

RECEIVED: 29/08/2024

Appendix 7.1

Killala Area GCS Report (GSI)

Keerglen Wind Farm

Mayo Planning Authority - Inspection Purposes Only

MAYO - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Killala Area

Other names used for site

IGH THEME

IGH7 Quaternary

TOWNLAND(S)

Townpotts East, Killala, Tawnaghmore Lower, Mullaghfarry, Tawnaghmore Upper, Meelick, Kilroe, Moyne, Crosspatrick, Lisglennon, Ballinteean, Carrowreagh, Abbeylands, Rathglass East, Rusheens, Newtownwhite, Knockalough, Derreens, Rosserk, Ballysakeery

NEAREST TOWN/VILLAGE

Killala

SIX INCH MAP NUMBER

22, 30

ITM CO-ORDINATES

522370E 827000N

1:50,000 O.S. SHEET NO. 24

GSi BEDROCK 1:100,000 SHEET NO. 6

GIS Code MO068**Outline Site Description**

The site comprises an extensive area of ridges and glacial features on the west side of the Moy Estuary.

Geological System/Age and Primary Rock Type

These features are Quaternary in age. Bedrock comprises Carboniferous (Ballina Limestones) limestones, sandstone, and shale.

Main Geological or Geomorphological Interest

This field of discrete glaciotectonic ridges and interspersed glacial features form a body of tectonised proglacial features west of the Moy Estuary, in a coastal embayment. The site covers an area ~7km wide (west-east) at its widest point, along a coastal strip of almost 5km north-south, on the western side of the estuary, and includes numerous ridge features.

The ridge features contain significant bedrock outcrops, as well as tectonised, ground-up, and generally bouldery tectonite (tectonically deformed rocks). They occur on both pure and impure bedded limestones, and the deposition of the subglacial bedforms is understood to be linked to the hydrogeology of the underlying bedrock. The cliffs of the east side of Kilcummin Head exhibit a remarkable cross section through a glacio-tectonic thrust, where slabs of bedrock up to 300m long were dislodged and transported north by the ice. This main thrust sheet is covered by bouldery, sandstone-dominant, de-glacial-phase diamicts enclosing "floating" rafts.

Site Importance – County Geological Site

The features at this County Geological Site are remarkable examples of glaciotectonic ridges. Some of the coastal exposures of these features are within the Killala Bay/Moy Estuary SAC (000458).

Management/promotion issues

These features are so large, that there are no threats that should dramatically alter their overall geometry or configuration.



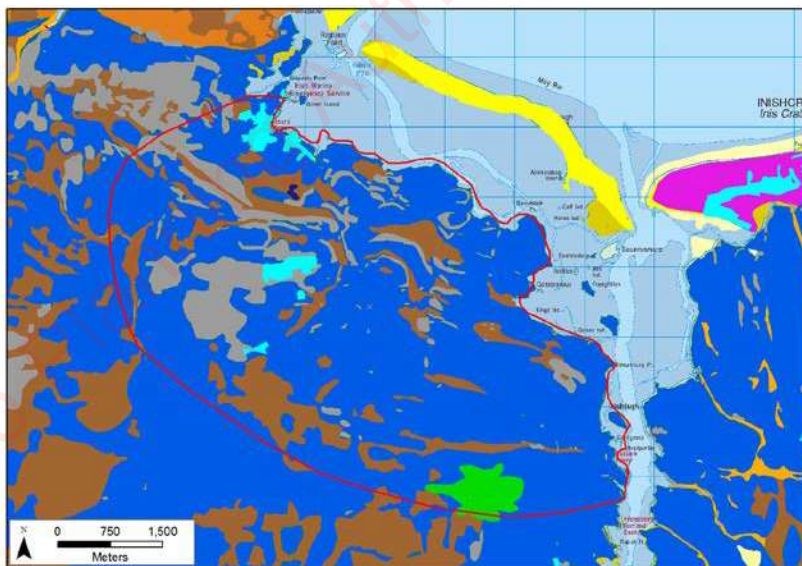
East-west trending ridge at Tawnaghmore, 2km south of Killala.



East side of Kilcummin head looking north to site of glaciotectionic thrust.



Ridge of glacial deposits by the R314 Ballina-Killala road.



This map shows the subsoils geology. The areas of blue are of limestone till, which is the material the majority of the ridges are comprised of. Areas of bedrock outcrop also occur in the ridges (grey). The brown colour shows peat, which has formed between the ridges. Cyan shows areas of 'manmade' ground, at Killala Town and industrial areas. Green areas are sorted sands and gravels.

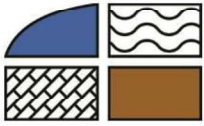
RECEIVED: 29/08/2024

Appendix 7.2

Flood Risk Assessment

Keerglen Wind Farm

Mayo Planning Authority - Inspection Purposes Only



**HYDRO
ENVIRONMENTAL
SERVICES**

22 Lower Main St
Dungarvan
Co. Waterford
Ireland

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

**KEERGLEN WIND FARM,
CO. MAYO**

SITE SPECIFIC FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

ABO Energy Ireland Ltd

Prepared by:

Hydro-Environmental Services

DOCUMENT INFORMATION

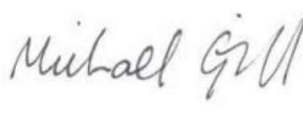
Document Title:	Proposed Keerglen Wind Farm, Co. Mayo – Site-Specific Flood Risk Assessment
Issue Date:	20th June 2024
Project Number:	P1583-0
Project Reporting History:	P1583-0_FRA_Draft D0
Current Revision No:	P1583-0_FRA_Final_F0
Author(s):	Michael Gill Conor McGettigan
Signed:	 Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services
<i>Disclaimer:</i> This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client, and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site-specific, and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.	

TABLE OF CONTENTS

1. INTRODUCTION.....	4
1.1 BACKGROUND	4
1.2 STATEMENT OF EXPERIENCE	4
1.3 REPORT LAYOUT & METHODOLOGY	4
2. BACKGROUND INFORMATION	6
2.1 INTRODUCTION	6
2.2 SITE LOCATION AND TOPOGRAPHY	6
2.3 PROPOSED DEVELOPMENT DETAILS	7
3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTIC	8
3.1 INTRODUCTION	8
3.2 BASELINE HYDROLOGY	8
3.2.1 Regional and Local Hydrology	8
3.3 RAINFALL AND EVAPORATION	9
3.4 GEOLOGY	10
3.5 DESIGNATED SITES & HABITATS	11
4. SITE SPECIFIC FLOOD RISK ASSESSMENT	12
4.1 INTRODUCTION	12
4.2 FLOOD RISK ASSESSMENT PROCEDURE	12
4.3 FLOOD RISK IDENTIFICATION	14
4.3.1 Soils Maps – Fluvial Maps	14
4.3.2 Historical Mapping	15
4.3.3 OPW Past Flood Events Mapping	15
4.3.4 GSI Historic Surface Water Flood Mapping	15
4.3.5 CFRAM Maps – Fluvial and Pluvial Flooding	16
4.3.6 National Indicative Fluvial Flood Mapping	16
4.3.7 Groundwater Flooding	17
4.3.8 Coastal Flooding	17
4.3.9 Climate Change	17
4.3.10 Summary – Flood Risk Identification	18
4.4 INITIAL FLOOD RISK ASSESSMENT	19
4.4.1 Site Survey and Drainage	19
4.4.2 Hydrological Flood Conceptual Model	19
4.4.3 Summary – Initial Flood Risk Assessment	20
4.5 REQUIREMENT FOR A JUSTIFICATION TEST	21
5. FLOOD IMPACT PREVENTION AND DRAINAGE MANAGEMENT	24
5.1 PLANNING POLICY AND THE MAYO COUNTY DEVELOPMENT PLAN	24
5.2 PROPOSED DRAINAGE	25
5.3 PROPOSED ON-SITE RUNOFF ATTENUATION	25
5.4 DOWNSTREAM FLOOD RISK	26
6. REPORT CONCLUSIONS.....	27
7. REFERENCES	28

FIGURES IN TEXT

Figure A: Site Location Map	7
Figure B: Regional Hydrology Map	9
Figure C: OPW Past Flood Events Mapping (www.floods.ie)	15
Figure D: National Indicative Fluvial Flood Mapping (Present Day Scenario)	17

TABLES IN TEXT

Table A: Rainfall Return Periods for the Wind Farm Site	10
Table B: Surface Water Flow Monitoring	19
Table C: S-P-R Assessment of Flood Sources for the proposed site	20
Table D: Matrix of Vulnerability versus Flood Zone	21
Table E: Format of Justification Test for Development Management	22
Table F: Mayo County Development Plan Objectives/Policies and Project Responses	24

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by ABO Energy Ireland to undertake a site specific Flood Risk Assessment (FRA) for a proposed windfarm development at Keerglen, Co. Mayo.

This FRA is written to accompany Chapter 7 of the Environmental Impact Assessment Report (EIAR) for the Proposed Development. The Proposed Development is described in full in Chapter 3 of the EIAR. For the purposes of this FRA, and consistent with the EIAR, the various components are described and assessed using the following references: 'Proposed Development', 'Wind Farm Site' and 'Underground Electricity Export Connection'.

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009).

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services ("HES") are a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland.

HES was established in 2005, and our office is located in Dungarvan, County Waterford. Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling, and prepare flood risk assessment reports.

This report was prepared by Michael Gill and Conor McGettigan.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland, as well as accompanying Flood Risk Assessments. 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 for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm-related projects.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science and a B.Sc. in Geology from UCD. Conor has prepared the Environmental Impact Assessment Reports (EIARs) for numerous wind farm developments, grid connections and quarries. Conor has worked on several wind farm EIAR projects and associated Flood Risk Assessments.

1.3 REPORT LAYOUT & METHODOLOGY

This Stage II FRA report has the following format:

- Section 2 describes the proposed site setting and details of the Proposed Development;
- Section 3 outlines the hydrological and geological characteristics of the local surface water catchments in the vicinity of the Proposed Development;

- Section 4 presents our initial flood risk assessment and site-specific flood risk assessment undertaken for the Proposed Development based on desk studies, walkover surveys, and also includes a Justification Test based on our overall findings;
- Section 5 presents the drainage design for the Proposed Development in terms of flood prevention; and,
- Section 6 presents the FRA report conclusions.

As stated above this FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The assessment methodology involves researching and collating flood-related information from the following data sources:

- Base maps – Ordnance Survey of Ireland;
- Geological Survey of Ireland (GSI) maps on superficial deposits (www.gsi.ie);
- EPA hydrology maps (www.catchments.ie);
- OPW Flood Hazard Maps and flooding information for Ireland (www.floodinfo.ie);
- National Indicative Fluvial Mapping (released early 2022) (available to view at www.floodinfo.ie);
- CFRAM mapping;
- Mayo County Development Plan (2022-2028); and,
- Site Walkover, drainage mapping and flow monitoring completed by HES on 2nd – 3rd March 2022, 13th May 2022, 21st September 2022, 29th March 2023 and 19th April 2023.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the Proposed Development Site along with a description of the Proposed Development.

2.2 SITE LOCATION AND TOPOGRAPHY

The Wind Farm Site is located approximately 5.1km southwest of the village of Ballycastle and approximately 15km northwest of Crossmolina town in north Co. Mayo. The Wind Farm Site has a total area of c.82.48ha and is located in an area of upland blanket bog, in the townlands Keerglen, Ballinglen and Ballkinlettragh in north Co. Mayo.

The Wind Farm Site can be accessed via local roads which extend to the west from the R315, located ~2.2km to the east, and connects the R310 at Pontoon to the R314 at Ballycastle. A network of local access roads and forestry tracks extend from this national road into the Wind Farm Site. These tracks have facilitated previous peat cutting at Keerglen. Site walkover surveys have revealed that the peat harvesting methodology used at Keerglen has been sausage peat cutting. As part of the Proposed Development, it is proposed to access the main Wind Farm Site via the L51723 through the upgrade of this existing local road and the provision of new sections of site access tracks and a temporary access junction and roadway connecting the R315 to the L51723 in the townland of Ballinglen.

The Wind Farm Site is dissected by the Keerglen River which flows to the west and north, before veering to the east. The Keerglen River has eroded out a deeply incised valley into the peat and exposes subsoils and bedrock along its course through the Wind Farm Site. Several smaller watercourses and manmade drains also drain the Wind Farm Site and discharge into the Keerglen River.

The main area of the Wind Farm Site is characterised by upland sloping ground with elevations ranging from ~200mOD (metres above Ordnance Datum) to 100mOD. The topography slopes towards the Keerglen River valley. Topography falls steeply to the northeast, whereby the temporary access junction and roadway between the R315 and the L51723 are located at elevations of ~30 to 40mOD in the vicinity of Ballinglen River.

The proposed underground Underground Electricity Export Connection, which is c.22.8km in length, follows local public roads and the R315 to connect to the existing Tawnaghmore 110kV substation.

A site location map is shown as **Figure A** below.

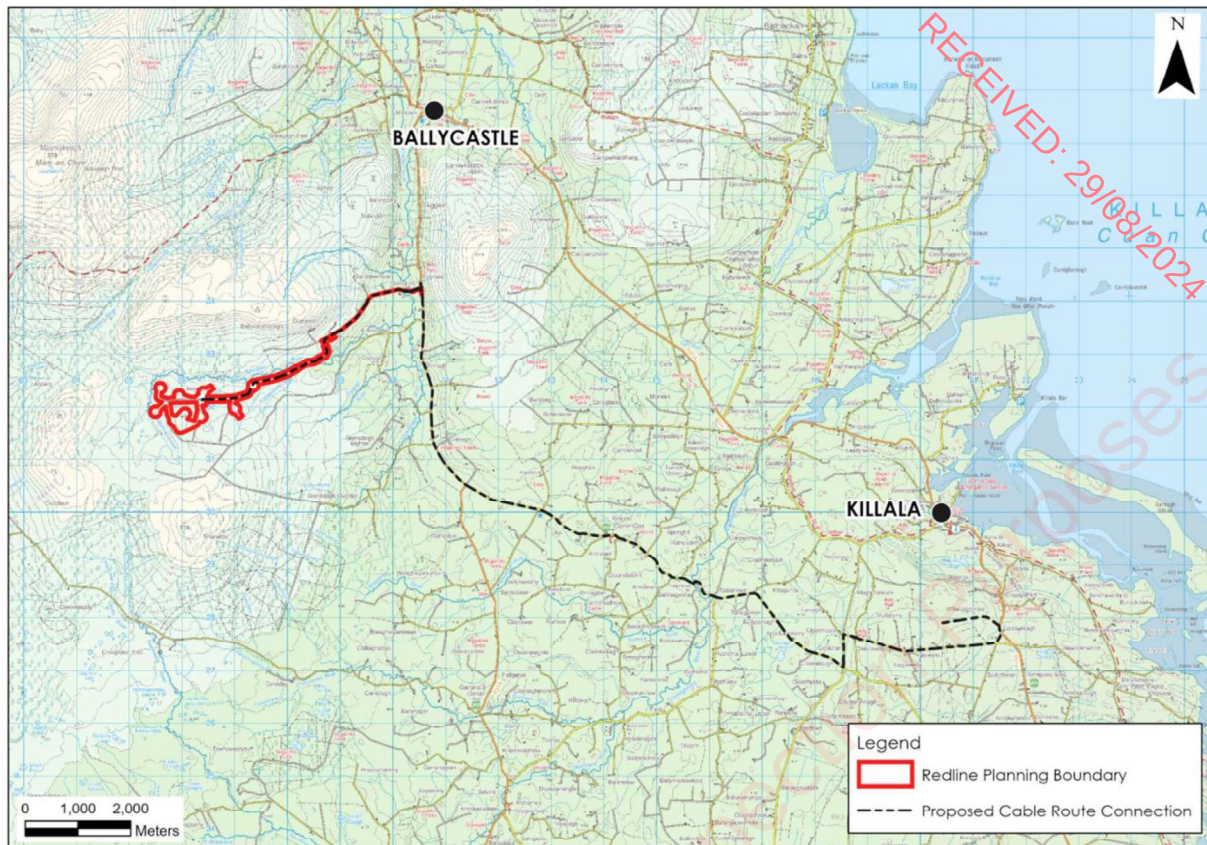


Figure A: Site Location Map

2.3 PROPOSED DEVELOPMENT DETAILS

The Proposed Development is defined in full in Chapter 3 of the EIAR.

In summary the Proposed Development will comprise of 8 no. wind turbines (Turbine tip height range between 176 and 180m, hub height range between 105 and 112 and rotor diameter range between 133 and 150m) and associated hardstanding areas, 1 no. electricity substation, 1 no. borrow pit, 2 no. temporary construction compounds, upgrade of existing roads, construction of new site access roads, road widening and accommodation works along the turbine delivery route, site drainage and all associated works. In addition, this EIAR assessed the proposed Underground Electricity Export Connection to the existing Tawnaghmore Substation and the installation of 1 no. temporary meteorological mast at the Wind Farm Site (note that these will be subject to separate planning permissions in the future but are assessed in this EIAR).

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics in the area of the Proposed Development.

3.2 BASELINE HYDROLOGY

3.2.1 Regional and Local Hydrology

On a regional scale, the Wind Farm Site is located in the Blacksod-Broadhaven surface water catchment within Hydrometric Area 33 of the Western River Basin District (WRBD). This catchment includes the area drained by all streams entering the tidal water between Corraun Point and Benwee Head, Co. Mayo. The catchment has a total area of 1,302km².

On a more local scale, the Wind Farm Site is located in the Glencullin River sub-catchment (Glencullin[NorthMayo]_SC_010) and 3 no. WFD river sub-basins.

- The vast majority of the Wind Farm Site, including all proposed turbines, construction compounds, the on-site substation and the proposed borrow pit, is mapped in the Keerglen_010 WFD river sub-basin.
- The majority of the access road along the L51723 is mapped in the Ballinglen_010 WFD river sub-basin.
- The temporary access junction and roadway is mapped at the boundary between the Ballinglen_010 and Ballinglen_020 WFD river sub-basins.

A small stream, referred to as the Fiddauncushaneen stream, originates to the south of the Wind Farm Site and flows northwards within the site for ~700m before it merges with a small stream from the southwest to form the Keerglen River. The Keerglen River then flows to the north along the eastern boundary of Ummerantarry Bog NHA, before it veers to the east along the northern boundary of the site. Several small 1st order streams that originate within the Wind Farm Site flow downslope and discharge into the Keerglen River. These watercourses are largely unnamed with the exception of the Fiddaunboy stream in the east. The Keerglen River then continues flowing to the northeast before it discharges into the Ballinglen River, ~2.3km northeast of the Wind Farm Site. The Ballinglen River flows northwards before discharging into Bunatrahir Bay ~6.5km northeast of the site.

Meanwhile, the Underground Electricity Export Connection is located in 2 no. WFD surface water catchments. The west of the route, in the vicinity of the Wind Farm Site is located in the Blacksod-Broadhaven surface water catchment (Hydrometric Area 33). Meanwhile, the east of the route is located in the Moy and Killala Bay surface water catchment within Hydrometric Area 34.

A regional hydrology map is shown as **Figure B**.

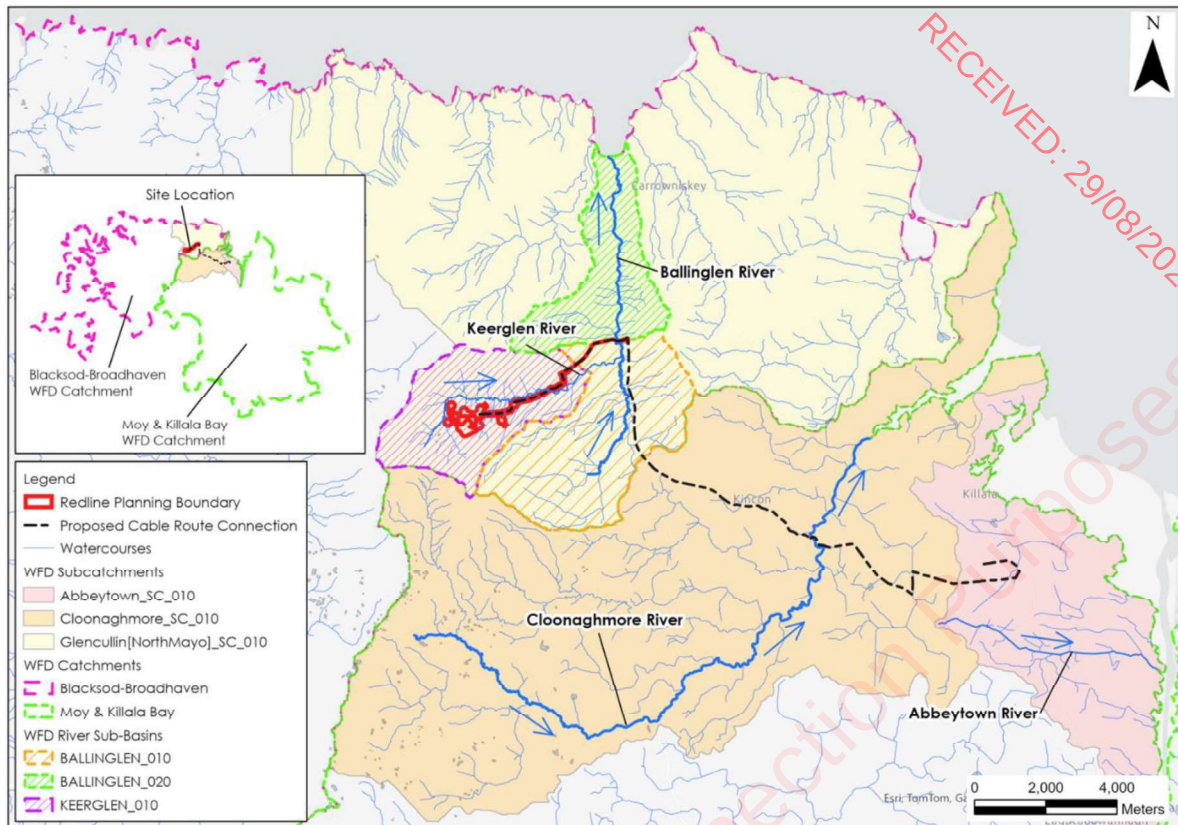


Figure B: Regional Hydrology Map

3.3 RAINFALL AND EVAPORATION

The SAAR (Standard Average Annual Rainfall) recorded at Bellacorick (Lacktanvack), which is located ~8.3km southwest of the Wind Farm Site is ~1,564mm (www.met.ie).

Met Éireann also provide a grid of average annual rainfall for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the average annual rainfall at the Wind Farm Site is ~1,714mm/yr. This is considered to be the most accurate estimate of average annual rainfall from the available sources.

The average long-term potential evapotranspiration (PE) at Belmullet weather station, the closest synoptic station to the Wind Farm Site, located ~36km to the west, is taken to be ~527mm/yr (www.met.ie). The actual evapotranspiration ("AE") is calculated to be 501mm/yr (95% PE). Using the above figures the effective rainfall ("ER")¹ for the area is calculated to be (ER = SAAR – AE) 1,213mm/yr.

Table A below presents return period rainfall depths for the area of the Wind Farm Site. These data are taken from <https://www.met.ie/climate/services/rainfall-return-periods> and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year). These extreme rainfall depths will be the basis of the proposed wind farm drainage hydraulic design as described further below.

¹ ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.

Table A: Rainfall Return Periods for the Wind Farm Site

Duration	Return Period (Years)			
	1	5	30	100
5 mins	4.2	7.1	12.3	17.3
15 mins	6.8	11.6	20.2	28.4
30 mins	8.9	14.9	25.3	35.1
1 hour	11.6	19.0	31.6	43.4
6 hours	23.0	35.9	56.6	75.0
12 hours	30.1	45.9	70.9	92.8
24 hours	39.2	58.7	88.7	114.7
2 days	51.2	73.5	106.4	133.8

3.4 GEOLOGY

The published Teagasc soils map (www.gsi.ie) for the local area shows that the Wind Farm Site is predominantly overlain by blanket peat. Other soils mapped in the Wind Farm Site include mainly acidic poorly drained mineral soils, which are mapped along the Keerglen River in the north and the Ballinglen River in the east. A small area of these acidic mineral soils is also mapped in the centre of the Wind Farm Site along a small tributary of the Keerglen River. Mineral alluvium is also mapped in the immediate vicinity of the river channels associated with the Keerglen and Ballinglen rivers. In terms of the key Proposed Development infrastructure, all proposed turbines, the onsite substation, borrow pit and construction compounds are all mapped in areas of blanket peat. The temporary access junction and roadway between the R315 and the L51723 is mapped in an area of acid poorly drained mineral soils.

The published subsoils map (www.gsi.ie) for the local area shows that blanket peat (BkPt) underlies the majority of the Wind Farm Site. Other mapped subsoil types include till derived from Devonian and Carboniferous sandstones (TDCSs) which is locally mapped along the Keerglen River and its tributaries. More extensive deposits of till are mapped further east in the valley of the Ballinglen River. Meanwhile, alluvium is also mapped along the Keerglen and Ballinglen river channels. In terms of the key Proposed Development infrastructures, all proposed turbines, the onsite substation, borrow pit and construction compounds are underlain by blanket peat. The temporary access junction and roadway between the R315 and the L51723 is mapped in an area underlain by till.

The presence of peat at the Wind Farm Site has been confirmed by intrusive site investigations comprising of peat probes, gouge cores and trial pits.

The GSI map the bedrock underlying the majority of the Wind Farm Site to comprise of Dinantian (early) Sandstones, Shales and Limestones. The Wind Farm Site is underlain by the Downpatrick Formation comprising of cross-bedded sandstones and siltstones. Meanwhile, a small section in the northeast of the Wind Farm Site, in the area of the temporary access junction and roadway between the R315 and the L51723, is underlain by Dinantian Pure Bedded Limestones of the Moynty Point Limestone Member. The GSI state that Moynty Point Limestones are comprised of tabular bedded limestone and shales. The GSI also map several northwest to southeast trending dolerite and felsite dykes in the northeast of the Wind Farm Site.

The Underground Electricity Export Connection will be placed within the carriageway of existing public roads. The published subsoils map (www.epa.ie) shows that the Underground Electricity Export Connection is underlain largely by cutover raised peat and limestone derived tills in the east, and tills derived from Devonian and Carboniferous sandstones in the west. The GSI also map mineral alluvium along the main watercourses along the Underground Electricity Export Connection. In terms of the bedrock geology, the western section

of the Underground Electricity Export Connection will be underlain by the Downpatrick Formation and the Moyny Point Limestone Member which are described above. Further to the south and east, the Underground Electricity Export Connection will be underlain by the Ballina Limestone Formation, which consists of dark fine-grained limestone and shale.

3.5 DESIGNATED SITES & HABITATS

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). The Proposed Development site is not located within any designated conservation site.

The Wind Farm Site is not hydrologically connected to any designated site.

The nearest designated site to the Wind Farm Site is Ummerantary Bog NHA (Site Code: 001570) which is located immediately in the west of the Wind Farm Site and to the west of the Fiddauncushaneen stream and the Keerglen River. All Proposed Development infrastructure is located to the east of these watercourses, and they therefore act as a hydrological barrier between the Proposed Development and the NHA. Also due to the low permeability of the bedrock underlying the Wind Farm Site, groundwater flowpaths will be short, following surface topography, with groundwaters discharging to nearby streams and the Keerglen River. Therefore, no groundwater connection is expected between the Wind Farm Site and Ummerantary Bog NHA.

The Glenamoy Bog Complex SAC (Site Code: 000500) is located ~1km northeast of the Wind Farm Site. This SAC is of ecological importance due to a number of E.U. Annex I habitats, including two priority habitats – blanket bog and machair. The site also supports populations of Habitats Directive listed plant and animal species. The SAC stands at a significant elevation above the Ballinglen River (~149m). Surface and groundwater will flow from the SAC towards the Ballinglen River. Therefore the SAC has no potential to be affected by the Proposed Development.

Other designated sites within 5km of the Wind Farm Site include:

- Bellacorick Bog Complex SAC/pNHA (Site Code: 001922), located ~3.5km to the south. This designated site is not located in the same sub-catchment as the Wind Farm Site.
- Inagh Bog NHA (Site Code: 002391), located ~3.5km to the northwest. This designated site is not located in the same sub-catchment as the Wind Farm Site.

With regards to the Underground Electricity Export Connection, the Killala Bay/Moy Estuary SPA (Site Code: 004036), SAC/pNHA (Site Code: 000458) exist downstream along the Cloonaghmore River and the Moyne Stream watercourses.

4. SITE-SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

A stage 1 assessment of flood risk requires an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors). It is necessary to identify whether there may be any flooding or surface water management issues related to the proposed site that may warrant further detailed investigation.

As per the guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site; and,
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development.

Further to this, a stage 2 assessment involves the confirmation of sources of flooding, appraising the adequacy of existing information and determining what surveys and modelling approach may be required for further assessment.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the Proposed Project site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the Proposed Project. As per the Guidelines, the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment* – quantitative appraisal of potential risk to a proposed development.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;
- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,
- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Due to its inland location, coastal flooding is not applicable to the site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.
- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.
- Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and the system becomes blocked, and / or cannot discharge due to a high water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.
- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water level may rise slowly, it may be in place for extended periods of time. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.
- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e. interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea tending to increase water levels inland, which may flood over river banks.

The Guidelines provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

- Flood Zone A –** where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

- Flood Zone B –** where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and,
- Flood Zone C –** where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the Guidelines set out the different types of development appropriate to each identified zone (pg 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for through the application of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.
- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Soils Maps – Fluvial Maps

A review of the soil types in the vicinity of the Wind Farm Site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers deposits of transported silts/clays referred to as alluvium build up within the floodplain and hence the presence of these soils is a good indicator of potentially flood-prone areas.

Based on the EPA soil map for the area (www.epa.ie), mineral alluvium soils (fluvial deposits) are mapped along the Keerglen and Ballinglen rivers. However, these deposits are confined to the immediate vicinity of the river channels. These deposits are confined to the relatively steep sided valleys associated with the Keerglen and Ballinglen rivers and do not indicate the presence of widespread flooding associated with a floodplain.

Downstream of the Wind Farm Site, alluvium deposits are also mapped along the length of the Ballinglen River as far as Bunatrahair Bay. In general, there does not appear to be any significant or widespread alluvium deposition, which would be associated with a flood plain or a large geographical area prone to flooding.

In terms of the Underground Electricity Export Connection, alluvium deposits are mapped along the Ballinglen and Cloonaghmore rivers. These deposits do not extend any significant distance from the respective watercourse.

4.3.2 Historical Mapping

There is no text on local available historical 6" or 25" mapping for the Wind Farm Site that identifies areas that are "liable to flooding". Similarly there is no text along the Underground Electricity Export Connection that identifies land that is "prone to flooding".

4.3.3 OPW Past Flood Events Mapping

To identify those areas as being at risk of flooding, OPW's River Flood Extents Mapping, National Indicative Fluvial Mapping, Past Flood Event mapping (<https://www.floodinfo.ie/map/floodmaps/>) were consulted.

The OPW Past Flood Events Maps have no records of any recurring or historic flood instances within the Wind Farm Site. The closest mapped flood event is located ~10km to the northeast and is associated with coastal flooding at Lacken Strand (refer to **Figure C**).

Meanwhile, along the Underground Electricity Export Connection, a recurring flood event is mapped on the Cloonaghmore River at Tonrehown. With regard to this flood event, the local area engineers report states that "road and property flooding at junction in Tonrehown area from the river Cloonaghmore once or twice a year". There are no additional historic flood events mapped along the Underground Electricity Export Connection.

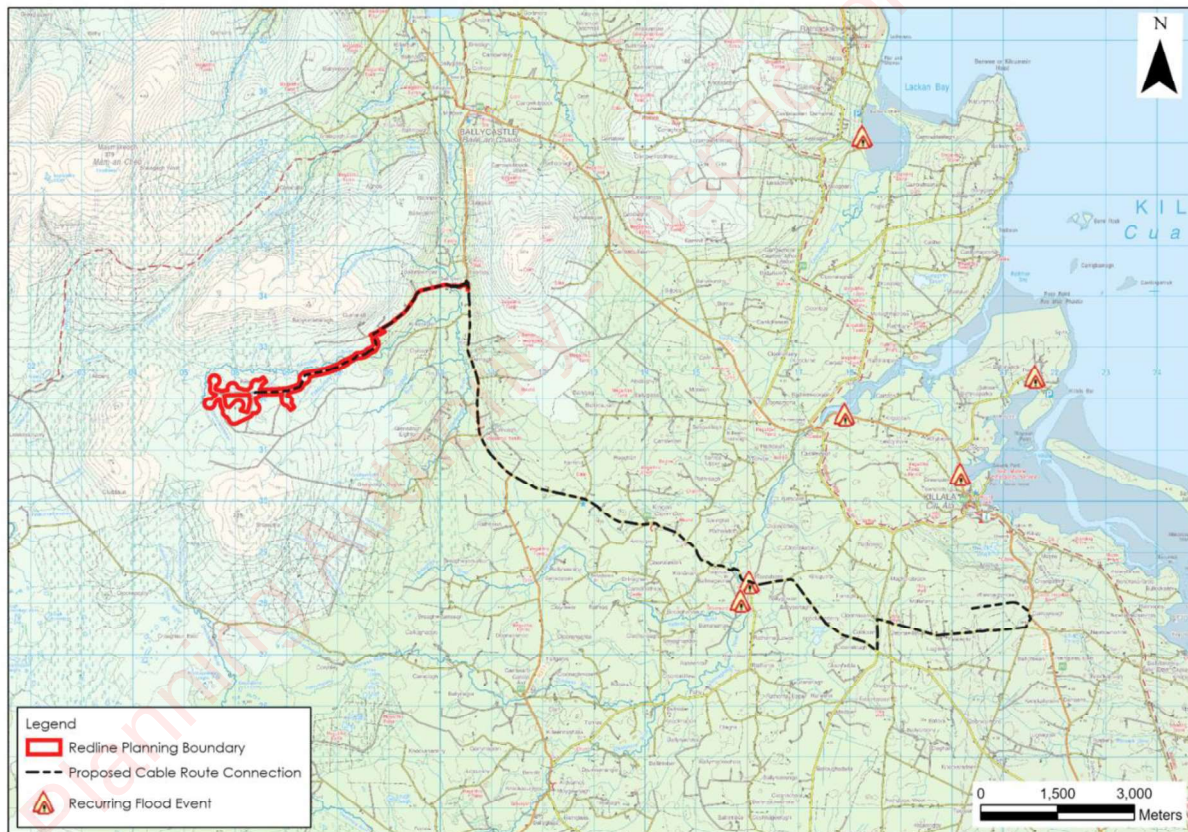


Figure C: OPW Past Flood Events Mapping (www.floods.ie)

4.3.4 GSI Historic Surface Water Flood Mapping

The GSI Winter (2015/2016) Surface Water Flooding map shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas. This surface water flood map is available to view at www.floodinfo.ie.

The GSI Winter 2015/2016 Surface Water Flood Map does not record any flood zones long the streams and watercourses which drain the Wind Farm Site or the Underground Electricity Export Connection (UEEC). Several historic surface water flood zones are located ~3.5km southwest of the Wind Farm Site. These flood zones occur within a large expanse of bog, known as Oweninny Bog.

In terms of the UEEC, the closest area of flooding is located ~300m east of the UEEC along the R344 in the townland of Carrowreagh. Historic flooding has also been recorded at Meelick Lough ~1.2km northeast of Tawnaghmore substation.

4.3.5 CFRAM Maps – Fluvial and Pluvial Flooding

Catchment Flood Risk Assessment and Management (CFRAM)² OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PFRA maps. CFRAM mapping of river flood extents are available at www.floodinfo.ie.

CFRAM mapping has not been completed for the area of the Wind Farm Site or Underground Electricity Export Connection.

The closest mapped CFRAM fluvial flood zones are located at Ballina and Crossmolina. The closest CFRAM coastal flood zones are mapped on the River Moy Estuary, ~2.5km to the east of the Underground Electricity Export Connection.

4.3.6 National Indicative Fluvial Flood Mapping

The National Indicative Fluvial Flood Mapping (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km² for which flood maps were not produced under the CFRAM Programme.

The Present Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.9** below.)

For the Present Day Scenario medium (1 in 100) and low probability (1 in 1,000) fluvial flood extents have been mapped along the Keerglen and Ballinglen rivers in the vicinity of the Wind Farm Site. However these modelled fluvial flood zones are localised to the river valleys and do not extend any significant distance from the steep-sided river valleys. No flood zones are mapped along any of the smaller streams, which drain the Wind Farm Site.

With regard to NIFM mapping for the Present Day Scenario, all key proposed development infrastructure within the Wind Farm Site is located in Fluvial Flood Zone C, where the probability of fluvial flooding is low (less than 0.1%). A fluvial map showing the National Indicative Fluvial Flood Mapping for the present day is included as **Figure D** below.

In terms of the Underground Electricity Export Connection, fluvial flood zones are mapped along the Cloonaghmore River at Tonrehown Bridge and along a local road in the townland of Magherbrack 9 (associated with a tributary of the Cloonaghmore River). These mapped flood zones are at existing watercourse crossings and along existing public roads.

² CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.

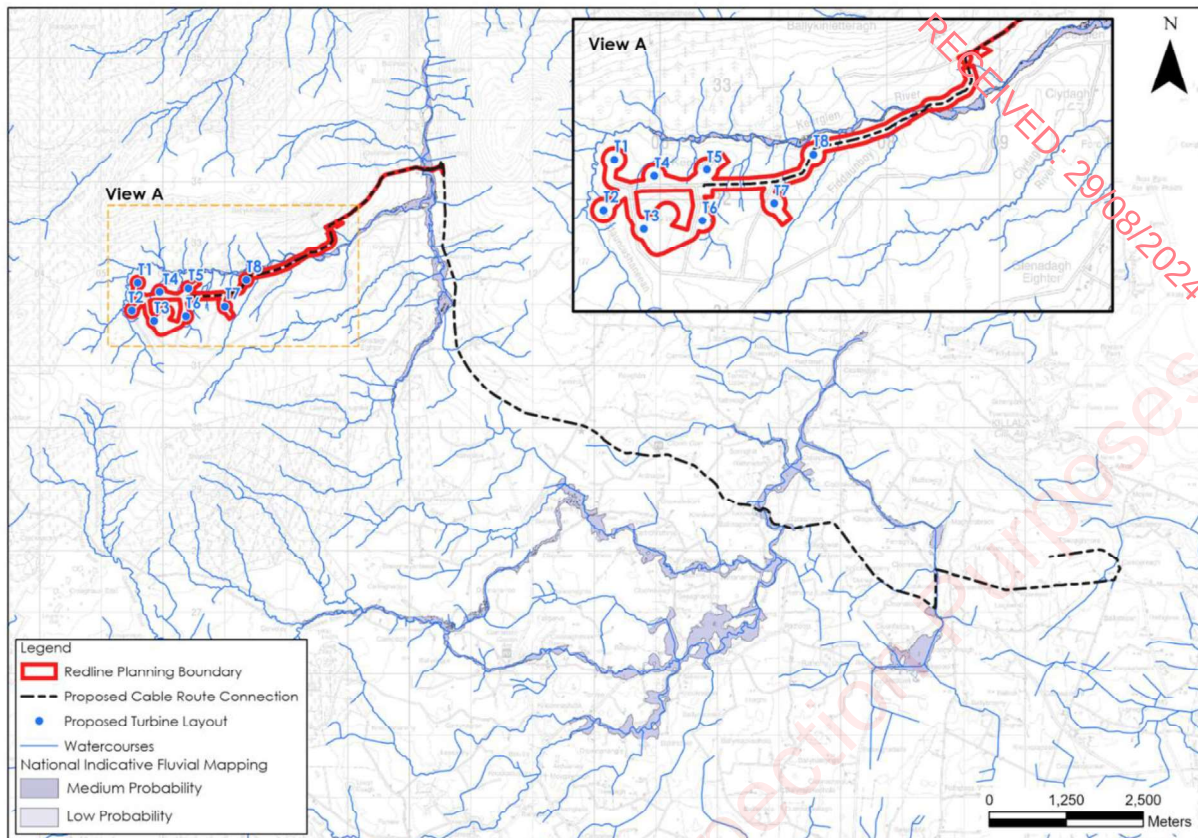


Figure D: National Indicative Fluvial Flood Mapping (Present Day Scenario)

4.3.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the wind farm site or along the Underground Electricity Export Connection.

4.3.8 Coastal Flooding

The closest mapped coastal (tidal) flood zones are located at the Moy Estuary, ~16km southeast of the Wind Farm Site and ~2.5km east of the Underground Electricity Export Connection.

The Wind Farm Site is not at risk of coastal flooding due to its elevation, with topography in excess of 100mOD.

4.3.9 Climate Change

It is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall. The CFRAM Programme has modelled flooding associated with potential future climate change scenarios.

However, as stated above no CFRAM fluvial flood modelling has been completed in the vicinity of the Wind Farm Site/Underground Electricity Export Connection Route. Meanwhile, the mapped CFRAM coastal flood zones in the Moy Estuary for the High-End Scenario remain ~2.5km east of the Underground Electricity Export Connection.

National Indicative Fluvial Mapping has been completed for catchments greater than 5km² for which flood maps were not produced under the CFRAM Programme. These flood zones have also been modelled for 2 no. potential future climate change scenarios, with the Mid-

Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively.

Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.3.6**. Therefore, flood zones at the Wind Farm Site and along the Underground Electricity Export Connection are unlikely to be significantly impacted by future climate change.

4.3.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process it would appear that the Wind farm Site is not largely constrained by coastal, fluvial or pluvial flooding. Whilst the majority of the Wind Farm Site is located in Flood Zone C, Fluvial Flood Zones A and B are mapped along the Keerglen River in the north of the site. However, these flood zones do not extend any significant distance from the mapped watercourse and are constrained to the deep-sided valley.

Much of the Underground Electricity Export Connection is located in Flood Zone C. However sections of the route are located in Flood Zones A and B – these are limited to existing watercourse crossings over the Cloonaghmore River at Tonrehown Bridge and a tributary of the Cloonaghmore River in the townland of Magherbrack.

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Survey and Drainage

Detailed walkover surveys of the Wind Farm Site and the Underground Electricity Export Connection were undertaken by HES on several occasions between March 2022 and April 2023.

The primary drainage feature within the Wind Farm Site is the Keerglen River. This watercourse flows to the north within the western section of the site, and to the west of all the Proposed Development infrastructure. The Keerglen River veers to the east along the northern boundary of the Wind Farm Site and continues to the east before dissecting the site.

During site walkover surveys it was noted that the Keerglen River has eroded a deep valley into the subsoil peat, exposing the underlying glacial tills and occasionally the bedrock geology at the surface. Whilst the Keerglen River valley is wide in certain areas, the valley is steep sided and topography within the Wind Farm Site slopes relatively steeply towards the Keerglen River.

Several unnamed first and second order streams flow from the high ground surrounding the Keerglen River valley and discharge into Keerglen River. Some of these streams have themselves, eroded out relatively deep valleys.

Drainage of the Wind Farm Site is further facilitated by a network of drainage ditches, which have been constructed locally to facilitate turbary peat cutting activities. The drains have a relatively low density and are generally present every 40m. These features direct water downslope towards the Keerglen River and its tributaries.

4 no. rounds of surface water flow monitoring were carried out at the main streams draining the wind farm site, with the results shown in **Table B** below. The measured flows are typical of seasonal flows for first/second order.

Location	16/03/2021	24/05/2021	04/06/2021	19/04/2023
	Flow (l/sec)	Flow (l/sec)	Flow (l/sec)	Flow (l/sec)
SW1	~4	~2	~6	~5
SW2	~50	~30	~50	~25
SW3	~120	~90	~120	~60
SW4	~16	~12	~15	~20

In relation to the flooding along the Keerglen River, due to the steep-sided nature of the river valley, no fluvial flooding will occur outside of the river valley itself. In addition, no fluvial flooding will occur along the smaller watercourses, as these flow rapidly downslopes and discharge into the Keerglen River.

4.4.2 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the Wind farm Site and along the Underground Electricity Export Connection can be described using the Source – Pathway – Receptor Model ("S-P-R").

Given the sloping topography of the Wind Farm Site, the potential for flooding is low. The primary potential source of flooding is fluvial, however given the steep-sided nature of the Keerglen River valley, the risk to the proposed infrastructure is considered to be very low. Pluvial flooding may occur on some of the flatter areas of the site following periods of prolonged or

intense rainfall. However, the existing drainage regime and the sloping nature of the site limits the potential for significant areas of surface water ponding to arise.

4.4.3 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process, it would appear that flooding is unlikely to be problematic at the site or downstream of the site. The potential sources of flood risk for the Proposed Site are outlined and assessed in **Table C**.

Table C: S-P-R Assessment of Flood Sources for the proposed site

Source	Pathway	Receptor	Comment
Tidal	Not applicable	Land and infrastructure.	The Wind Farm Site is located ~8km from the coast, and at an elevation ~112 to 179m OD. There is no risk of coastal/tidal flooding. Furthermore, the Underground Electricity Export Connection is located in excess of 2km from the coast at the nearest point and is not mapped in any coastal flood zone.
Fluvial	Overbank flooding of the Keerglen River and its tributaries.	Land and infrastructure.	NIFM fluvial flood zones are mapped in the immediate vicinity of the Keerglen and Ballinglen rivers in the area of the Wind Farm Site. These flood zones are constrained to the valleys associated with these watercourses and do not extend significant distances from the river channel. In addition, within the Wind Farm Site all proposed turbines and key infrastructures are located in Fluvial Flood Zone C. The only infrastructure located in the flood zones is a new proposed crossing over the Keerglen River and an existing crossing over the Ballinglen River. Sections of the UEEC are mapped fluvial flood extents associated with flooding of the Cloonaghmore River and a tributary in the townland of Magherbrack. However, existing watercourse crossings already exist at these locations and no new crossings are proposed.
Pluvial	Ponding of rainwater on site	Land and infrastructure.	There is very little risk of pluvial flooding within the Wind Farm Site due to the sloping nature of the land. Drainage moves relatively freely downslope towards the Keerglen River and there is a high density of natural and manmade drainage features. Therefore, there is little risk of pluvial flooding at the Wind Farm Site.
Surface water	Surface ponding/ Overflow	Land and infrastructure	Same as above (pluvial).

Groundwater	Rising groundwater levels	Land and infrastructure.	Based on local hydrogeological regime and GSI mapping, there is no apparent risk from groundwater flooding.
-------------	---------------------------	--------------------------	---

4.5 REQUIREMENT FOR A JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test³ is shown in **Table D** below.

The proposed wind farm development can be categorised as “Highly Vulnerable Development” as electricity generating infrastructure will be present.

The majority of the Wind Farm Site, including all turbines and the onsite substation, is situated within Flood Zone C and is deemed appropriate from a flood risk perspective. The only infrastructure located within fluvial flood zones comprises a new proposed crossing over the Keerglen River and existing crossings over the Ballinglen and Cloonaghmore Rivers.

A justification test has been completed below for the new proposed crossing over the Keerglen River and the existing crossings along the Underground Electricity Export Connection which are located in the mapped fluvial flood zones.

Table D: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	<u>Justification test</u>	<u>Justification test</u>	<u>Appropriate</u>
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: Taken from Table 3.2 (DoEHLG, 2009)

Bold: Applies to this project

Box 5.1 (**Table E**) of “The Planning System and Flood Risk Management Guidelines” (PSFRM Guidelines) outlines the criteria required to complete the “Justification Test”.

³ A ‘Justification Test’ is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).

Table E: Format of Justification Test for Development Management

Box 5.1 Justification Test for Development Management (to be submitted by the applicant)
When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied: 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: i. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; ii. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes. The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: this table has been adapted from Box 5.1 of "The Planning System and Flood Risk Management Guidelines", (2009).

Referring to Point 1 and Points 2 (i) to (iv) inclusive:

- Some of the Proposed Development is located in mapped fluvial flood zones along the Keerglen, Ballingen and Cloonaghmore rivers and a tributary of the Cloonaghmore River;
 - No displacement of floodwaters will result from the emplacement of the GUnderground Electricity Export Connection underground cable. The works at the crossing locations will be achieved by directional drilling and there will be no in-stream works or alteration of the existing hydromorphological regime;
 - The new proposed crossing over the Keerglen River will be constructed using a new clear span bridge and will result in no disturbance to the existing river channel;
 - No works are proposed in the flood zone associated with the existing crossing along the L51723 over the Ballingen River. This existing road will be used as an access road for the Wind Farm and there will be no potential for the displacement of floodwaters; and,
 - During the construction phase, works at these locations may be postponed in the event of temporary flooding.
1. The Proposed Development has been the subject of a flood risk assessment (this report) and the following has been determined:
 - i. Due to the relatively small footprint of the Proposed Development and given that the only portions of the Proposed Development located within modelled flood zones are at proposed and existing watercourse crossings, the Proposed Development is predicted to have no impact on flood water levels downstream. No increase in downstream flood risk will occur;
 - ii. All proposed turbines and all other site infrastructure are located outside of the flood zones. These measures will mitigate against any potential disruption to the natural hydrology of the Wind Farm Site. No increase in flood risk to people, property, the economy or the environment during extreme flood events as a result of the Proposed Development is predicted due to the

- appropriate design measures which will result in unmeasurable/imperceptible upstream and downstream effects;
- iii. The Underground Electricity Export Connection crossings of the Cloonaghmore River at Tonrehown Bridge will not have an effect on flood levels. This crossing will be achieved by horizontal directional drilling. Therefore, there will be no displacement of flood waters;
 - iv. The new proposed crossing over the Keerglen River will be achieved through the construction of a new clear-span bridge. There will be no instream works and no disturbance of the existing river channel; and,
 - v. The Proposed Development is compatible with the wider planning objectives of the area, including the provision of wind energy developments at appropriate locations and the proper planning and sustainable development of the area.

5. FLOOD IMPACT PREVENTION AND DRAINAGE MANAGEMENT

5.1 PLANNING POLICY AND THE MAYO COUNTY DEVELOPMENT PLAN

The following policies are defined in the Mayo CDP 2022-2028 (**Table F**) in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the Proposed Development design:

Table F: Mayo County Development Plan Objectives/Policies and Project Responses

No.	Objectives	Development Design Response
INO 19	To ensure that a flood risk assessment is carried out for any development proposal where a flood risk is identified in accordance with the Planning System and Flood Risk Management (DoEHLG/OPW 2009) and Circular PL2/2014. This assessment shall be appropriate to the scale and nature of risk to the potential development.	This FRA is consistent with the requirements of the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" and is in line with the recommendations of the SFRA prepared as part of the Mayo County Development Plan 2022-2028.
INO 20	To consult with the OPW in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible and retain a strip on either side of such channels where required, to facilitate maintenance access thereto.	OPW mapping has been consulted.
INO 21	To assist the OPW in developing catchment-based Flood Risk Management Plans for rivers in County Mayo and have regard to their provisions/recommendations.	No plan in place currently for the Wind Farm Site.
INO 22	To protect the integrity of any formal (OPW or Mayo County Council) flood risk management infrastructure, thereby ensuring that any new development does not negatively impact any existing defence infrastructure or compromise any proposed new infrastructure.	No existing defences exist at the Wind Farm Site.
INO 23	To ensure that where flood risk management works take place that natural heritage, cultural heritage, rivers, streams and watercourses are appropriately protected.	No flood risk management works i.e flood barriers are required or recommended.
INO 24	Consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the provision of flood alleviation measures in the County.	N/A
INO 25	Ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the OPW Climate Change Sectoral Adaptation Plan Flood Risk Management applicable at the time.	No flood risk management activity is required or recommended.

5.2 PROPOSED DRAINAGE

The site drainage system was designed integrally with the wind farm layout as a measure to ensure that the proposal will not change the existing flow regime across the Wind Farm Site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from wind farm related sediment runoff.

Overland flow rates are likely to be significant, given the presence of several surface streams in the vicinity of the Wind Farm Site. Therefore, the drainage system must be designed and managed properly if it is to work effectively. A fundamental principle in the drainage design is that clean water continues to flow downstream along and in existing pathways/streams. The primary threat is due to potential contamination by silt from the construction works. The dirty water from the construction works areas will be collected in a separate drainage system and treated by removing the suspended solids before discharging into the existing watercourses.

The existing drainage network will be utilised to collect overland flow that is intercepted by the works areas or by new access roads. These will be constructed on the uphill side of the works and piped to the downhill side, bypassing the works areas. However, this will cause the normally dispersed flow to be concentrated at specific discharge points downstream of the works. In order to disperse this flow, each clean water drain will be terminated in a discharge channel running parallel to the ground contours that will function as a weir to disperse the flow over a wider area of vegetation. This will prevent erosion of the ground surface and will attenuate the flow rate to the downstream receiving waters.

The resultant diversion of clean water runoff will ensure that the treatment system will only need to deal with construction related runoff. The treatment system consists of a series of settlement ponds that are located at each works site and at intervals along the access roads. The outflow from the settlement ponds will be allowed to disperse across vegetation and will become diluted through contact with the clean water runoff in the buffer areas, before entering the downstream watercourses.

5.3 PROPOSED ON-SITE RUNOFF ATTENUATION

The creation of impermeable areas within a development site has the effect of increasing rates of runoff into the downstream drainage system and this may increase flood risk and flood severity downstream. This applies particularly to urban areas that drain to closed pipe systems, which do not have the capacity to cater for increased hydraulic loads. The proposed Keerglen Wind Farm Development is located within a rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is very small in the context of the current catchment size, and therefore represents a negligible increase in downstream flood risk. Notwithstanding the low increase in flood risk due to the development, the drainage system has been designed to prevent any increase in discharge rates above normal greenfield runoff rates.

The volume of water requiring attenuation relates to direct precipitation on the roads and hard-standing footprint only. The aim of the stormwater attenuation measures is to limit the flow rate from the developed area to that which prevails on the undeveloped site. This is achieved by limiting the flow rate to the downstream receiving waters and temporarily storing the excess water that accumulates as a result. The developed surfaces have some permeability and this reduces the attenuation requirement.

All runoff from the developed areas will be routed through settlement ponds downstream. The outflow from the settlement ponds will be released in a controlled and diffuse manner. Therefore, the proposal will not increase the magnitude of the hydrograph peak. The control measures are passive as opposed to mechanical and do not require maintenance to ensure their ongoing effectiveness.

5.4 DOWNSTREAM FLOOD RISK

With the implementation of the proposed wind farm drainage system, there will be no increase in downstream flood risk associated with the Proposed Development.

The wind farm drainage system as outlined above will provide additional surface water attenuation to what already exists at the Wind Farm Site.

The proposed bridge crossing over the Keerglen River is located in a deep ravine. The crossing will be achieved through the use a clear span bridge, there will be no instream works and all works will be completed as per OPW Section 50 Guidance. Subsequently there will be no displacement of floodwaters.

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the Proposed Wind Farm Development at Keerglen, Co. Mayo. From this study:
 - No instances of historical flooding were identified in historic OS maps within the Wind Farm Site;
 - No instances of recurring flooding were identified on OPW maps within the Wind Farm Site;
 - The GSI Historical 2015/2016 Surface Water Flood Map does not record any areas of surface water flooding within the Wind Farm Site;
 - The GSI Groundwater Flood Mapping does not record any historic or predictive groundwater flood zones within the Wind Farm Site; and,
 - National Indicative Fluvial Flood Mapping is available for the Wind Farm Site and shows some fluvial flood zones along the Keerglen River in the north of the site.
- A section of the Wind Farm Site is located in Fluvial Flood Zone A and B, associated with fluvial flooding along the Keerglen and Ballinglen Rivers. However, due to the steep sided nature of the river valleys, all flooding is constrained to be immediate vicinity of this watercourse. All key proposed infrastructure within the Wind Farm Site is located in Flood Zone C and is at low risk of fluvial flooding;
- As for the Underground Electricity Export Connection, the majority of the route is located in Flood Zone C. However, some areas are located in Flood Zone A and B. These flood zones are along the Cloonaghmore River at Tonrehown Bridge and along a tributary of the Cloonaghmore River in the townland of Magherbrack. These are existing watercourse crossings over these watercourses and therefore the Proposed Development will not be at risk of fluvial flooding at these locations;
- The Justification Test concluded that the Proposed Wind Farm Site and associated infrastructure is located within a low-risk area (Flood Zone C), and as such is appropriate from a flood risk perspective;
- Flood risks associated with potential fluvial flooding downstream of the Proposed Development can be managed by way of avoidance during flooding, standard road drainage measures, scour protection measures and the implementation of attenuation systems; and,
- The overall risk of flooding within the proposed Wind Farm Site is estimated to be low. While there is a risk of flooding along sections of the Underground Electricity Export Connection, the road crossings already exist in these areas and therefore no change will occur to the hydrological regime post construction.

* * * * *

7. REFERENCES

AGMET	1996	Agroclimatic Atlas of Ireland.
DOEHLG	2009	The Planning System and Flood Risk Management.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Mayo County Council	2021	Mayo County Development Plan 2022-2028.

RECEIVED: 29/08/2024

Mayo Planning Authority - Inspection Purposes Only

© **HYDRO-ENVIRONMENTAL SERVICES**

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

www.hydroenvironmental.ie

RECEIVED: 29/08/2024

Appendix 7.3

Lab Reports

Keerglen Wind Farm

Mayo Planning Authority - Inspection Purposes Only



ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax: +353 (0) 52 617 8103
www.alsglobal.ie



Report No: HYDR-858030322
Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 03/03/2022
Date Reported 15/03/2022
Order Number P1583-0

For the Attention of: Hydro Environmental Services
Sample Reception 6 sample(s) received in good condition.

Comments Supplementary Certificate issued to update the sample type

Report Authorised by:

Rosemary Thomas
Environmental Chemistry Manager

Conditions:

1. Results in this report relate only to the items tested
2. Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd
3. All queries regarding this report should be addressed to the Technical Manager at the above address
4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON* indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
8. Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation
9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing
10. This supplementary certificate replaces the previous certificate which must be destroyed



ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax: +353 (0) 52 617 8103
www.alsglobal.ie



Report No: HYDR-858030322

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Date Received 03/03/2022

Date Reported 15/03/2022

Order Number P1583-0

Sample Type Surface Water
Client ID P1583-SW1 02.03.22 @ 1pm
Date Tested 03/03/2022
ALS ID 4919235

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Suspended Solids	0.4	mg / l	P202*
Phosphorus	<0.10	mg/l P	P207
Turbidity	0.76	NTU	P239
BOD 5 day Total	<1	mg/l O2	P280
Ammonia	0.09	mg/l NH3-N	P281
Chloride	35.8	mg/l Cl	P281
Orthophosphate	<0.02	mg/l P	P281
Nitrate	<5.0	mg/l NO3	P281*
Nitrite	<0.05	mg/l NO2	P281*
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Surface Water
Client ID P1583-SW2 02.03.22 @ 2pm
Date Tested 03/03/2022
ALS ID 4919236

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Suspended Solids	0.2	mg / l	P202*
Phosphorus	<0.10	mg/l P	P207
Turbidity	0.75	NTU	P239
BOD 5 day Total	<1	mg/l O2	P280
Ammonia	<0.02	mg/l NH3-N	P281
Chloride	39.3	mg/l Cl	P281
Orthophosphate	<0.02	mg/l P	P281
Nitrate	<5.0	mg/l NO3	P281*
Nitrite	<0.05	mg/l NO2	P281*
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by:

Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager



ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax: +353 (0) 52 617 8103
www.alsglobal.ie



Report No: HYDR-858030322

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Date Received 03/03/2022

Date Reported 15/03/2022

Order Number P1583-0

Sample Type Surface Water
Client ID P1583-SW3 02.03.22 @ 3pm
Date Tested 03/03/2022
ALS ID 4919237

Test	Result	Unit	Method
Suspended Solids	12	mg / l	P202
Suspended Solids	11.6	mg / l	P202*
Phosphorus	<0.10	mg/l P	P207
Turbidity	1.46	NTU	P239
BOD 5 day Total	<1	mg/l O2	P280
Ammonia	<0.02	mg/l NH3-N	P281
Chloride	34.9	mg/l Cl	P281
Orthophosphate	<0.02	mg/l P	P281
Nitrate	<5.0	mg/l NO3	P281*
Nitrite	<0.05	mg/l NO2	P281*
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Surface Water
Client ID P1583-SW4 02.03.22 @ 4pm
Date Tested 03/03/2022
ALS ID 4919238

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Suspended Solids	1.2	mg / l	P202*
Phosphorus	<0.10	mg/l P	P207
Turbidity	0.69	NTU	P239
BOD 5 day Total	<1	mg/l O2	P280
Ammonia	0.03	mg/l NH3-N	P281
Chloride	36.9	mg/l Cl	P281
Orthophosphate	<0.02	mg/l P	P281
Nitrate	<5.0	mg/l NO3	P281*
Nitrite	<0.05	mg/l NO2	P281*
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by:

Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager



ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax: +353 (0) 52 617 8103
www.alsglobal.ie



Report No: HYDR-858030322

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Date Received 03/03/2022

Date Reported 15/03/2022

Order Number P1583-0

Sample Type Surface Water
Client ID P1583-SW5 02.03.22 @ 5pm
Date Tested 03/03/2022
ALS ID 4919239

Test	Result	Unit	Method
Suspended Solids	8	mg / l	P202
Suspended Solids	7.8	mg / l	P202*
Phosphorus	<0.10	mg/l P	P207
Turbidity	2.50	NTU	P239
BOD 5 day Total	<1	mg/l O2	P280
Ammonia	0.02	mg/l NH3-N	P281
Chloride	34.3	mg/l Cl	P281
Orthophosphate	<0.02	mg/l P	P281
Nitrate	<5.0	mg/l NO3	P281*
Nitrite	<0.05	mg/l NO2	P281*
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Surface Water
Client ID P1583-SW6 02.03.22 @ 6pm
Date Tested 03/03/2022
ALS ID 4919240

Test	Result	Unit	Method
Suspended Solids	5	mg / l	P202
Suspended Solids	5	mg / l	P202*
Phosphorus	<0.10	mg/l P	P207
Turbidity	1.60	NTU	P239
BOD 5 day Total	<1	mg/l O2	P280
Ammonia	0.03	mg/l NH3-N	P281
Chloride	33.1	mg/l Cl	P281
Orthophosphate	<0.02	mg/l P	P281
Nitrate	<5.0	mg/l NO3	P281*
Nitrite	<0.05	mg/l NO2	P281*
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by:

Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: HYDR-098200423

Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Submitted 20/04/2023

Date Reported 27/04/2023

Order Number N/A

For the Attention of: Hydro Environmental Services

Sample Reception 6 sample(s) received in good condition.

Comments N/A

Report Authorised by:

Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

Conditions:

1. Results in this report relate only to the items tested
2. Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd
3. All queries regarding this report should be addressed to the Technical Manager at the above address
4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON* indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
8. Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation
9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing
10. Statement of conformity made against the result does not take into account the uncertainty of measurement associated with the method



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: HYDR-098200423

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Submitted 20/04/2023

Date Reported 27/04/2023

Order Number N/A

Sample Type Water
Client ID P1583 Keerglen SW 1 15:00 19/04/2023
Date Tested 21/04/2023
ALS ID 5527544

Test	Result	Unit	Method
Suspended Solids	8	mg / l	P202
Phosphorus	0.15	mg/l P	P207
Turbidity	1.18	NTU	P239
BOD 5 day Total	3	mg/l O2	P280
Ammonia	0.09	mg/l NH3-N	P281
Chloride	16.3	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	<0.02	mg/l P	P281
Total Oxidised Nitrogen	<0.25	mg/L N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID P1583 Keerglen SW 2 15:30 19/04/2023
Date Tested 21/04/2023
ALS ID 5527545

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
Turbidity	0.93	NTU	P239
BOD 5 day Total	1	mg/l O2	P280
Ammonia	<0.02	mg/l NH3-N	P281
Chloride	17.7	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	<0.02	mg/l P	P281
Total Oxidised Nitrogen	<0.25	mg/L N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by:

Rosemary Thomas



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: HYDR-098200423

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Submitted 20/04/2023

Date Reported 27/04/2023

Order Number N/A

Sample Type Water
Client ID P1583 Keerglen SW 3 16:00 19/04/2023
Date Tested 21/04/2023
ALS ID 5527546

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
Turbidity	1.13	NTU	P239
BOD 5 day Total	1	mg/l O2	P280
Ammonia	<0.02	mg/l NH3-N	P281
Chloride	21.0	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	<0.02	mg/l P	P281
Total Oxidised Nitrogen	<0.25	mg/L N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID P1583 Keerglen SW 4 16:30 19/04/2023
Date Tested 21/04/2023
ALS ID 5527547

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.19	mg/l P	P207
Turbidity	0.87	NTU	P239
BOD 5 day Total	1	mg/l O2	P280
Ammonia	0.03	mg/l NH3-N	P281
Chloride	17.0	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	<0.02	mg/l P	P281
Total Oxidised Nitrogen	0.73	mg/L N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by:

Rosemary Thomas



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100



Report No: HYDR-098200423

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Submitted 20/04/2023
Date Reported 27/04/2023
Order Number N/A

Sample Type Water
Client ID P1583 Keerglen SW 5 17:00 19/04/2023
Date Tested 21/04/2023
ALS ID 5527548

Test	Result	Unit	Method
Suspended Solids	7	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
Turbidity	5.52	NTU	P239
BOD 5 day Total	1	mg/l O2	P280
Ammonia	<0.02	mg/l NH3-N	P281
Chloride	26.3	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	0.05	mg/l P	P281
Total Oxidised Nitrogen	0.36	mg/L N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID P1583 Keerglen SW 6 18:00 19/04/2023
Date Tested 21/04/2023
ALS ID 5527549

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
Turbidity	1.28	NTU	P239
BOD 5 day Total	1	mg/l O2	P280
Ammonia	0.03	mg/l NH3-N	P281
Chloride	23.2	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	<0.02	mg/l P	P281
Total Oxidised Nitrogen	<0.25	mg/L N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by:

Rosemary Thomas

RECEIVED: 29/08/2024

Appendix 7.4

Water Framework Directive Assessment

Keerglen Wind Farm

Mayo Planning Authority - Inspection Purposes Only



**HYDRO
ENVIRONMENTAL
SERVICES**

22 Lower Main St
Dungarvan
Co. Waterford
Ireland

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

**WATER FRAMEWORK DIRECTIVE ASSESSMENT
PROPOSED KEERGLLEN WIND FARM, CO. MAYO**

FINAL REPORT

Prepared for:
ABO ENERGY IRELAND LTD

Prepared by:
HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

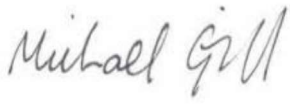
Document Title:	WATER FRAMEWORK DIRECTIVE ASSESSMENT PROPOSED KEERGLEN WIND FARM, CO. MAYO
Issue Date:	20 th June 2024
Project Number:	P1583-0
Project Reporting History:	P1583-0_WFD_DRAFT_D0
Current Revision No:	P1583-0_WFD_FINAL_F0
Author:	MICHAEL GILL CONOR MCGETTIGAN
Signed:	 Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services
Disclaimer: This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.	

TABLE OF CONTENTS

1. INTRODUCTION	4
1.1 BACKGROUND	4
1.2 STATEMENT OF AUTHORITY	4
1.3 WATER FRAMEWORK DIRECTIVE	5
2. WATERBODY IDENTIFICATION AND CLASSIFICATION	6
2.1 INTRODUCTION	6
2.2 SURFACE WATERBODY IDENTIFICATION	6
2.3 SURFACE WATER BODY CLASSIFICATION	9
2.4 GROUNDWATER BODY IDENTIFICATION	11
2.5 GROUNDWATER BODY CLASSIFICATION	11
2.6 PROTECTED AREA IDENTIFICATION	13
2.6.1 Nature Conservation Designations	13
2.6.2 Bathing Waters	13
2.6.3 Nutrient Sensitive Areas	14
2.6.4 Shellfish Area	14
2.6.5 Drinking Water	14
3. WFD SCREENING	15
3.1 SURFACE WATER BODIES	15
3.2 GROUNDWATER BODIES	15
3.3 PROTECTED AREAS	16
3.4 WFD SCREENING SUMMARY	17
4. WFD COMPLIANCE ASSESSMENT	21
4.1 PROPOSALS	21
4.2 POTENTIAL EFFECTS	21
4.2.1 Construction Phase (Unmitigated)	21
4.2.2 Operational Phase (Unmitigated)	25
4.3 MITIGATION MEASURES	27
4.3.1 Construction Phase	28
4.3.2 Operational Phase	35
4.3.1 Decommissioning Phase	36
4.3.2 Potential Effects with the Implementation of Mitigation	38
5. SUMMARY AND CONCLUSION	39

FIGURES (IN TEXT)

Figure A: Local Hydrology Map	8
Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021)	12

TABLES IN TEXT

Table A: Catchment Area Downstream of the Proposed Development	7
Table B: Summary WFD Information for River Water Bodies	10
Table C: Summary WFD Information for Groundwater Bodies	11
Table D: Screening of WFD Waterbodies and Protected Areas	18
Table E: Potential Surface Water Quality Effects at Wind Farm Site During Construction Phase (Unmitigated)	22
Table F: Potential Surface Water Quality Effects along UEE Connection During Construction Phase (Unmitigated)	23
Table G: Potential Groundwater Quality Effects at Wind Farm Site During Construction Phase (Unmitigated)	23
Table H: Groundwater Quantity Effects Along the UEE Connection During Construction Phase (Unmitigated)	24
Table I: Potential Surface Water Quantity Effects Downstream of the Wind Farm Site During Operational Phase (Unmitigated)	26
Table J: Potential Surface Water Quality Effects at Wind Farm Site During Operational Phase (Unmitigated)	26
Table K: Groundwater Quality Effects at Wind Farm Site During Operational Phase (Unmitigated)	27
Table L: Groundwater Quality Effects at Wind Farm Site During Operational Phase (Unmitigated)	27
Table M: Summary of Drainage Mitigation & their Application	29
Table N: Summary of WFD Status for Unmitigated and Mitigated Scenarios	38

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by ABO Energy Ireland to complete a Water Framework Directive (WFD) Compliance Assessment for the Proposed Development (as detailed in Chapter 3 of the EIAR). The Proposed Development comprises an 8 no. turbine windfarm, underground electricity export connection (UEEC) and all associated site development works. Please note that the proposed UEEC will be subject to a separate planning application but is assessed in the EIAR and in this WFD Compliance Assessment.

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

This WFD Assessment is intended to supplement the EIAR submitted as part of the Keerglen Wind Farm planning application. The Proposed Development is described in full in Chapter 3 of the EIAR. For the purposes of this WFD Assessment, and consistent with the EIAR, the various components are described and assessed using the following references: 'Proposed Development', 'Wind Farm Site', 'Underground Electricity Export Connection' and the 'Turbine Delivery Route' (TDR). This WFD Assessment is intended to supplement the EIAR submitted as part of the wind farm planning application.

1.2 STATEMENT OF AUTHORITY

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

This WFD assessment was prepared by Michael Gill and Conor McGettigan.

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

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares hydrological and hydrogeological impact assessments and WFD compliance assessments for a variety of development types, primarily wind farms and quarries.

1.3 WATER FRAMEWORK DIRECTIVE

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

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

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

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

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

Furthermore, the Department of Housing, Local Government and Heritage are currently reviewing the submissions made on the Draft 3rd Cycle River Basin Management Plan (2022 - 2027) which was out for public consultation in Q4 of 2021 and Q1 of 2022. As of June 2024, the plan has not been published while the draft plan is available to view at <https://www.gov.ie/en/consultation/2bda0-public-consultation-on-the-draft-river-basin-management-plan-for-ireland-2022-2027/>.

HES's 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 AND CLASSIFICATION

2.1 INTRODUCTION

This section identifies those Surface Waterbodies (SWBs), Groundwater Bodies (GWBs) and protected areas with potential to be affected by the Proposed Development and reviews all available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

Regionally the Wind Farm Site is located in the Blacksod-Broadhaven surface water catchment within Hydrometric Area 33 of the Western River Basin District (WRBD). On a more local scale, the Wind Farm Site is located in the Glencullin River sub-catchment (Glencullin[NorthMayo]_SC_010).

Locally, the Wind Farm Site is located in a total of 3 no. WFD river sub-basins:

- The vast majority of the Wind Farm Site is located in the Keerglen_010 WFD river sub-basin. Within this WFD river sub-basin, a small stream referred to as the Fiddauncushaneen stream, originates to the south of the Wind Farm Site and flows northwards within the Site for ~700m before it merges with a small stream from the southwest to form the Keerglen River. The Keerglen River then flows to the north along the eastern boundary of Ummerantarry Bog NHA, before it veers to the east along the northern boundary of the site. Several small 1st order streams which originate within the Wind Farm Site flow downslope and discharge into the Keerglen River. These watercourses are largely unnamed with the exception of the Fiddaunboy stream in the east. The Keerglen River and its associated tributaries which drain the Wind Farm Site form part of the Keerglen_010 river waterbody;
- The majority of the access road along the L51723 is situated in the Ballinglen_010 WFD river sub-basin; and,
- The temporary access junction and roadway between the R315 and the L51723 is located on the boundary between the Ballinglen_010 and Ballinglen_020 WFD river sub-basins.

The Keerglen River (Keerglen_010 SWB) flows to the northeast before it discharges into the Ballinglen River (Ballinglen_010 SWB). The Ballinglen River then flows to the north before the Ballinglen_020 SWB discharges into the Bunatrahair Bay transitional waterbody ~6.5km northeast of the Wind Farm Site at Ballycastle Beach. Further out to sea, Bunatrahair Bay is connected to the Western Atlantic Seaboard coastal waterbody.

The UEEC will run from the proposed onsite 38kV substation to the existing Tawnaghmore 110kV substation. In the vicinity of the Wind Farm Site the UEEC is located in the Glencullin River sub-catchment and the Keerglen_010 and Ballinglen_010 WFD river sub-basins. There are a total of 5 no. crossings over EPA mapped watercourses (outside of the Wind Farm Site) in this area of the UEEC along the R315. Meanwhile, the eastern section of the UEEC is located Moy and Killala Bay surface water catchment and the Cloonaghmore and Abbeytown River sub-catchments. This section of the UEEC passes through a total of 4 no. WFD River sub-basins (Breaghwy_010, Cloonaghmore_040, Cloonaghmore_050 and Moyne_010) and includes a total of 6 no. crossings over EPA mapped watercourses.

Downstream of the UEEC, the Cloonaghmore River discharges into the Cloonaghmore Estuary transitional waterbody which in turn discharges into Killala Bay coastal waterbody. Meanwhile, the Moyne_010 SWB discharges directly into the Killala Bay coastal waterbody.

Figure A below is a local hydrology map which identifies all SWBs downstream of the Proposed Development.

Table A presents the catchment area of each waterbody downstream of the Proposed Development. The catchment area for the waterbodies increases progressively downstream as more tributaries discharge into the Ballinglen and Cloonaghmore Rivers. For example, in the vicinity of the Wind Farm Site, the Keerglen_010 SWB has a catchment area of 14.13km² whilst the Ballinglen River upstream of the Bunatrahir Bay has a total catchment area of 44.05km². The greatest flows in the vicinity and downstream of the Proposed Development will occur downstream of the UEEC along the Cloonaghmore River, with the Cloonaghmore_060 SWB having a total catchment area of 145.48km². Those waterbodies which have smaller catchment areas will be more susceptible to water quality impacts as a result of activities associated with the Proposed Development. The potential for the Proposed Development 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 the Proposed Development

WFD River Sub-Basin	Total Upstream Catchment Area (km ²)
Blacksod-Broadhaven Surface Water Catchment	
Keerglen_010	14.13
Ballinglen_010	32.98
Ballinglen_020	44.05
Moy & Killala Bay Surface Water Catchment	
Breaghwy_010	12.94
Cloonaghmore_040	96.47
Cloonaghmore_050	123.12
Cloonaghmore_060	145.48
Moyne_010	15.23

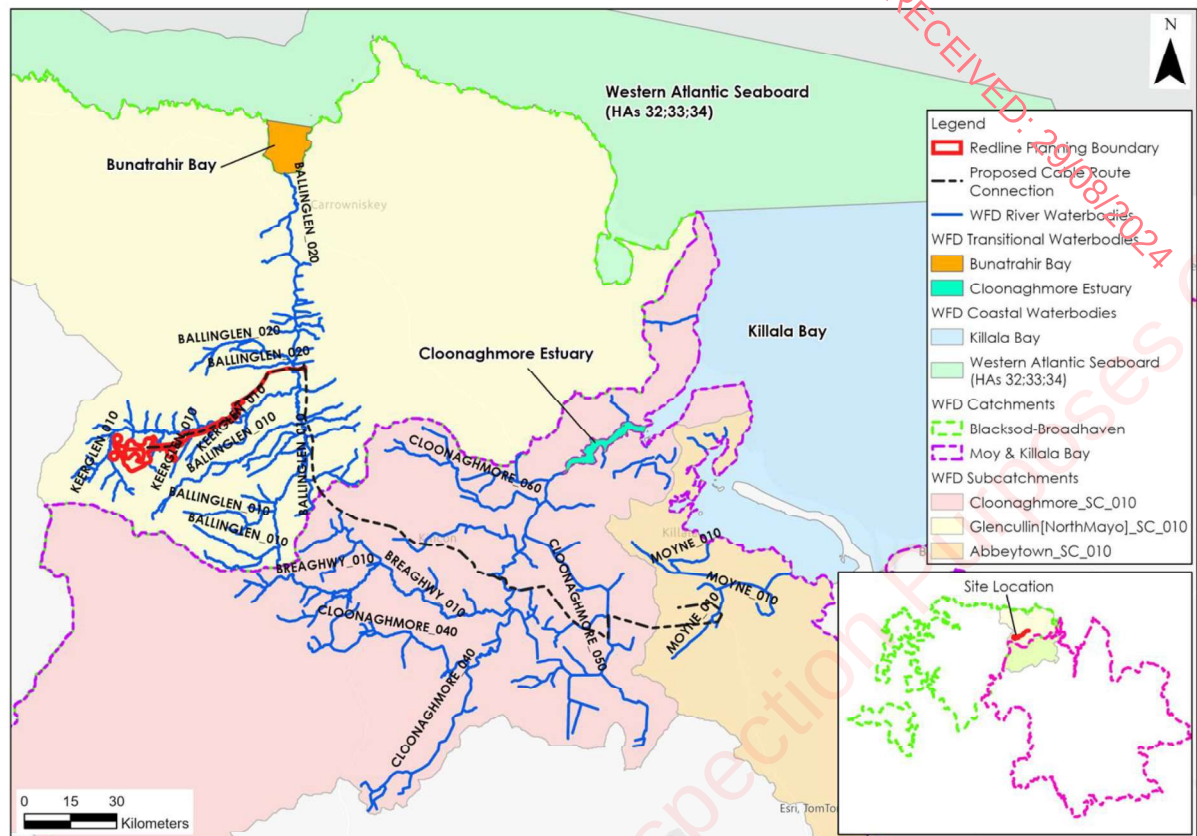


Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

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

In the vicinity of the Wind Farm Site and within the Blacksod-Broadhaven surface water catchment, the Keerglen_010 SWB achieved 'Moderate' status in the latest WFD cycle (2016-2021). This represented a deterioration in the status of this SWS as it has previously achieved 'High' status in the 1st (2010-2015) and 2nd (2013-2018) WFD cycles. The Keerglen_010 SWB is listed as a high ecological status waterbody and is therefore not currently meeting this objective. Further downstream, the Ballinglen_010 and Ballinglen_020 SWBs achieved 'Poor' and 'Moderate' status respectively in the latest WFD cycle (2016-2021). This also represents a deterioration in the status of these SWBs as they had achieved 'Moderate' and 'Good' status respectively in the 2nd WFD cycle. In terms of transitional SWBs, Bunatrahir Bay achieved 'Good' status in the latest WFD cycle.

The risk status of the Keerglen_010 and Ballinglen_010 SWBs is currently under review. Meanwhile, the Ballinglen_020 has been deemed to be 'at risk' of failing to meet its WFD objectives. Bunatrahir Bay has been deemed to be 'not at risk' of failing to meet its WFD objectives.

The Draft 3rd Cycle Blacksod-Broadhaven Catchment Report (EPA, 2021) states that excess nutrients and sediment impacts are the most prevalent issues in this catchment. No significant pressures have been identified to be impacting the Keerglen_010 SWB. The Ballinglen_010 SWB is listed as being under significant pressure from anthropogenic activities. The Draft Catchment Report states that the fish status is driving the Moderate Status in this SWB, with a decline in both salmon and trout numbers. The report states that the exact pressure is unknown, but that siltation is expected to be an issue. In relation to the Ballinglen_020 SWB the Draft Catchment Report states that there is a possible pressure associated with a Wastewater Treatment Plant, although this requires confirmation.

Within the Moy Killala Bay surface water catchment, the Breaghwy_010, Cloonaghmore_040, Cloonaghmore_050 and Cloonaghmore_060 SWBs all achieved 'Good' status in the latest WFD cycle. In the vicinity of Killala Business Park, the Moyne_010 SWB achieved 'Moderate' status. Whilst the Cloonaghmore Estuary remains unassigned with regards WFD status we note that this SWB achieved 'High' status in the 2013-2018 WFD cycle. Further downstream the Killala Bay coastal waterbody is of 'Good' status.

In terms of risk status, the Breaghwy_010, Cloonaghmore_040, Cloonaghmore_050, Cloonaghmore Estuary and the Killala Bay SWBs have all been deemed to be 'not at risk' of failing to meet their respective WFD objectives. Meanwhile, the risk status of the Moyne_010 SWB is currently 'under review'.

The Draft 3rd Cycle Moy Killala Bay Catchment Report (EPA, 2021) states that excess nutrients and morphological impacts remain the most prevalent issues in this catchment. However, no significant pressures have been identified on any of the SWBs downstream of the Proposed Development.

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

Table B: Summary WFD Information for River Water Bodies

SWB	Overall status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3 rd Cycle)	Pressures
Keerglen_010	High	High	Moderate	Not at risk	None
Ballinglen_010	Moderate	Moderate	Poor	At risk	Anthropogenic
Ballinglen_020	Moderate	Good	Moderate	Under Review	(Possible WwTP)
Bunatrahir Bay	Unassigned	Good	Good	Not at risk	None
Breaghwy_010	Good	Good	Good	Not at risk	None
Cloonaghmore_050	Good	Good	Good	Not at risk	None
Cloonaghmore_040	Good	Good	Good	Not at risk	None
Cloonaghmore_060	Unassigned	Good	Good	Not at risk	None
Cloonaghmore Estuary	Unassigned	High	Unassigned	Not at risk	None
Moyne_010	Unassigned	Good	Moderate	Review	None
Killala Bay	Good	Good	Good	Not at risk	None
Western Atlantic Seaboard	Unassigned	High	High	Not at risk	None

2.4 GROUNDWATER BODY IDENTIFICATION

The Dinantian (early) Sandstones, Shales and Limestones of the Downpatrick Formation, which are mapped beneath the majority of the Wind Farm Site are classified by the GSI as a Poor Aquifer – Bedrock which is generally unproductive except for local zones (PI). Meanwhile, the Dinantian Pure Bedded Limestones of the Moyny Point Limestone Member are classified as being a Locally Important Karstified Aquifer. In terms of GWBs the Wind Farm Site is underlain by the Belmullet GWB (IE_WE_G_0057).

The western section of the UEEC is underlain by a Poor Bedrock Aquifer and the Belmullet GWB as described above. Meanwhile, the eastern section is underlain by a Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones (LI). This section of the UEEC is underlain by the Bellacorick-Killala GWB (IE_WE_G_0041) which is characterised by poorly productive bedrock.

2.5 GROUNDWATER BODY CLASSIFICATION

A summary of the WFD status and risk result for GWBs downstream of the Proposed Development are shown in **Table C**. The overall status is based on the quantitative and qualitative status of each GWB. Local GWB status information is available from (www.catchments.ie).

The Belmullet and the Bellacorick-Killala GWBs both achieved "Good" status in all 3 no WFD cycles (2010-2015, 2013-2018 and 2016-2021). These GWBs have been deemed to be "not at risk" of failing to meet their respective WFD objectives. No significant pressures have been identified to be impacting these GWBs.

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

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3 rd Cycle)	Pressures
Belmullet	Good	Good	Good	Not at risk	None
Bellacorick - Killala	Good	Good	Good	Not at risk	None

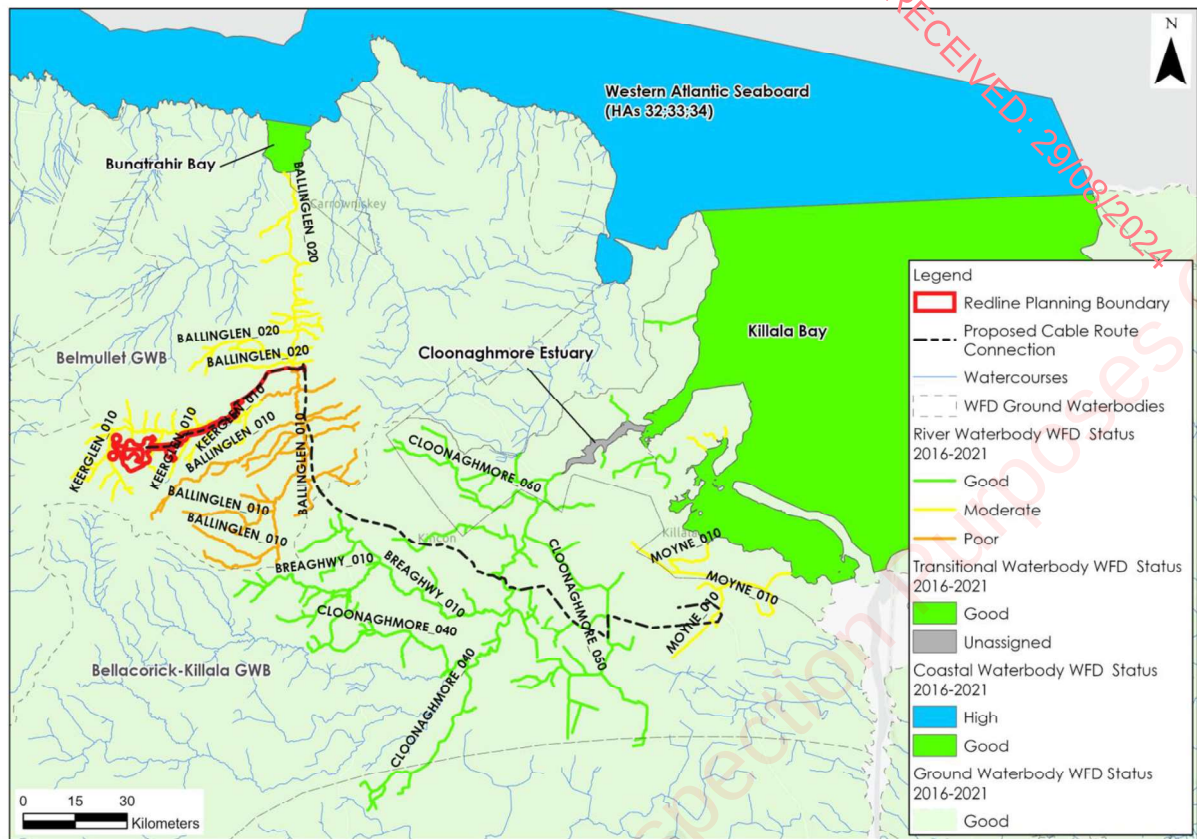


Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021)

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.

Ummerantarry Bog NHA (Site Code: 001570) is located in the west of the Wind Farm Site. This designated site is located to the west of the Fiddauncushaneen stream and the Keerglen River. This NHA is considered of conservation importance as it contains intact upland blanket bog and wet heath and features pool systems, flushes, and undisturbed blanked bog. The site also contains the Breeding Golden Plover, a species listed in the Irish Red Data Book. The site was originally part of an extensive upland bog habitats which has largely been destroyed by peat cutting and afforestation. Elevations within this designated site range from 140m to 230m.

The Glenamoy Bog Complex SAC (Site Code: 000500) is located ~1km northeast of the Wind Farm Site. This SAC is of ecological importance due to a number of E.U. Annex I habitats, including two priority habitats – blanket bog and machair. The site also supports populations of Habitats Directive listed plant and animal species. The SAC stands at a significant elevation above the Ballinglen River (~149m). Surface and groundwater will flow from the SAC towards the Ballinglen River. Therefore, the SAC has no potential to be affected by the Proposed Development.

Other designated sites within 5km of the Wind Farm Site include:

- Bellacorick Bog Complex SAC/pNHA (Site Code: 001922), located ~3.5km to the south. This designated site is not located in the same sub-catchment as the Wind Farm Site.
- Inagh Bog NHA (Site Code: 002391), located ~3.5km to the northwest. This designated site is not located in the same sub-catchment as the Wind Farm Site.
- Glenamoy Bog Complex pNHA (Site Code: 00500), located ~4.5km to the northwest. While located in the same surface water sub-catchment, no hydrological linkages exist between the wind farm site and the pNHA.

In terms of the UEEC, the Killala Bay/Moy Estuary SPA (Site Code: 004036), SAC/pNHA (Site Code: 000458) exist downstream along the Cloonaghmore River and the Moyne_010 SWBs. Furthermore, the Killala Esker pNHA (Site Code: 001517) is located ~700m north of Killala Business Park and Tawnaghmore 110kV substation.

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 Wind Farm Site/UEEC. The closest designated bathing waters are located at Ross beach in Killala and at Enniscrone

Beach in Co. Sligo (IEWEWC420_0000_0100). These bathing waters are situated within the Killala Bay coastal waterbody.

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.

According to the Draft 3rd Cycle Blacksod-Broadhaven Catchment Report (EPA, 2021) there are no NSAs in this catchment.

According to the Draft 3rd Cycle Moy Killala Bay Catchment Report (EPA, 2021) there are two NSAs in this catchment. However, there are no NSAs downstream of the Proposed Development.

The nearest NSA is the Clydagh River NSA (IERI_WE_1994_0003b) located ~35km southeast of the Proposed Development. This NSA is not located within the same sub-catchment as the Proposed Development. Therefore, no hydrological linkage exists and there is no potential for the Proposed Development to impact this NSA.

2.6.4 Shellfish Area

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 designated shellfish areas located in the vicinity or downstream of the Wind Farm Site.

Killala Bay (IE_WE_420_0000) is the nearest designated shellfish area and this is located downstream of the UEEC within the Killala Bay coastal waterbody.

2.6.5 Drinking Water

There are no DWPA's located in the vicinity or downstream of the Wind Farm Site or UEEC.

The Proposed Development is ~9km northwest of Lough Conn DWPA (IEPA1_WE_34_406b), which is the nearest DWPA. The DWPA has no direct hydrological linkage to the Proposed Development.

Meanwhile, all GWBs within the catchment are listed as DWPAs. However, the GSI do not map the presence of any National Federation registered Group Water Schemes (GWS) or Public Water Schemes (PWS) or an associated Source Protection Area (SPA) within the Wind Farm Site, in the surrounding lands or in the vicinity of the UEEC (www.gsi.ie).

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 3 no. river water bodies, 1 no. transitional waterbody and 1 no. coastal waterbody that are located in the vicinity or downstream of the Wind Farm Site. Meanwhile, there are an additional 5 no. river waterbodies, 1 no. transitional waterbody and 1 no. coastal waterbody downstream of the UEEC. In terms of GWBs, there are 2 no. GWBs underlying the Proposed Development site. Furthermore, there are several protected areas in the vicinity and downstream of the Proposed Development site.

3.1 SURFACE WATER BODIES

With consideration for the construction, operational and decommissioning phases of the Proposed Development, it is considered that due to their proximal location to the Wind Farm Site that the Keerglen_010, Ballinglen_010 and Ballinglen_020 SWBs are carried through into the WFD Compliance Assessment. These SWBs have been screened in due to their close proximity to the Proposed Development site and the occurrence of proposed infrastructure and within these WFD river sub-basins. The Keerglen_010 SWB also has a relatively small catchment area, making it susceptible to potential water quality impacts associated with the Proposed Development. The Proposed Development 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.

Along the UEEC, the Breaghwy_010, Cloonaghmore_040, Cloonaghmore_050 and Moyne_010 SWBs have been carried through into the WFD Compliance Assessment. These SWBs have been screened in due to their close proximity to the UEEC and the occurrence of proposed UEEC works within these WFD river sub-basins. The Proposed Development 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 Cloonaghmore_060 SWB has been screened out of the WFD Compliance Assessment due to the large volumes of water within this SWB and the absence of any works within this WFD river sub-basin. Furthermore, the works upstream of this SWB along the UEEC are minor and transient in nature. 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.

Meanwhile, the Cloonaghmore Estuary and the Bunatrahair Bay transitional SWBs and the Killala Bay and Western Atlantic Seaboard have been screened out due to their distant location from the Proposed Development, the large volumes of water within these SWBs and the saline nature of these waters. The Proposed Development 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.

We note that the Cloonaghmore Estuary is currently unassigned with regards to its WFD status. However, irrespective of its condition, due to the small-scale and transient nature of the proposed works along the UEEC and the large volumes of water within the estuary, the Proposed Development does not cause a deterioration in the status of this SWB or prevent this SWB from achieving 'Good' status in the future.

3.2 GROUNDWATER BODIES

All GWBs underlying the Proposed Development site (i.e the Belmullet GWB and Bellacorick-Killala GWB) have been screened in due to their location directly underlying the Proposed Development. The Proposed Development works must not in any way result in a deterioration

in the status of this GWB and/or prevent it from meeting the biological and chemical characteristics for 'Good' status in the future.

3.3 PROTECTED AREAS

Ummerantarry Bog NHA: The Ummerantarry Bog NHA is located to the west of the Wind Farm Site and to the west of the Keerglen River and the Fiddauncushaneen stream. The NHA is of considerable conservation significance, as it contains intact upland blanket bog and wet heath and features pool systems, flushes, and undisturbed blanket bog.

However, all of the Proposed Development infrastructure is located to the east of the Keerglen River and the Fiddauncushaneen stream. The characteristics of the local hydrological/hydrogeological regime, detailed below, ensure that there is no potential for effects on this designated site:

- The area of the Wind Farm Site adjacent to the NHA is underlain by an aquifer of low permeability;
- Groundwater flowpaths are therefore typically very short (~300m maximum) and follow surface topography;
- Consequently, the groundwater flows in the Wind Farm Site will discharge into the Keerglen River and its tributaries;
- The Keerglen River and the Fiddauncushaneen stream act as a hydrological barrier between the Proposed Development infrastructure and the Ummerantarry Bog NHA (no surface water connections exist between the proposed infrastructure locations and the NHA);
- 2 no. piezometer transects were inserted between the NHA and the nearest proposed turbine locations. Groundwater level monitoring in the installed piezometers over a period of 12 months found that groundwater flows downslope and discharges into the Keerglen River.

Therefore, based on our hydrogeological assessment of the Wind Farm Site, we can robustly say the potential to effect Ummerantarry Bog NHA is negligible.

Killala Bay/Moy Estuary SPA/SAC/pNHA: The Killala Bay/Moy Estuary SPA/SAC/pNHA is hydrologically connected to the UEEC via the Cloonaghmore River and the Moyne stream. Therefore, this designated site will be carried through into the WFD Compliance Assessment.

Glenamoy Bog Complex SAC: The Glenamoy Bog Complex SAC is located approximately 1km northeast of the Wind Farm Site. While located in the same surface water sub-catchment, no hydrological linkages exist between the Wind Farm Site and this SAC. The SAC stands at a significant elevation above the Ballinglen River (~149m). Surface and groundwater will flow from the SAC towards the Ballinglen River. Therefore, there is no potential for the Proposed Development to affect the status of this SAC/pNHA.

Bellacorick Bog Complex SAC/pNHA: The Bellacorick Bog Complex SAC/pNHA is located ~3.5km south of the Wind Farm Site. This SAC/pNHA is located in the Cloonaghmore River sub-catchment and therefore has no potential to be affected by the works at the proposed Wind Farm Site. Furthermore, this SAC/pNHA is located in the upstream of the proposed UEEC. Therefore, there is no potential for the Proposed Development to affect the status of this SAC/pNHA.

Inagh Bog NHA: Inagh Bog NHA is located ~3.5km to the northwest of the Wind Farm Site. This NHA is located in a separate river sub-catchment from the Proposed Development. Therefore, there is no potential for the Proposed Development to affect the status of this NHA.

Glenamoy Complex pNHA: The Glenamoy Complex pNHA is located ~4.5km to the northwest of the Wind Farm Site. While located in the same surface water sub-catchment, no

hydrological linkages exist between the wind farm site and this pNHA. Therefore, there is no potential for the Proposed Development to affect the status of this pNHA.

Killala Esker pNHA: This designated site is located in close proximity to the eastern section of the UEEC and the existing Tawnaghmore 100kV substation. However, this pNHA is recognised for geological reasons and has no water dependent qualifying interests. Therefore, there is no potential for the Proposed Development to affect the status of this pNHA in terms of WFD Compliance.

Clydagh River NSA: The Clydagh River NSA has been screened out due to its distant location (~35km) from the Proposed Development. The Proposed Development has no potential to cause a deterioration in the status of this NSA.

Lough Conn DWPA: The Lough Conn DWPA has been screened out due to its distant location (~16km) from the Wind Farm Site. The Proposed Development has no potential to cause a deterioration in the status of this DWPA.

Enniscrone Bathing Waters: The bathing waters at Enniscrone Beach have been screened out due to its distant location from the Proposed Development. These bathing waters are located within the Killala Bay coastal waterbody and due to the large volumes of water within this coastal waterbody and the saline nature of these waters, the Proposed Development has no potential to cause a deterioration to this bathing area.

Killala Bay Shellfish Waters: The shellfish waters in Killala Bay have been screened out due to the large volumes of water within this coastal waterbody and the small-scale nature of the proposed works along the UEEC. The Proposed Development has no potential to cause a deterioration in the status of these designated shellfish waters.

3.4 WFD SCREENING SUMMARY

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

Table D: Screening of WFD Waterbodies and Protected Areas

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Bodies				
Surface Water Body	River	Keerglen_010	Yes	The vast majority of the Wind Farm Site, including all proposed turbines, construction compounds, the on-site substation and the proposed borrow pit, is located within the Keerglen_010 river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Development on this waterbody.
	River	Ballingen_010	Yes	The Ballingen_010 SWB is located directly downstream of the Keerglen_010 SWB. Furthermore, the majority of the access road along the L51723 is located within this river sub-basin. The UEEC including 4 no. crossings over EPA mapped watercourses is also located within this river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Development on this waterbody.
	River	Ballingen_020	Yes	The Ballingen_020 SWB is located directly downstream of the Ballingen_010 SWB and in close proximity to the Wind Farm Site. The proposed temporary access junction and roadway between the R315 and the L51723 is located in this river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Development on this waterbody.
	River	Breaghwy_010	Yes	Approximately 2km of the UEEC is located within the Breaghwy_010 river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Development on this waterbody.
	River	Cloonaghmore_050	Yes	Approximately 6.7km of the UEEC, including a total of 3 no. crossings over EPA mapped watercourses, is mapped in the Cloonaghmore_050 river sub-basin. Therefore, an assessment is required to consider the potential effects of the Proposed Development on this waterbody.
	River	Cloonaghmore_040	Yes	Approximately 2.1km of the UEEC is located within the Cloonaghmore_060 sub-basin which includes works in close proximity to EPA mapped watercourses. Therefore, an assessment is required to consider the potential effects of the Proposed Development on this waterbody.
	River	Cloonaghmore_060	No	The Cloonaghmore_060 SWB lies downstream of the Cloonaghmore_050 SWB. However, due to the small scale and transient nature of the works associated with the UEEC combined with the large volumes of water within the Cloonaghmore River at this location, there is no potential for effects. Therefore, this waterbody is screened out of the WFD Compliance Assessment.
	River	Moyne_010	Yes	Approximately 2.5km of the UEEC is located in the Moyne_010 sub-basin, including 3 no. crossings over EPA mapped watercourses. Therefore, an assessment is required to consider the potential effects of the Proposed Development on this waterbody.
	Transitional	Bunatrahir Bay	No	The Bunatrahir Bay SWB has been screened out due to the large volumes of water within the waterbody and the saline nature of its waters. The Proposed Development has no potential to effect the status of this SWB.
	Transitional	Cloonaghmore Estuary	No	The Bunatrahir Bay SWB has been screened out due to the large volumes of water within the waterbody and the saline nature of its waters. The Proposed Development has no potential to effect the status of this SWB.

	Coastal	Western Atlantic Seaboard	No	The Western Atlantic Seaboard SWB has been screened out due its distant location, the large volume of water within this waterbody and the saline nature of its waters. The Proposed Development has no potential to effect the status of this SWB.
	Coastal	Killala Bay	No	The Killala Bay SWB has been screened out due its distant location, the large volume of water within the waterbody and the saline nature of its waters. The Proposed Development has no potential to effect the status of this SWB.
Groundwater Bodies				
Groundwater Body	Groundwater	Belmullet	Yes	The Wind Farm Site including all key Proposed Development infrastructure is underlain by the Belmullet GWB. An assessment is required to consider potential effects of the Proposed Development to this GWB.
	Groundwater	Bellacorick - Killala	Yes	The Bellacorick-Killala GWB underlies the eastern section of the UEEC. Therefore, an assessment is required to consider potential effects of the Proposed Development to this GWB.
Protected Areas				
Protected Areas	Nature Conservation Designations	Ummerantary Bog NHA	No	Ummerantary Bog NHA is located to the west of the Wind Farm site. However, this NHA is also located to the west of the Keerglen River which acts as a hydrological barrier between the Proposed Development and the NHA. Due to the local hydrogeological regime, the Proposed Development has no potential to affect the status of this designated site.
		Glenamoy Bog Complex SAC	No	The Glenamoy Bog Complex SAC is located ~1km northeast of the Wind Farm Site. The SAC stands at a significant elevation above the Ballinglen River (~149m). Surface and groundwater will flow from the SAC towards the Ballinglen River. Therefore, the SAC has no potential to be affected by the Proposed Development.
		Bellacorick Bog Complex SAC and pNHA	No	The Bellacorick Bog Complex SAC and pNHA are mapped within a different sub-catchment to the Wind Farm Site. Furthermore, this SAC/pNHA is located upstream of the UEEC. Therefore, no hydrological or hydrogeological effects will occur on this designated site.
		Inagh Bog NHA	No	The Inagh Bog NHA is mapped within a different sub-catchment to the Wind Farm Site. Therefore, no hydrological or hydrogeological effects will occur on this designated site.
		Glenamoy Bog Complex pNHA	No	There are no hydrological linkages between the Wind Farm Site and the Glenamoy Bog Complex pNHA. Therefore, no hydrological or hydrogeological impacts will occur on this designated site.
		Killala Bay/Moy Estuary SAC/SPA/pNHA	Yes	The Killala Bay/Moy Estuary SPA, SAC/pNHA exists downstream of the UEEC and downstream of the Cloonaghmore River and the Moyne_010 SWBs. Therefore, an assessment is required to consider potential effects of the Proposed Development to this designated site.
		Killala Esker	No	The Killala Esker pNHA has been screened out due to the lack of any water-dependent qualifying interests and the lack of hydrological connections between the Proposed Development and this pNHA. There is no potential for the Proposed Development to effect the status of this pNHA.
	Bathing Waters	Enniscrone Beach	No	The Enniscrone Beach bathing waters have been screened out due to its distant location from the Proposed Development and the large volumes of water associated with the coastal waterbody. The Proposed Development has no potential to effect these Bathing Waters
	Nutrient Sensitive Areas	Clydagh River NSA	No	The Clydagh River NSA has been screened out due to its distant location from the Proposed Development. The Proposed Development has no potential to effect this NSA.
	Shellfish Areas	Killala Bay	No	The Killala Bay shellfish area has been screened out due to its distant location from the Proposed

				Development and the large volumes of water within the Killala Bay coastal waterbody. The Proposed Development has no potential to impact this Shellfish Area.
	Drinking Water Protected Areas	Lough Conn DWPA	No	The Lough Conn DWPA has been screened out due to its distant location (~16km) from the Proposed Development. The Proposed Development has no potential to cause a deterioration in the status of this DWPA.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

The Proposed Development is defined in full in Chapter 3 of the EIAR.

In summary the Proposed Development will comprise of 8 no. wind turbines (Turbine tip height range between 176 and 180m, hub height range between 105 and 112 and rotor diameter range between 133 and 150m) and associated hardstanding areas, 1 no. electricity substation, 1 no. borrow pit, 1 no. temporary construction compound, upgrade of existing roads, construction of new site access roads, road widening and accommodation works along the turbine delivery route, site drainage and all associated works. In addition, this EIAR assessed the proposed UEEC to the existing Tawnaghmore Substation and the installation of 1 no. temporary meteorological mast at the Wind Farm Site (note that these will be subject to separate planning permissions in the future but are assessed in this EIAR).

Due to the nature of wind farm developments (and associated UEECs and TDR works), being near surface construction activities, impacts on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risks to groundwater 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 along with hydrocarbons and cement-based compounds. The Proposed Development may also result in changes to surface water runoff volumes and flow patterns.

There are a number of potential adverse effects to both surface and groundwater.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

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

Construction phase activities including tree felling, site levelling/construction and building turbine foundation excavation, borrow pit excavation, the storage of peat and spoil onsite 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 borrow pit drainage during construction works.

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

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

Some minor clear felling of coniferous forestry plantations is also proposed over 0.005ha. 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 8 no. crossings proposed over mapped watercourses in the Wind Farm Site. There are also several additional crossings over unmapped hydrological features and manmade drains. These works have the potential to result in morphological changes to the Keerglen River and its tributaries.

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

The SWB likely to be most impacted by these activities is the Keerglen_010 SWB. Further downstream, the potential for water quality effects will decrease downstream due to the increasing volumes of water within the Ballinglen River and the minor nature of the works proposed within the Ballinglen_010 and Ballinglen_020 sub-basins.

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

Table E: Potential Surface Water Quality Effects at Wind Farm Site During Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Keerglen_010	IE_WE_33K010200	Moderate	Poor
Ballinglen_010	IE_WE_33B010100	Poor	Poor
Ballinglen_020	IE_WE_33B010200	Moderate	Moderate

4.2.1.2 Potential Surface Water Quality Effects along the UEEC

Based on the WFD mapping, there will be a requirement for 11 no. watercourse crossings over EPA mapped waterbodies along the proposed UEEC (outside of the Wind Farm Site). These are located over existing bridges and culvert crossings.

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

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

Construction activities along the UEEC only have the potential for short term effects due to the minor and transient nature of the works. The limits the potential for the Proposed Development to alter the overall status of a SWB.

A summary of potential status change to SWBs arising from works along the UEEC during the unmitigated construction phase are outlined in **Table F**.

Table F: Potential Surface Water Quality Effects along UEEC During Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Status Change
Ballinglen_010	IE_WE_33B010100	Poor	Poor
Cloonaghmore_040	IE_WE_34C030200	Good	Good
Cloonaghmore_050	IE_WE_34C030270	Good	Good
Breaghwy_010	IE_WE_34B060600	Good	Good
Moyne_010	IE_WE_34M190890	Moderate	Moderate

4.2.1.3 Potential Groundwater Quality/Quantity Effects at Wind Farm Site

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.

In addition, groundwater seepages may occur in turbine base excavations, particularly those on lower elevations and this will create additional volumes of water to be treated by the drainage management system.

Furthermore, temporary dewatering of excavations (turbine bases etc) may drawdown the local groundwater table.

However, due to the low permeability of the bedrock aquifer, the shallow nature of the proposed works, and the scale of the overall Belmullet GWB (1.204km²) there is limited potential for the Proposed Development to alter the overall status of the Belmullet GWB.

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table G**.

Table G: Potential Groundwater Quality Effects at Wind Farm Site During Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Status Change
Belmullet GWB	IE_WE_G_0057	Good	Good

4.2.1.4 Potential Groundwater Quality/Quantity Effects Along the UEEC

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

However, due to the small scale and transient nature of the proposed works along the UEEC, groundwater quality effects are not likely to be significant.

No groundwater level impacts are anticipated from the construction of the underground cabling trench between the proposed turbines and the substation due to the shallow nature of the excavation (i.e. ~1.2m).

A summary of potential status change to GWBs arising from potential groundwater quality effects during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table H**.

Table H: Groundwater Quantity Effects Along the UEEC During Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Status Change	Potential
Belmullet GWB	IE_WE_G_0057	Good	Good	
Bellacorick-Killala GWB	IE_WE_G_0041	Good	Good	

4.2.1.5 Potential Effects on Protected Areas

As detailed in Section 3.3, the only protected area with the potential to be impacted by the Proposed Development is the Killala Bay/Moy Estuary SPA/SAC/pNHA.

The UEEC drains to this designated site via the Cloonaghmore River and the Moyne_010 SWB.

Killala Bay/ Moy Estuary SPA: Killala Bay/Moy Estuary SPA is of high ornithological importance as it supports eight species that have populations of national importance, including a very substantial population of Grey Plover (3.4% of the all-Ireland total). The presence of Red throated Diver, Golden Plover and Bar-tailed Godwit is of particular note as these species are listed on Annex I of the E.U. Birds Directive.

The actual conservation interests of the SPA are listed below:

- A137 Ringed Plover (*Charadrius hiaticula*)
- A140 Golden Plover (*Pluvialis apricaria*)
- A141 Grey Plover (*Pluvialis squatarola*)
- A144 Sanderling (*Calidris alba*)
- A149 Dunlin (*Calidris alpina alpina*)
- A157 Bar-tailed Godwit (*Limosa lapponica*)
- A160 Curlew (*Numenius arquata*)
- A162 Redshank (*Tringa tetanus*)
- A999 Wetlands

A hydrological linkage exists between the UEEC and this SPA. With the requirement for earthworks during the construction phase there is potential for contaminants, mainly suspended solids, to enter the Cloonaghmore River and ultimately the Killala Bay/Moy Estuary SPA.

Therefore, it can be concluded that the Proposed Development may have the potential to affect this SPA in an unmitigated scenario throughout the construction phase.

However, due to the small-scale and transient nature of the proposed works along the UEEC, combined with the large volumes of water with these transitional and coastal waterbodies, the potential for effects is not significant.

Killala Bay / Moy Estuary SAC: Killala Bay and the Moy Estuary are also designated as an SAC (Site Code: 000458) which contains many water-dependent protected habitats and species.

The site is a Special Area of Conservation for the following habitats and species listed on Annex I/II of the E.U. Habitats Directive:

- [1130] Estuaries
- [1140] Tidal Mudflats and Sandflats
- [1210] Annual Vegetation of Drift Lines
- [1230] Vegetated Sea Cliffs
- [1310] Salicornia Mud
- [1330] Atlantic Sea Meadows
- [2110] Embryonic Shifting Dunes
- [2120] Marram Dunes
- [2130] Fixed Dunes
- [2190] Humid Dune Slacks
- [1014] Narrow-mouthed Whorl Snail (*Vertigo angustior*)
- [1095] Sea Lamprey (*Petromyzon marinus*)
- [1365] Common (Harbour) Seal (*Phoca vitulina*)

The UEEC is hydrologically linked with this SAC via the Cloonaghmore River. With the requirement for earthworks during the construction phase there is potential for contaminants, mainly suspended solids, to enter the Cloonaghmore River and ultimately the Killala Bay/Moy Estuary SAC.

Therefore, it can be concluded that the Proposed Development may have the potential to affect this SAC in an unmitigated scenario throughout the construction phase.

However, due to the small-scale and transient nature of the proposed works along the UEEC combined with the large volumes of water with these transitional and coastal waterbodies, the potential for effects is not significant.

4.2.2 Operational Phase (Unmitigated)

Potential effects associated with the operational phase of the Proposed Development 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 or changes in runoff volumes associated with the footprint of the Proposed Development.

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

4.2.2.1 Potential Surface Water Quantity Effects Downstream of Wind Farm Site

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 site and increase flood risk downstream of the development. In reality, the access roads will have a higher permeability than the underlying peat.

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.

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

Table I: Potential Surface Water Quantity Effects Downstream of the Wind Farm Site During Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Status Change	Potential
Keerglen_010	IE_WE_33K010200	Moderate	Poor	
Ballinglen_010	IE_WE_33B010100	Poor	Poor	
Ballinglen_020	IE_WE_33B010200	Moderate	Poor	

4.2.2.2 Potential Surface Water Quality Effects at Wind Farm Site

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.

There will be no surface water quality effects along the UEEC.

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

Table J: Potential Surface Water Quality Effects at Wind Farm Site During Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Status Change	Potential
Keerglen_010	IE_WE_33K010200	Moderate	Moderate	
Ballinglen_010	IE_WE_33B010100	Poor	Poor	
Ballinglen_020	IE_WE_33B010200	Moderate	Moderate	

4.2.2.3 Potential Groundwater Quality Effects at 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 Wind Farm site with only minor maintenance required during the operational phase.

There will be no groundwater quality impacts along the proposed UEEC.

A summary of potential status change to GWBs arising from groundwater quality impacts during the operation phase of the Proposed Development in the unmitigated scenario are outlined in **Table K**.

Table K: Groundwater Quality Effects at Wind Farm Site During Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Status	Potential Status Change
Belmullet GWB	IE_WE_G_0057	Good	Good	

4.2.2.4 Potential Groundwater Quantity Effects at Wind Farm Site

It is proposed to install a groundwater well adjacent to the substation in accordance with the Institute of Geologists Ireland, Guide for Drilling Wells for Private Water Supplies (IGI, 2007).

The proposed groundwater well and associated extraction has the potential to effect local groundwater levels in the surrounding lands.

The abstraction rate for the proposed groundwater well at the substation will be comparable to a domestic well, with a well supplying a single household typically abstracting less than 1m³/day. The well is proposed in a Poor Bedrock Aquifer. This aquifer forms part of the Belmullet GWB which is composed primarily of low transmissivity rocks. Most groundwater flow will occur in the uppermost broken and weathered part of the aquifer and in the vicinity of fault zones. Therefore due to the nature of the bedrock aquifer and the proposed extraction rate, no effects on the quantitative status of the underlying GWB will occur.

A summary of potential status change to GWBs arising from groundwater quality impacts during the operation phase of the Proposed Development in the unmitigated scenario are outlined in **Table L**.

Table L: Groundwater Quality Effects at Wind Farm Site During Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Status	Potential Status Change
Belmullet GWB	IE_WE_G_0057	Good	Good	

4.2.2.5 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.

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

4.3 MITIGATION MEASURES

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

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Protect Surface Water Quality During Earthworks

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

During the construction phase of the Proposed Development, excavations will be limited to minimise the generation of peat and spoil. Sediment will be generated where excavations are required (turbine foundations) and dirty water from these work areas will be routed via drains to settlement ponds for treatment and removal of suspended solids prior to release into the existing drainage network. There will be no direct or untreated discharge from construction work areas into the existing drainage network.

Finally, regular inspection and maintenance for the on-site drainage system will be completed regularly during the construction phase. This will be of particular importance following periods of heavy rainfall to check for blockages in any drains and any excess build-up of silt within settlement ponds which will decrease the effectiveness of the drainage system unless removed.

Table M: Summary of Drainage Mitigation & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	- Application of 50m buffer zones to natural watercourses where possible; - Using small working areas; - Working in appropriate weather and suspending certain work activities in advance of forecasted wet weather.	Construction work areas where sediment is being generated.
Source Controls:	Use of upstream interceptor drains and downstream collector drains, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment is being generated.
	- Using small working areas; - Covering stockpiles; - Weathering off / sealing stockpiles and promoting vegetation growth.	Stockpiles areas
In-Line Controls:	- Interceptor drains, vee-drains, oversized swales/collector drains; - Erosion and velocity control measures such as: - sand bags; - oyster bags filled with gravel; - filter fabrics; - straw bales; - flow limiters; - weirs or baffles; - and/or other similar/equivalent or appropriate systems. - Silt fences, filter fabrics; - Collection sumps, temporary sumps, pumping systems; - Attenuation lagoons; - Sediment traps, stilling / settlement ponds.	Interceptor and collection drainage systems
Water Treatment Controls:	- Temporary sumps; - Attenuation ponds; - Temporary storage lagoons; - Sediment traps, Stilling / Settlement ponds, silt bags; - Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.	Surface water treatment locations
Outfall Controls:	- Levelspreaders; - Buffered outfalls; - Vegetation filters; - Silt bags; - Flow limiters and weirs.	Drainage run outfalls and overland discharge points

Each element of the Proposed Development (i.e., access roads, turbines, and peat storage areas) 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).

Where works are proposed within the delineated hydrological buffer zone, the following additional mitigation measures will be implemented to ensure there are no effects on surface water quality:

- Double or triple silt fences will be placed downgradient of all work locations within the hydrological buffer zones.
- All works will be completed during the dry summer months and works will be postponed in the event of rainfall.

4.3.1.2 Mitigation Measures to Protect Against Release of Hydrocarbons

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:

- All plant will be inspected and certified to ensure that they are leak free and in good working order prior to use at the site;
- 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 off site and will be towed around the site by a 4x4 jeep to where machinery is located.
 - The 4x4 jeep will also carry 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;
- Onsite refuelling will be carried out by trained personnel only;
- A permit to fuel system will be put in place;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- All fuel storage areas will be bunded appropriately for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The electrical control building (at the onsite substation) will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose;
- An emergency plan for the construction phase to deal with accidental spillages is included within the Construction and Environmental Management Plan; and,
- Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

4.3.1.3 Mitigation Measures to Prevent Release of Wastewater

The best practice methods for wastewater management at the proposed on-site construction compound during the construction phase include:

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at each of the site construction compounds, 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 from the site to be discharged at a suitable off-site treatment location; and,
- No water or wastewater will be sourced on the site, nor discharged to the Proposed Development Site.

4.3.1.4 Mitigation Measures to Prevent Release of Cement-Based Products

Best practice methods for cement-based compounds includes:

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

4.3.1.5 Mitigation Measures for Clear Felling

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

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" will be adhered to during felling operations. The setback distance from sensitive hydrological features means that adequate room is maintained for the proposed mitigation measures (discussed below) to be properly installed and operate effectively.

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

- Machine combinations will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance. The harvester and the forwarder are designed specifically for the forest environment and are low ground pressure machines;
- All machinery will be operated by suitably qualified personnel;
- Checking and maintenance of roads and culverts will be on-going through any felling operations. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- These machines will traverse the site along specified off-road routes (referred to as racks);
- The location of racks will be chosen to avoid wet and potentially sensitive areas;
- Brash mats will be placed on the racks to support the vehicles on soft ground, reducing peat and mineral soil disturbance and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Silt fences will be installed at the outfalls of existing drains downstream of felling areas. No direct discharge of such drains to watercourses will occur. Sediment traps and silt fences will be installed in advance of any felling works and will provide surface water

settlement for runoff from work areas and will prevent sediment from entering downstream watercourses. Accumulated sediment will be carefully disposed of at pre-selected peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;

- In areas particularly sensitive to erosion it will be necessary to install double or triple sediment traps and increase buffer zone width. These measures will be reviewed on site during construction;
- Double silt fencing will also be put down slope of felling areas which are located in close proximity to streams and/or relevant watercourses;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded;
- Timber will be stacked in dry areas, and outside watercourse buffer zones. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water runoff;
- Refuelling or maintenance of machinery will not occur within 50m of an aquatic zone or within 20m of any other hydrological feature. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; and,
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

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

4.3.1.6 Mitigation Measures to Prevent Morphological Changes to Surface Watercourses within the Wind Farm Site

The Proposed Development design has been optimised to utilise the existing infrastructure (i.e. existing site roads) where practicable. 2 no. crossings are located at existing bridges and culverts, with 1 no. crossing proposed for upgrade to the southwest of T04 and no works proposed at Ballingen Bridge. This design prevents additional unnecessary disturbance at these locations.

The new proposed crossing over the Keerglen River will involve the construction a new clear span bridge and will result in no disturbance to the existing river channel. All other watercourse crossings will be completed via piped or box culverts. Mitigation measures for the upgrade of the existing crossing and the new proposed crossing are detailed below:

- All proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing location;
- Section 50 consent (Arterial Drainage Act, 1945) will be required for the new crossings. The Section 50 requirement will determine final pipe culvert dimensions, but will allow for a minimum 300mm embed of the pipe below the existing bed level, plus sufficient freeboard. The dimensions and design of the clear span bridge over the Keerglen River accompany this planning application;
- IFI will be provided with a copy of the finalised pipe crossing dimensions and construction method statements. If the channels are not fully dried out during the construction period, a water management technique will be employed (dam and pump over or temporary piping) to dry out the construction reach. Any additional measures stipulated by IFI will be incorporated into the final design and construction method statement for the proposed crossing;
- Instream construction will be carried out in the period July to September inclusive. This is a conservative working window that will help ensure construction occurs during very

low or no flow and will minimise the risk of entrainment of suspended sediment in surface water runoff to the Keerglen tributary of the Ballinglen River; and,

- During the near-stream construction work, double row silt fences will be placed immediately down-gradient of the construction areas for the duration of the construction phase. There will be no batching or storage of cement allowed on-site. The bottom edge of geotextile silt fence material will be installed to a 200mm embed below ground level. Stakes will be placed at the ends, on any bends, and at 2m intervals along the silt fence. Stakes will be driven a minimum of 400mm to provide adequate support. The silt fence will have a tensioned wire backing - a minimum of 2 lines of wire run along the stakes. The top wire is used to clip the geotextile onto to hold it up and provide strength against trapped sediment. Silt fences will be checked and maintained weekly at minimum, and always before any forecasted heavy rain event.

Furthermore, with regard to the new proposed clear-span bridge crossing along the Keerglen River, the bridge design has been assessed using flood modelling. The baseline 100-year flood plus climate change flood level at the proposed bridge crossing was modelled as being 117.76mOD. The model was rerun to consider the potential effects of the bridge design and found that with a 300mm freeboard above 117.76mOD as per OPW Section 50 guidance, the flood level remains at 117.76mOD. With this clear-span design, there will be no issues with scour as the river channel will not be blocked or altered in any way.

4.3.1.7 Mitigation Measures to Prevent Morphological Changes to Surface Watercourses along the UEEC

Prior to the commencement of cable trenching or crossing works the following key temporary drainage measures will be installed:

- All existing roadside drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Culverts, manholes and other drainage inlets will also be temporarily blocked;
- A double silt fence perimeter will be placed along the road verge on the down-slope side of works areas that are located inside the watercourse 50m buffer zone.
- No stockpiling of construction materials will take place along the UEEC;
- No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works will not take place at periods of high rainfall, and will be scaled back or suspended if heavy rain is forecast;
- Local road drainage, culverts and manholes will be temporarily blocked during the works;
- Machinery deliveries will be arranged using existing structures along the public road;
- All machinery operations will take place away from the stream and ditch banks, apart from where crossings occur. Although no instream works are proposed or will occur;
- Any excess construction material will be immediately removed from the area and sent to a licenced waste facility;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits will be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

Horizontal directional drilling (HDD) will be used at the existing bridge crossings along the UEEC. The following mitigation measures will be implemented:

- Although no in-stream works are proposed, the HDD works will only be done over a dry period between July and September (as required by IFI for in-stream works) to avoid the salmon spawning season and to have more favourable (drier) ground conditions;

- The crossing works area will be clearly marked out with fencing or flagging tape to avoid unnecessary disturbance;
- There will be no storage of material / equipment or overnight parking of machinery inside the 15m buffer zone;
- Before any ground works are undertaken, double silt fencing will be placed upslope of the watercourse channel along the 15m buffer zone boundary;
- Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions / channels that slope towards the watercourse;
- Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered;
- The area around the bentonite batching, pumping and recycling plant will be bunded using terram (as it will clog) and sandbags in order to contain any spillages;
- Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area;
- Spills of drilling fluid will be clean up immediately and stored in an adequately sized skip before been taken off-site;
- If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e. soil and subsoil exposures created during site preparation works);
- This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed percolation area at least 50m from the watercourse;
- The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water. The entire percolation area will be enclosed by a perimeter of double silt fencing;
- Any sediment laden water from the works area will not be discharged directly to a watercourse or drain;
- Works shall not take place during periods of heavy rainfall and will be scaled back or suspended if heavy rain is forecasted;
- Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied;
- On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated and re-seeded at the soonest opportunity to prevent soil erosion;
- The silt fencing upslope of the river will be left in place and maintained until the disturbed ground has re-vegetated;
- There will be no batching or storage of cement allowed at the watercourse crossing;
- There will be no refuelling allowed within 100m of the watercourse crossing; and,
- All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing.

Fracture Blow-out (Frac-out) Prevention and Contingency Plan:

- 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;
- One or more lines 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.

4.3.1.8 Mitigation Measures to Water Quality During Excavation Dewatering

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

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work should immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction sites. They will be used as a final line of defence if needed.

4.3.1.9 Mitigation Measures for Protected Areas

The potential for material to enter the downstream protected areas is negligible 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 Development, the potential to affect the qualifying interests of downstream 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 Development will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where

suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;

- Swales/road-side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds have been designed in consideration of the greenfield runoff rate.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

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

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlines in **Section 4.3.1.2** 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.

4.3.2.4 Mitigation Measures to Protect Groundwater Quantity

No specific mitigation measures are required due to the small proposed abstraction volume (1m³/day) and the low permeability nature of the bedrock aquifer.

4.3.2.5 Mitigation Measures for Protected Area's

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

Mitigation measures for oils and fuels during the operational phase of the Proposed Development are the same as those outlines in **Section 4.3.1.2** above.

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

4.3.1 Decommissioning Phase

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

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

The wind farm site roadways will be kept and maintained following decommissioning of the wind farm infrastructure, as these will be utilised by ongoing forestry works and by other participating landowners.

The electrical cabling connecting the site infrastructure to the on-site substation will be removed, while the ducting itself will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

The turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported off-site along their original delivery route. The disassembly and removal of the turbines will not have an impact on the hydrological/hydrogeological environment at the wind farm site.

Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site. Similar mitigation as outlined in **Section 4.3.1.1** and **4.3.1.2** for the construction phase will be implemented during the decommissioning phase to ensure no impacts of receiving waters.

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

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

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 N** below.

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

SWB	WFD Code	Current Status	Assessed Potential Status Change (Unmitigated Scenario)	Assessed Status – with Mitigation Measures
Keerglen_010	IE_WE_33K010200	Moderate	Poor	Moderate
Ballinglen_010	IE_WE_33B010100	Poor	Poor	Poor
Ballinglen_020	IE_WE_33B010200	Moderate	Moderate	Moderate
Cloonaghmore_040	IE_WE_34C030200	Good	Good	Good
Cloonaghmore_050	IE_WE_34C030270	Good	Good	Good
Breaghwy_010	IE_WE_34B060600	Good	Good	Good
Moyne_010	IE_WE_34M190890	Moderate	Moderate	Moderate
Belmullet GWB	IE_WE_G_0057	Good	Good	Good
Bellacorick-Killala GWB	IE_WE_G_0041	Good	Good	Good

5. SUMMARY AND CONCLUSION

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

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

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

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

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Proposed Development. 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.

Furthermore, mitigation measures during the construction, operation and decommissioning phases of the Proposed Development will ensure that there will be no significant effects on any of the protected areas in the vicinity of the Proposed Development including the Lackan Killala Bay / Moy Estuary SPA, SAC and pNHA.

As such, the Proposed Development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in Section 7.1.3 of EIAR Chapter 7).

* * * * *

RECEIVED: 29/08/2024

© **HYDRO-ENVIRONMENTAL SERVICES**

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

www.hydroenvironmental.ie

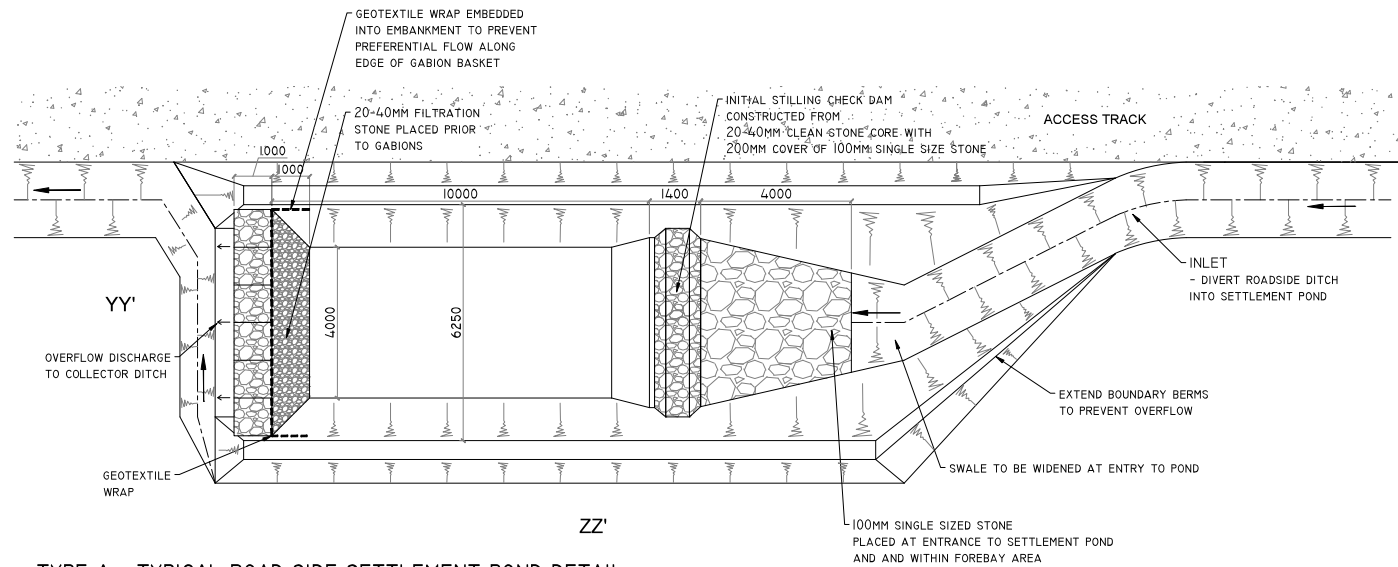
RECEIVED: 29/08/2024

Appendix 7.5a

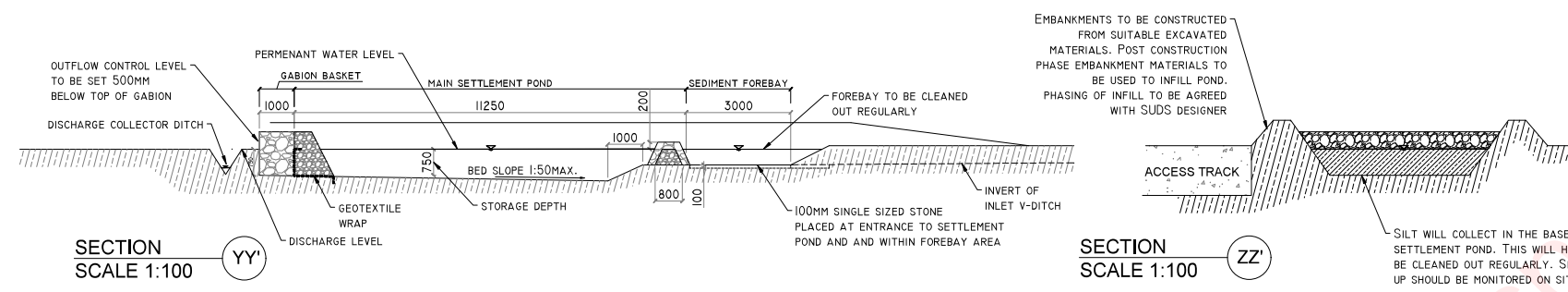
Detailed Drainage Drawing No. D501

Keerglen Wind Farm

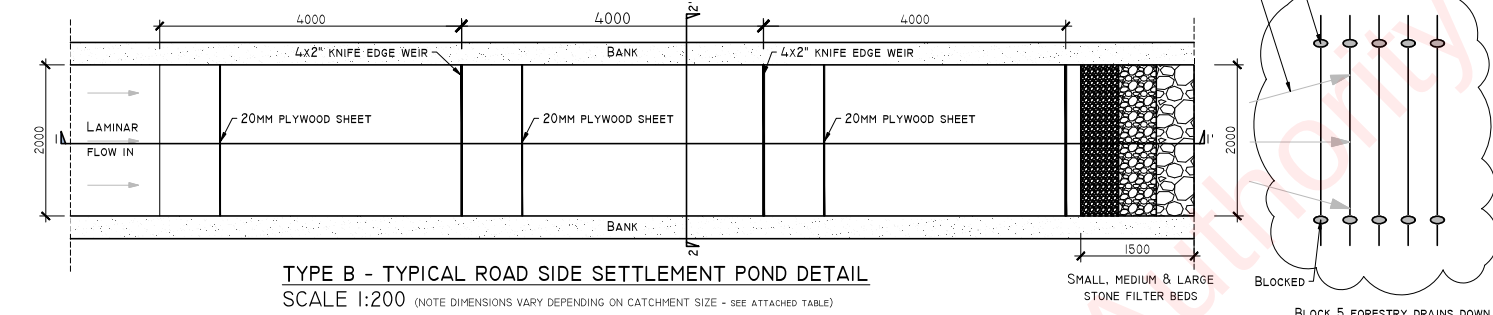
Mayo Planning Authority - Inspection Purposes Only



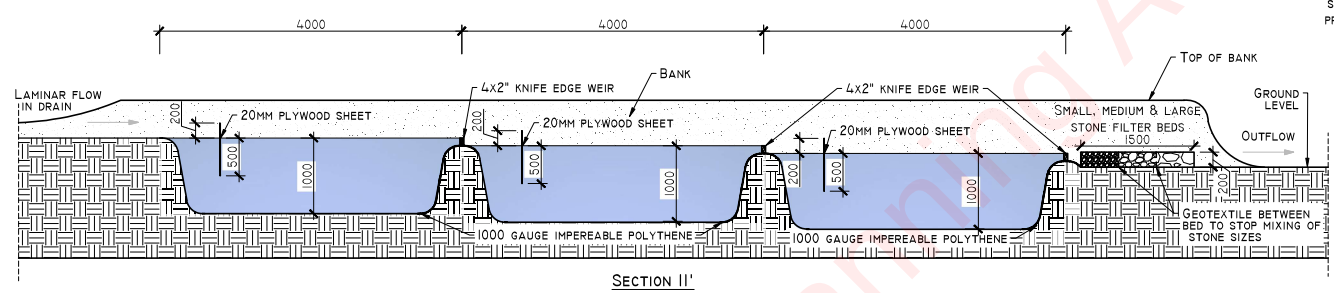
TYPE A - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)



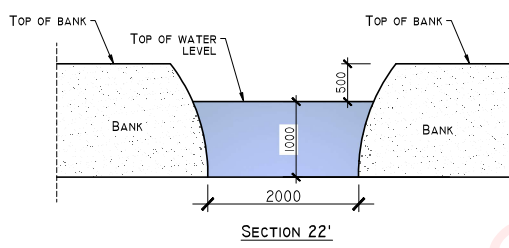
DETAIL A2



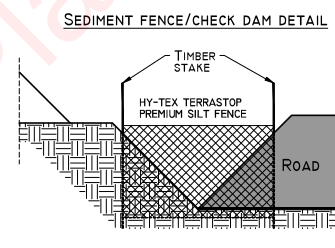
TYPE B - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)



SECTION II'



SECTION 22'

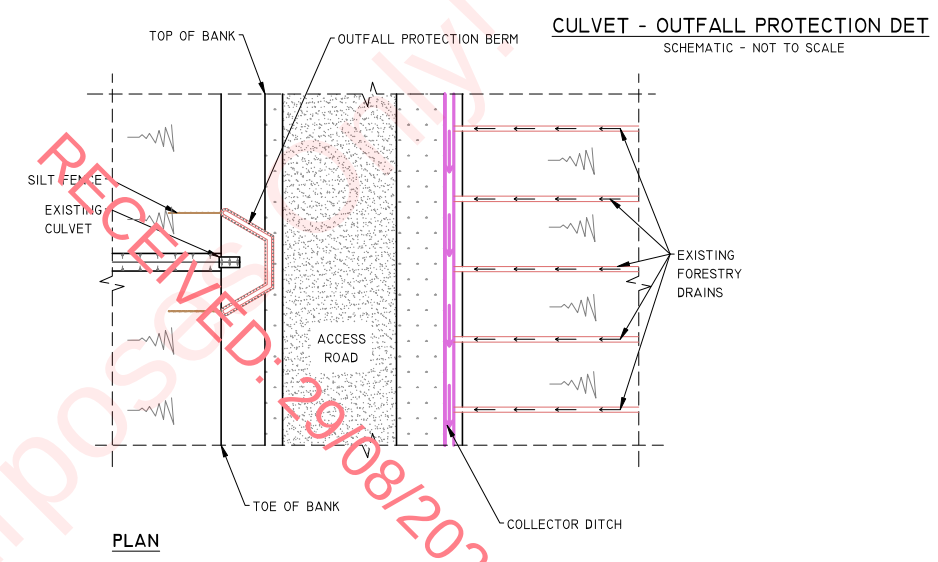


SEDIMENT FENCE/CHECK DAM DETAIL

POND SIZE W [m] x L [m] x D [m]			TRACK/HARDSTAND CATCHMENT SIZE (M²)		
RETURN PERIOD	10 YRS	STORM DURATION	500	1000	2000
6HR RETENTION FOR COARSE SILT	6 HRS	2.75 x 8.5 x 1 m	4 x 13.25 x 1 m	6.5 x 22 x 1 m	
11HR RETENTION FOR MEDIUM SILT	12 HRS	4.0 x 12.0 x 1 m	5.75 x 18.5 x 1 m	9.75 x 29.0 x 1 m	
24HR RETENTION FOR FINE SILT	24 HRS	5.5 x 16 x 1 m	8.25 x 25.75 x 1 m	14 x 42 x 1 m	

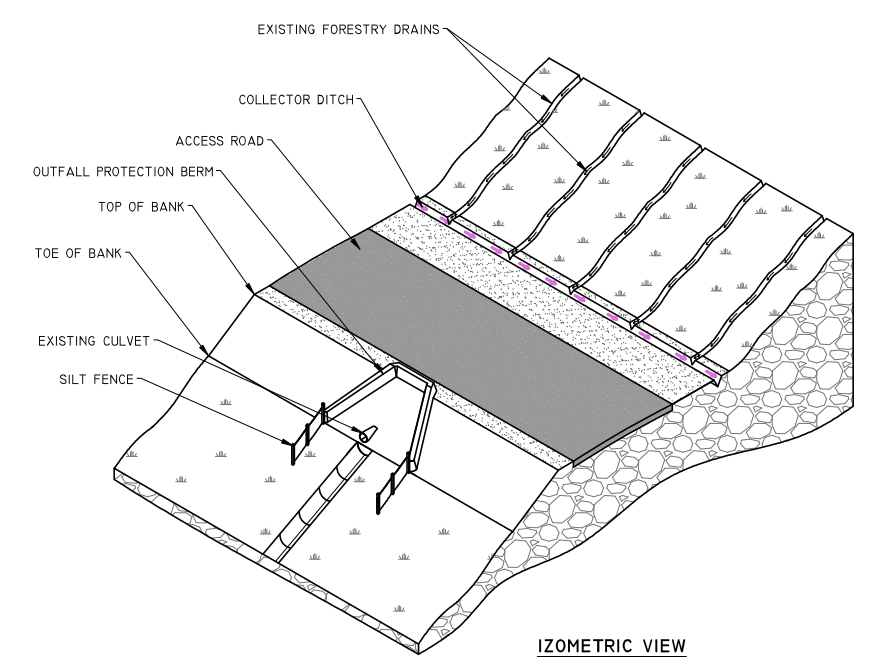
DETAIL A1

DETAIL B

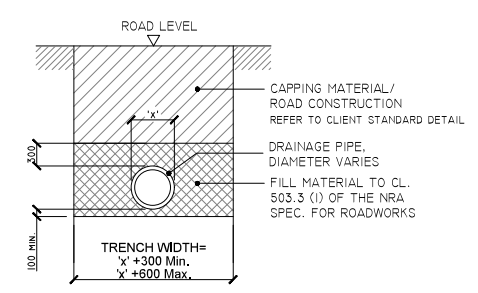


PLAN

DETAIL B1



IZOMETRIC VIEW



'TYPE B' CULVERT - DRAINAGE CROSSING BENEATH EXCAVATED ROAD
SCALE 1:50

PROJECT DESIGN DRAWING NOTES
1. DRAWINGS ISSUED ARE FOR PLANNING STAGE ONLY.
2. COPYRIGHT: ALL RIGHTS RESERVED. NO PART HERE WITH MAY BE COPIED OR REPRODUCED PARTIALLY OR WHOLLY IN ANY FORM WHATSOEVER WITHOUT THE PRIOR NOTICE OF THE COPYRIGHT OWNER HYDRO-ENVIRONMENTAL SERVICES.
3. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.

20/06/24	Planning	MG	MG
Date	Description	Chkd	Signed
Revisions			
HYDRO ENVIRONMENTAL SERVICES 22 Lower Main St Tel: +353 (0) 86-441722 Dunganon Tel: +353 (0) 86-442444 Co. Waterford Email: info@hydroenvironmental.ie Ireland Web: www.hydroenvironmental.ie			
Client: ABO ENERGY IRELAND LTD			
Job: KEERGLLEN WIND FARM, Co. MAYO			
Title: DRAINAGE DETAILS I			
Figure No: D501			
Drawing No: P1583-0-0624-A1-D501-00A			
Sheet Size: A1		Project No.: P1583-0	
Scale: as shown (A1)		Drawn By: MG/GA	
Date: 20/06/2024		Checked By: MG	

RECEIVED: 29/08/2024

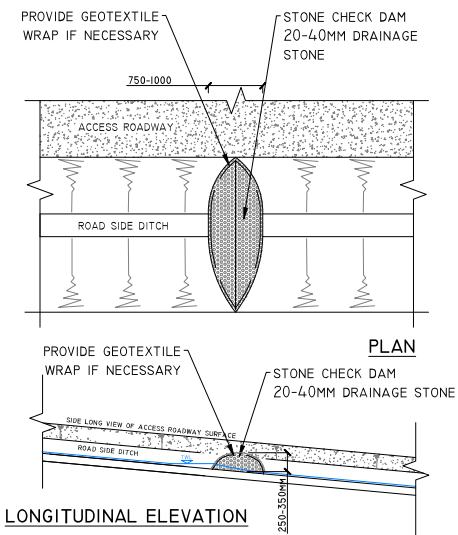
Appendix 7.5b

Detailed Drainage Drawing No. D502

Keerglen Wind Farm

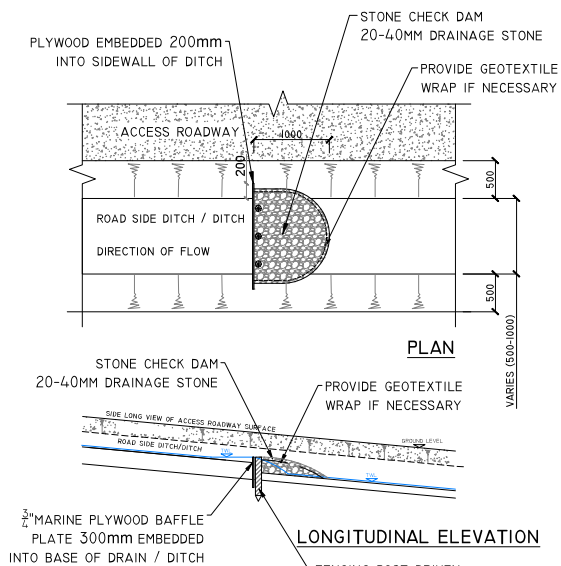
Mayo Planning Authority - Inspection Purposes Only

DETAIL C

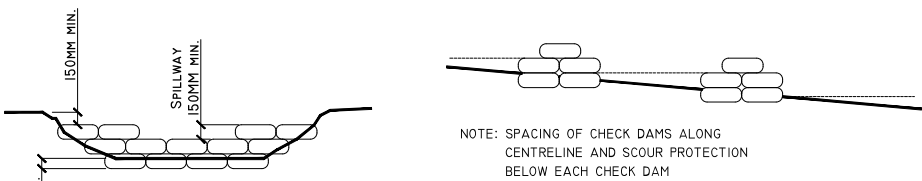


TYPE X - CHECK DAM DETAIL
SCALE 1:50

DETAIL D



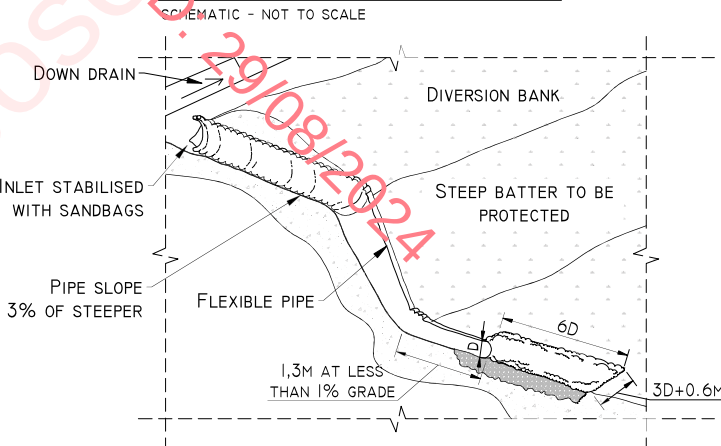
TYPE Y - CHECK DAM DETAIL
SCALE 1:100



TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW
SAND FILLED BAG CONSTRUCTION
SCHEMATIC - NOT TO SCALE

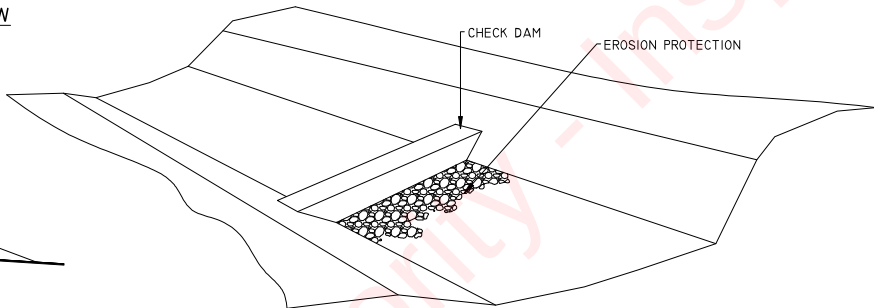
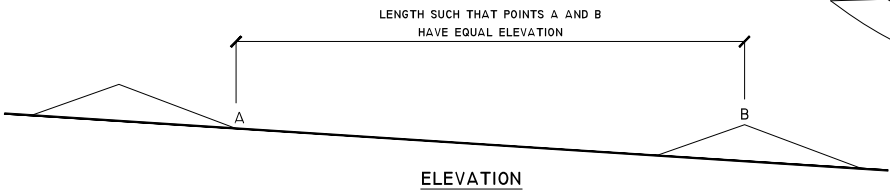
DETAIL E

TYPICAL PIPE SPILLWAY DETAIL

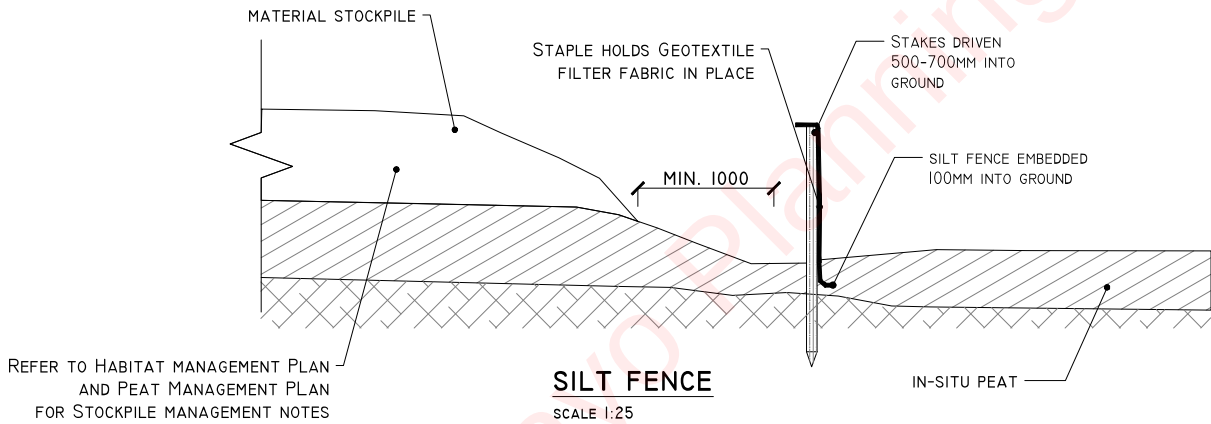


DETAIL C2

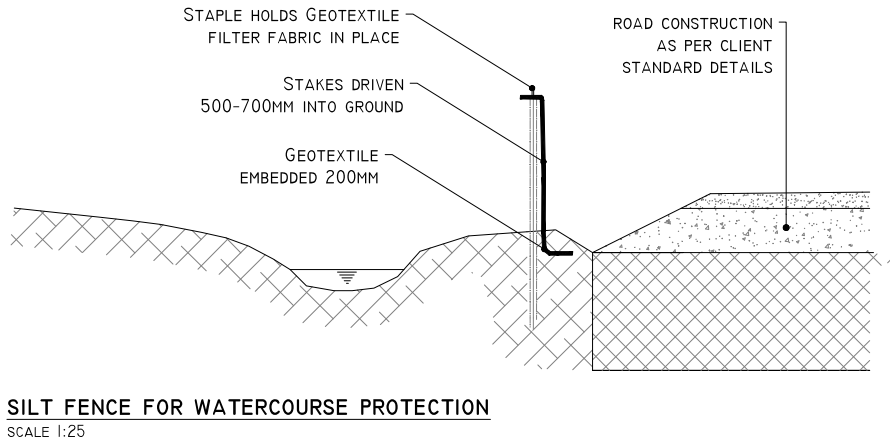
TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW
SCHEMATIC - NOT TO SCALE



DETAIL F-I



DETAIL F-II



PROJECT DESIGN DRAWING NOTES
1. DRAWINGS ISSUED ARE FOR PLANNING STAGE ONLY.
2. COPYRIGHT, ALL RIGHTS RESERVED. NO PART HERE WITH MAY BE COPIED OR REPRODUCED PARTIALLY OR WHOLLY IN ANY FORM WHATSOEVER WITHOUT THE PRIOR NOTICE OF THE COPYRIGHT OWNER HYDRO-ENVIRONMENTAL SERVICES.
3. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.

20/06/24	Planning	MG	MG
Date	Description	Chkd	Signed
Revisions			
 HYDRO ENVIRONMENTAL SERVICES 22 Lower Main St Dungannon Co. Waterford Ireland Tel: +353 (0) 56-441722 Tel: +353 (0) 56-442444 email: info@hydroenvironmentalisle web: www.hydroenvironmentalisle			
Client: ABO ENERGY IRELAND LTD			
Job: KEERGLEN WIND FARM, Co. MAYO			
Title: DRAINAGE DETAILS 2			
Figure No: D502			
Drawing No: P1583-0-0624-A1-D502-00A			
Sheet Size: A1		Project No.: P1583-0	
Scale: as shown (A1)		Drawn By: MG/GA	
Date: 20/06/2024		Checked By: MG	

RECEIVED: 29/08/2024

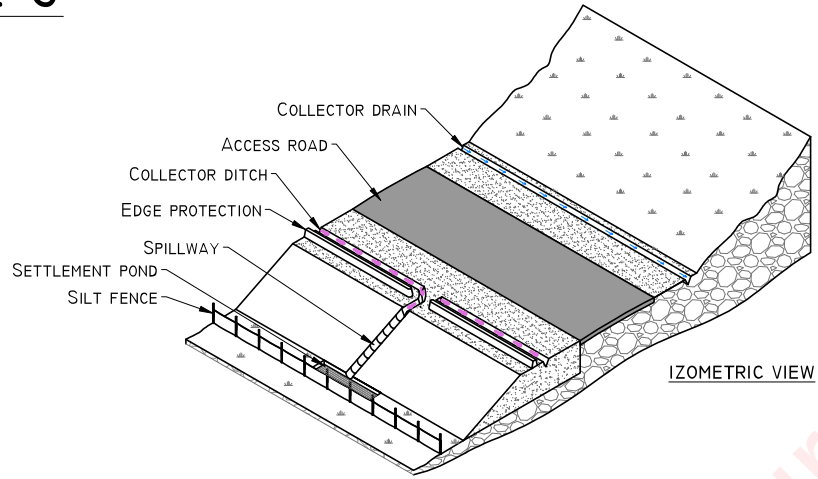
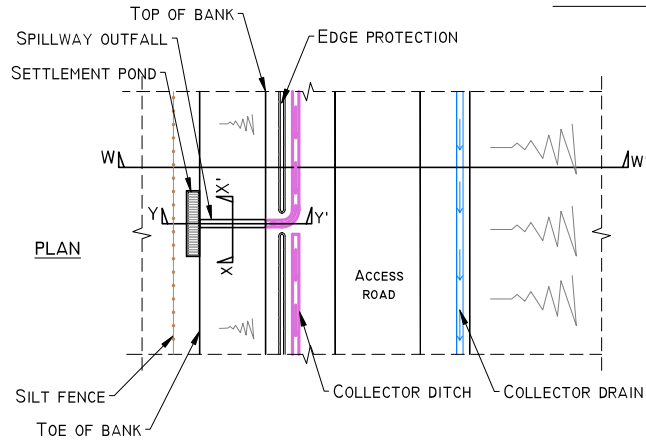
Appendix 7.5c

Detailed Drainage Drawing No. D503

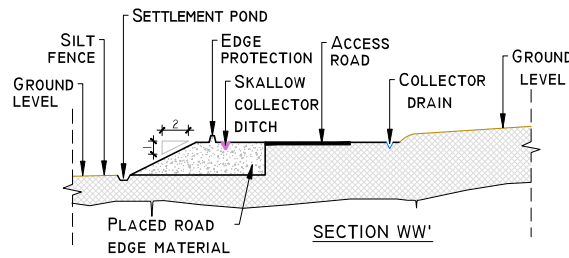
Keerglen Wind Farm

Mayo Planning Authority - Inspection Purposes Only

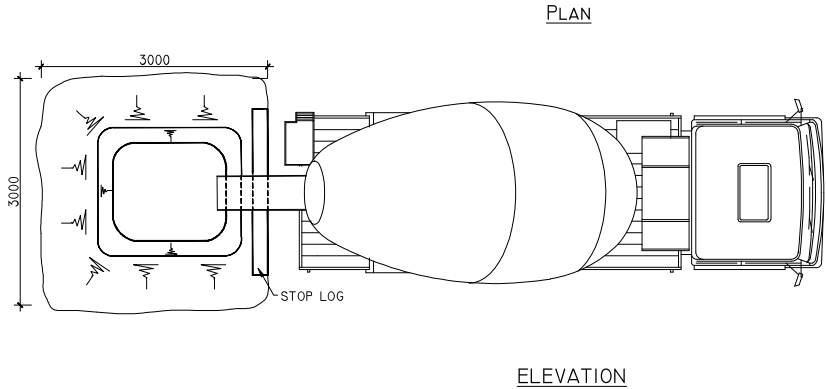
DETAIL G



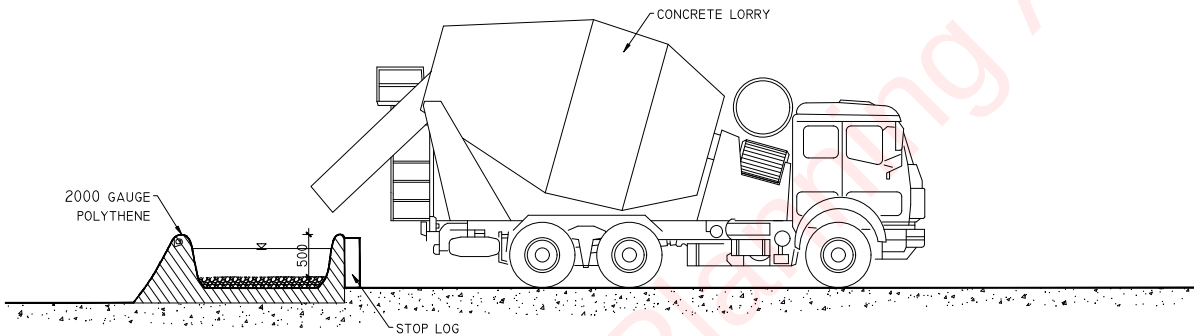
SPILLWAY OUTFALL PLAN
SCHEMATIC - NOT TO SCALE



TEMPORARY CONCRETE WASH OUT PIT
SCALE 1:50

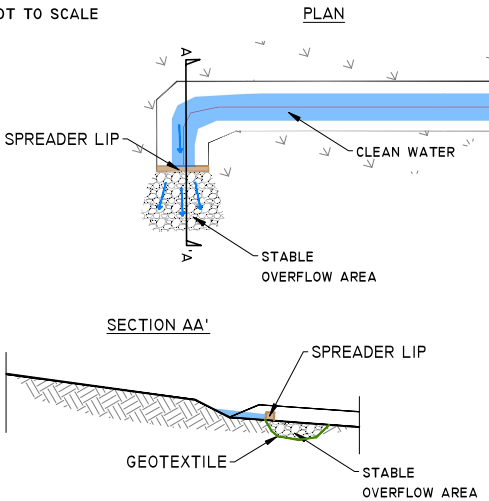
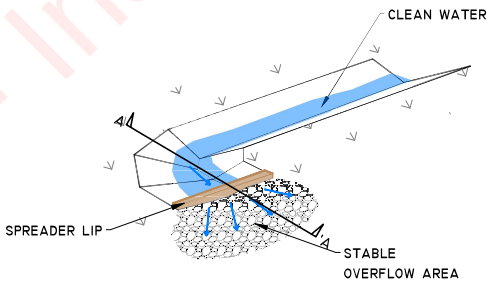


DETAIL H



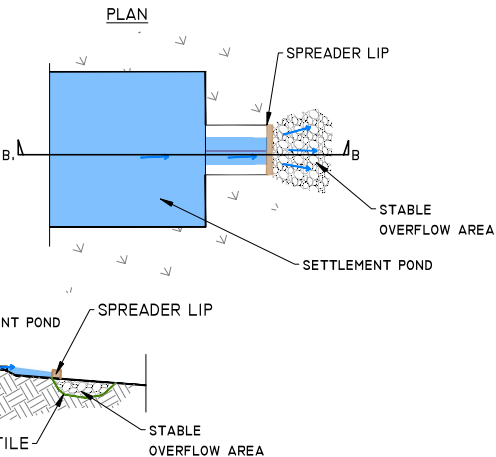
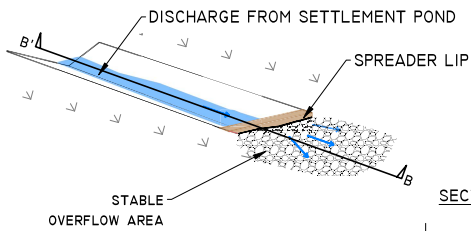
DETAIL J-1

LEVEL SPREADER DETAIL
SCHEMATIC - NOT TO SCALE



DETAIL J-2

LEVEL SPREADER DETAIL
SCHEMATIC - NOT TO SCALE



PROJECT DESIGN DRAWING NOTES
1. DRAWINGS ISSUED ARE FOR PLANNING STAGE ONLY.
2. COPYRIGHT, ALL RIGHTS RESERVED. NO PART HERE WITH MAY BE COPIED OR REPRODUCED PARTIALLY OR WHOLLY IN ANY FORM WHATSOEVER WITHOUT THE PRIOR NOTICE OF THE COPYRIGHT OWNER HYDRO-ENVIRONMENTAL SERVICES.
3. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.

20/06/24	Planning	MG	MG
Date	Description	Chkd	Signed
Revisions			
 HYDRO ENVIRONMENTAL SERVICES 22 Lower Main St Tel: +353 (0) 56-441722 Dungannon Tel: +353 (0) 56-442444 Co. Waterford email: info@hydroenvironmental.ie Ireland web: www.hydroenvironmental.ie			
Client: ABO ENERGY IRELAND LTD			
Job: KEERGLLEN WIND FARM, Co. MAYO			
Title: DRAINAGE DETAILS 3			
Figure No: D503			
Drawing No: P1583-0-0624-A1-D503-00A			
Sheet Size: A1		Project No.: P1583-0	
Scale: as shown (A1)		Drawn By: MG/GA	
Date: 20/06/2024		Checked By: MG	

POLLUTION PREVENTION NOTES:

1. SITE MANAGEMENT PROPOSALS ARE INTENDED TO ENSURE PROTECTION AGAINST SURFACE WATER AND GROUNDWATER POLLUTION, SILTATION AND EROSION.
2. SUITABLE DRAINAGE CONTROL MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT CONVEYANCE OF SIGNIFICANT VOLUMES OF SILT TO OFF SITE RECEIVING WATERCOURSE.
3. SILTY WATER CAN ARISE FROM DEWATERING EXCAVATIONS, EROSION OF EXPOSED/DISTURBED GROUND, TEMPORARY STOCKPILES, PLANT AND WHEEL WASH, SITE ROADS/TRACKS, AND DISTURBANCE OF EXISTING FIELD DRAINS AND DITCHES.

DISCHARGES

4. WATER CONTAINING SILT WILL NOT BE PUMPED DIRECTLY TO ANY NATURAL WATERCOURSE. ALL DISCHARGES TO BE MADE OVER OPEN GROUND OR INTO EXISTING FIELD DRAIN WITH SILT TRAP AT A MINIMUM OF 20M FROM NEAREST WATERCOURSE UNLESS OTHERWISE STATED.
5. NO EXCAVATED MATERIAL IS TO BE STORED WITHIN ANY SURFACE WATER BUFFER ZONE.
6. PUMPED WATER WILL BE DIRECTED INTO TRACK SIDE DITCHES AND TREATED IN SETTLEMENT PONDS AND VEGETATION SWALES PRIOR TO OVERLAND DISCHARGE.
7. PUMPING OF CLEAN WATER FROM EXCAVATIONS / OR OVER-PUMPING IN DRAINS/DITCHES/STREAMS WILL BE COMPLETED IN A MANNER THAT WILL NOT CAUSE SCOUR OR EROSION AT THE POINT OF RELEASE/DISCHARGE. THIS WILL BE DONE BY REDUCING THE FLOW VELOCITIES OR BY USE OF SUITABLE SPLASH PLATES, AND/OR OTHER SIMILAR DISCHARGE CONTROLS.
8. VEGETATION WILL NOT BE STRIPPED FROM EXISTING DRAINS/DITCHES UNLESS ABSOLUTELY NECESSARY.

EXCAVATIONS

9. WHERE (TEMPORARY) DEEP EXCAVATIONS ARE PROPOSED, CUT-OFF DRAINS WILL BE USED TO REDUCE THE AMOUNT OF SURFACE WATER ENTERING THE EXCAVATION. THIS WILL BE THE CASE AROUND TURBINE BASE EXCAVATIONS.

EXPOSED GROUND & STOCKPILES

10. THE AMOUNT OF TEMPORARY EXPOSED GROUND AND TEMPORARY STOCKPILES OPEN/EXPOSED AT ANY TIME WILL BE MINIMISED.

SITE TRACKS

11. USE OF TRACK SIDE SWALES WITH CHECK DAMS, AND/OR FILTRATION CHECK DAMS WILL REDUCE SILT IN RUNOFF WATER AS REQUIRED.
12. CHECK DAMS TO BE INSPECTED AND CLEANED REGULARLY.

REFUELLING

13. REFUELLING OF MOBILE PLANT WILL BE COMPLETED IN DESIGNATED REFUELLING AREAS ONLY, ON AN IMPERMEABLE SURFACE AND AWAY FROM FIELD DRAINS / DITCHES AND WATERCOURSES/WATERBODIES.
14. SPILL KITS AND DRIP TRAYS WILL BE AVAILABLE ON SITE FOR USE AS REQUIRED.

CONCRETE

15. CONCRETE POURS WILL BE MANAGED AND SUPERVISED TO ENSURE THERE WILL BE NO LEAKAGE/SEEPAGE/DISCHARGE OF CONCRETE OR CONCRETE WATER DURING THE CONSTRUCTION PHASE.
16. CONCRETE WASH WATER, AND WASTE CONCRETE WILL BE MANAGED APPROPRIATELY ON SITE AT A LINED CONCRETE WASH OUT PIT.

IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO:

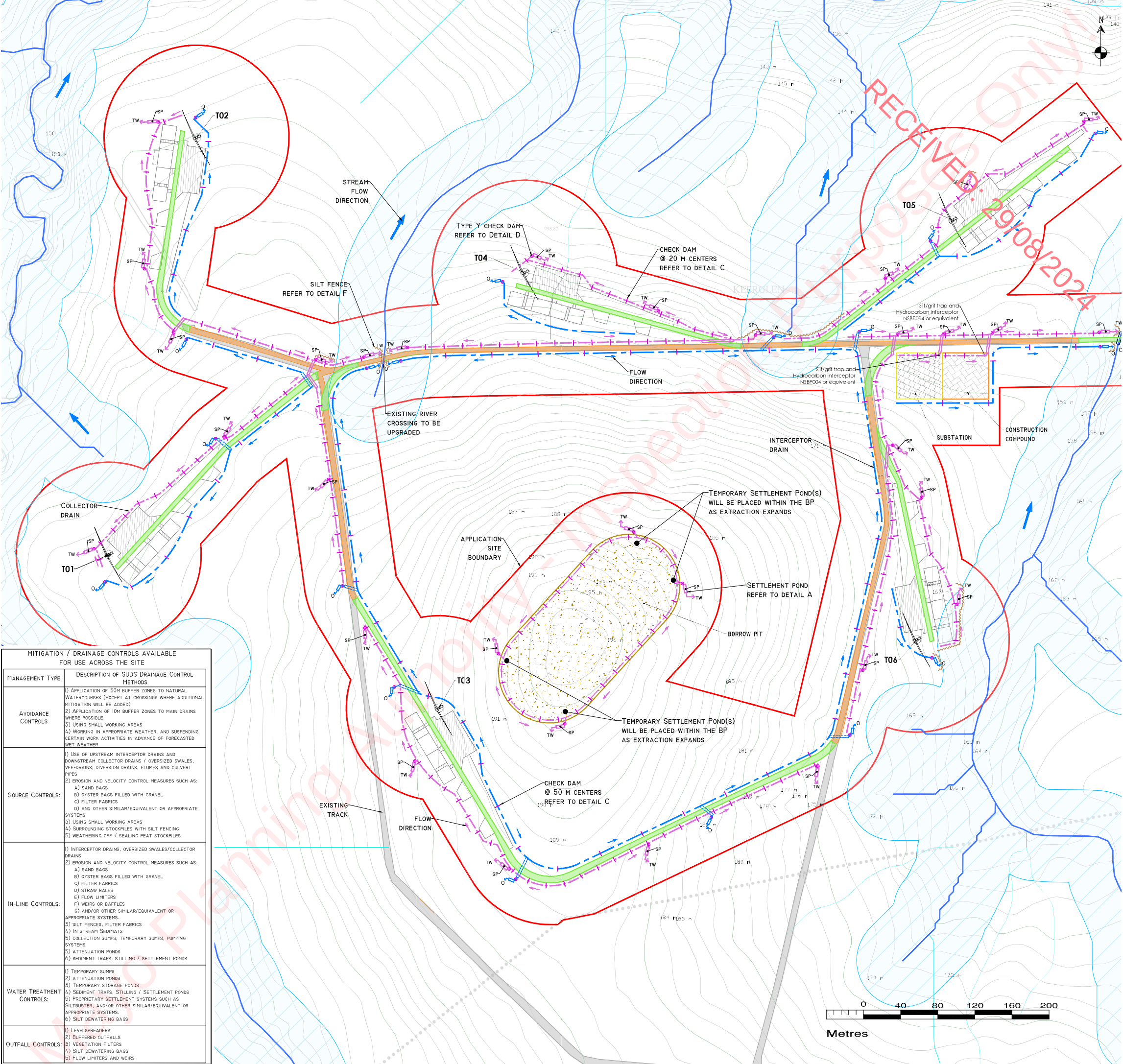
STOP - WORK IN THE IMMEDIATE AREA SHOULD BE STOPPED AND THE SOURCE OF THE POLLUTION IDENTIFIED.

CONTAIN - THE SOURCE OF THE POLLUTION SHOULD BE BUNDED USING A SUITABLE METHOD. NATURAL WATERCOURSES SHOULD BE TEMPORARILY DIVERTED AROUND ANY SOURCE OF POLLUTION.

NOTIFY - THE RELEVANT AUTHORITIES (SITE MANAGER / FISHERIES / NPWS / LOCAL AUTHORITY ETC.) SHOULD BE NOTIFIED IMMEDIATELY TO ENSURE THAT MEASURES CAN BE IMPLEMENTED DOWNSTREAM TO PROTECT FISHERIES AND OTHER SENSITIVE RECEPTORS.

DRAINAGE NOTES

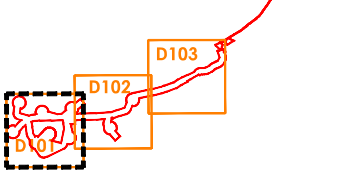
1. SITE TRACKS AND ROADWAY SURFACING DESIGN AND CONSTRUCTION TO ENGINEER'S SPECIFICATION (I.E. BY OTHERS).
2. SPARE STRAW BALES/SILT FENCING/ OR SIMILAR, WILL BE STORED ON SITE. THE LEVEL OF SILT IN RUNOFF DURING CONSTRUCTION IS TO BE MONITORED VISUALLY AND EXCESSIVE SILT LEVELS IN ANY AREA TO BE TEMPORARILY MANAGED BY PLACING SILT FENCES, STRAW BALES / OR SIMILAR OR ADDITIONAL CHECK DAMS AT THE PROBLEM AREAS. MOBILE SILTBUSTER SYSTEM TO BE AVAILABLE ON-SITE FOR USE AS REQUIRED ALSO.
3. SUDS DRAINAGE SYSTEM TO BE CONSTRUCTED PRIOR TO, OR AT THE SAME TIME AS THE ACCESS TRACKS. INTERIM MEASURES SUCH AS THE PLACEMENT OF STRAW BALES/SILT FENCING/OR SIMILAR APPROVED METHOD OR ADDITIONAL CHECK DAMS AND SILT FENCES TO BE EMPLOYED IN ALL INSTANCES WHERE WORK CARRIED OUT TO CONSTRUCT THE ACCESS TRACKS IS LIKELY TO CAUSE ADVERSE ENVIRONMENTAL EFFECTS THROUGH INCREASED SILT LOADINGS BEING GENERATED DURING THE CONSTRUCTION PHASE.
4. SUITABLE PREVENTION MEASURES WILL BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SIGNIFICANT VOLUMES OF SILT TO RECEIVING WATERCOURSES. SEE NOTES ON POLLUTION PREVENTION.
5. INTERCEPTOR SWALES / DITCHES WILL BE USED TO COLLECT UPSTREAM SURFACE WATER FLOWS. REGULAR CROSS DRAINS / DISCHARGE TO FIELD DITCHES/DRAINS WILL BE INSTALLED TO TRANSFER / DISCHARGE SURFACE WATER IN INTERCEPTOR DRAINS TO SUITABLE FIELD DRAIN OUTFALL POINTS.
6. DRAINAGE SWALES / DITCHES TO BE EXCAVATED ADJACENT TO THE ACCESS TRACKS. REGULAR CROSS DRAINS TO BE LOCATED ALONG ACCESS TRACKS TO PREVENT EXCESSIVE VOLUMES OF WATER COLLECTING IN THE SWALES / DITCHES. LOCATIONS OF CROSS DRAINS TO BE AGREED WITH THE ENGINEER ON SITE. SURFACE WATER WILL NOT BE ALLOWED TO DISCHARGE DIRECTLY INTO EXISTING WATERCOURSES.
7. A BUFFER ZONE OF >20M TO ANY EXISTING WATERCOURSE WILL BE REQUIRED WHERE OVER LAND DISCHARGES ARE PROPOSED FROM ACCESS TRACK SWALES / DITCHES. THIS BUFFER WILL NOT BE POSSIBLE AT RIVER/STREAM CROSSINGS, BUT OTHER SUITABLE CONTROLS ARE PROPOSED IN THOSE AREAS (I.E. ADDITIONAL SILT FENCING).
8. BATTERS OF ALL PROPOSED SWALES / DITCHES TO HAVE A SLOPE OF BETWEEN 1 : 1.5 TO 1 : 2 DEPENDING UPON DEPTH OF SWALE/DITCH AND WILL BE LEFT AS CUT TO RE-VEGETATE WITH LOCAL SPECIES.
9. TRACK SIDE SWALES / DITCHES TO BE SHALLOW WITH MODERATE GRADIENTS TO PREVENT SCOURING. IN STEEP AREAS CHECK DAMS WILL BE INSTALLED TO REDUCE FLOW VELOCITIES AND PROVIDE SOURCE CONTROL OF SILT CONTAINMENT. THESE HAVE BEEN DESIGNATED IN CONJUNCTION WITH SETTLEMENT PONDS AND SILT TRAPS, PRIOR TO DISCHARGE.
10. SETTLEMENT PONDS TO BE CONSTRUCTED FOR SILT REMOVAL AT TURBINE BASES AND HARD STAND AREAS. POND SIZES DEPEND ON THE CATCHMENT AREA BEING SERVED. SAMPLE POND SIZES FOR VARIOUS CATCHMENT AREAS SHOWN ON DRAWING D501.
11. STRAW BALES / OR SIMILAR AND SILT FENCES TO BE USED ALSO AROUND SPILL HEAPS TO MITIGATE SILT RUNOFF. SILT FENCES MAY BE REMOVED WHEN SUITABLE VEGETATION COVER IS ESTABLISHED.
12. SILT FENCES TO BE PROVIDED ALONG THE EDGE OF EXISTING WATERCOURSES WHERE WORKS COMES WITHIN <15M OF EDGE OF ANY DITCH / DRAIN / EPHEMERAL CHANNEL.
13. SLOPES OF THE SWALES / DITCHES TO BE VEGETATED OR PROTECTED FROM EROSION UNTIL VEGETATION HAS BEEN ESTABLISHED. STRIPPER VEGETATIVE LAYER (PEAT 'SOD' OR 'SCRAW') FROM EXCAVATIONS TO BE STORED LOCALLY AND USED TO LINE SLOPES AND BASE OF SWALES / DITCHES OR LONGITUDINAL MOUNDS OF VEGETATION SWALES AT FIELD DRAIN DISCHARGE POINTS.
14. AREAS STRIPPED OF VEGETATION WILL BE KEPT TO A MINIMUM.
15. CLEAN STONE FLOW CONTROL CHECK DAMS TO BE MADE OF LOCALLY WON / GEOLOGICALLY SIMILAR WELL GRADED STONE. AGGREGATE SIZE FOR STONE CHECK DAMS TO BE TYPICALLY 20-40MM CLEAN STONE. ON SLOPING SECTIONS OF THE ACCESS TRACKS, 40MM CHECK DAMS TO BE PROTECTED FROM WASHING AWAY THROUGH THE PLACEMENT OF 100M STONE ON THE DOWNHILL FACE OF THE CHECK DAM AND BY WRAPPING IN GEOTEXTILE.
16. BUILD UP OF SILT LEVELS AT CHECK DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING DRAINAGE MAINTENANCE PROGRAMME DURING THE CONSTRUCTION PHASE. WHEN CHECK DAMS BECOME CLOGGED WITH SILT OR VEGETATION, STONE CHECK DAM TO BE REMOVED AND REPLACED SUBSEQUENT TO THE REMOVAL OF SILT.
17. SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDENT UPON LONGITUDINAL GRADIENT OF SWALE.
18. LOCATION OF FILTRATION CHECK DAMS (IF REQUIRED) TO BE AGREED ON SITE WITH ENGINEER. SETTLEMENT PONDS TO BE CONSTRUCTED IN A MANNER WHERE THEY MAY BE EASILY INFILLED AT A LATER DATE (POST COMPLETION OF THE TURBINE BASE AND HARDSTAND CONSTRUCTION). ONLY SUITABLE MATERIALS EXCAVATED FROM THE POND TO BE USED TO FORM PART OF THE EMBANKMENT AROUND THE POND.
19. OIL FUEL WILL ONLY BE STORED WITHIN BUNDED CONTAINMENT STRUCTURES.
20. SILT BAGS WILL BE USED ON SITE AT FIELD DRAIN DISCHARGE LOCATIONS.



DRAWING LEGEND :

- RIVERS/STREAMS (WC - WATERCOURSE)
- RIVERS/STREAMS 50M BUFFER
- STREAM FLOW DIRECTION
- UPSTREAM INTERCEPTOR DRAIN
- SWALES/DOWNSTREAM COLLECTOR DRAIN
- DIRECTION OF FLOW
- SILT FENCES
- DOUBLE/TRIPLE SILT FENCES
- SETTLEMENT POND - LEVEL SPREADER
- CHECK DAM 'TYPE A'
- CHECK DAM 'TYPE B'
- PROPOSED WC CROSSING
- EXISTING WC CROSSING
- INTERCEPTOR DITCH CULVERT
- COLLECTOR DITCH CULVERT
- OVERLAND FLOW DISCHARGE
- TREATED WATER DISCHARGE
- SETTLEMENT POND
- SEMI-NATURAL VEGETATION SWALE / FILTER BED / SECONDARY SP
- PUMPING SUMP
- APPLICATION SITE BOUNDARY
- EXISTING GROUND SURFACE
- MINOR CONTOUR (1 M INTERVAL)
- EXISTING GROUND SURFACE
- MAJOR CONTOUR (5 M INTERVAL)
- TURBINE AND TURBINE FOUNDATION
- PROPOSED NEW ROADS
- EXISTING ROADS PROPOSED TO BE UPGRADED
- EXISTING ROADS
- SUBSTATION
- CONSTRUCTION COMPOUND
- BORROW PIT

KEY PLAN



DRAWING NOTES

1. DRAWINGS ISSUED ARE FOR PLANNING APPLICATION PURPOSES ONLY.
2. COPYRIGHT, ALL RIGHTS RESERVED. NO PART HERE WITH MAY BE COPIED OR REPRODUCED PARTIALLY OR WHOLLY IN ANY FORM WHATSOEVER WITHOUT THE PRIOR NOTICE OF THE COPYRIGHT OWNER HYDRO-ENVIRONMENTAL SERVICES.
3. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.
4. ALL DIMENSIONS ARE IN METRES.

Ordnance Survey Ireland Licence No. EN 0044724
© Ordnance Survey Ireland/Government of Ireland

Date	Description	Chkd	Signed
Revisions			

HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
Dungarvan
Co. Waterford
Ireland
tel: +353 (0) 58-4122
tel: +353 (0) 58-4124
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: ABO ENERGY IRELAND LTD

Job: KEERGLLEN WIND FARM, Co. MAYO

Title: PROPOSED DRAINAGE LAYOUT

Figure No: D101

Drawing No: P1583-0-0624-A1-D101-00A

Sheet Size: A1 Project No.: P1583-0

Scale: 1:2,000 (A1) Drawn By: GA

Date: 20/06/2024 Checked By: MG

POLLUTION PREVENTION NOTES:

1. SITE MANAGEMENT PROPOSALS ARE INTENDED TO ENSURE PROTECTION AGAINST SURFACE WATER AND GROUNDWATER POLLUTION, SILTATION AND EROSION.
2. SUITABLE DRAINAGE CONTROL MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT CONVEYANCE OF SIGNIFICANT VOLUMES OF SILT TO OFF SITE RECEIVING WATERCOURSES.
3. SILTY WATER CAN ARISE FROM DENATERING EXCAVATIONS, EROSION OF EXPOSED/DISTURBED GROUND, TEMPORARY STOCKPILES, PLANT AND WHEEL WASH, SITE ROADS/TRACKS, AND DISTURBANCE OF EXISTING FIELD DRAINS AND DITCHES.

DISCHARGES

4. WATER CONTAINING SILT WILL NOT BE PUMPED DIRECTLY TO ANY NATURAL WATERCOURSE. ALL DISCHARGES TO BE MADE OVER OPEN GROUND OR INTO EXISTING FIELD DRAIN WITH SILT TRAP AT A MINIMUM OF 20M FROM NEAREST WATERCOURSE UNLESS OTHERWISE STATED.
5. NO EXCAVATED MATERIAL IS TO BE STORED WITHIN ANY SURFACE WATER BUFFER ZONE.
6. PUMPED WATER WILL BE DIRECTED INTO TRACK SIDE DITCHES AND TREATED IN SETTLEMENT PONDS AND VEGETATION SWALES PRIOR TO OVERLAND DISCHARGE.
7. PUMPING OF CLEAN WATER FROM EXCAVATIONS / OR OVER-PUMPING IN DRAINS/DITCHES/STREAMS WILL BE COMPLETED IN A MANNER THAT WILL NOT CAUSE SCOUR OR EROSION AT THE POINT OF RELEASE/DISCHARGE. THIS WILL BE DONE BY REDUCING THE FLOW VELOCITIES OR BY USE OF SUITABLE SPLASH PLATES, AND/OR OTHER SIMILAR DISCHARGE CONTROLS.
8. VEGETATION WILL NOT BE STRIPPED FROM EXISTING DRAINS/DITCHES UNLESS ABSOLUTELY NECESSARY.

EXCAVATIONS

9. WHERE (TEMPORARY) DEEP EXCAVATIONS ARE PROPOSED, CUT-OFF DRAINS WILL BE USED TO REDUCE THE AMOUNT OF SURFACE WATER ENTERING THE EXCAVATION. THIS WILL BE THE CASE AROUND TURBINE BASE EXCAVATIONS.

EXPOSED GROUND & STOCKPILES

10. THE AMOUNT OF TEMPORARY EXPOSED GROUND AND TEMPORARY STOCKPILES OPEN/EXPOSED AT ANY TIME WILL BE MINIMISED.

SITE TRACKS

11. USE OF TRACK SIDE SWALES WITH CHECK DAMS, AND/OR FILTRATION CHECK DAMS WILL REDUCE SILT IN RUNOFF WATER AS REQUIRED.
12. CHECK DAMS TO BE INSPECTED AND CLEANED REGULARLY.

REFUELLING

13. REFUELLING OF MOBILE PLANT WILL BE COMPLETED IN DESIGNATED REFUELLING AREAS ONLY, ON AN IMPERMEABLE SURFACE AND AWAY FROM FIELD DRAINS / DITCHES AND WATERCOURSES/WATERBODIES.
14. SPILL KITS AND DRIP TRAYS WILL BE AVAILABLE ON SITE FOR USE AS REQUIRED.

CONCRETE

15. CONCRETE POURS WILL BE MANAGED AND SUPERVISED TO ENSURE THERE WILL BE NO LEAKAGE/SEEPAGE/DISCHARGE OF CONCRETE OR CONCRETE WATER DURING THE CONSTRUCTION PHASE.
16. CONCRETE WASH WATER, AND WASTE CONCRETE WILL BE MANAGED APPROPRIATELY ON SITE AT A LINED CONCRETE WASH OUT PIT.

IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO:

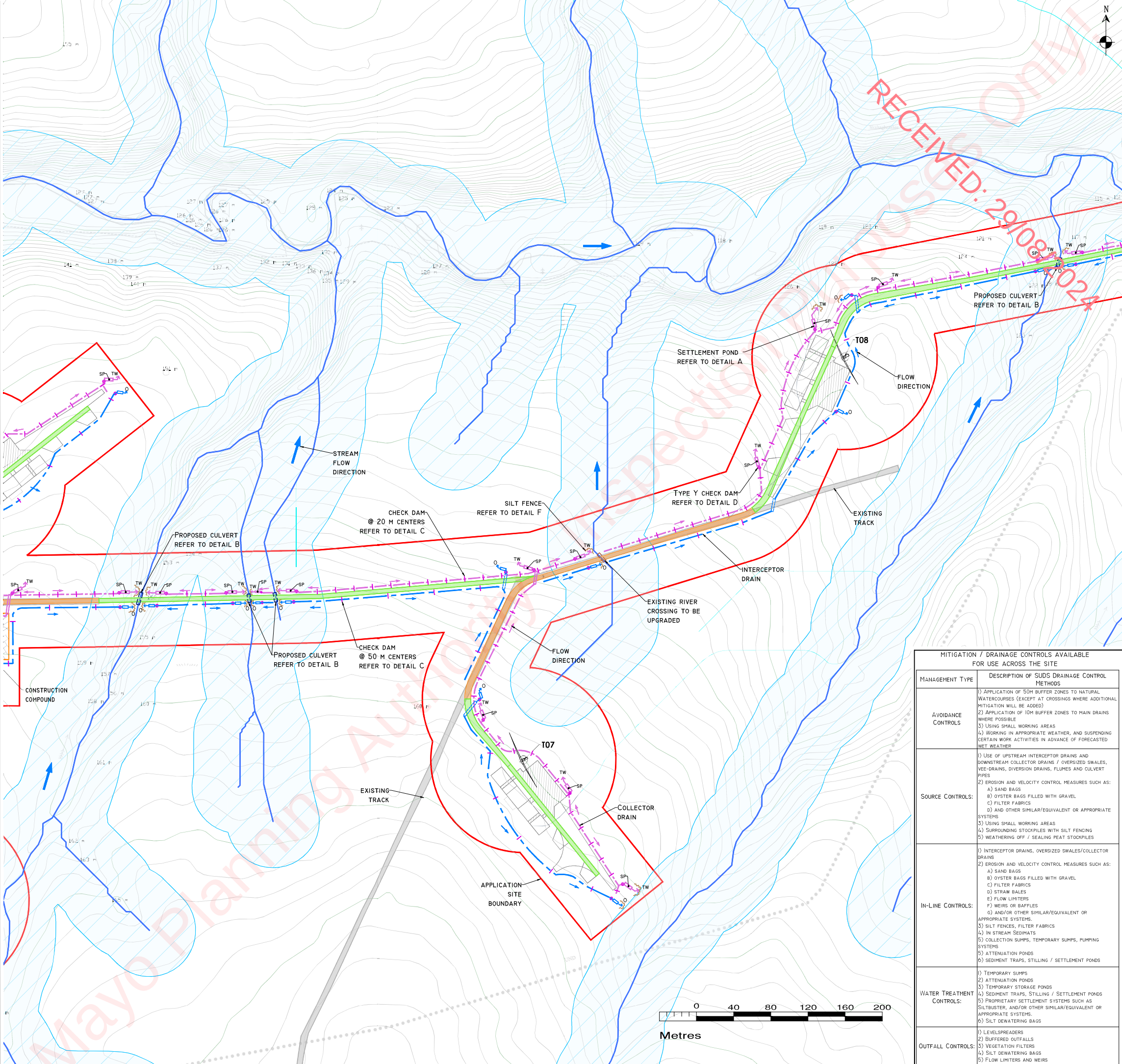
STOP - WORK IN THE IMMEDIATE AREA SHOULD BE STOPPED AND THE SOURCE OF THE POLLUTION IDENTIFIED.

CONTAIN - THE SOURCE OF THE POLLUTION SHOULD BE BUNDED USING A SUITABLE METHOD. NATURAL WATERCOURSES SHOULD BE TEMPORARILY DIVERTED AROUND ANY SOURCE OF POLLUTION.

NOTIFY - THE RELEVANT AUTHORITIES (SITE MANAGER / FISHERIES / NPWS / LOCAL AUTHORITY ETC.) SHOULD BE NOTIFIED IMMEDIATELY TO ENSURE THAT MEASURES CAN BE IMPLEMENTED DOWNSTREAM TO PROTECT FISHERIES AND OTHER SENSITIVE RECEPTORS.

DRAINAGE NOTES

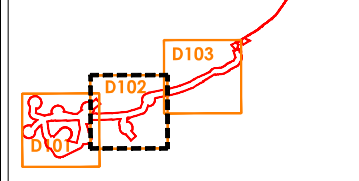
1. SITE TRACKS AND ROADWAY SURFACING DESIGN AND CONSTRUCTION TO ENGINEER'S SPECIFICATION (I.E. BY OTHERS).
2. SPARE STRAW BALES/SILT FENCING/ OR SIMILAR, WILL BE STORED ON SITE. THE LEVEL OF SILT IN RUNOFF DURING CONSTRUCTION IS TO BE MONITORED VISUALLY AND EXCESSIVE SILT LEVELS IN ANY AREA TO BE TEMPORARILY MANAGED BY PLACING SILT FENCES, STRAW BALES / OR SIMILAR OR ADDITIONAL CHECK DAMS AT THE PROBLEM AREAS. MOBILE SILTBUSTER SYSTEM TO BE AVAILABLE ON-SITE FOR USE AS REQUIRED ALSO.
3. SUDS DRAINAGE SYSTEM TO BE CONSTRUCTED PRIOR TO, OR AT THE SAME TIME AS THE ACCESS TRACKS. INTERIM MEASURES SUCH AS THE PLACEMENT OF STRAW/BALES/SILT FENCING OR SIMILAR APPROVED METHOD OR ADDITIONAL CHECK DAMS AND SILT FENCES TO BE EMPLOYED IN ALL INSTANCES WHERE WORK CARRIED OUT TO CONSTRUCT THE ACCESS TRACKS IS LIKELY TO CAUSE ADVERSE ENVIRONMENTAL EFFECTS THROUGH INCREASED SILT LOADINGS BEING GENERATED DURING THE CONSTRUCTION PHASE.
4. SUITABLE PREVENTION MEASURES WILL BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SIGNIFICANT VOLUMES OF SILT TO RECEIVING WATERCOURSES. SEE NOTES ON POLLUTION PREVENTION.
5. INTERCEPTOR SWALES / DITCHES WILL BE USED TO COLLECT UPSTREAM SURFACE WATER FLOWS. REGULAR CROSS DRAINS / DISCHARGE TO FIELD DITCHES/DRAINS WILL BE INSTALLED TO TRANSFER / DISCHARGE SURFACE WATER IN INTERCEPTOR DRAINS TO SUITABLE FIELD DRAIN OUTFALL POINTS.
6. DRAINAGE SWALES / DITCHES TO BE EXCAVATED ADJACENT TO THE ACCESS TRACKS. REGULAR CROSS DRAINS TO BE LOCATED ALONG ACCESS TRACKS TO PREVENT EXCESSIVE VOLUMES OF WATER COLLECTING IN THE SWALES / DITCHES. LOCATIONS OF CROSS DRAINS TO BE AGREED WITH THE ENGINEER ON SITE. SURFACE WATER WILL NOT BE ALLOWED TO DISCHARGE DIRECTLY INTO EXISTING WATERCOURSES.
7. A BUFFER ZONE OF >20M TO ANY EXISTING WATERCOURSE WILL BE REQUIRED WHERE OVER LAND DISCHARGES ARE PROPOSED FROM ACCESS TRACK SWALES / DITCHES. THIS BUFFER WILL NOT BE POSSIBLE AT RIVER/STREAM CROSSINGS, BUT OTHER SUITABLE CONTROLS ARE PROPOSED IN THOSE AREAS (I.E. ADDITIONAL SILT FENCING).
8. BATTERS OF ALL PROPOSED SWALES / DITCHES TO HAVE A SLOPE OF BETWEEN 1 : 1.5 TO 1 : 2 DEPENDING UPON DEPTH OF SWALE/DITCH AND WILL BE LEFT AS CUT TO RE-VEGETATE WITH LOCAL SPECIES.
9. TRACK SIDE SWALES / DITCHES TO BE SHALLOW WITH MODERATE GRADIENTS TO PREVENT SCOURING. IN STEEP AREAS CHECK DAMS WILL BE INSTALLED TO REDUCE FLOW VELOCITIES AND PROVIDE SOURCE CONTROL OF SILT CONTAINMENT. THESE HAVE BEEN DESIGNATED IN CONJUNCTION WITH SETTLEMENT PONDS AND SILT TRAPS, PRIOR TO DISCHARGE.
10. SETTLEMENT PONDS TO BE CONSTRUCTED FOR SILT REMOVAL AT TURBINE BASES AND HARD STAND AREAS. POND SIZES DEPEND ON THE CATCHMENT AREA BEING SERVED. SAMPLE POND SIZES FOR VARIOUS CATCHMENT AREAS SHOWN ON DRAWING D501.
11. STRAW BALES / OR SIMILAR AND SILT FENCES TO BE USED ALSO AROUND SPILL HEAP TO MINIMISE SILT RUNOFF. SILT FENCES MAY BE REMOVED WHEN SUITABLE VEGETATION COVER IS ESTABLISHED.
12. SILT FENCES TO BE PROVIDED ALONG THE EDGE OF EXISTING WATERCOURSES WHERE WORKS COMES WITHIN <15M OF EDGE OF ANY DITCH / DRAIN / EPHEMERAL CHANNEL.
13. SLOPES OF THE SWALES / DITCHES TO BE VEGETATED OR PROTECTED FROM EROSION UNTIL VEGETATION HAS BEEN ESTABLISHED. STRIPPED VEGETATIVE LAYER (PEAT 'SOD' OR 'SCRAW') FROM EXCAVATIONS TO BE STORED LOCALLY AND USED TO LINE SLOPES AND BASE OF SWALES / DITCHES OR LONGITUDINAL MOUNDS OF VEGETATION SWALES AT FIELD DRAIN DISCHARGE POINTS.
14. AREAS STRIPPED OF VEGETATION WILL BE KEPT TO A MINIMUM.
15. CLEAN STONE FLOW CONTROL CHECK DAMS TO BE MADE OF LOCALLY WON / GEOLOGICALLY SIMILAR WELL GRADED STONE. AGGREGATE SIZE FOR STONE CHECK DAMS TO BE TYPICALLY 20- 40MM CLEAN STONE. ON SLOPING SECTIONS OF THE ACCESS TRACKS, 40MM CHECK DAMS TO BE PROTECTED FROM WASHING AWAY THROUGH THE PLACEMENT OF 100M STONE ON THE DOWNHILL FACE OF THE CHECK DAM AND BY WRAPPING IN GEOTEXTILE.
16. BUILD UP OF SILT LEVELS AT CHECK DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING DRAINAGE MAINTENANCE PROGRAMME DURING THE CONSTRUCTION PHASE. WHERE CHECK DAMS BECOME CLOGGED WITH SILT OR VEGETATION, STONE CHECK DAM TO BE REMOVED AND REPLACED SUBSEQUENT TO THE REMOVAL OF SILT.
17. SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDENT UPON LONGITUDINAL GRADIENT OF SWALE.
18. LOCATION OF FILTRATION CHECK DAMS (IF REQUIRED) TO BE AGREED ON SITE WITH ENGINEER. SETTLEMENT PONDS TO BE CONSTRUCTED IN A MANNER WHERE THEY MAY BE EASILY INFILLED AT A LATER DATE (POST COMPLETION OF THE TURBINE BASE AND HARDSTAND CONSTRUCTION). ONLY SUITABLE MATERIALS EXCAVATED FROM THE POND TO BE USED TO FORM PART OF THE EMBANKMENT AROUND THE POND.
19. OIL FUEL WILL ONLY BE STORED WITHIN BUNDED CONTAINMENT STRUCTURES.
20. SILT BAGS WILL BE USED ON SITE AT FIELD DRAIN DISCHARGE LOCATIONS.



DRAWING LEGEND :

- RIVERS/STREAMS (WC - WATERCOURSE)
- RIVERS/STREAMS 50M BUFFER
- STREAM FLOW DIRECTION
- UPSTREAM INTERCEPTOR DRAIN
- SWALES/DOWNSTREAM COLLECTOR DRAIN DIRECTION OF FLOW
- SILT FENCES
- DOUBLE/TRIPLE SILT FENCES
- SETTLEMENT POND - LEVEL SPREADER
- CHECK DAM 'TYPE A'
- CHECK DAM 'TYPE B'
- PROPOSED WC CROSSING
- EXISTING WC CROSSING
- INTERCEPTOR DITCH CULVERT
- COLLECTOR DITCH CULVERT
- OVERLAND FLOW DISCHARGE
- TREATED WATER DISCHARGE
- SETTLEMENT POND
- SEMI-NATURAL VEGETATION SWALE / FILTER BED /SECONDARY SP
- PUMPING SUMP
- APPLICATION SITE BOUNDARY
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- EXISTING GROUND SURFACE MAJOR CONTOUR (5 M INTERVAL)
- TURBINE AND TURBINE FOUNDATION
- PROPOSED NEW ROADS
- EXISTING ROADS PROPOSED TO BE UPGRADED
- EXISTING ROADS
- SUBSTATION
- CONSTRUCTION COMPOUND
- BORROW PIT

KEY PLAN



DRAWING NOTES

1. DRAWINGS ISSUED ARE FOR PLANNING APPLICATION PURPOSES ONLY.
2. COPYRIGHT, ALL RIGHTS RESERVED. NO PART HERE WITH MAY BE COPIED OR REPRODUCED PARTIALLY OR WHOLLY IN ANY FORM WHATSOEVER WITHOUT THE PRIOR NOTICE OF THE COPYRIGHT OWNER HYDRO-ENVIRONMENTAL SERVICES.
3. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.
4. ALL DIMENSIONS ARE IN METRES.

MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

MANAGEMENT TYPE	DESCRIPTION OF SUDS DRAINAGE CONTROL METHODS
AVOIDANCE CONTROLS	1) APPLICATION OF 50M BUFFER ZONES TO NATURAL WATERCOURSES (EXCEPT AT CROSSINGS WHERE ADDITIONAL MITIGATION WILL BE ADDED) 2) APPLICATION OF 10M BUFFER ZONES TO MAIN DRAINS WHERE POSSIBLE 3) USING SMALL WORKING AREAS 4) WORKING IN APPROPRIATE WEATHER, AND SUSPENDING CERTAIN WORK ACTIVITIES IN ADVANCE OF FORECASTED WET WEATHER
SOURCE CONTROLS:	1) USE OF UPSTREAM INTERCEPTOR DRAINS AND DOWNSTREAM COLLECTOR DRAINS / OVERSIZED SWALES, VEE-DRAINS, DIVERSION DRAINS, FLUMES AND CULVERT PIPES 2) EROSION AND VELOCITY CONTROL MEASURES SUCH AS: A) SAND BAGS B) OYSTER BAGS FILLED WITH GRAVEL C) FILTER FABRICS D) FLOW LIMITERS E) AND OTHER SIMILAR/EQUIVALENT OR APPROPRIATE SYSTEMS 3) USING SMALL WORKING AREAS 4) SURROUNDING STOCKPILES WITH SILT FENCING 5) WEATHERING OFF / SEALING PEAT STOCKPILES
IN-LINE CONTROLS:	1) INTERCEPTOR DRAINS, OVERSIZED SWALES/COLLECTOR DRAINS 2) EROSION AND VELOCITY CONTROL MEASURES SUCH AS: A) SAND BAGS B) OYSTER BAGS FILLED WITH GRAVEL C) FILTER FABRICS D) STRAW BALES E) FLOW LIMITERS F) WEIRS OR BAFFLES G) AND/OR OTHER SIMILAR/EQUIVALENT OR APPROPRIATE SYSTEMS. 3) SILT FENCES, FILTER FABRICS 4) IN STREAM SEPARATORS 5) COLLECTION SUMPS, TEMPORARY SUMPS, PUMPING SYSTEMS 6) ATTENUATION PONDS 7) SEDIMENT TRAPS, STILLING / SETTLEMENT PONDS
WATER TREATMENT CONTROLS:	1) TEMPORARY SUMPS 2) ATTENUATION PONDS 3) TEMPORARY STORAGE PONDS 4) SEDIMENT TRAPS, STILLING / SETTLEMENT PONDS 5) PROPRIETARY SETTLEMENT SYSTEMS SUCH AS SILTBUSTER, AND/OR OTHER SIMILAR/EQUIVALENT OR APPROPRIATE SYSTEMS. 6) SILT DENATERING BAGS
OUTFALL CONTROLS:	1) LEVELSPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DENATERING BAGS 5) FLOW LIMITERS AND WEIRS

Ordnance Survey Ireland Licence No. EN 0044724 © Ordnance Survey Ireland/Government of Ireland			
Date	Description	Chkd	Signed
Revisions			
 HYDRO ENVIRONMENTAL SERVICES			
22 Lower Main St Dungarvan Co. Waterford Ireland		tel: +353 (0) 5844122 tel: +353 (0) 5844244 email: info@hydroenvironmental.ie web: www.hydroenvironmental.ie	
Client: ABO ENERGY IRELAND LTD			
Job: KEERGLLEN WIND FARM, Co. MAYO			
Title: PROPOSED DRAINAGE LAYOUT			
Figure No: D102			
Drawing No: P1583-0-0624-A1-D102-00A			
Sheet Size: A1		Project No.: P1583-0	
Scale: 1:2,000 (A1)		Drawn By: GA	
Date: 20/06/2024		Checked By: MG	

POLLUTION PREVENTION NOTES:

1. SITE MANAGEMENT PROPOSALS ARE INTENDED TO ENSURE PROTECTION AGAINST SURFACE WATER AND GROUNDWATER POLLUTION, SILTATION AND EROSION.
2. SUITABLE DRAINAGE CONTROL MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT CONVEYANCE OF SIGNIFICANT VOLUMES OF SILT TO OFF SITE RECEIVING WATERCOURSES.
3. SILTY WATER CAN ARISE FROM DEWATERING EXCAVATIONS, EROSION OF EXPOSED/DISTURBED GROUND, TEMPORARY STOCKPILES, PLANT AND WHEEL WASH, SITE ROADS/TRACKS, AND DISTURBANCE OF EXISTING FIELD DRAINS AND DITCHES.

DISCHARGES

4. WATER CONTAINING SILT WILL NOT BE PUMPED DIRECTLY TO ANY NATURAL WATERCOURSE. ALL DISCHARGES TO BE MADE OVER OPEN GROUND OR INTO EXISTING FIELD DRAIN WITH SILT TRAP AT A MINIMUM OF 20M FROM NEAREST WATERCOURSE UNLESS OTHERWISE STATED.
5. NO EXCAVATED MATERIAL IS TO BE STORED WITHIN ANY SURFACE WATER BUFFER ZONE.
6. PUMPED WATER WILL BE DIRECTED INTO TRACK SIDE DITCHES AND TREATED IN SETTLEMENT PONDS AND VEGETATION SWALES PRIOR TO OVERLAND DISCHARGE.
7. PUMPING OF CLEAN WATER FROM EXCAVATIONS / OR OVER-PUMPING IN DRAINS/DITCHES/STREAMS WILL BE COMPLETED IN A MANNER THAT WILL NOT CAUSE SCOUR OR EROSION AT THE POINT OF RELEASE/DISCHARGE. THIS WILL BE DONE BY REDUCING THE FLOW VELOCITIES OR BY USE OF SUITABLE SPLASH PLATES, AND/OR OTHER SIMILAR DISCHARGE CONTROLS.
8. VEGETATION WILL NOT BE STRIPPED FROM EXISTING DRAINS/DITCHES UNLESS ABSOLUTELY NECESSARY.

EXCAVATIONS

9. WHERE (TEMPORARY) DEEP EXCAVATIONS ARE PROPOSED, CUT-OFF DRAINS WILL BE USED TO REDUCE THE AMOUNT OF SURFACE WATER ENTERING THE EXCAVATION. THIS WILL BE THE CASE AROUND TURBINE BASE EXCAVATIONS.

EXPOSED GROUND & STOCKPILES

10. THE AMOUNT OF TEMPORARY EXPOSED GROUND AND TEMPORARY STOCKPILES OPEN/EXPOSED AT ANY TIME WILL BE MINIMISED.

SITE TRACKS

11. USE OF TRACK SIDE SWALES WITH CHECK DAMS, AND/OR FILTRATION CHECK DAMS WILL REDUCE SILT IN RUNOFF WATER AS REQUIRED.
12. CHECK DAMS TO BE INSPECTED AND CLEANED REGULARLY.

REFUELLING

13. REFUELLING OF MOBILE PLANT WILL BE COMPLETED IN DESIGNATED REFUELLING AREAS ONLY, ON AN IMPERMEABLE SURFACE AND AWAY FROM FIELD DRAINS / DITCHES AND WATERCOURSES/WATERBODIES.
14. SPILL KITS AND DRIP TRAYS WILL BE AVAILABLE ON SITE FOR USE AS REQUIRED.

CONCRETE

15. CONCRETE POURS WILL BE MANAGED AND SUPERVISED TO ENSURE THERE WILL BE NO LEAKAGE/SEEPAGE/DISCHARGE OF CONCRETE OR CONCRETE WATER DURING THE CONSTRUCTION PHASE.
16. CONCRETE WASH WATER, AND WASTE CONCRETE WILL BE MANAGED APPROPRIATELY ON SITE AT A LINED CONCRETE WASH OUT PIT.

IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO:

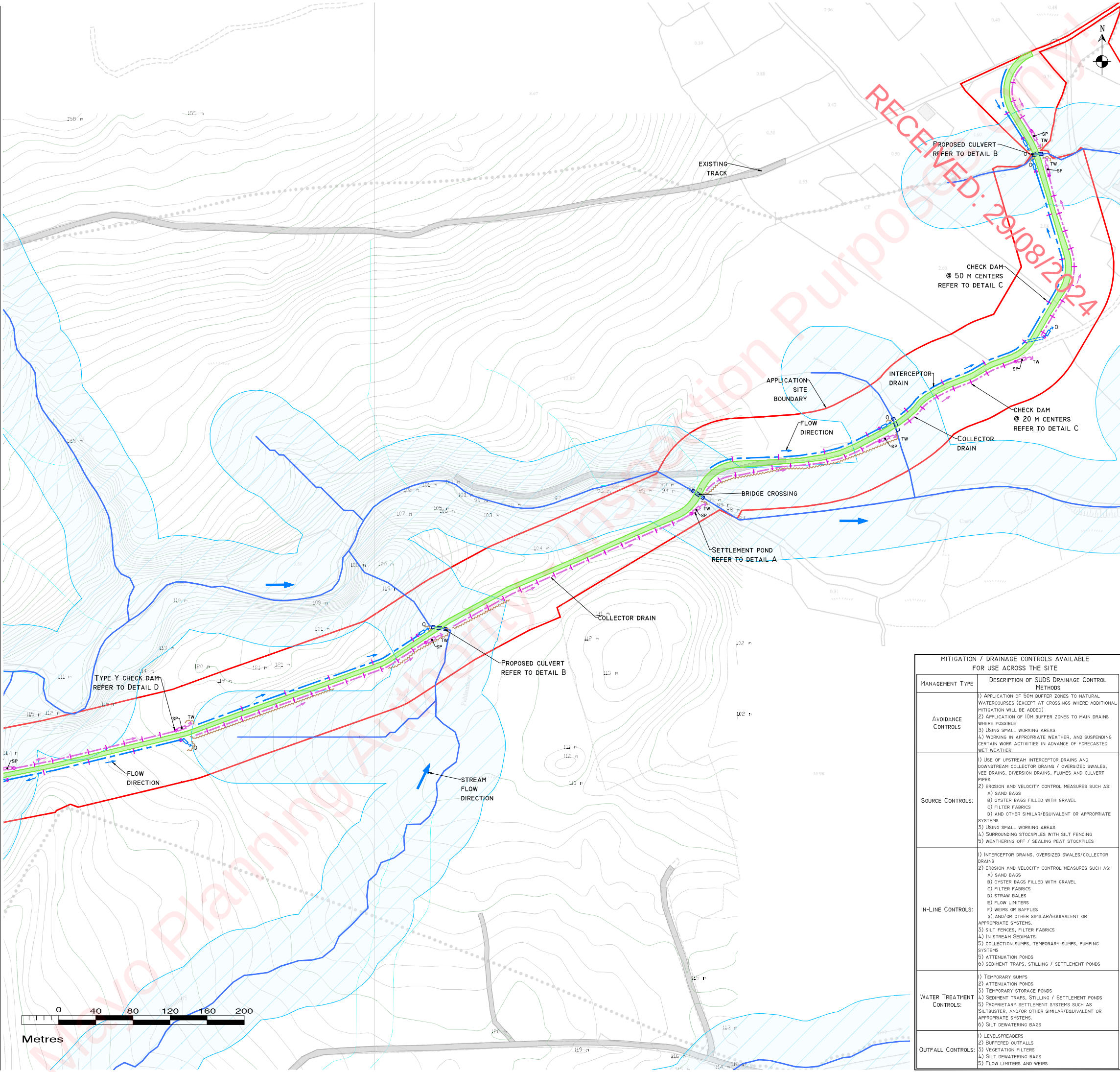
STOP - WORK IN THE IMMEDIATE AREA SHOULD BE STOPPED AND THE SOURCE OF THE POLLUTION IDENTIFIED.

CONTAIN - THE SOURCE OF THE POLLUTION SHOULD BE BUNDED USING A SUITABLE METHOD. NATURAL WATERCOURSES SHOULD BE TEMPORARILY DIVERTED AROUND ANY SOURCE OF POLLUTION.

NOTIFY - THE RELEVANT AUTHORITIES (SITE MANAGER / FISHERIES / NPWS / LOCAL AUTHORITY ETC.) SHOULD BE NOTIFIED IMMEDIATELY TO ENSURE THAT MEASURES CAN BE IMPLEMENTED DOWNSTREAM TO PROTECT FISHERIES AND OTHER SENSITIVE RECEPTORS.

DRAINAGE NOTES

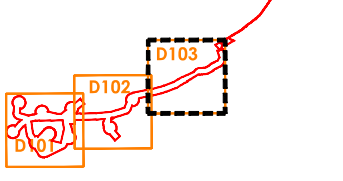
1. SITE TRACKS AND ROADWAY SURFACING DESIGN AND CONSTRUCTION TO ENGINEER'S SPECIFICATION (I.E. BY OTHERS).
2. SPARE STRAW BALES/SILT FENCING/ OR SIMILAR, WILL BE STORED ON SITE. THE LEVEL OF SILT IN RUNOFF DURING CONSTRUCTION IS TO BE MONITORED VISUALLY AND EXCESSIVE SILT LEVELS IN ANY AREA TO BE TEMPORARILY MANAGED BY PLACING SILT FENCES, STRAW BALES / OR SIMILAR OR ADDITIONAL CHECK DAMS AT THE PROBLEM AREAS. MOBILE SILTBUSTER SYSTEM TO BE AVAILABLE ON-SITE FOR USE AS REQUIRED ALSO.
3. SUDS DRAINAGE SYSTEM TO BE CONSTRUCTED PRIOR TO, OR AT THE SAME TIME AS THE ACCESS TRACKS. INTERIM MEASURES SUCH AS THE PLACEMENT OF STRAW/SILT FENCING/OR SIMILAR APPROVED METHOD OR ADDITIONAL CHECK DAMS AND SILT FENCES TO BE EMPLOYED IN ALL INSTANCES WHERE WORK CARRIED OUT TO CONSTRUCT THE ACCESS TRACKS IS LIKELY TO CAUSE ADVERSE ENVIRONMENTAL EFFECTS THROUGH INCREASED SILT LOADINGS BEING GENERATED DURING THE CONSTRUCTION PHASE.
4. SUITABLE PREVENTION MEASURES WILL BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SIGNIFICANT VOLUMES OF SILT TO RECEIVING WATERCOURSES. SEE NOTES ON POLLUTION PREVENTION.
5. INTERCEPTOR SWALES / DITCHES WILL BE USED TO COLLECT UPSTREAM SURFACE WATER FLOWS. REGULAR CROSS DRAINS / DISCHARGE TO FIELD DITCHES/DRAINS WILL BE INSTALLED TO TRANSFER / DISCHARGE SURFACE WATER INTO INTERCEPTOR DRAINS TO SUITABLE FIELD DRAIN OUTFALL POINTS.
6. DRAINAGE SWALES / DITCHES TO BE EXCAVATED ADJACENT TO THE ACCESS TRACKS. REGULAR CROSS DRAINS TO BE LOCATED ALONG ACCESS TRACKS TO PREVENT EXCESSIVE VOLUMES OF WATER COLLECTING IN THE SWALES / DITCHES. LOCATIONS OF CROSS DRAINS TO BE AGREED WITH THE ENGINEER ON SITE. SURFACE WATER WILL NOT BE ALLOWED TO DISCHARGE DIRECTLY INTO EXISTING WATERCOURSES.
7. A BUFFER ZONE OF >20M TO ANY EXISTING WATERCOURSE WILL BE REQUIRED WHERE OVER LAND DISCHARGES ARE PROPOSED FROM ACCESS TRACK SWALES / DITCHES. THIS BUFFER WILL NOT BE POSSIBLE AT RIVER/STREAM CROSSINGS, BUT OTHER SUITABLE CONTROLS ARE PROPOSED IN THOSE AREAS (I.E. ADDITIONAL SILT FENCING).
8. BATTERS OF ALL PROPOSED SWALES / DITCHES TO HAVE A SLOPE OF BETWEEN 1 : 1.5 TO 1 : 2 DEPENDING UPON DEPTH OF SWALE/DITCH AND WILL BE LEFT AS CUT TO RE-VEGETATE WITH LOCAL SPECIES.
9. TRACK SIDE SWALES / DITCHES TO BE SHALLOW WITH MODERATE GRADIENTS TO PREVENT SCOURING. IN STEEP AREAS CHECK DAMS WILL BE INSTALLED TO REDUCE FLOW VELOCITIES AND PROVIDE SOURCE CONTROL OF SILT CONTAINMENT. THESE HAVE BEEN DESIGNATED IN CONJUNCTION WITH SETTLEMENT PONDS AND SILT TRAPS, PRIOR TO DISCHARGE.
10. SETTLEMENT PONDS TO BE CONSTRUCTED FOR SILT REMOVAL AT TURBINE BASES AND HARD STAND AREAS. POND SIZES DEPEND ON THE CATCHMENT AREA BEING SERVED. SAMPLE POND SIZES FOR VARIOUS CATCHMENT AREAS SHOWN ON DRAWING D501.
11. STRAW BALES / OR SIMILAR AND SILT FENCES TO BE USED ALSO AROUND SPILL HEAPS TO MITIGATE SILT RUNOFF. SILT FENCES MAY BE REMOVED WHEN SUITABLE VEGETATION COVER IS ESTABLISHED.
12. SILT FENCES TO BE PROVIDED ALONG THE EDGE OF EXISTING WATERCOURSES WHERE WORKS COMES WITHIN <15M OF EDGE OF ANY DITCH / DRAIN / EPHEMERAL CHANNEL.
13. SLOPES OF THE SWALES / DITCHES TO BE VEGETATED OR PROTECTED FROM EROSION UNTIL VEGETATION HAS BEEN ESTABLISHED. STRIPPED VEGETATIVE LAYER (PEAT 'SOD' OR 'SCRAW') FROM EXCAVATIONS TO BE STORED LOCALLY AND USED TO LINE SLOPES AND BASE OF SWALES / DITCHES OR LONGITUDINAL MOUNDS OF VEGETATION SWALES AT FIELD DRAIN DISCHARGE POINTS.
14. AREAS STRIPPED OF VEGETATION WILL BE KEPT TO A MINIMUM.
15. CLEAN STONE FLOW CONTROL CHECK DAMS TO BE MADE OF LOCALLY WON / GEOLOGICALLY SIMILAR WELL GRADED STONE. AGGREGATE SIZE FOR STONE CHECK DAMS TO BE TYPICALLY 20- 40MM CLEAN STONE. ON SLOPING SECTIONS OF THE ACCESS TRACKS, 40MM CHECK DAMS TO BE PROTECTED FROM WASHING AWAY THROUGH THE PLACEMENT OF 100M STONE ON THE DOWNHILL FACE OF THE CHECK DAM AND BY WRAPPING IN GEOTEXTILE.
16. BUILD UP OF SILT LEVELS AT CHECK DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING DRAINAGE MAINTENANCE PROGRAMME DURING THE CONSTRUCTION PHASE. WHERE CHECK DAMS BECOME CLOGGED WITH SILT OR VEGETATION, STONE CHECK DAM TO BE REMOVED AND REPLACED SUBSEQUENT TO THE REMOVAL OF SILT.
17. SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDENT UPON LONGITUDINAL GRADIENT OF SWALE.
18. LOCATION OF FILTRATION CHECK DAMS (IF REQUIRED) TO BE AGREED ON SITE WITH ENGINEER. SETTLEMENT PONDS TO BE CONSTRUCTED IN A MANNER WHERE THEY MAY BE EASILY INFILLED AT A LATER DATE (POST COMPLETION OF THE TURBINE BASE AND HARDSTAND CONSTRUCTION). ONLY SUITABLE MATERIALS EXCAVATED FROM THE POND TO BE USED TO FORM PART OF THE EMBANKMENT AROUND THE POND.
19. OIL FUEL WILL ONLY BE STORED WITHIN BUNDED CONTAINMENT STRUCTURES.
20. SILT BAGS WILL BE USED ON SITE AT FIELD DRAIN DISCHARGE LOCATIONS.



DRAWING LEGEND :

- RIVERS/STREAMS (WC - WATERCOURSE)
- RIVERS/STREAMS 50M BUFFER
- STREAM FLOW DIRECTION
- UPSTREAM INTERCEPTOR DRAIN
- SWALES/DOWNSTREAM COLLECTOR DRAIN DIRECTION OF FLOW
- SILT FENCES
- DOUBLE/TRIPLE SILT FENCES
- SETTLEMENT POND - LEVEL SPREADER
- CHECK DAM 'TYPE A'
- CHECK DAM 'TYPE B'
- PROPOSED WC CROSSING
- EXISTING WC CROSSING
- INTERCEPTOR DITCH CULVERT
- COLLECTOR DITCH CULVERT
- OVERLAND FLOW DISCHARGE
- TREATED WATER DISCHARGE
- SETTLEMENT POND
- SEMI-NATURAL VEGETATION SWALE / FILTER BED /SECONDARY SP
- PUMPING SUMP
- APPLICATION SITE BOUNDARY
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- EXISTING GROUND SURFACE MAJOR CONTOUR (5 M INTERVAL)
- TURBINE AND TURBINE FOUNDATION
- PROPOSED NEW ROADS
- EXISTING ROADS PROPOSED TO BE UPGRADED
- EXISTING ROADS
- SUBSTATION
- CONSTRUCTION COMPOUND
- BORROW PIT

KEY PLAN



DRAWING NOTES

1. DRAWINGS ISSUED ARE FOR PLANNING APPLICATION PURPOSES ONLY.
2. COPYRIGHT, ALL RIGHTS RESERVED. NO PART HERE WITH MAY BE COPIED OR REPRODUCED PARTIALLY OR WHOLLY IN ANY FORM WHATSOEVER WITHOUT THE PRIOR NOTICE OF THE COPYRIGHT OWNER HYDRO-ENVIRONMENTAL SERVICES.
3. DO NOT SCALE OFF THIS DRAWING. FIGURED METRIC DIMENSIONS ONLY SHOULD BE TAKEN OFF THIS DRAWING.
4. ALL DIMENSIONS ARE IN METRES.

MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE	
MANAGEMENT TYPE	DESCRIPTION OF SUDS DRAINAGE CONTROL METHODS
AVOIDANCE CONTROLS	1) APPLICATION OF 50M BUFFER ZONES TO NATURAL WATERCOURSES (EXCEPT AT CROSSINGS WHERE ADDITIONAL MITIGATION WILL BE ADDED) 2) APPLICATION OF 10M BUFFER ZONES TO MAIN DRAINS WHERE POSSIBLE 3) USING SMALL WORKING AREAS 4) WORKING IN APPROPRIATE WEATHER, AND SUSPENDING CERTAIN WORK ACTIVITIES IN ADVANCE OF FORECASTED WET WEATHER
SOURCE CONTROLS	1) USE OF UPSTREAM INTERCEPTOR DRAINS AND DOWNSTREAM COLLECTOR DRAINS / OVERSIZED SWALES, VEE-DRAINS, DIVERSION DRAINS, FLUMES AND CULVERT PIPES 2) EROSION AND VELOCITY CONTROL MEASURES SUCH AS: A) SAND BAGS B) OYSTER BAGS FILLED WITH GRAVEL C) FILTER FABRICS D) AND OTHER SIMILAR/EQUIVALENT OR APPROPRIATE SYSTEMS 3) USING SMALL WORKING AREAS 4) SURROUNDING STOCKPILES WITH SILT FENCING 5) WEATHERING OFF / SEALING PEAT STOCKPILES
IN-LINE CONTROLS	1) INTERCEPTOR DRAINS, OVERSIZED SWALES/COLLECTOR DRAINS 2) EROSION AND VELOCITY CONTROL MEASURES SUCH AS: A) SAND BAGS B) OYSTER BAGS FILLED WITH GRAVEL C) FILTER FABRICS D) STRAW BALES E) FLOW LIMITERS F) WEIRS OR BAFFLES G) AND/OR OTHER SIMILAR/EQUIVALENT OR APPROPRIATE SYSTEMS 3) SILT FENCES, FILTER FABRICS 4) IN STREAM SEDIMENTS 5) COLLECTION SUMPS, TEMPORARY SUMPS, PUMPING SYSTEMS 5) ATTENUATION PONDS 6) SEDIMENT TRAPS, STILLING / SETTLEMENT PONDS
WATER TREATMENT CONTROLS	1) TEMPORARY SUMPS 2) ATTENUATION PONDS 3) TEMPORARY STORAGE PONDS 4) SEDIMENT TRAPS, STILLING / SETTLEMENT PONDS 5) PROPRIETARY SETTLEMENT SYSTEMS SUCH AS SILTBUSTER, AND/OR OTHER SIMILAR/EQUIVALENT OR APPROPRIATE SYSTEMS. 6) SILT DEWATERING BAGS
OUTFALL CONTROLS	1) LEVELSPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

Ordnance Survey Ireland Licence No. EN 0044724 © Ordnance Survey Ireland/Government of Ireland			
Date Description Chkd Signed			
Revisions			
 HYDRO ENVIRONMENTAL SERVICES			
22 Lower Main St Dungarvan Co. Waterford Ireland		tel: +353 (0) 58-44122 tel: +353 (0) 58-44244 email: info@hydroenvironmental.ie web: www.hydroenvironmental.ie	
Client: ABO ENERGY IRELAND LTD			
Job: KEERGLLEN WIND FARM, Co. MAYO			
Title: PROPOSED DRAINAGE LAYOUT			
Figure No: D103			
Drawing No: P1583-0-0624-A1-D103-00A			
Sheet Size: A1		Project No: P1583-0	
Scale: 1:2,000 (A1)		Drawn By: GA	
Date: 20/06/2024		Checked By: MG	