Cush Wind Farm

Environmental Impact Assessment Report

Annex 7.3: Water Framework Directive Compliance Assessment

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WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT
PROPOSED CUSH WIND FARM, CO. OFFALY

FINAL REPORT

Prepared for:

CUSH WIND LIMITED

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by Galetech Energy Services on behalf of Cush Wind Limited to complete a Water Framework Directive (WFD) Compliance Assessment for a planning application with regard the proposed Cush Wind Farm, Co. Offaly.

The term 'project site' refers to the lands within the EIAR/planning application boundary for the proposed wind farm development. The term 'project site' is as defined within Chapter 1 of the EIAR.

In summary, the project site which includes 8 no. turbines, substation, underground grid connection and turbine delivery route (TDR) works is located at Cush (and surrounding townlands), situated approximately 4km north of the town of Birr and c. 28km south-west of Tullamore, County Offaly. Off-site and secondary developments; including the forestry replant lands and candidate quarries which may supply construction materials; also form part of the project.

The purpose of this WFD assessment is to determine if any specific components or activities associated with the proposed project will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be affected, 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 and grid connections.

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

Michael Gill P. Geo. (B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer/Hydrologist with over 22 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.

David Broderick P.Geo. (BSc, H.Dip Env Eng, MSc) is a Hydrogeologist with over 17 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.

Jenny Law (BSc, MSc) is a junior Environmental Geoscientist, holding an M.Sc. in Applied Environmental Geoscience (2022) from University College Cork. Jenny has also completed a B.Sc. in Earth and Ocean Science (2019) from National University of Ireland. In recent times Jenny has assisted in the preparation of hydrological and hydrogeological impact assessments for a variety of developments.

1.3 WATER FRAMEWORK DIRECTIVE

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

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

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

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

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

Furthermore, the Department of Housing, Local Government and Heritage are currently reviewing the submissions made on the Draft River Basin Management Plan (2022 - 2027) which was out for public consultation in Q4 of 2021 and Q1 of 2022. The draft plan was be updated with a view to finalization and publication in Q3/Q4 of 2022. As of yet, no final publications have been made.

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

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

This section identifies those surface water, 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

On a regional scale, the proposed project site is located within Hydrometric Area 25 (Lower Shannon Catchment) and mainly situated inside the Shannon[lower]_SC_040 sub-catchment (i.e. Rapemills River). The grid connection route extends into the Shannon[lower]_SC_060 (Little Brosna River) sub-catchment. On a local scale, the Rapemills River (Rapemills_010) rises approximately 8km to the east of the project site and then flows in westerly direction through the wind farm site itself. The Rapemills River then flows into the River Shannon approximately 10.5km downstream of the project site.

Approximately 2.7km of the grid connection route is located in the Rapemills River catchment while the other 2.9km is located in the Little Brosna River catchment. The Little Brosna River flows approximately 1km to the southwest of the existing Dallow substation, at Clondallow, before joining the River Shannon a further 12km downstream. **Figure** A below shows a local hydrology map of the area.

Table A presents the catchment area of each waterbody downstream of the proposed project site as far as the Shannon (Lower) River. The catchment area for the waterbodies increases progressively downstream. 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 proposed project. The potential for the proposed project to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

Table A: Catchment Area Downstream of Project Site

WFD River Sub-Basin	Total Upstream Catchment Area (km²)
Shannon[Lower] sub-catchment (Shannon[Lower]_SC_040)	
Rapemills_010	56.83
Rapemills_020	92.66
Shannon (Lower)_020	>7989
Shannon[Lower] sub-catchment (Shannon[Lower]_SC_060)	
LittleBrosna_060	481
Incherky_010	561.4
Shannon (Lower)_030	> 9633.6

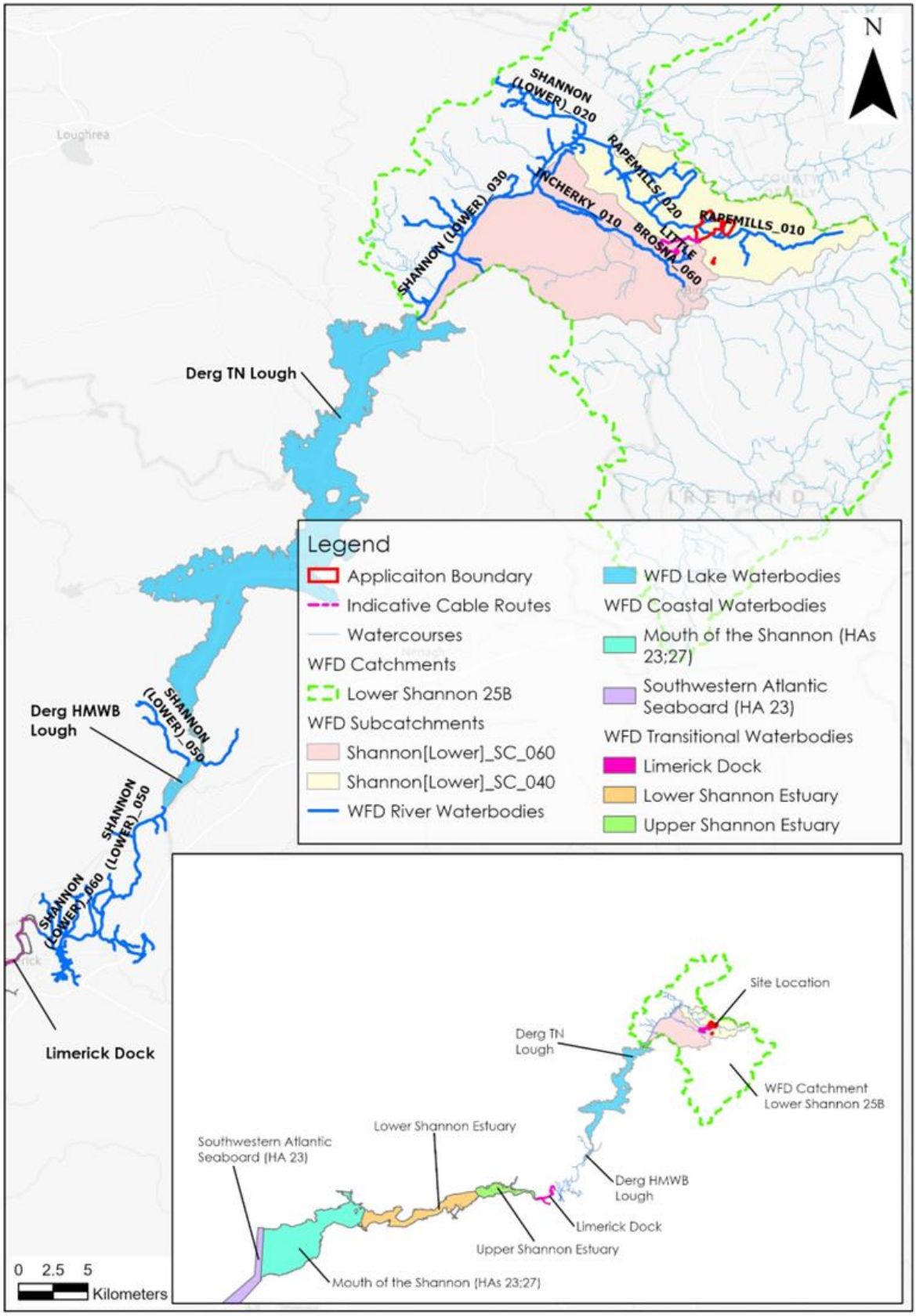

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the proposed project site are shown in **Table B**. The overall status is based on the ecological, chemical and quantitative status of each SWB.

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

As described in **Section 2.2** above, the proposed project site is drained locally by the Rapemills River and Little Brosna River.

The latest 2016-2021 WFD cycle status of the Rapemills River in the vicinity and downstream of the project site is "Moderate" (Rapemills_010 and _020 river segments). Both segments of the Rapemills River (Rapemills_010 and _020) have been deemed to be "At risk" of failing to meet their WFD objectives by 2027. Agricultural activities have been found to be significantly impacting each of the waterbodies. Peat harvesting and drainage is additionally impacting the Rapemills_020 river waterbody.

The Rapemills River feeds into the Shannon (Lower) River. The Shannon (Lower)_020 and Shannon (Lower)_030 SWB's downstream of the site achieved "Moderate" status in the latest WFD cycle. The Shannon (Lower)_020 is classified as being "At risk", whereas the risk status of the Shannon (Lower)_030 SWB is currently "Under review". Diffuse urban pressures, caused by misconnections, leaking sewers and runoff from paved and unpaved areas, have been identified as a significant pressure on the Shannon (Lower)_020 SWB.

Further downstream, the Shannon (Lower)_030 river waterbody drains into Lough Derg or the 'Derg TN' lake waterbody as per its WFD name, which achieved "Moderate" status. Further south, between Killaloe and Ballina town, the Derg TN lake waterbody flows into the Derg HMWB lake waterbody, which was found to be of "Good" status for the 2016-2021 WFD cycle. The Derg TN lake waterbody is "At risk" with agricultural activities and hydromorphology acting as significant pressures on the SWB. Dams, Barriers, Locks and Weirs is the hydromorphological sub-pressures category attributed to the Derg TN waterbody creating barriers for fish migration. Additionally, the Derg TN Lake waterbody has zebra mussels present, which have been identified as a significant pressure. Furthermore, Lough Derg has Asian clams and up to 14 other alien species according to IFI and the Lough Derg Science Group. The Derg HMWB lake waterbody's risk status is "Under review".

The Shannon (Lower)_050 SWB outflows from the Derg HMWB lake waterbody, which in turn flows into the Shannon (Lower)_060 SWB. The Shannon (Lower)_050 and the Shannon (Lower)_060 SWB's achieved "Poor" and "Moderate" Status, respectively. Hydromorphological pressures have been attributed to the Shannon (Lower)_050 waterbody which is "At risk", whilst the Shannon (Lower)_060 SWB is currently "Under review".

Transitional waterbodies downstream of the proposed project include the Limerick Dock, Upper Shannon Estuary and the Lower Shannon Estuary. Both the Limerick Dock and Upper Shannon Estuary waterbodies have "Poor" status and are "At risk", whereas the Lower Shannon Estuary achieved "Good" status and is "Not at risk". The coastal waterbodies downstream of the development consist of the Mouth of the Shannon (HAs 23;27) and the Southwestern Atlantic Seaboard (HA 23) which achieved "Good" and "High" status respectively and are both "Not at risk" of failing to meet their WFD objectives in the future.

The proposed underground grid connection route is mapped within and the Rapemills_010, and Rapemills_020 river basin as mentioned above for the wind farm, as well as the Little Brosna_060 and the Incherky_010 river sub basins. The Little Brosna_060 SWB achieved "Good" status and is "Not at risk". The Incherky_010 SWB is of "Good" status and currently "Under

review" with regard to its risk status. The Incherky_010 discharges into the Shannon (Lower)_030 SWB as described above.

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

Table B: Summary WFD Information for River Water Bodie

SWB	Overall Status 2010-2015	Risk Status 2nd Cycle	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
	Lower Shannon Catchment					
Rapemills_010	Good	Not at risk	Moderate	Moderate	At risk	Agriculture
Rapemills_020	Unassigned	Under review	Moderate	Moderate	At risk	Agriculture & peat
Shannon (Lower)_020	Good	Not at risk	Moderate	Moderate	At risk	Urban run-off
Little Brosna_060	Good	Not at risk	Good	Good	Not at risk	-
Incherky_010	Unassigned	Under review	Moderate	Good	Under review	-
Shannon (Lower)_030	Unassigned	Under review	Moderate	Moderate	Under review	-
Derg TN	Poor	At risk	Moderate	Moderate	At risk	Agriculture, hydromorphology & other
Derg HMWB	Good	Not at risk	Good	Good	Under Review	-
Shannon (Lower)_050	Moderate	At risk	Moderate	Poor	At risk	Hydromorphology
Shannon (Lower)_060	Unassigned	Not at risk	Moderate	Moderate	Under Review	-
Limerick Dock	Moderate	At risk	Good	Poor	At Risk	-
Upper Shannon Estuary	Poor	At risk	Poor	Poor	At Risk	Agriculture
Lower Shannon Estuary	Moderate	At risk	Good	Good	Not at Risk	-
Mouth of the Shannon (HAs 23;27)	Moderate	Under review	Good	Good	Not at Risk	-
Southwestern Atlantic Seaboard (HA 23)	Unassigned	Not at risk	High	High	Not at Risk	-

2.4 GROUNDWATER BODY IDENTIFICATION

In terms of local Groundwater Bodies (GWBs), the proposed project site straddles the Banagher GWB (IE_SH_G_040), Birr GWB (IE_SH_G_041) and the Birr Gravels GWB (IE_SH_G_244). The majority of the wind farm site itself is located in the Banagher GWB.

Sand and gravels are mapped to overlie the bedrock along the majority of the grid connection route (i.e. Birr Gravels GWB). These gravels deposits are classified as a Locally Important Gravel Aquifer (Lg) by the GSI.

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

2.5 GROUNDWATER BODY CLASSIFICATION

The GWBs are assigned a status based on the assessment of groundwater chemical and quantitative figures.

The Banagher GWB (IE_SH_G_040) and the Birr GWB (IE_SH_G_041) that underly the wind farm site have been assigned 'Good' status in all 3 no. WFD cycles and have been deemed to be 'Not at Risk'.

The Birr Gravels GWB (IE_SH_G_244) is also of 'Good' status and it has been deemed to be 'Not at Risk'.

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status 2010-2015	Risk Status 2nd Cycle	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
Banagher	Good	Not at risk	Good	Good	Not at risk	-
Birr	Good	Under review	Good	Good	Not at risk	-
Birr Gravels	Good	Under review	Good	Good	Not at risk	-

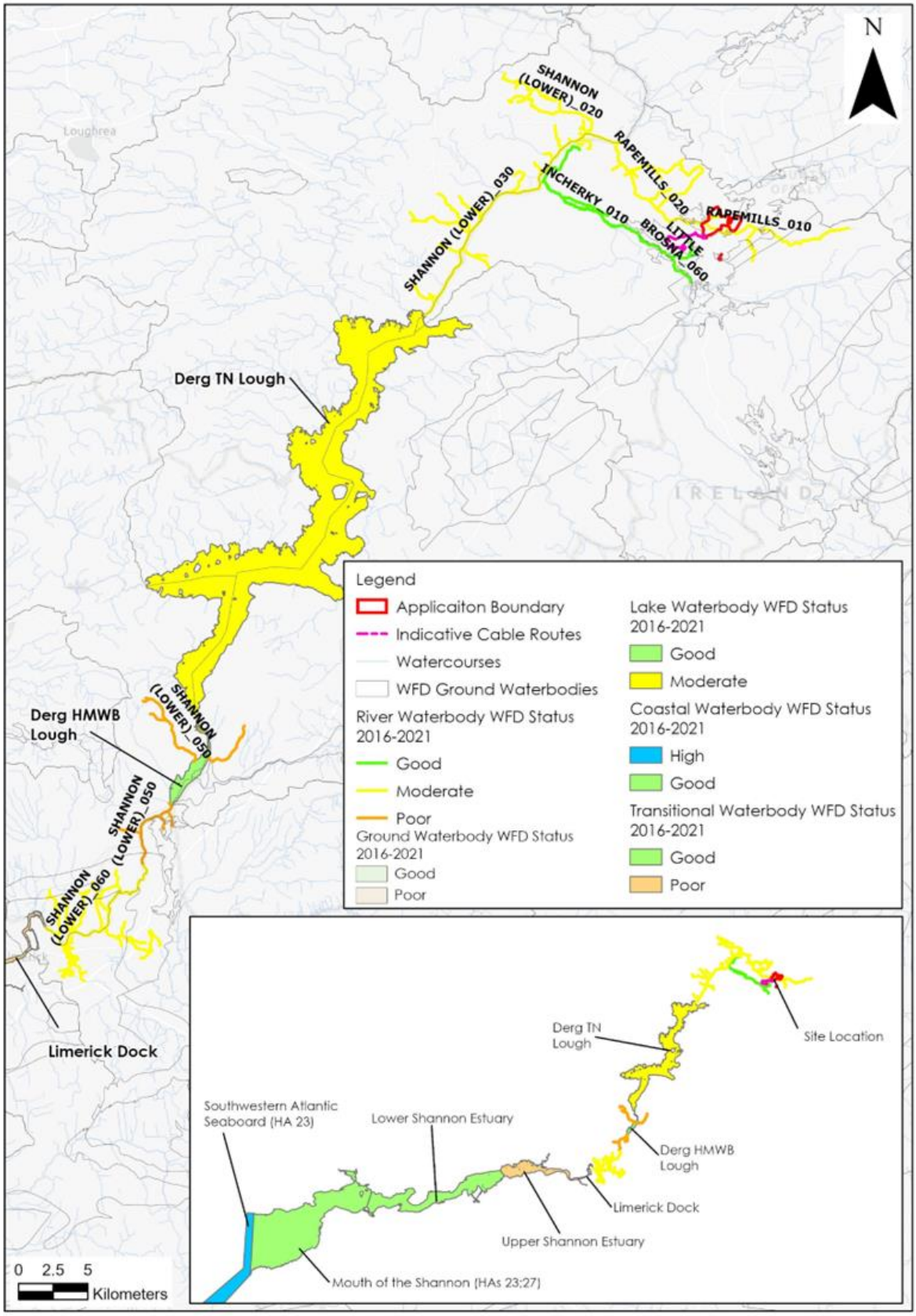

Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021)

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 closest designated sites to the proposed project include:

- Ross and Glenns Eskers pNHA (Site Code: 000920).
- The Dovegrove Callows SPA (Site Code: 004137).
- Woodville Woods pNHA (Site Code: 000927).
- The Ridge Road, SW of Rapemills SAC and pNHA.

The abovementioned close proximity designated sites are not water dependant and are therefore screen out for further assessment.

The wind farm site drains to the northwest via the Rapemills River, which passes the All Saints Bog and Esker SAC and pNHA (Site Code: 000566) and the All Saints Bog SPA (Site Code:004103) approximately 3.5km from the project site.

However, there is no surface water connection between the project site and All Saints Bog and Esker SAC as All Saints Bog discharges into Rapemills River and not vice versa.

Groundwater flow in the area of the project site is likely to be westerly towards All Saints Bog and Esker SAC. However, groundwater flow below All Saints Bog will be limited to the deeper glacial deposits which are separated from the overlying bog by very low permeability marl and lacustrine clay deposits which underlies the basin peat in this area.

The Rapemills River ultimately drains into the River Shannon and flows through the River Shannon Calllows SAC (Site Code: 00216) and the Middle Shannon Callows SPA (Site Code:004096), which lie approximately 6.8km northwest of the project site.

The Little Brosna River drains through the Little River Brosna Callows SPA and NHA.

The project site has hydrological connections with designated sites situated within and beyond Lough Derg (Derg TN). These sites include the following:

- Lough Derg northeast Shore SAC (Site Code: 002241)
- Lough Derg pNHA (Site Code: 000011)
- Lough Derg (Shannon) SPA (Site Code: 002058)
- Lower River Shannon SAC (002165)
- Fergus Estuary and Inner Shannon, North Shore pNHA (Site Code: 002048)
- River Shannon and River Fergus Estuary SPA (Site Code: 004077)

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 proposed project site. The proposed project site is ~20km northeast of the Bathing Place at Portumna (IESHBWL25_191a_0100), the nearest bathing water site (as the crow flies).

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.

The Derg TN NSA (IELK_SH_1994_0007) is the only NSA downstream of the proposed project. The NSA objective for Derg TN NSA is being met.

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 located in the vicinity of the proposed project site. The proposed project site is ~65km east of Clarinbridge/Kinvara Bay (IEPA2_0005), the nearest shellfish area site (as the crow flies).

2.6.5 Drinking Water

There are 2 no. DWPA's downstream of the proposed project, the Derg TN DWPA (IEPA1_SH_25_191a) and the Shannon (Lower)_060 DWPA (IEPA1_SH_25S012600).

Meanwhile, all GWBs within the catchment are listed as DWPAs.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 8 no. surface waterbodies which are located in the vicinity or downstream of the proposed project site.

There are also 2 no. lake waterbodies, 3 no. transitional waterbodies and 2 no. coastal waterbodies downstream of the proposed project site. In addition, 3 no. groundwater bodies underlie the proposed project site.

Furthermore, there are protected areas in downstream of the project site, namely the nature designation areas including the River Shannon Calllows SAC and the Middle Shannon Callows SPA.

3.1 SURFACE WATER BODIES

The river waterbodies in the immediate vicinity and downstream of the proposed 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 proposed project, it is considered that all sections of the Rapemills River (Rapemills_010 & Rapemills_020) and the upper reaches of the Shannon (Lower) River (Shannon (Lower)_020 & _030) within the vicinity and downstream of the project are carried through into the WFD Impact Assessment. These SWBs have been included for further assessment due to their proximal location to the proposed project works. The proposed project works 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 Little Brosna_060 and Incherky_010 SWB's have also been screened in due to their proximal location in the vicinity and downstream of the grid connection route. The proposed project works 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 2 no. lake waterbodies downstream of the proposed project, Derg TN and Derg HMWB, have been screened out due to their distal location from the proposed works and the large volumes of water within these lake waterbodies. 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 lower reaches of the Shannon (Lower) River (Shannon (Lower)_050 & _060) have been screened out due to their distal location (>10km) from the proposed project site and due to its increased catchment area and flow volumes, which decreases the potential for the proposed project to impact a waterbody. The proposed works have no potential to cause a deterioration in the status of these screened out SWBs and/or jeopardise their attainment of good surface water status.

All transitional waterbodies downstream of the proposed project, including the Limerick Dock, Upper Shannon Estuary and the Lower Shannon Estuary, have been screened out due to the large volumes of water within these SWBs and the saline nature of these 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 same reasoning applies to the coastal waterbodies downstream of the site (Mouth of the Shannon (HAs 23;27) and the Southwestern Atlantic Seaboard (HA 23)), hence they too have been screened out of the WFD Impact Assessment.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Banagher GWB, Birr GWB and the Birr Gravels GWB are carried through to the WFD Impact Assessment due to their location directly underlying the proposed project.

3.3 PROTECTED AREAS

The project site has hydrological connections with downstream designated sites including the River Shannon Calllows SAC and the Middle Shannon Callows SPA (within the Shannon (Lower) River where the Rapemills River and Little Brosna Rivers drains to). With consideration for the construction, operational and decommissioning phases of the proposed development, it is considered that the River Shannon Calllows SAC and the Middle Shannon Callows SPA are all carried through into the WFD Impact Assessment due to their proximal locations downstream of the proposed project site.

Any designated sites mapped within or beyond Lough Derg (Derg TN Lake waterbody), as listed above in **Section 2.6.1,** have been screened out due to their distal locations from the proposed works and the large volumes of water within the Derg TN lake waterbody and SWB's beyond the Lake where the designated sites are mapped within. The proposed project has no potential to cause a deterioration in status of these designated sites.

The Derg TN NSA downstream of the proposed project, has been screened out due to its distal location from the proposed works and the large volumes of water within the lake waterbody. The proposed project has no potential to cause a deterioration in status of this NSA.

Similarly, the Derg TN DWPA downstream of the proposed project, has been screened out due to its distal location from the proposed works and the large volumes of water within the lake waterbody. The proposed project has no potential to cause a deterioration in status of this DWPA.

The Shannon (Lower)_060 DWPA has also been screened out due to its distal location (>10km) from the proposed project site and due to its increased catchment area and flow volumes, which decreases the potential for the proposed project to impact the DWPA. The proposed works have no potential to cause a deterioration in the status of the DWPA.

The bathing waters at Bathing Place at Portumna and Shellfish areas at Clarinbridge/Kinvara Bay, have been screened out due to their distal location from the proposed project site. The proposed project has no potential to cause a deterioration to the bathing, or shellfish 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	Lower Shannon Catchment			
	River	Rapemills_010	**Yes**	The wind farm site, including all 8 no. turbines, is mapped within the Rapemills_010 river sub-basin. An assessment is required to consider the potential impacts of the proposed project on this SWB.
	River	Rapemills_020	**Yes**	The Rapemills_020 is located proximally to the project site and directly downstream of the Rapemills_010 SWB. An assessment is required to consider the potential impacts of the proposed project on this SWB.
	River	Shannon (Lower)_020	**Yes**	The Shannon (Lower)_020 is located proximally to the project site and directly downstream of the Rapemills_020 SWB. An assessment is required to consider the potential impacts of the proposed project on this SWB.
	River	Little Brosna_060	**Yes**	The grid connection route is mapped within the Little Brosna_060 river sub-basin. An assessment is required to consider the potential impacts of the proposed project on this SWB
	River	Incherky_010	**Yes**	The grid connection route is mapped immediately upstream of the Incherky_010 river sub-basin. An assessment is required to consider the potential impacts of the proposed project on this SWB
	River	Shannon (Lower)_030	**Yes**	The Shannon (Lower)_030 is located proximally to the project site and directly downstream of the Incherky_010 SWB. An assessment is required to consider the potential impacts of the proposed project on this SWB.
	Lake	Derg TN	No	Derg TN lake waterbody has been screened out due to its distal location from the proposed project site and the large volume of water within the Lake. The proposed project has no potential to impact the status of this SWB.
	Lake	Derg HMWB	No	Derg HMWB lake waterbody has been screened out due to its distal location from the proposed project site and the large volume of water within the Lake. The proposed project has no potential to impact the status of this SWB.
	River	Shannon (Lower)_050	No	The Shannon (Lower)_050 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Shannon (Lower) River.
	River	Shannon (Lower)_060	No	The Shannon (Lower)_060 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Shannon (Lower) River.
	Transitional	Limerick Dock	No	The Limerick Dock SWB has been screened out due to the saline nature of its waters and the large volumes of water within the transitional waterbody. The Proposed project has no potential to impact the status of this SWB.
	Transitional	Upper Shannon Estuary	No	The Upper Shannon Estuary SWB has been screened out due to the saline nature of its waters and the large volumes of water within the Estuary. The Proposed project has no potential to impact the status of this SWB.
	Transitional	Lower Shannon Estuary	No	The Lower Shannon Estuary SWB has been screened out due to the saline nature of its waters and the large volumes of water within the Bay. The Proposed project has no potential to impact the status of this SWB.
	Coastal	Mouth of the	No	The Mouth of the Shannon (HAs 23;27) SWB has been screened out due to the saline nature of its

		Shannon (HAs 23;27)		waters and the large volumes of water within the SWB. The proposed project has no potential to impact the status of this SWB.
	Coastal	Southwestern Atlantic Seaboard (HA 23)	No	The Southwestern Atlantic Seaboard (HA 23) SWB has been screened out due to the saline nature of its waters and the large volumes of water within the Bay. The proposed project has no potential to impact the status of this SWB.
	Groundwater Bodies			
Groundwater Body	Groundwater	Banagher	**Yes**	The wind farm site is mapped to overlie the Banagher GWB. An assessment is required to consider the potential impacts of the proposed project on this GWB.
	Groundwater	Birr	**Yes**	The wind farm site is mapped to overlie the Birr GWB. An assessment is required to consider the potential impacts of the proposed project on this GWB.
	Groundwater	Birr Gravels	**Yes**	The grid connection route is mapped to overlie the Birr Gravels GWB. An assessment is required to consider the potential impacts of the proposed project on this GWB.
	Protected Areas			
Protected Areas	Nature Conservation Designations	River Shannon Calllows SAC	**Yes**	The Rapemills ultimately drains into the River Shannon and flows through the River Shannon Calllows SAC, ~6.8km northwest of the site. An assessment is required to consider the potential impacts of the proposed project on this designated site.
		Middle Shannon Callows SPA	**Yes**	The Rapemills ultimately drains into the River Shannon and flows through the Middle Shannon Callows SPA, ~6.8km northwest of the site. An assessment is required to consider the potential impacts of the proposed project on this designated site.
		Lough Derg northeast Shore SAC	No	The Lough Derg northeast Shore SAC has been screened out due to its distal location from the proposed project site and its location within the Derg TN lake waterbody. The proposed project has no potential to impact this designated site.
		Lough Derg pNHA	No	The Lough Derg pNHA has been screened out due to its distal location from the proposed project site and its location within the Derg TN lake waterbody. The proposed project has no potential to impact this designated site.
		Lough Derg (Shannon) SPA	No	The Lough Derg (Shannon) SPA has been screened out due to its distal location from the proposed development site and its location within the Derg TN lake waterbody. The proposed project has no potential to impact this designated site.
		Lower River Shannon SAC	No	The Lower River Shannon SAC has been screened out due to its distal location from the proposed development site and its location downstream of the Derg TN lake waterbody. The proposed project has no potential to impact this designated site.
		Fergus Estuary and Inner Shannon, North Shore pNHA	No	The Fergus Estuary and Inner Shannon, North Shore pNHA has been screened out due to its distal location from the proposed project site and its location downstream of Derg TN and Derg HMWB lake waterbodies. The proposed project has no potential to impact this designated site.
		River Shannon and River Fergus Estuary	No	The River Shannon and River Fergus Estuary SPA has been screened out due to its distal location from the proposed project site and its location downstream of Derg TN and Derg HMWB lake waterbodies. The proposed project has no potential to impact this designated site.

		SPA		
	Bathing Waters	Bathing Place at Portumna	No	The Bathing Place at Portumna has been screened out due to its distal location from the proposed project site (>20km). The proposed project has no potential to impact these bathing waters.
	Nutrient Sensitive Areas	Derg TN NSA	No	Derg TN DWPA has been screened out due to its distal location from the proposed project site and the large volume of water within the Lake. The proposed project has no potential to impact the status of this DWPA.
	Shellfish Area	Clarinbridge/Kinvara Bay	No	Clarinbridge/Kinvara Bay Shellfish waters have been screened out due to its distal location from the proposed project site (>65km). The proposed project has no potential to impact this designated shellfish area.
	Drinking Water	Derg TN	No	Derg TN DWPA has been screened out due to its distal location from the proposed project site and the large volume of water within the Lake. The proposed project has no potential to impact the DWPA.
		Shannon (Lower)_060	No	The Shannon (Lower)_060 DWPA has been screened out due to its distal location from the site and the increasing volumes of water within the Shannon (Lower) River.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

Due to the nature of wind farm developments (and associated grid connections and haul route 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 at the site will be from cementitious materials, hydrocarbon spillage and leakages, and potential piling works.

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 cement-based compounds.

The proposed project includes works over and in close proximity to waterbodies. There are a number of potential adverse effects to both surface and groundwater.

The primary risks of degradation of surface water bodies include:

- Changes in surface runoff flow volumes and flow patterns;
- Entrainment of suspended solids in surface waters; and,
- Chemical pollution of surface waters by concrete, oil and or fuels.

The primary risks of degradation of groundwaters include:

- Chemical pollution of groundwaters by concrete, oils and fuels.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Clear Felling and Potential Surface Water Quality Impacts

A total of c. 23 hectares (ha) of forestry (18ha of commercial forestry and 5ha of woodland scrub), accounting for 17% of the existing forestry coverage at the project site (135ha), will be permanently felled to accommodate the construction and operation of the wind farm.

The tree felling activities required as part of the proposed project will be the subject of a Felling Licence application to the Forest Service, in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments.

Potential effects during tree felling occurs mainly from:

- Exposure of soil and subsoils due to vehicle tracking, and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff and enter surface water courses;
- Entrainment of suspended sediment in watercourses due to vehicle tracking through watercourses;
- Damage to roads resulting in a source of suspended sediment which can become entrained in surface water runoff and enter surface water courses;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

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

Table E: Surface Water Quality Impacts during Tree felling (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Rapemills_010	IE_SH_25R010300	Moderate	Poor
Rapemills_020	IE_SH_25R010500	Moderate	Poor
Shannon (Lower)_020	IE_SH_25S012060	Moderate	Moderate
Shannon (Lower)_030	IE_SH_25S012350	Moderate	Moderate

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

Construction phase activities including site levelling/construction and building turbine foundations 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, spoil storage areas and dewatering 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.

Therefore, construction phase activities could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which could affect the water quality and fish stocks in surface waterbodies downstream of the wind farm site including the Rapemills River.

As outlined in **Table A** the catchment area for the Shannon (Lower)_020 (7989km^2) river segment immediately downstream of the Rapemills_020 river waterbody (92.6 km^2) increases dramatically. The potential for the proposed project to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

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

Table F: Surface Water Quality Impacts (WF Site) during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Rapemills_010	IE_SH_25R010300	Moderate	Poor
Rapemills_020	IE_SH_25R010500	Moderate	Poor
Shannon (Lower)_020	IE_SH_25S012060	Moderate	Moderate

Shannon (Lower)_030	IE_SH_25S012350	Moderate	Moderate

4.2.1.3 Potential Surface Water Quality Effects along Grid Connection Route

The proposed grid connection route passes through 4 no. WFD river sub-basins (Rapemills_010, Rapemills_020, Incherky_010, and the Little Brosna_060) and there will be no requirement for watercourse crossings.

There are no EPA mapped watercourse crossings along the proposed grid connection route. The closest EPA mapped watercourse, which is a headwater stream of the Little Brosna River, is located approximately 500m to the east of the Clondallow substation. Effects are unlikely.

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Rapemills_010	IE_SH_25R010300	Moderate	Moderate
Rapemills_020	IE_SH_25R010500	Moderate	Moderate
Incherky_010	IE_SE_14G030100	Moderate	Moderate
Little Brosna_060	IE_SH_25L021000	Good	Good

4.2.1.4 Morphological Changes to Surface Water Courses & Drainage Patterns

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 are 3 no. proposed (new) watercourse crossings (1 no. on Rapemills, 1 no. on West Galros and 1 no. on minor watercourse west of T7/T8). There is 1 no. existing crossing proposed for upgrade on the West Galros Stream just southeast of the main construction compound.

There are no EPA mapped watercourse crossings along the proposed grid connection route.

Table H: Morphological Changes to surface waters during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Rapemills_010	IE_SH_25R010300	Moderate	Poor
Rapemills_020	IE_SH_25R010500	Moderate	Poor
Incherky_010	IE_SE_14G030100	Moderate	Moderate
Little Brosna_060	IE_SH_25L021000	Good	Good

4.2.1.5 Potential Groundwater Quality Impacts

In terms of local Groundwater Bodies (GWBs), the proposed project site straddles the Banagher GWB (IE_SH_G_040), Birr GWB (IE_SH_G_041)and Birr Gravels GWB (IE_SH_G_244). The majority of the wind farm site itself is located in the Banagher GWB.

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

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

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 I**.

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

GWB	WFD Code	Current Status	Assessed Potential Status Change
Banagher	IE_SH_G_040	Good	Moderate
Birr Gravels	IE_SH_G_244	Good	Moderate
Birr	IE_SH_G_041	Good	Moderate

4.2.1.6 Potential Impacts on Protected Areas

River Shannon Callows SAC

The Rapemills River ultimately drains into the River Shannon which flows through the River Shannon Calllows SAC.

Downstream, surface water quality effects are unlikely to be significant at the location of the SAC due to dilution/assimilation capacity effects over such distances, particularly in the River Shannon itself.

It can be concluded that the proposed project has reduced potential to affect the River Shannon Calllows SAC even in an unmitigated scenario throughout the construction phase.

Middle Shannon Callows SPA

The Rapemills River ultimately drains into the River Shannon which flows through the Middle Shannon Callows SPA.

Downstream, surface water quality effects are unlikely to be significant at the location of the SPA due to dilution/assimilation capacity effects over such distances, particularly in the River Shannon itself.

It can be concluded that the proposed project has reduced potential to affect the Middle Shannon Callows SPA even in an unmitigated scenario throughout 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 wind farm site and will be associated with minor maintenance works.

Little maintenance work will be required along the grid connection route 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 Hydromorphology Effects

Progressive replacement of the soil, peat or vegetated surface 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 project site and increase flood risk downstream of the development.

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.

The emplacement of the proposed project footprint could result in an average total site increase in surface water runoff of 272m^3/month, for the month of highest average recorded rainfall. This equates to an average increase of 8.8m^3/day. This represents a 0.12% increase in the average daily/monthly volume of runoff from the project site 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 project site being developed. Specifically, the proposed permanent hardstand area is approximately 8.65ha, representing 3% of the total landholding area of 290ha.

The additional runoff volume is low due to the fact that the runoff potential from the site is naturally very high (96% runoff coefficient) due to the prevailing baseline hydrogeological conditions at the project site (i.e. peat surfaces, lacustrine clays etc). Also, this calculation assumes that all hardstanding areas will be impermeable which is a conservative approach given that access tracks and crane hardstands will be constructed of aggregates which will facilitate the permeation/recharge of rainfall.

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 J**.

Table J: Potential Impact on Surface Water Flows (Wind Farm) during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Rapemills_010	IE_SH_25R010300	Moderate	Moderate
Rapemills_020	IE_SH_25R010500	Moderate	Moderate
Shannon (Lower)_020	IE_SH_25S012060	Moderate	Moderate
Shannon (Lower)_030	IE_SH_25S012350	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.

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 K**.

Table K: Surface Water Quality Impacts (WF Site) during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Rapemills_010	IE_SH_25R010300	Moderate	Moderate
Rapemills_020	IE_SH_25R010500	Moderate	Moderate
Shannon (Lower)_020	IE_SH_25S012060	Moderate	Moderate
Shannon (Lower)_030	IE_SH_25S012350	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 4.2.1.5** but of a lesser extent than during the construction phase due to the limited activity at the wind farm 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 are outlined in **Table L**.

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

GWB	WFD Code	Current Status	Assessed Potential Status Change
Banagher	IE_SH_G_040	Good	Good
Birr Gravels	IE_SH_G_244	Good	Good
Birr	IE_SH_G_041	Good	Good

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 Clear Felling Surface Water Quality Effects

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 roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and 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 disposal 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 minimized 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 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 roads and culverts will be on-going through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted:
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors;
- Crossing of streams will not be permitted;
- Trees will be cut manually from along streams and using machinery to extract whole 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 and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring:

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

Details of the proposed surface water quality monitoring programme are outlined in the Water Quality Monitoring Plan (refer to **Annex 3.4** of the EIAR).

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 taken 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 by using a 50m buffer. From the constraints map (Figure 7.10 of the EIAR) it is evident that; other than some sections of access tracks, watercourse crossings (4 no.), part of the crane hardstanding of turbine T7, the southern end of the main construction compound and the northern end of the spoil deposition area at turbine T5; the majority of the proposed wind farm infrastructure (including all turbine locations and the spoil deposition are) is located outside of areas that have been assessed to be hydrologically sensitive. Additional mitigation in the form of double silt fencing will be placed around all infrastructure that encroaches the 50m buffer zone.

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 bog and forestry drains already exists, and these will be integrated and enhanced as required and used within the wind farm development drainage system. The integration of the existing land drainage network and the proposed wind farm network is common practice in wind energy developments and will also result in benefits to surrounding agricultural 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 is 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 proposed settlement ponds 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 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 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 a dedicated spoil deposition area.

The main spoil deposition area is located outside the 50m stream buffer zone (refer to Figure 7.10 of the EIAR). A small section of the spoil deposition area at turbine T5 encroaches the 50m buffer zone. Additional mitigation in the form of double silt fencing will be placed around all infrastructure that encroaches the 50m buffer zone.

During the initial placement of spoil in the deposition area, silt fences, straw bales and biodegradable matting will be used to control surface water runoff. Double silt fencing will be placed along the edge of the bog drain that intercepts the deposition area.

Drainage from the overburden deposition area will ultimately be into to the existing bog drain network where it is proposed that check dams will be installed every 20m or so to create a series of settlement ponds, before being discharged.

Spoil deposition areas will be sealed with a digger bucket and vegetated as soon possible 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. Surface water protection infrastructure will be left in place until the areas have stabilised.

Grid Connection Installation Works

Temporary silt fencing/silt trap arrangements will be placed within existing roadside/field drainage features along the grid connection to remove any suspended sediments from the works area. The trapped sediment will be removed and disposed at an appropriate licenced facility. The bare ground re-seeded/reinstated immediately and silt fencing temporally left in place if necessary.

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 SWMP will be prepared to detail the siting and composition of the surface water management measures. The respective plans, which will form part of a detailed Construction Environmental Management Plan (CEMP), will be prepared prior to the commencement of development.

The CEMP will also include a detailed Water Quality Monitoring Plan 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. The surface water sampling locations used in this EIAR (i.e. SW1 – SW4) will be used during construction activities. 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.

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 compound. 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 re-fuelling 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 spillage in;
- 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; 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:

- 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 compound, 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 site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.4 Mitigation for Protected Areas

The potential for material to enter the local protected areas is imperceptible as mitigation controls as described 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 project, the potential for the project to impact upon the qualifying interests 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 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/roadside 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 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 do 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 outlines in **Section 4.3.1** above.

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

4.3.2.3 Mitigation Measures to Protect Groundwater Quality

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

4.3.1 Decommissioning Phase

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.

Likely effects would be similar to the construction phase but to a lesser degree. There would be increased trafficking and an increased risk of disturbance to underlying soils at the project site. Any such effects would be less than during the construction phase as the drainage system would be fully mature and would provide additional filtration of runoff. Any diesel or fuel oils stored on site would be bunded.

Following decommissioning, turbine foundations, hardstanding areas and access tracks will be rehabilitated in accordance with the methods outlined at Chapter 3 of the EIAR. The access tracks may be left in place, subject to agreement with the Planning Authority and the landowner. It is considered that this approach will result in lesser effects that would their removal.

4.3.2 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 M** below.

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

SWB	WFD Code	Current Status	Assessed Status - Unmitigated	Assessed Status with Mitigation Measures
Nore Catchment				
Rapemills_010	IE_SH_25R010300	Moderate	Poor	Moderate
Rapemills_020	IE_SH_25R010500	Moderate	Poor	Moderate
Shannon (Lower)_020	IE_SH_25S012060	Moderate	Moderate	Moderate
Shannon (Lower)_030	IE_SH_25S012350	Moderate	Moderate	Moderate
Incherky_010	IE_SE_14G030100	Moderate	Moderate	Moderate
Little Brosna_060	IE_SH_25L021000	Good	Good	Good
Groundwater Bodies				
Banagher	IE_SH_G_040	Good	Moderate	Good
Birr Gravels	IE_SH_G_244	Good	Moderate	Good
Birr	IE_SH_G_041	Good	Moderate	Good

5. SUMMARY AND CONCLUSION

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

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

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

The potential for the project to impact upon nearby and downstream designated sites and protected areas is not significant due to the physical, hydrological and hydrogeological separations between them, as explained individually in **Section** Error! Reference source not found.. Nevertheless, best practice methods will be adhered to throughout regarding the preservation of the protected areas.

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 impact upon any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of good status.

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 EIAR Chapter 7).

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