activities associated with the project. The potential for the project to impact a waterbody decreases further downstream due to the increasing catchment area to the river surface waterbodies and resulting increase in flow volumes and large volumes of water within downstream lake waterbodies.

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

Table A: Catchment Area Downstream of the Project

WFD River Sub-Basin	Total Downstream Catchment Area (km ²)
Moy River sub-catchment (Moy_SC_030)	
Owengarve (Sligo)_010	44
Owengarve (Sligo)_020	65
Owengarve (Sligo)_030	122
Moy_060	242
Lung River sub-catchment (Lung_SC_020)	
Lung_050	233
Lough Gara Catchment	484

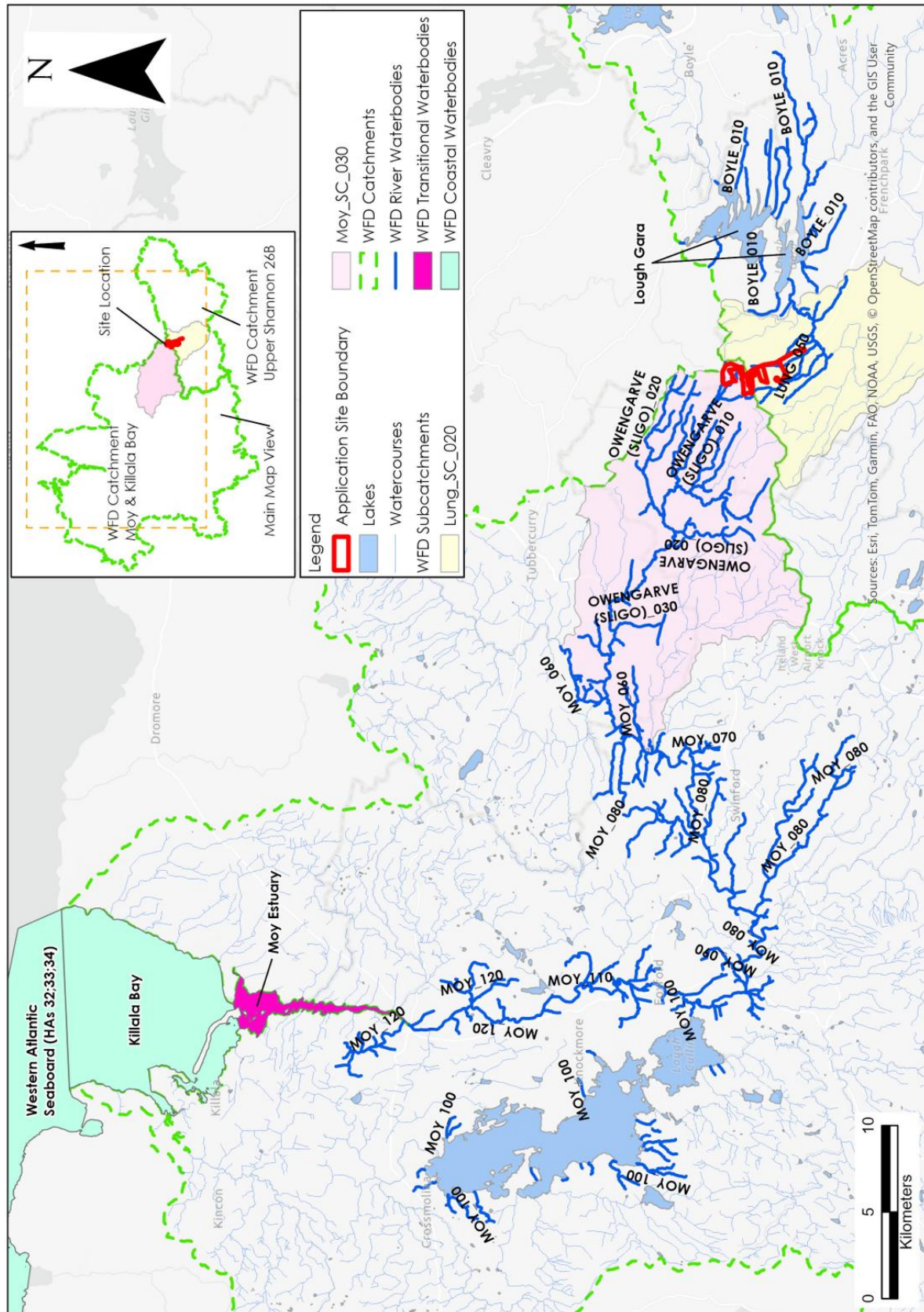


Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the project is shown in **Table B**. The overall status is based on the ecological, chemical and quantitative status of each SWB. Local Surface water Body (SWB) status information is available from (www.catchments.ie).

The northern portion of the project site is located within the River Moy sub-catchment Moy_SC_030 which contains the Owengarve (Sligo)_010 to Owengarve (Sligo)_030 river waterbodies and the Moy_060 river waterbody.

The Owengarve River is a 'High Ecological Status Objective' Waterbody. Waterbodies are assigned High Ecological Status Objective where they were consistently achieving high ecological status in the past (irrespective of whether or not they are currently achieving high status), or where they were within one of eight particularly important freshwater pearl mussel catchments.

The latest WFD cycle status (2019-2024) for Owengarve (Sligo)_010 to Owengarve (Sligo)_030 river waterbodies is "Good". The Owengarve (Sligo)_010 to Owengarve (Sligo)_020 river waterbodies however are assigned to be "At Risk" due to the hydromorphological significant pressures acting on the waterbodies. The risk status represents the risk for each waterbody of failing to meet their WFD objectives by 2027. No significant pressure is currently reported for the Owengarve (Sligo)_030, albeit it is still deemed 'At Risk'.

Downstream of the Owengarve (Sligo)_030, the Moy_060 river waterbody also achieved "Good" status in the current cycle and is considered "Not at Risk" of failing to achieve its objectives.

The southern portion of the project site within the Lung_SC_020 sub catchment is drained by the Lung_050 river waterbody which achieved "Moderate" status in the latest WFD cycle. The Lung River drains into Lough Gara which is also assigned "Moderate" status. The Lung_050 and Lough Gara are both assigned "At Risk" of not achieving their objectives.

No significant pressures have been identified for the Lung_050 waterbody. Invasive species and agricultural activities are identified as a significant pressure on Lough Gara.

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

Table B: Summary WFD Information for Surface Water Bodies

SWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	Risk Status 3 rd Cycle	Pressures
Moy and Killala Bay Catchment					
Owengarve (Sligo)_010	Good	Good	Good	At risk	Hydromorphology
Owengarve (Sligo)_020	Good	Good	Good	At risk	Hydromorphology
Owengarve (Sligo)_030	High	High	Good	At Risk	-
Moy_060	Good	High	Good	Not at risk	-
Upper Shannon (Boyle) Catchment					
Lung_050	Good	Moderate	Moderate	At risk	-
Lough Gara	Moderate	Moderate	Moderate	At risk	Agriculture & Invasive Species

2.4 GROUNDWATER BODY IDENTIFICATION

The northern portion of the project site is mapped within the Kilkelly Charlestown Groundwater Body (IE_WE_G_0032). The southern portion of the project site, including the underground electricity line and haul route works are mapped in the Curlew Mountains GWB (IE_SH_G_073).

Both GWBs are classified as 'poorly productive bedrock' according to WFD mapping. Poorly productive bedrock refers to rock units with low permeability and limited groundwater storage according to the GSI.

2.5 GROUNDWATER BODY CLASSIFICATION

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

Both the Kilkelly Charlestown GWB and Curlew Mountains GWB are assigned 'Good' status and "Not at Risk".

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

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status 2013-2018	Overall Status 2016-2021	Overall Status 2019-2024	Risk Status 3 rd Cycle	Pressures
Kilkelly Charlestown	Good	Good	Good	Not at risk	-
Curlew Mountains	Good	Good	Good	Not at risk	-

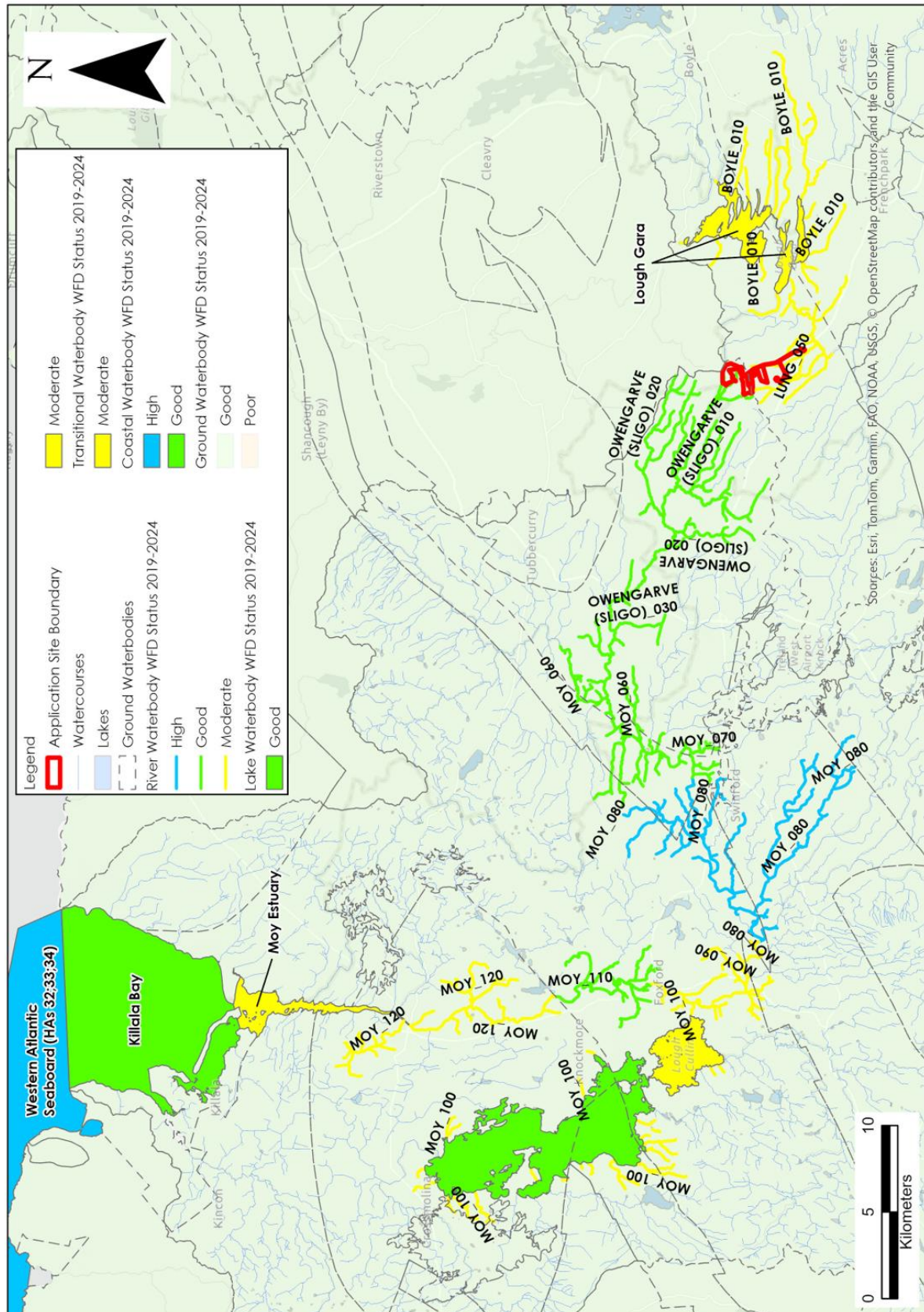


Figure B: WFD Groundwater and Surface Waterbody Status (2019-2024)

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 Areas (DWPA) within the vicinity of the project 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).

Also, 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 project is not located within any designated conservation site or Ramsar site.

The project site is hydrologically connected to the River Moy SAC (Site Code: 002298). At its closest point, this designated site is located approximately 4.9km to the northwest and downstream of the project site and is hydrologically connected via the Owengarve River.

Lough Gara SPA (Site Code: 004048) and pNHA (Site Code: 000587) are located approximately 6km downstream of the project site and are hydrologically connected via the Lung River.

Tullaghanrock Bog SAC (Site Code: 002354) and Callow Bog SAC (Site Code: 000595) are located along the banks of the Lung River upstream of Lough Gara and are located c. 1.6km and 2.7km downstream of the project site respectively.

There are also several pNHA designated sites located along the banks of the Owengarve River, approximately 5.5km downstream of the project site. These bogs include Gowlaun Bog pNHA, Tawnaghbeg Bog pNHA, Kilgarraff Bog pNHA, and Derrynabrock Bog pNHA).

Similarly, hydrological connectivity with the project site and these designated bogs will be limited to surface water flows in the Owengarve River.

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 no bathing water sites located in the vicinity of the project site. The nearest bathing water site is Enniscrone Beach (PA3_0109) located roughly 45km to the northwest and downstream of the River Moy.

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 nutrient sensitive waterbodies downstream of the project.

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.

The closest shellfish protected area is Killala Bay (IEPA2_0060) located 48km northwest of the project site and downstream of the River Moy.

2.6.5 Drinking Water

There are no river waterbody Drinking Water Protected Areas (DWPA) downstream of the project site. Downstream from the project site via the Lung River is the Lough Gara DWPA (IEPA1_SH_26_728) which is approximately 6km downstream of the project site.

As raised in the Uisce Éireann EIAR scoping response (refer to EIAR Water Chapter 7), the public water supply surface water abstraction is located at the southern end of Lough Gara (WAB0000214/WAB0000208); and the associated North Roscommon Water Treatment Plant at Lough Gara provides water to 6,500-customers.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 6 no. surface waterbodies located in project water study area.

There are 5 no. river waterbodies and 1 no. lake waterbody downstream of the project site. In addition, 2 no. groundwater bodies underlie the project site. Furthermore, there are protected areas downstream of the project including SACs, SPA, pNHAs and a DWP.

3.1 SURFACE WATER BODIES

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

With consideration for the construction, operational and decommissioning phases of the project, it is considered that all river waterbodies of the Owengarve River (Owengarve (Sligo)_010, Owengarve (Sligo)_020 and Owengarve (Sligo)_030) and the Lung River (Lung_050) within the vicinity and downstream of the project are screened in for assessment. These SWBs have been included for further assessment due to their proximal location to the project. The works related to the project must not in any way result in a deterioration in the status of these SWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

The Lung River discharges into Lough Gara c. 6km downstream of the project. Lough Gara lake waterbody has been screened in due to its downstream proximity to the project.

Downstream of its confluence with the Owengarve River, the River Moy (Moy_060) has been screened out due to its distal location (~25km) from the project site, large catchment size and increasing flows in the River Moy itself.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Kilkelly Charlestown GWB and Curlew Mountains GWB are screened in due to their location directly underlying the project.

3.3 PROTECTED AREAS

The River Moy SAC and Lough Gara SPA/pNHA are screened in due to their downstream locations on the Owengarve River and Lung River respectively.

Tullaghanrock Bog SAC and Callow Bog SAC are located along the banks of the Lung River upstream of Lough Gara and are located c. 1.6km and 2.7km downstream of the project site respectively. Hydrological connectivity with the project site and will be limited to surface water flows in the adjacent Lung River (i.e. there is no groundwater flow connectivity with the project site and these designated bogs due to large separation distances, dominant surface water drainage regime and poor productivity bedrock aquifers). Therefore, Tullaghanrock Bog SAC and Callow Bog SAC are screened out for further assessment due to lack of groundwater connectivity which is the critical pathway for effects.

There are also several pNHA designated bogs located along the banks of the Owengarve River, approximately 5.5km downstream of the project site. These bogs include Gowlaun Bog pNHA, Tawnaghbeg Bog pNHA, Kilgarraff Bog pNHA, and Derrynabrock Bog pNHA).

Similarly, hydrological connectivity with the project site and these designated bogs will be limited to surface water flows in the Owengarve River (i.e. there is no groundwater flow connectivity with the project site and these designated bogs due to separation distances and the surface water flow regime).

Therefore, the pNHA designated bogs are screen out for further assessment due to lack of groundwater connectivity.

The bathing waters at Enniscrone Beach and Shellfish areas at Killala Bay have been screened out due to their distal location from the project site. The project has very low potential to cause a deterioration to the bathing, or shellfish areas.

Lough Gara is a DWPA due to the North Roscommon Public Water Supply abstraction from the most southerly (upper) lake of the Lough Gara group. The southern portion of the project site drains into the middle lake of the Lough Gara group which is downstream of the upper water supply abstraction lake. Therefore, the project has no likely hydrological connectivity with the Lough Gara public water supply abstraction and is therefore screened out for further assessment.

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 Water Study Area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	Moy and Killala Bay Catchment			
	River	Owengarve (Sligo)_010	Yes	The northern portion of the project site is located within the Owengarve (Sligo)_010 river sub-basin. An assessment is required to consider the potential impacts of the project on this SWB.
	River	Owengarve (Sligo)_020	Yes	The Owengarve (Sligo)_020 is located downstream of the Owengarve (Sligo)_010 SWB. An assessment is required to consider the potential impacts of the project on this SWB.
	River	Owengarve (Sligo)_030	Yes	The Owengarve (Sligo)_030 is located downstream of the Owengarve (Sligo)_020 SWB. An assessment is required to consider the potential impacts of the proposed project on this SWB.
	River	Moy_060	No	The Moy_060 to Moy_120 SWBs have been screened out due to their distal location from the project site and the increasing volumes of water within the River Moy.
	River	Moy_070	No	
	River	Moy_080	No	
	River	Moy_090	No	
	River	Moy_100	No	
	River	Moy_110	No	
	River	Moy_120	No	
	Upper Shannon (Boyle) Catchment			
	River	Lung_050	Yes	The southern portion of the project site is mapped within the Lung_050 river sub-basin. An assessment is required to consider the potential impacts of the project on this SWB.
	Lake	Lough Gara	Yes	Lough Gara has been screened in due to its downstream location on the Lung River.
	Groundwater Bodies			
	Groundwater	Kilkelly Charlestown	Yes	The northern portion of the project site is mapped to overlie the Kilkelly Charlestown GWB. An assessment is required to consider the potential impacts of the project on this GWB.
	Groundwater	Curlew Mountains	Yes	The southern portion of the project site is mapped to overlie the Curlew mountains GWB. An assessment is required to consider the potential impacts of the project on this GWB.
	Protected Areas			
	Nature Conservation Designations	River Moy SAC	Yes	Due to its proximal location downstream of the project site, an assessment is required to consider the potential impacts of the project on this SAC.
		Kilgarraiff Bog pNHA	No	There is no groundwater flow connectivity with the project site and these designated bogs due to large separation distances, dominant surface water drainage regime and poor productivity bedrock aquifers).
		Gowlaun and Tawnaghbeg pNHA	No	
		Derrynabrock pNHA	No	
		Tawnaghbea	No	

		pNHA		
		Lough Gara SPA/pNHA	Yes	Lough Gara SPA/pNHA has been screened in due to its downstream location on the Lung River.
		Tullaghanrock Bog SAC /pNHA	No	There is no groundwater flow connectivity with the project site and these designated bogs due to large separation distances, dominant surface water drainage regime and poor productivity bedrock aquifers).
		Callow Bog SAC	No	
	Bathing Waters	Enniscrone Beach	No	The bathing waters at Enniscrone Beach have been screened out due to its distal location from the project site. The project has very low potential to cause a deterioration to the bathing area.
	Shellfish Waters	Killala Bay	No	The Shellfish area at Killala Bay has been screened out due to its distal location from the project site. The project has very low potential to cause a deterioration to the shellfish area.
	DWPA	Lough Gara	No	The project site has no hydrological connectivity with the Lough Gara public water supply abstraction and is therefore screened out for further assessment.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROJECT PROPOSAL

In summary, the project comprises the following main components as described in full within **Chapter 3**:

- 10 no. wind turbines, 3 no. with an overall height of 185m and 7 no. with an overall height of 150m;
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure and forestry felling;
- Works to the public road network along the turbine component haul route; and,
- 110kV electricity substation and installation of c. 7km of underground electricity line to facilitate connection of the wind farm to the existing Tonroe 110kV electricity substation at Ballaghaderreen, County Roscommon.

It is envisaged that turbine components will be transported from the Port of Galway through the counties of Galway, Mayo and Roscommon to the project site utilising, predominately, motorway and national roads.

A Planning-Stage SWMP, incorporating the surface water drainage design has been prepared, see **Annex 3.4** of the EIAR, and incorporates the principles of Sustainable Drainage Systems (SuDS) through an arrangement of surface water drainage infrastructure. The SWMP has had regard to greenfield runoff rates and is designed to mimic same and is sufficient to accommodate a 1-in-100 year rainfall event.

While the SuDS is an amalgamation of a suite of drainage infrastructure, the overall philosophy is straightforward. In summary:

- Clean water drains will be installed upslope of the works area to intercept clean surface water to prevent it becoming contaminated by silt/sediment from construction activities;
- All surface water runoff from construction works areas will be directed to specially constructed downslope dirty-water swales surrounding all areas of ground proposed to be disturbed (including areas for the temporary storage of material);
- The swales will direct runoff into settlement ponds/silt traps where silt/sediment will be allowed to settle; and,
- Following treatment and the settlement of silt/sediment, clean water will be discharged indirectly to the local drainage network via buffered outfalls thus ensuring that no scouring occurs.

A full description of the project is presented in **Chapter 3** of the EIAR.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects during the Wind Farm Construction Phase

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

Hydrocarbons and cement-based compounds will be used during the construction phase. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a 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 6.5ha. 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.

There are also 2 no. new proposed crossings over natural watercourses at the wind farm. Works have the potential to result in water quality affects.

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

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Owengarve (Sligo)_010	IE_WE_34O030050	Good	Moderate
Owengarve (Sligo)_020	IE_WE_34O030100	Good	Moderate
Owengarve (Sligo)_030	IE_WE_34O030200	Good	Moderate
Lung_050	IE_SH_26L030400	Moderate	Poor
Lough Gara	IE_SH_26_728	Moderate	Poor

4.2.1.2 Potential Surface Water Quality Effects during the Underground Electricity Line Construction Phase

The underground electricity line is located entirely within the Lung River Catchment. The underground electricity line intercepts EPA mapped watercourses at 6 no. locations. 5 no. of these locations are on existing public roads where a culvert or bridge is present; while the 6th location is an existing crossing/culvert located on a private access track near the Tonroe electricity substation.

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

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

However, construction activities along the underground electricity line only have the potential for short term effects due to the phased and transient nature of the works. Also, no instream works are proposed at the underground electricity line watercourse crossing locations, with all crossings being carried out via HDD by design. These factors limit the potential for the underground electricity line 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 project in the unmitigated scenario is outlined in **Table F**.

Table F: Potential Surface Water Quality Impacts during the Underground Electricity Line Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Lung_050	IE_SH_26L030400	Moderate	Moderate
Lough Gara	IE_SH_26_728	Moderate	Moderate

4.2.1.3 Potential Groundwater Quality/Quantity Effects during the Project Construction Phase

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 quality at the project site.

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

However, due to the low permeability of the subsoils and poor productive bedrock aquifer along with the shallow nature of the proposed works, there is no potential for the project to change the overall status of the underlying GWBs.

Also, due to the shallow, short-term and transient nature of the underground electricity line 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/quantity impacts during the construction phase of the project in the unmitigated scenario is outlined in **Table G**.

Table G: Potential Groundwater Quality/Quantity Effects during the Project Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Status Change	Potential
Kilkelly Charlestown	IE_WE_G_0032	Good	Good	
Curlew Mountains	IE_SH_G_073	Good	Good	

4.2.1.4 Potential Morphological Changes to Surface Water Courses & Drainage Patterns due to the Project

Diversion, culverting and bridge crossing of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats. The construction of structures over water courses also has the potential to significantly interfere with water quality and flows during the construction phase.

Within the wind farm site there is 1 no. proposed watercourse crossing within the Owengarve River catchment and 1 no. within the Lung River catchment. Both watercourses to be crossed by the wind farm access roads are small headwater streams.

There are no new proposed watercourse crossing structures along the underground electricity line route.

Table H: Potential Morphological Changes to Surface Water Courses & Drainage Patterns due to the Project

SWB	WFD Code	Current Status	Assessed Status Change	Potential
Owengarve (Sligo)_010	IE_WE_34O030050	Good	Good	
Lung_050	IE_SH_26L030400	Moderate	Moderate	

4.2.1.5 Potential Protected Area Impacts

River Moy SAC and Lough Gara SPA/pNHA

The project is hydrologically connected to the River Moy SAC. At its closest point, this designated site is located approximately 4.9km downstream of the project site and is downstream (hydrologically connected) via the Owengarve River.

Lough Gara SPA/pNHA is located approximately 6km downstream of the project site and is hydrologically connected via the Lung River which the drains the southern portion of the project site.

Surface water effects are unlikely to be significant due to dilution/assimilation capacity effects over such distances (both the River Moy SAC and Lough Gara SPA being >4km downstream from the project site). Notwithstanding this, surface water management and mitigation is proposed to protect local surface water and thereby avoiding significant negative downstream surface water quality effects.

4.2.2 Operational Phase (Unmitigated)

Potential effects associated with the operational phase of the project will be much reduced in comparison to the construction phase. Any effects that would occur at the wind farm site will be associated with minor maintenance works.

During the operational phase SuDs through an arrangement of surface water drainage infrastructure will be in place. The SuDs has had regard to greenfield runoff rates and is designed to mimic same and is sufficient to accommodate a 1-in-100 year rainfall event.

No maintenance work will be required along the underground electricity line and therefore there is no potential to impact on the status of downstream SWBs or underlying GWBs.

4.2.2.1 Increased Wind Farm Site Runoff and Potential Hydromorphological Effects

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 increase runoff from the project site and potentially increase flood risk downstream of the project.

Hardstand emplacement will only be required at the wind farm and not the underground electricity line. Therefore, the underground cabling cannot alter the hydrological regime along the route which is already a hardstand surface.

The emplacement of the wind farm footprint, as described in Chapter 4 of the EIAR, (assuming emplacement of impermeable materials as a worst-case scenario) could result in an average total site increase in surface water runoff of approximately 1,948m³/month or 63m³/day. Refer to Section 7.4.5.1 of the Water chapter for the runoff assessment.

This represents a potential increase of approximately 0.97% in the average daily/monthly volume of runoff from the wind farm 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 wind farm site being developed. Specifically, the wind farm permanent footprint is approximately 8.6ha, representing 5.5% of the overall project site (157ha).

The additional volume is low due to the fact that the runoff potential from the wind farm is naturally high (85%). Also, this calculation assumes that all hardstanding areas will be impermeable which is 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.

There are also 2 no. new proposed crossings over natural watercourses at the wind farm. Both proposed crossings are located on small headwater streams and therefore the potential for hydromorphological effects is negligible.

A summary of potential status change to SWBs arising from hydromorphological effects during the operation stage of the proposed project in the unmitigated scenario is outlined in **Table I**.

Table I: Potential Hydromorphological Effects during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Status Change	Potential
Owengarve (Sligo)_010	IE_WE_34O030050	Good	Good	
Owengarve (Sligo)_020	IE_WE_34O030100	Good	Good	

Owengarve (Sligo)_030	IE_WE_34O030200	Good	Good
Lung_050	IE_SH_26L030400	Moderate	Moderate
Lough Gara	IE_SH_26_728	Moderate	Moderate

4.2.2.2 Surface Water Quality Impacts from Operational Wind Farm Site Drainage

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

A summary of potential status change to SWBs arising from surface water quality impacts during the operation stage of the project in the unmitigated scenario is outlined in **Table J**.

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

SWB	WFD Code	Current Status	Assessed Status Change	Potential
Owengarve (Sligo)_010	IE_WE_34O030050	Good	Good	
Owengarve (Sligo)_020	IE_WE_34O030100	Good	Good	
Owengarve (Sligo)_030	IE_WE_34O030200	Good	Good	
Lung_050	IE_SH_26L030400	Moderate	Moderate	
Lough Gara	IE_SH_26_728	Moderate	Moderate	

4.2.2.3 Groundwater Quality Impacts at the Wind Farm Site

The risks to groundwater quality are the same as those described in **Section 4.2.1.3** but of a lesser extent than during the construction phase due to the limited activity at the project site with only minor maintenance required during the operational phase.

A summary of potential status change to GWBs arising from groundwater quality impacts during the operation stage of the proposed project in the unmitigated scenario is outlined in **Table K**.

Table K: Groundwater Quality Impacts (WF Site) During Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Status Change	Potential
Kilkelly Charlestown	IE_WE_G_0032	Good	Good	
Curlew Mountains	IE_SH_G_073	Good	Good	

4.2.2.4 Potential Effects on Protected Areas

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.

Therefore, the risk of any operational phase activities that may affect the conservation objectives on designated sites is greatly reduced.

4.2.3 Decommissioning Phase (Unmitigated)

Decommissioning phase effects are likely to be very similar to construction phase impacts but the overall likelihood of significant negative effects will be much lower due to reduced groundworks and excavations taking place.

Some of the effects will be reduced or avoided by retaining some elements of the project where appropriate; for example, access tracks within the site are likely to be retained for forestry uses. No effects on WFD status are expected during the decommissioning phase.

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 project. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Protect Clear Felling Surface Water Quality Effects

A total of 6.5ha of forestry will be permanently felled to accommodate the construction and operation of the project.

During the construction phase, a self-imposed conservative buffer zone of 50m will be maintained for all streams. These buffer zones are illustrated at **EIAR Figure 7.10**. Only approximately 0.8ha of the total 6.5ha proposed for felling is located inside a 50m watercourse buffer zone.

The large distance between the majority of the proposed felling areas and sensitive aquatic zones means that potential poor-quality runoff from felling areas can be adequately managed and attenuated prior to even reaching the aquatic buffer zone and primary drainage routes. Where tree felling is required in the vicinity of streams, the following additional mitigation measures will be employed.

- Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance;
- Checking and maintenance of tracks and culverts will be on-going through any felling operation. No tracking of vehicles through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute

angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and avoid being placed at right angles to the contour;

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

Silt Traps:

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

Drain Inspection and Maintenance:

The following items will be carried out during pre-felling inspections and after:

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;

- Inspection of main drainage ditches and outfalls. During pre-felling inspections the main drainage ditches will be identified. Ideally the pre-felling inspection will be carried out during rainfall;
- Following tree felling all main drains will be inspected to ensure that they are functioning;
- Extraction tracks within 10m of drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the site, if impeded by silt or debris, will be unblocked; and,
- All accumulated silt will be removed from drains, culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring:

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

Details of the proposed surface water quality monitoring programme are outlined in the Surface Water Management Plan.

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

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

Also, daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be populated daily and kept on site for record and inspection.

4.3.1.2 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Water

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas where possible by using a 50m buffer.

From the hydrological constraints map (EIAR Figure 7.10), it is evident that other than some small sections of crane hardstandings and associated access tracks at T1 and T4, the watercourse crossings at turbines T4 and T9, and some sections of haul route upgrade works; the majority of the wind farm infrastructure (including all turbine foundation locations, borrow pit and peat/spoil deposition areas) is located outside of areas that have been assessed to be hydrologically sensitive.

Specific mitigation measures, incorporated into the design of the development and through implementation of best practice methodologies (discussed below) will be employed where work inside buffer zones is proposed.

The generally large setback distance from sensitive hydrological features means that sufficient space is provided for the installation of proposed drainage mitigation measures (discussed below) and to ensure their effective operation. The proposed buffer zone will ensure:

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

Mitigation by Prevention

The following section details the measures which will be put in place during the construction phase to ensure that surface water features are protected from the release of silt or sediment and to ensure that all surface water runoff is fully attenuated to avoid the discharge of dirty water.

- Source controls to limit the likelihood for 'dirty water' to occur include:
 - Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sand bags, oyster bags filled with clean washed gravel, filter fabrics, and other similar/equivalent or appropriate systems;
 - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls to ensure appropriate management of silt laden water:
 - Interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.
- Treatment systems to fully attenuate silt laden waters prior to discharge:
 - Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.
 - Final Tertiary treatment lagoons

It should be noted for this site that an extensive network of land, bog and forestry drains already exists and these will be integrated and enhanced as required and used within the wind farm drainage system. The integration of existing land drainage networks and wind farm networks is common practice in wind energy developments and will also result in benefits to surrounding lands.

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

- Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the proposed wind farm drainage into the existing site drainage network. This will reduce the likelihood for any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps will be placed in the existing drains upstream of any streams where construction works are taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area;

- During the operational phase of the wind farm, runoff from individual turbine hardstanding areas will be not discharged into the existing drain network but discharged locally at each turbine location through stilling ponds and buffered outfalls onto vegetated surfaces;
- Buffered outfalls which will be numerous over the site will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site;
- Drains running parallel to the existing roads that requiring widening will be upgraded. Velocity and silt control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles and silt fences will be used during the upgrade works. Regular buffered outfalls will also be added to these drains to protect downstream surface waters.

Water Treatment Train

While the primary, secondary and tertiary silt/sediment ponds and lagoons are assessed as providing a sufficient level of protection to avoid any deterioration in downstream water quality; a final line of defence can be provided by a water treatment train such as a "Siltbuster", if required. If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train (sequence of water treatment processes) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This water treatment train will apply for the entirety of the construction phase.

Silt Fences

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

Silt Bags

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

Management of Runoff from Soil Deposition Areas

It is proposed that excavated peat/overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which is unsuitable for this purpose, will be stored, permanently, at dedicated peat/spoil deposition areas and in the 1 no. spent borrow pit.

Proposed peat/spoil deposition areas and the borrow pit are located outside the 50m stream buffer zone (refer to **EIAR Figure 7.10**).

During the initial placement of peat/spoil in the deposition areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Drainage from overburden deposition areas will ultimately be routed to an oversized swale and a number of

silt/settlement ponds with appropriate storage and settlement capacity, designed for a '1-in-100 year 6-hour return' period, before being discharged.

Spoil deposition areas will be sealed with a digger bucket and allowed to vegetate naturally. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Surface water protection infrastructure will be left in place until the areas have stabilised.

Spoil deposition areas will be sealed with a digger bucket and vegetated naturally to reduce sediment entrainment in runoff. Once re-vegetated and stabilised, spoil deposition areas will no longer be a likely source of silt laden runoff. Settlement ponds will be left in place until the areas have stabilised.

Underground Electricity Line Installation Works

Mitigation measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the trenching work does not discharge directly to the water:

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

Specific mitigation measures relating to the directional drilling at the crossing location are detailed below.

Directional Drilling

The following mitigation will be carried out during directional drilling works along the underground electricity line:

- Firstly, the crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance of vegetation;
- A minimum 10 metre vegetative buffer zone will be maintained (if present) between disturbed areas and the watercourse bank. There will be no storage of material / equipment, excavated material (see below) or overnight parking of machinery inside the 10m buffer zone;
- Double silt fencing will be placed upslope of the buffer zone on each side of the watercourse.
- Mats will be used underneath the excavator, inside the 10 metre vegetative buffer zone, to prevent soil erosion/rutting and potential surface water quality impacts from localised surface water runoff;
- Temporary storage of excavated material will be undertaken outside of the 10m buffer on flat ground or within a local hollow area. A containment berm will be placed downslope of the excavated material which in turn will be surrounded by secondary silt fence protection to prevent saturated soil from flowing back into the watercourse;
- Operation of machinery and use of equipment within the 10m buffer will be kept to a minimum to avoid any unnecessary disturbance;
- There will be no refuelling allowed within 100m of the watercourse crossing;
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing; and,
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted.

Mitigation Measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling include:

- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages;
- Two 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.

A Fracture Blow-out (Frac-out) Prevention and Contingency Plan will be prepared by the drilling contractor prior to construction and will include the following measures:

- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- A double row of silt fencing will be placed between the works area and the adjacent river;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process/pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site;
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix; and,
- If the risk of further frac-out is high, a new drilling alignment will be sought at the crossing location.

Pre-emptive Site Drainage Management

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

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

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- Meteo Alarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3 hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent

rainfall. A 3 hour record is given and is updated every 15 minutes. Radar images are not predictive; and,

- Consultancy Service: Met Eireann provide a 24 hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

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

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

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

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

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24-hours after heavy events to ensure drainage systems are not overloaded.

Timing of Site Construction Works

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

Monitoring

Prior to the commencement of development, a detailed Site Drainage Plan and Surface Water Management Plan (SWMP) will be prepared to detail the siting and composition of the surface water management measures. The respective plans, which will form part of the detailed Construction Environmental Management Plan (CEMP), will be agreed in writing with the Planning Authority.

The SWMP will also include a programme for the monitoring of surface waters in the vicinity of the construction site by a designated Environmental Manager. The monitoring programme will comprise field testing and laboratory analysis of a range of agreed parameters. The civil works contractor, who will be responsible for the construction of the site drainage system, and Environmental Manager will undertake regular inspections of the drainage system to ensure that all measures are functioning effectively. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels that may decrease the effectiveness of the drainage feature, will be removed and disposed of in an appropriate manner.

Each element of the wind farm development (i.e., access roads, turbines, borrow pit and clear felling) 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).

4.3.1.3 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 include:

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compounds. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. No refuelling will be permitted at works locations within the 50m hydrological buffer. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser 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 to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be readily available to deal with and accidental spillages;
- All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or for storage within the spoil deposition areas; and,
- An outline emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage CEMP (Annex 3.4 of the EIAR). This emergency plan will be further developed prior to the commencement of development and will be agreed with the Planning Authority as part of the detailed CEMP.

Wastewater:

Measures to avoid contamination of ground and surface waters by wastewaters will comprise:

- The provision of self-contained port-a-loos (chemical toilets) with an integrated waste holding tank will be installed at the site compound, maintained by the providing contractor, and removed from site on completion of the construction works;
- Water supply for the site office and other sanitation will be brought to site and removed after use to be discharged at a suitable off-site treatment location; and,
- No water will be sourced on the site, nor will any wastewater be discharged to the site.

Best practice methods for cement-based compounds:

The following mitigation measures are proposed to ensure that the release of cement-based products is avoided:

- No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products will be utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided.

- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout ponds with waters being stored in the temporary construction compounds, removed off site and disposed of at an approved licensed facility. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- The concrete pour sites will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.4 Morphological Changes to Surface Water Courses & Drainage Patterns

The following mitigation measures are proposed:

- The 2 no. proposed new stream crossings will be clear span bridges (bottomless culverts) and the stream beds will remain undisturbed. No in-stream excavation works at the crossing locations are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Wind farm electrical cabling or the underground electricity line cabling will be installed either above or below an existing culvert and will not directly interfere with the culvert;
- At the time of construction, all guidance/best practice requirements of the Office of Public Works (OPW) or Inland Fisheries Ireland will be incorporated into the design/construction of the proposed watercourse/culvert crossings;
- As a further precaution, in-stream construction work (if/where required) will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016) (i.e., July 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 works (i.e. within the 50m buffer zone), double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase;
- The 2 no. new watercourse crossings at the wind farm site will require a Section 50 license application to the OPW in accordance with the Arterial Drainage Act 1945. The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent; and,
- No instream works are proposed at the underground electricity line watercourse crossings, with all crossings being carried out via HDD.

4.3.1.5 Mitigation for Protected Areas

The potential for material to enter the local protected areas is negligible as mitigation controls as described in **Sections 4.3.1** above will be implemented. These measures include the use of silt fences, silt traps and check dams. Emphasis will also be placed on prevention of hydrocarbon releases to local watercourses. It can be concluded that with best practice methods adhered to during the construction of the proposed wind farm development, the potential for the project to impact upon the qualifying interests of 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 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 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 tracks, turbine hardstanding areas and substation compound areas which may contain entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains;
- Check dams will be used along sections of access tracks drains to intercept silts at source. Check dams will be constructed from a 40mm non-friable crushed rock or similar;
- Settlement ponds, emplaced downstream of track swale sections, turbine locations and the selected substation option, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in accordance with the greenfield runoff rate requirements; and,
- Imported rock for construction purposes and road surfacing will be strong, well-graded limestone which will be resistant to erosion and have a low likelihood to generate fines in hardstand runoff.

The operation of the underground grid connection will not result in any likely hydrological or water quality effects and therefore does not require mitigation measures.

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 4.3.2.1** above.

Mitigation measures for oils and fuels during the operational phase of the proposed project are the same as those outlined in **Section 4.3.1.3** above.

It is proposed that bedrock won from the on-site borrow pit 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 the borrow pit or local quarries.

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 for Protected Areas

The implementation of the operational mitigation measures will ensure the protection of downstream protected sites.

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.

As in the construction phase, temporary surface runoff control measures will again be put in place during decommissioning works. The drainage system will remain operational during the decommissioning phase and will serve to treat any sediment laden surface water run-off due to a renewed disturbance of soils. Following decommissioning, re-vegetation will be implemented as soon as practicable and monitored to ensure vegetation is established.

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.

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. Similar mitigation as outlined in **Sections 4.3.1.1** and **4.3.1.3** for the construction stage will be implemented during the decommissioning phase to ensure no impacts on receiving waters.

Some of the potential impacts on water bodies will be avoided by leaving elements of the proposed project in place where appropriate. 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.

With the implementation of the mitigation measures outlined above no significant effects on the hydrological and hydrogeological environment will occur during the decommissioning stage of the 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 L** below.

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

SWB	WFD Code	Current Status	Assessed Status - Unmitigated	Assessed Status with Mitigation Measures
Moy Killala Bay Catchment				
Owengarve (Sligo)_010	IE_WE_34O030050	Good	Moderate	Good
Owengarve (Sligo)_020	IE_WE_34O030100	Good	Moderate	Good
Owengarve (Sligo)_030	IE_WE_34O030200	Good	Moderate	Good
Upper Shannon (Boyle) Catchment				
Lung_050	IE_SH_26L030400	Moderate	Poor	Moderate
Lough Gara	IE_SH_26_728	Moderate	Poor	Moderate
Groundwater Bodies				
Kilkelly Charlestown	IE_WE_G_0032	Good	Good	Good
Curlew Mountains	IE_SH_G_073	Good	Good	Good

5. SUMMARY AND CONCLUSION

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

The 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 project.

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

There is also mitigation proposed to protect groundwater quality within the project site during the construction, operational and decommissioning phases of the project. These mitigation measures will ensure the qualitative status of the underlying GWBs will not be altered by the project.

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

Mitigation proposed for the protection of protected areas during the construction, operation and decommissioning phases of the project will ensure the qualitative and quantitative status of the receiving ground and surface waters will not be altered by the project and thereby reduces the potential for the proposed development to negatively impact upon any designated site

As such, the 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 jeopardise the 'High Ecological Status Objective' of the Owengarve River;
- 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).

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