EcoQuest Environmental

APPENDIX 9.3

Dyrick Hill Wind Farm

County Waterford

Water Framework Directive Compliance Assessment

March 2023

Table 1 – Document Control

Client:	Jennings O'Donovan & Partners Limited			
Project Name:	Dyrick Hill Windfarm			
Document Title:	Water Framework Directive Assessment			
Revision Number	**Date**	**Prepared By**	**Reviewed By**	**Status**
01	22-3-2023	DP	AG	Draft
02	TBC	DP	RM	Final

Contents

List of Tables

List of Figures

Table 2 – Terms and Definitions

Acronym	Meaning
BSc.	Bachelor of Science
CEnv	Chartered Environmentalist
Co.	County
DEM	Digital Elevation Model
DO	Dissolved Oxygen
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
EQS	Environmental Quality Standards
GIS	Geographic Information System
GSI	Geological Survey of Ireland
GWB	Groundwater Body
HA	Hydrometric Area
HDD	Horizontal Directional Drilling
HMWBs	Heavily Modified Water Bodies
IFI	Inland Fisheries Ireland
Km	Kilometre
Kv	Kilovolt
LI	Locally Important
LIDAR	Light Detection and Ranging
MIEMA	Member of the Institute of Environmental Management and Assessment
MIGI	Member of the Institute of Geologists of Ireland
MSc.	Master of Science
MW	Megawatt
OPW	Office of Public Works
P.Geo	Registered Professional Geologist
RAMS	Risk Assessment and Method Statement
RBD	River Basin District
RPA	Registered Protected Area
SAC	Special Area of Conservation
SC	Subcatchment
SPR	Source-Pathway-Receptor
SWB	Surface Waterbody
T(No.)	Turbine Number
TDR	Turbine Delivery Route
TDS	Total Dissolved Solids
WFD	Water Framework Directive

1. Introduction

EcoQuest Environmental has been appointed by Jennings O'Donovan & Partners Limited on behalf of EMPower Limited to complete a Water Framework Directive (WFD) compliance assessment for a proposed wind farm at Dyrick Hill, Co. Donegal. Planning permission is being sought by the Developer for the construction of 12 wind turbines, a permanent met mast, 110Kv on-site substation and all ancillary works and the construction of an underground grid connection to Dungarvan 110Kv Substation, Co. Waterford.

Article 4(1) of the WFD sets out the environmental objectives for natural surface, groundwater bodies and artificial or heavily modified water bodies (HMWBs). Natural surface water bodies must, by 2027, adhere to good ecological and chemical status and groundwater bodies to good quantitative and chemical status. The primary purpose of this WFD compliance assessment is to establish if any aspects of the proposed Development could result in non-compliance with the requirements of the WFD. The summarised objectives of Article 4 of the WFD for which this WFD compliance assessment will assess the proposed Development area as follows:

- No further deterioration occurs in the status of the affected surface waters and/or groundwater bodies;
- Not to contribute to a failure of a waterbody to achieve at least "*Good*" status by 2027; and
- No changes which will permanently prevent or compromise environmental objectives being met in other water bodies.

This WFD assessment report has been prepared for the construction and operational phases of the proposed Dyrick Hill Wind Farm. This assessment will identify the surface waters and groundwater bodies with the potential to be impacted, outline the proposed mitigation measures and conclude whether the proposed Development is in compliance with the objectives of the WFD.

1.1 Statement of Authority

This chapter of the EIAR was prepared by David Parkinson (BSc.(Hons), MIEMA, CEnv) and was reviewed by Andrew Garne. David is the Principal Environmental Consultant of EcoQuest Environmental with over a decade of environmental consultancy experience in Ireland and Australia. David has completed numerous hydrological and hydrogeological impact assessments, is a Full Member of the Institute of Environmental Management and Assessment (MIEMA) and is a Chartered Environmentalist (CEnv). David's experience spans multiple industry sectors or disciplines, including numerous windfarm projects, flood alleviation schemes, infrastructure projects, transport, aviation, wastewater schemes, contaminated land and advisory on emerging contaminants. He has extensive experience in carrying out water quality assessments on major Irish rivers or their tributaries such as the Shannon, Dodder, Morell, Corrib, Broadmeadow, Finisk, Bandon and Garavogue rivers. In addition to nationwide water quality assessment experience, David has also assisted with water quality management of sensitive wetlands of international significance in Australia. David also has a background in water and wastewater chemistry laboratory analytical roles which help form the scientific basis of his environmental assessment expertise.

Andrew Garne (B.Sc., M.Sc., P.Geo) is an independent Engineering Geologist who specialises in hydrogeological, geotechnical and geological impact assessment. Andrew is a Full Member of the Institute of Geologists of Ireland (MIGI) and is a registered professional geologist (P.Geo). Andrew has worked on multiple EIAR impact assessments, including multiple windfarm developments, across the disciplines of hydrogeology, geology and soils. He also has extensive experience of windfarm peat stability assessments, geotechnical earthworks designs, geotechnical inspections and supervision, contaminated land assessments, slope stability assessments, site investigation design, procurement and supervision, soil and rock core logging, and writing of geotechnical advisory reports. Andrew has worked in tandem with David throughout the duration of this project, including in the field, at virtual meetings and through extensive collaboration. Andrew has provided input to, and has reviewed, this Chapter of the EIAR.

2. Water Framework Directive

The European Communities Directive (2000/60/EC), as amended established a framework for community action in the field of water policy known as the Water Framework Directive (WFD). Ireland has published the draft River Basin Management Plan (2022-2027) which defines the actions that will be taken to improve water quality and achieve "*Good*" ecological status in rivers, lakes, estuaries and coastal waters by 2027. The WFD is the overarching mechanism by which water quality management areas are divided and assessed. This section identifies the geographical distribution of WFD management areas and provides an assessment of the available water quality information relative to the proposed Site.

3. Description of the Project

3.1 Background

Planning permission is being sought by the Developer for the construction of 12 wind turbines, a permanent met mast, 110Kv on-site substation and all ancillary works and the construction of an underground grid connection to Dungarvan 110Kv Substation, Co. Waterford.

The Project will comprise of the following main components:

- Erection of 12 no. 6.0-7.2 MW wind turbines (Note* this is the current output available for the turbine of this size. It is possible that with improvements in technology, the output my increase at the time of construction.) with an overall ground tip height of up to 185m. The candidate wind turbines will have a rotor diameter of circa 162m and a hub height of 104m;
- Construction of crane hardstand areas and turbine foundations;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of a new wind farm site entrance with access onto the R671 regional road in the townlands of Lickoran;
- Improvement of existing site entrance with access onto local roads in the townlands of Broemountain;
- Improvements and temporary modifications to existing public road infrastructure to facilitate delivery of abnormal loads and turbine delivery;
- Construction of one temporary construction compound with associated temporary site offices, parking area and security fencing;
- Development of one-site borrow pit;
- Installation of one permanent meteorological mast up to a height of 110m;
- Development of a site drainage network;
- The change of use of an existing residential property to combined agricultural and commercial use (in the form of a mix of material storage and office space) for the duration of the wind farm operations;
- Construction of one permanent 110 kV substation;
- All associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation;
- All works associated with the connection of the wind farm to the national electricity grid, which will be via 110 kV underground cable connection approximately 16.8km in length to the existing Dungarvan 110 kV Substation;
- Upgrade works on the turbine delivery route from Waterford Port;
- Ancillary forestry felling to facilitate construction and operation of the Development and any onsite forestry replanting.

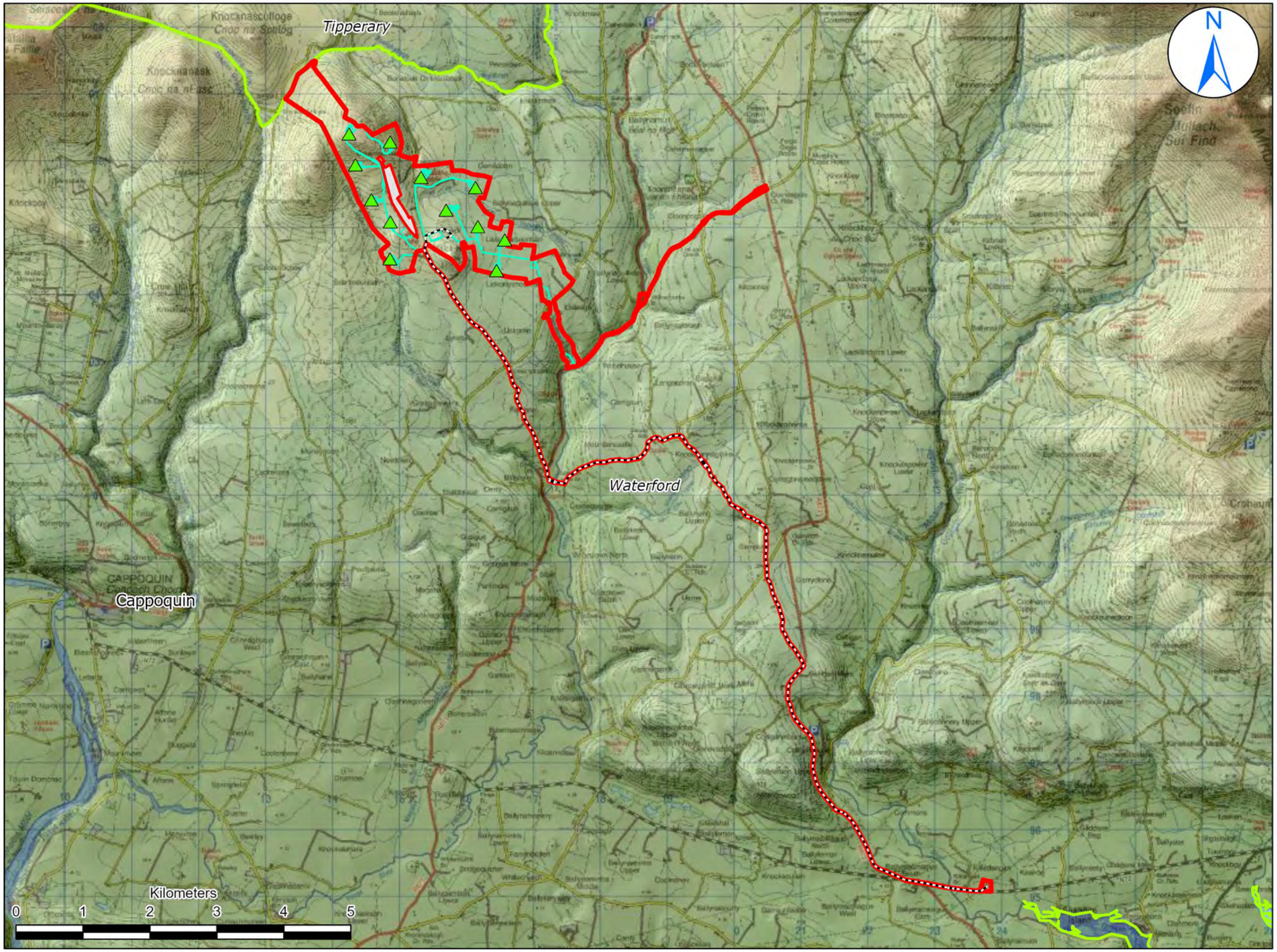
A 15-year planning permission and 40-year operational life from the date of commissioning of the entire wind farm is being sought.

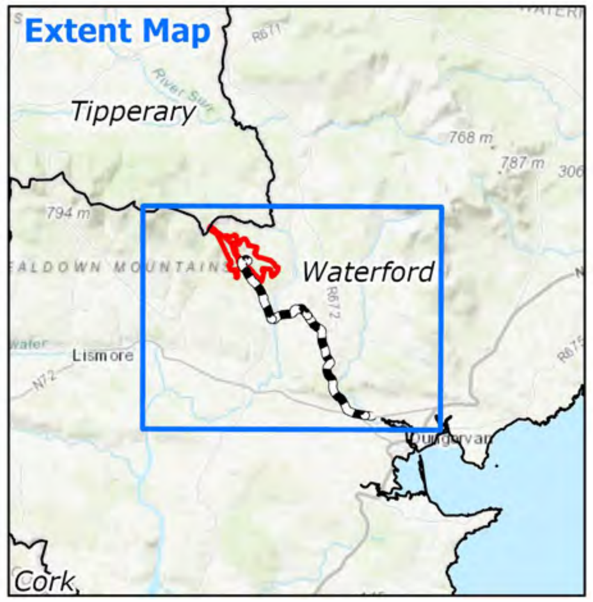
3.2 Site Location

The Site, as shown in Figure 1, is located within an area of farmland, forestry and upland heath, and is located within the townlands of Ballynaguilkee Upper, Broemountain, Corradoon, Dyrick, Lickoran, Lickoranmountain, Lisleagh, Lisleaghmountain, Lyrattin and Scartmountain. The Site is located 43km west of Waterford City, 55km northeast of Cork City, and 12.9km northwest of Dungarvan.

The proposed grid connection passes through the townlands of Broemountain, Lyrattin, Farnane Lower, Farnane Upper, Castlequarter, Mountaincastle South, Carrigaun (Mansfield), Langanoran, Sleadycastle, Knockaunnaglokee, Garryduff, Colligan More, Garryclone, Colliganwood, Ballymacmague North, Ballymacmague South and Killadangan.

Temporary works will be required to accommodate the delivery of the turbine components. These temporary works are located in the townlands of Ballynaguilkee Lower, Kilcooney, and Lisleagh Gorteens, Kilmurry, Rathpatrick, Ballyduff East, Joulterspark and Burgery. The redline boundary extends to 358.6ha, and comprises a mixture of farmland, forestry and upland heath.





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Project: Dyrick Hill Wind Farm	
Map Title: Water Framework Directive Assessment: Site Location	
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Legend

- EIAR Boundary
- Land Excluded From EIAR Boundary
- Turbine Locations
- Grid Connection Route
- Road Alignment
- County Boundaries

4. Classification of Hydrological Features

4.1 Surface Water Network Identification

This section describes the available information on the local and regional surface water hydrological environment. At a regional scale, the proposed wind farm Site, and grid connection route are located within the Blackwater (Munster) and Colligan-Mahon catchment areas in Hydrometric Areas 18 and 17 respectively. The proposed wind farm Development and grid connection to Dungarvan Substation at Killadangan are located within three WFD sub-catchments. These include the Blackwater (Munster) (SC_140), Finisk (SC_010) and Colligan (SC_010) subcatchments. All of the proposed wind farm Development and grid connection route are located within the National River Basin District (RBD) as defined by the 3rd Cycle of the WFD. Figures outlining the catchment and subcatchment boundaries relative to the Site and grid connection route are outlined in Figure 2 and Figure 3 respectively.

At the western extent of the site is the Farnane River which rises to the east of an area of upland forestry between Knocknasheega and Broemountain at an altitude of 290m. Two small unnamed streams merge with the Farnane River from both the east and west near the townland of Graigueavurra, approximately 1.3km southeast of the Site boundary. An additional small unnamed stream merges from the west of the Farnane River at Graigueavurra, approximately 2km southeast of the Site boundary. The total length of the Farnane River and its tributaries is 9.1km and it covers a catchment area of 8.1km^2. The Farnane River flows in a south-easterly direction, near parallel to the western Site boundary and then continues further to the south-east until it merges with the Finisk River at Millstreet, County Waterford.

The Lisleagh Stream rises near the central extent of the main Site, to the northwest of the proposed T4 position. According to the EPA maps for the area, an unnamed stream is located immediately west of the proposed T04 position which is mapped as flowing in a north-easterly direction for approximately 390m until it merges with the Lisleagh Stream. However, during all site survey visits, there were no indications that this stream existed. It was initially suspected that this stream could be ephemeral, however it was not visible at the site even after periods of heavy rainfall. It could also be the case that land drainage practices, or the construction of an unpaved road near the stream, have resulted in its removal or alteration of its course over time.

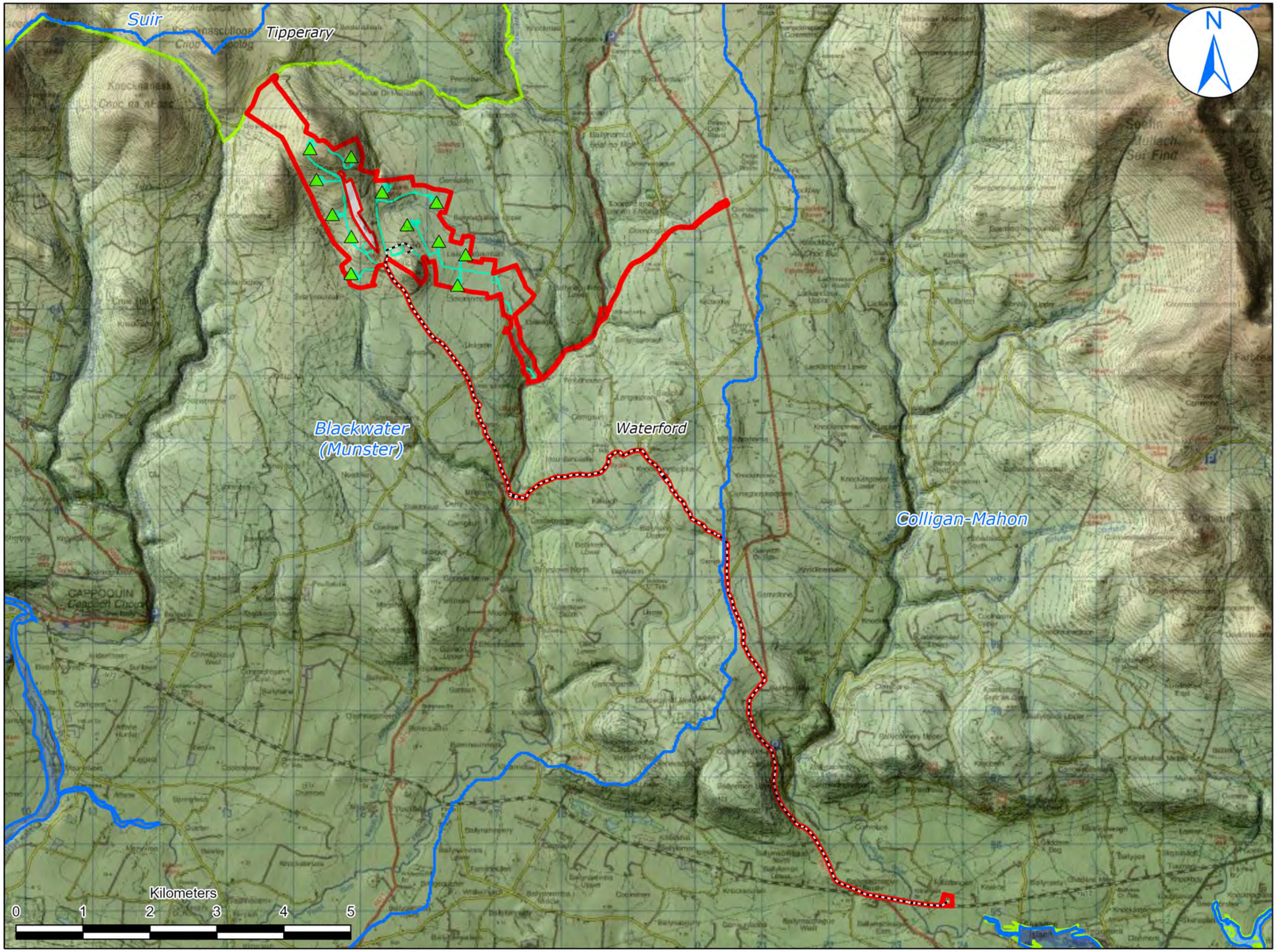
The Lisleagh Stream flows in south-easterly direction from its source for approximately 1.8km kilometres where it merges with a small unnamed stream that rises near the townland of Corradoon, approximately 1.5km north of this confluence. To the northeast of the proposed T05, at the north-eastern Site boundary, an additional unnamed stream flows in an easterly direction for approximately 660m until it merges with the unnamed stream mentioned above which ultimately merges with the Lisleagh Stream.

At the south-eastern extent of the Site, the Aughkilladoon Stream rises in the townland of Lickoranmountain. The Aughkilladoon Stream flows along the south-eastern site boundary and continues in a south-easterly direction for approximately 2km until it merges with the Finisk River, east of the townland of Woodhouse. Beyond the northern site boundary, five small unnamed streams flow in a north-easterly direction and merge with the Boolahallagh River. The Boolahallagh River flows along the boundary of Counties Waterford and Tipperary until it merges with the Aughavanlomaun Stream at Priestown Bridge, approximately 1.7km north-east of the Site. Beyond the western site boundary, to the west of Knocknasheega, the Glenshelane River rises to the east of Knocknanask. The Glenshelane River flows in a southerly direction between Knocknansk and Knocknasheega until it merges with the Blackwater River, south of Cappoquin. North-east of Coolagortboy and north of Scarthmountain, an unnamed stream rises approximately 670m west of the Site boundary and flows in a south-westerly direction until it merges with the Glenshelane River.

The WFD requires that status be assigned to all identified surface and groundwater bodies and sets out in detail how status should be assigned. Monitoring all water bodies in Ireland is not logistically feasible. Therefore, the EPA has grouped similar water bodies together and interpolated data for the purpose of assigning status. This is allowed for by the WFD if enough water bodies are monitored within a group to provide an accurate assessment of status of that group. In Ireland, just under 60% of identified water bodies have been assigned a status based on the results of monitoring which means that 40% of waterbodies require status to be assigned by other means such as grouping and expert

Within the EIAR Site boundary, a detailed drainage basin delineation of the Site has also been completed utilising LIDAR data and GIS software. In hydrology, a drainage basin is an area of land drained by a river and its tributaries, a diagram of a typical basin structure and the associated interaction with groundwater is provided in Appendix 1. This methodology allows for runoff flow paths and drainage patterns at the site to be identified. This technique enables potential impacts from the development on waterbodies to be assessed with high location data confidence and for area specific targeted mitigation measures to be implemented. Figure 4 outlines the drainage basin delineation at the main Site. There are numerous micro-basin areas located within the LIDAR coverage area and 12 drainage basins covering an area of 0.05 km^2 or greater. These 12 largest basins in the LIDAR coverage area have been labelled on Figure 4 by order of size (i.e. 1 being the largest and 12 being the smallest).

The density of natural drainage channels is greater in the northern/western commonage areas of the Site, artificial roadside and field drains are more prevalent at the central, southern and eastern extents of the site. The forestry drainage network at the north-east and western extents of the site are largely influenced by the gradient and topography in these forests. The forestry plantation structure, location of firebreaks and subsoils also have a bearing on the forestry drainage network. The forestry drainage network is the main drainage vector for the hydraulic movement of water from the forests at the Site to the surrounding natural waterbodies of the Farnane River and the Lisleagh Stream which are the primary receiving waters of the forestry drainage network at the Site. The Aughkilladoon Stream receives runoff from the open fields and associated drainage networks at the south-eastern extent of the Site.



Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: Water Framework Directive (WFD) Catchment Areas Relative to the Site and Grid Connection Route	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
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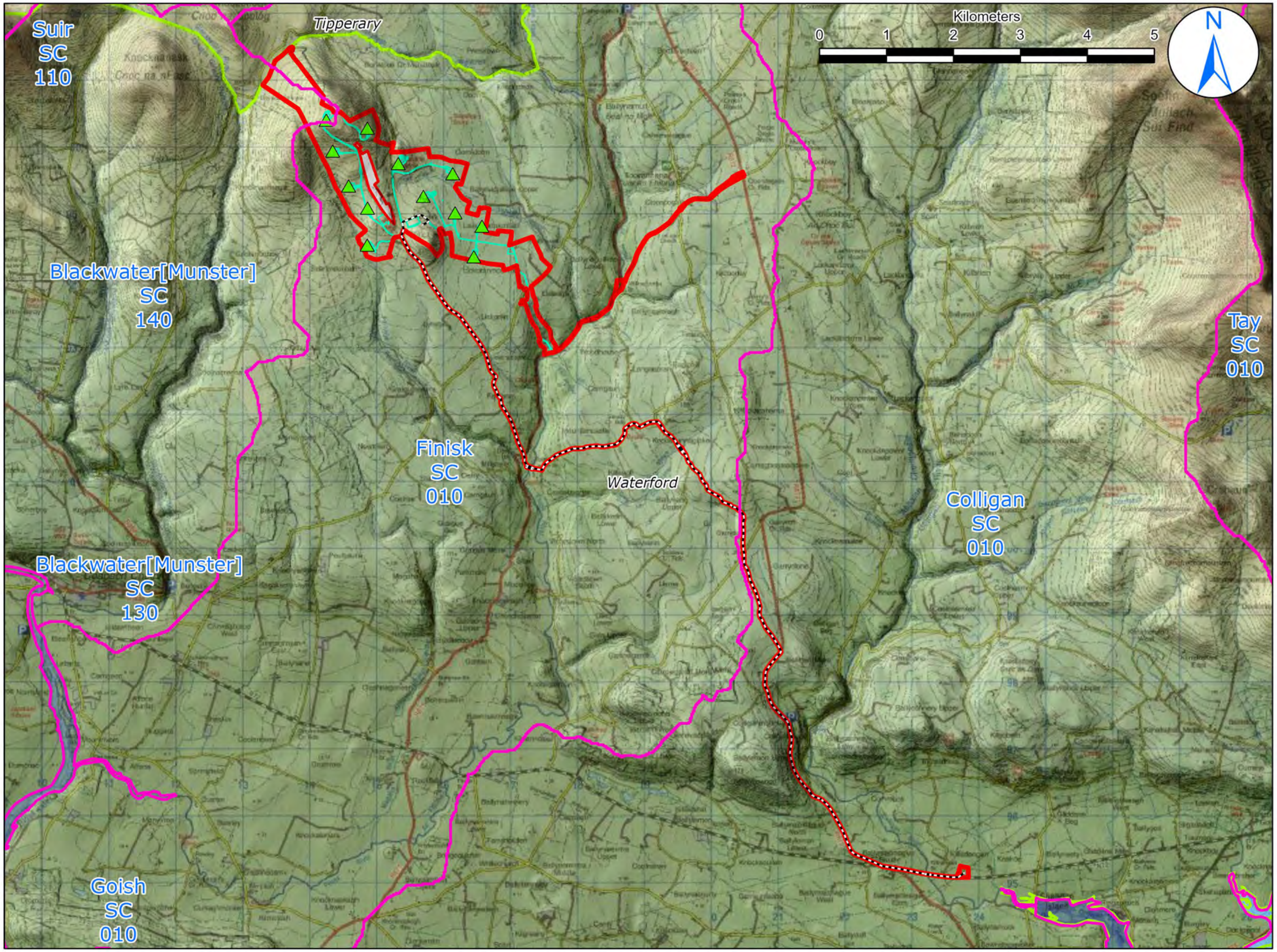
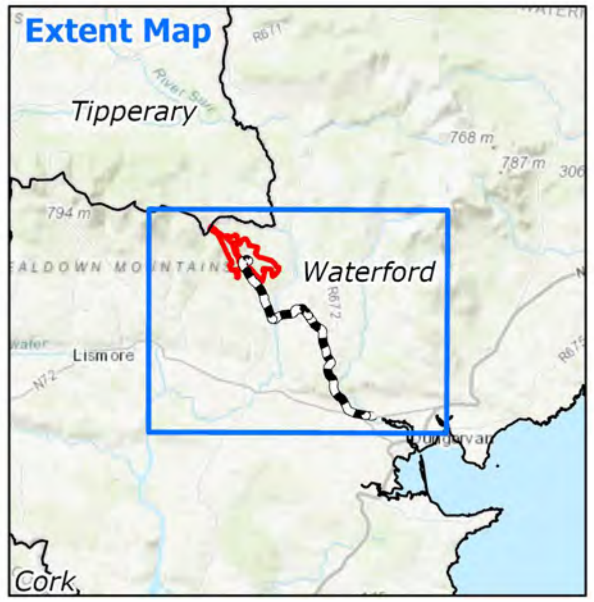
Legend

- WFD Catchments
- Turbine Locations
- Grid Connection Route
- EIAR Boundary
- Land Excluded From EIAR Boundary
- Road Alignment
- County Boundaries





Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: Water Framework Directive (WFD) Subcatchment Areas	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
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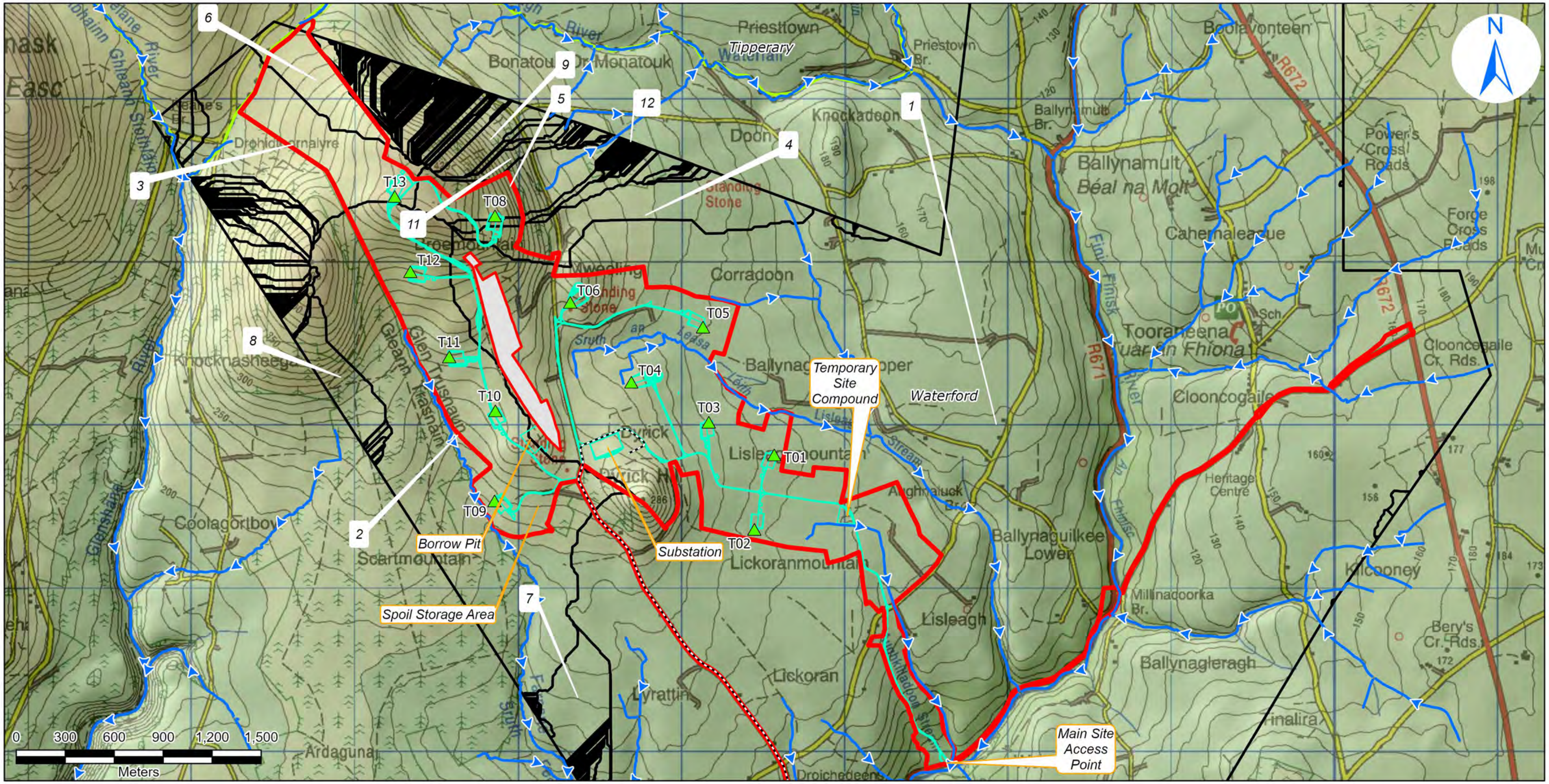
Legend

- WFD Subcatchments
- Turbine Locations
- Grid Connection Route
- EIAR Boundary
- Land Excluded From EIAR Boundary
- Road Alignment
- County Boundaries



Legend

- Drainage Basin Delineation Boundaries Within LIDAR Coverage Area
- River Network
- Turbine Locations
- Grid Connection Route
- EIAR Boundary
- Land Excluded From EIAR Boundary
- Road Alignment
- County Boundaries

Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: Drainage Basin Delineation at the main Site With the 12 Largest Basins Labelled by Size Order	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
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4.2 Surface Waterbody Status

A review of the latest available WFD surface waterbody (SWB) status and risk contained in the *3rd Cycle Draft Blackwater (Munster) Catchment Report (HA 18)*, (EPA, 2022) and the *3rd Cycle Draft Colligan-Mahon Catchment Report (HA 17)* (EPA, 2021) has been carried out. A summary of the results of this review, in addition to location of the WFD assigned watercourse grouping relative to the proposed Development features is contained in Table 4. The results of this review are also outlined on Figure 6 for the main Site/TDR and on Figure 7 for SWBs in close proximity to the grid connection route.

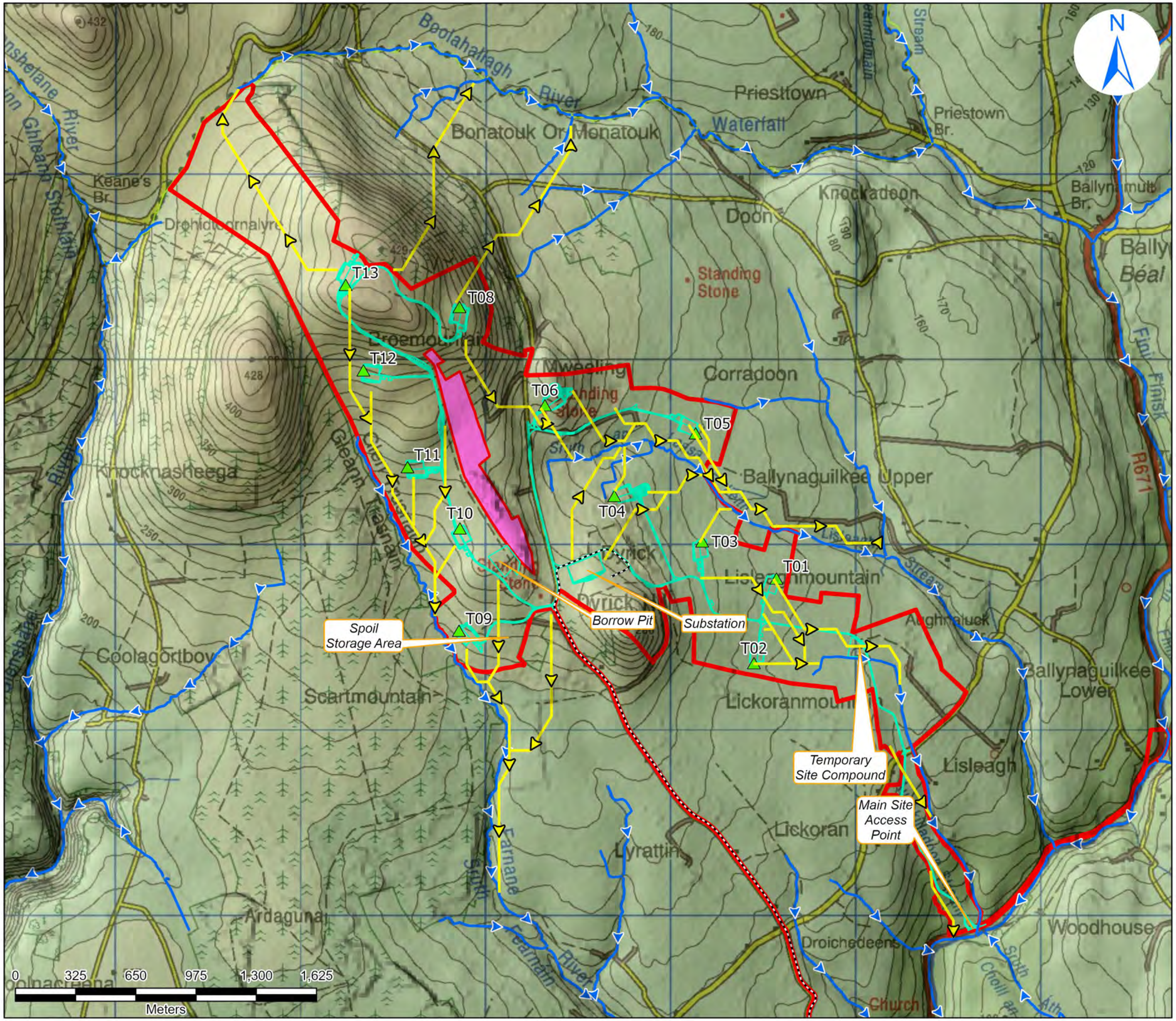
The north-western extent of the EIAR boundary drains to the Glenshelane River which has been classified as "*High*" status under the WFD for the 2013 – 2018 period. Further south, along the western EIAR boundary, the land within the EIAR boundary drains to the Farnane River. The Farnane River has also been classified as "*High*" status under the WFD for the 2013 – 2018 period. Beyond the north-eastern EIAR boundary of the Site, the Finisk_10, which includes the Boolahallagh River, and multiple unnamed streams, have been classified as "*Good*" status under the WFD for the 2013 – 2018 period. The Finisk_020 grouping includes the Aughkilladoon Stream and Lisleagh Stream which flow through the central and eastern extents of the site. The Finisk_020 grouping also includes multiple unnamed streams north of the site, north/south and intersecting the TDR, the Killeagh Stream, the Finisk River, and unnamed streams east and south of the grid connection route.

The Finisk_020 has been classified as "*Moderate*" status under the WFD for the 2013 – 2018 period. Further south, to the west of the grid connection route, the Finisk_030 grouping of surface unnamed waterbodies has been classified as *"Good"* status under the WFD for the 2013 – 2018 period. To the east of the grid connection route, the Colligan_030 grouping of unnamed surface waterbodies and the Knockanpower Stream are "*Unassigned*" under the WFD for the 2013 – 2018 period. Near the southern extent of the grid connection route, the Colligan River (Colligan_040) and a series of unnamed SWBs are classified as "*Good*" status under the WFD for the 2013 – 2018 period.

In relation to the assigned WFD risk of a waterbody not meeting its objectives by 2027, the Finisk_020 and the Colligan_030 are at "*Review*" status. Waterbodies may be categorised as "*Review*" either because additional information is needed to determine their status before resources and more targeted measures are initiated or measures have already been undertaken although the outcome hasn't yet been measured/monitored. All other identified WFD surface waterbodies at the Site and along the grid connection route are classified as "*Not at Risk*" of meeting their objectives by 2027.

Table 4 – Latest SWB Status

Surface Waterbody ID Code	Surface Waterbody Name	2013 - 2018 Water Quality Status	2013 - 2018 Significant Pressure	Risk Status of Not Meeting WFD Objectives	Location Relative to the Development
IE_SW_18F060300	Farnane_010	High	No	Not at Risk	Western Site Boundary and West of Grid Connection Route
IE_SW_18F020100	Finisk_010	Good	No	Not at Risk	North of the Main Site
IE_SW_18F020300	Finisk_020	Moderate	No	Review	Main Site, Grid Connection Route and TDR
IE_SW_18F020500	Finisk_030	Good	No	Not at Risk	West of Grid Connection Route
IE_SW_18G110300	Glenshelane_010	High	No	Not at Risk	West of the Main Site
IE_SE_17C010180	Colligan_030	Unassigned	No	Review	East of Grid Connection Route
IE_SE_17C010300	Colligan_040	Good	No	Not at Risk	East and Intersecting Grid Connection Route



Legend

- Generalised Runoff Flow Directions From Primary Constrction Areas (Derived From Digital Elevation Model)
- River Network
- Turbine Locations
- Grid Connection Route
- Road Alignment
- EIAR Boundary
- Land Excluded From EIAR Boundary

Project Extent Map

Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: Generalised Runoff Patterns Derived From a Digital Elevation Model (DEM)	
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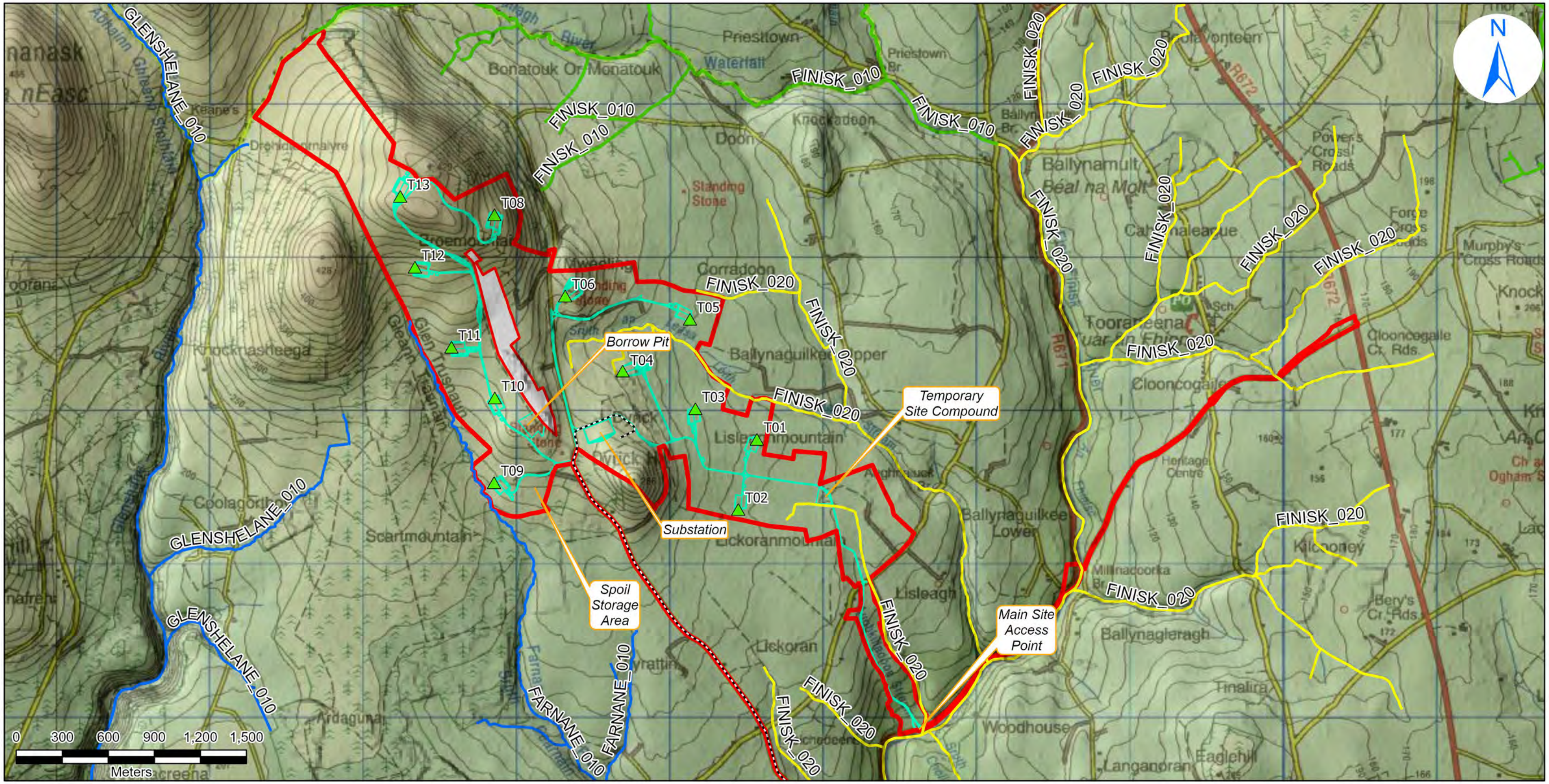

Legend

River Waterbody WFD Status 2013-2018

- High
- Good
- Moderate

- Turbine Locations
- Grid Connection Route
- EIAR Boundary
- Land Excluded From EIAR Boundary
- Road Alignment

Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: WFD Surface Water Classification (2013 - 2018) Near the Main Site and Turbine Delivery Route	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
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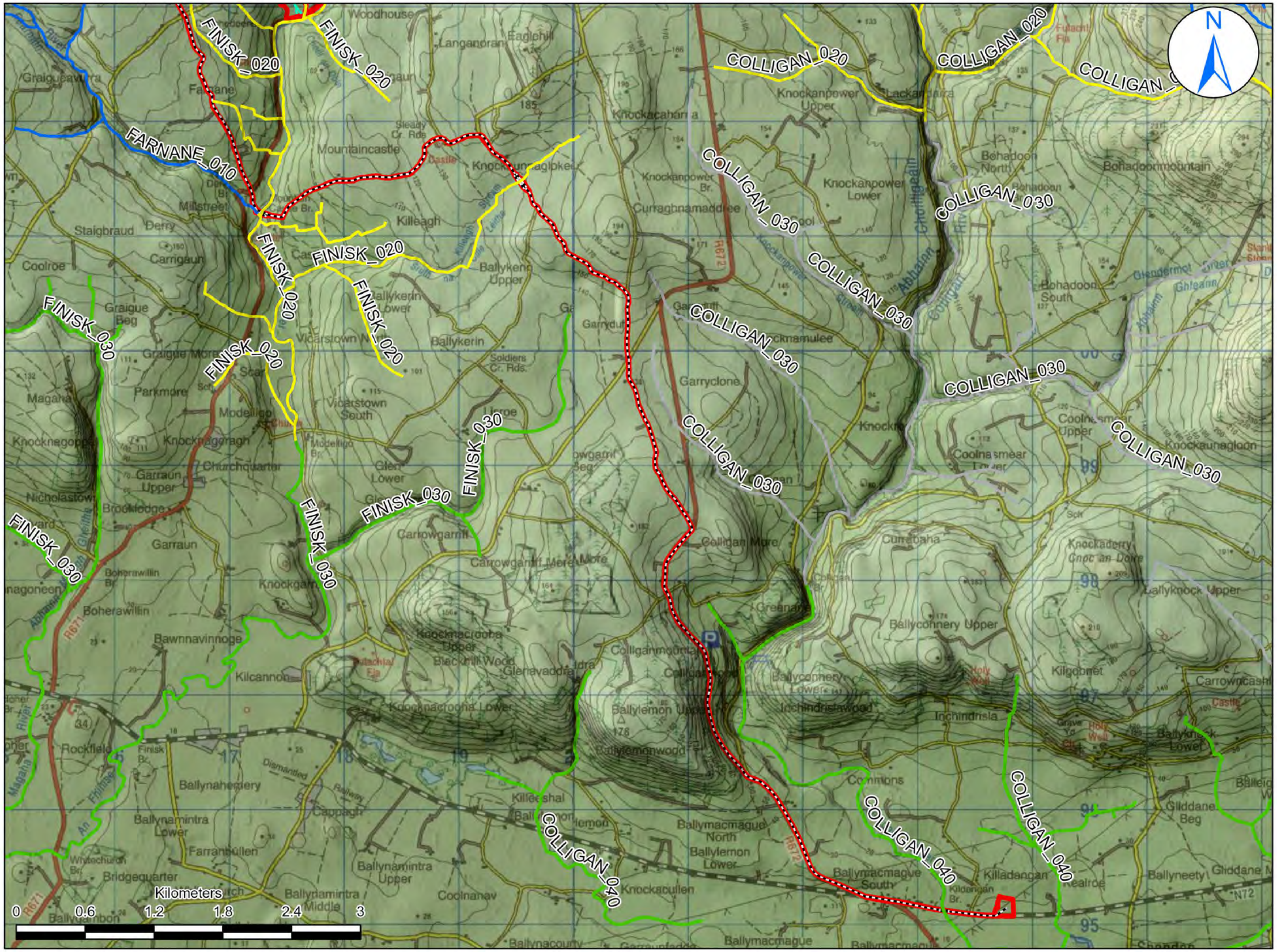

Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: WFD Surface Water Classification (2013 - 2018) Along the Grid Connection Route	
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Legend

- Grid Connection Route
- EIAR Boundary
- Road Alignment

River Waterbody WFD Status 2013-2018

- High
- Good
- Moderate
- Unassigned

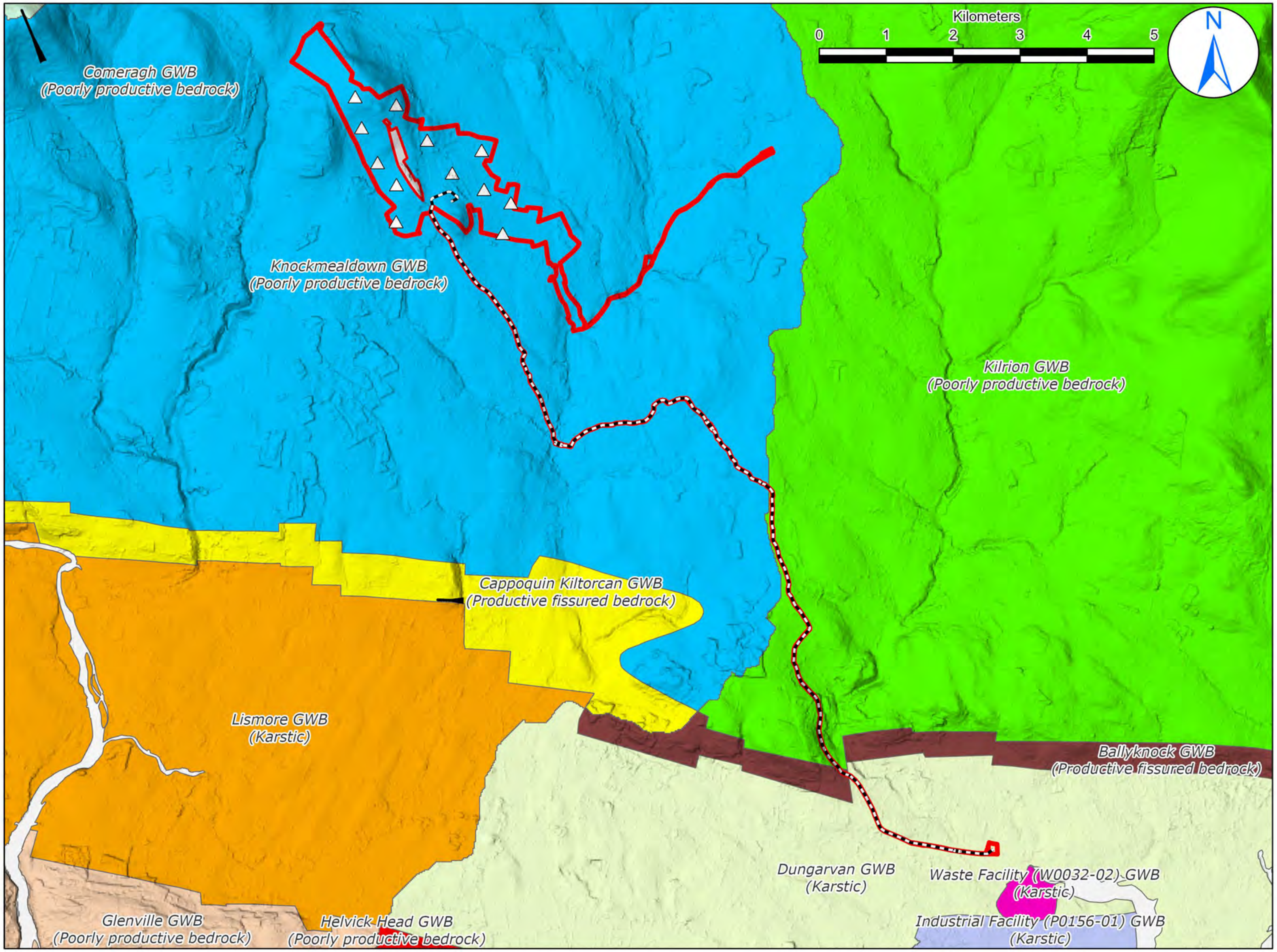
4.3 Groundwater Body Identification

The underlying bedrock within the main Site boundary and along the majority of the grid connection route consists of continental redbed facies; sandstone, conglomerate and siltstone. The bedrock formations underlying the main Site, and the majority of the grid connection route are classified by the GSI as Locally Important (LI), bedrock which is moderately productive only in local zones. The Knockmealdown groundwater body (GWB) underlies all of the main site, the TDR route located within the EIAR boundary and approximately 54% of the grid connection route.

The remainder of the grid connection route is underlain by the Kilrion GWB (~28%), the Ballyknock GWB (~1%) and the Dungarvan GWB (~17%). According to the GSI, these GWBs are categorised as poorly productive bedrock, productive fissured bedrock and karstic respectively. The Dungarvan GWB is a Registered Protected Area (RPA) for Shellfish as this GWB intersects with Designated Shellfish Zones under *S.I. No. 55/2009 European Communities (Quality of Shellfish Waters) (Amendment) Regulations 2009*.

For the majority of the development, the underlying Knockmealdown GWB rocks have no intergranular permeability, groundwater flow occurs in faults and joints. Most groundwater flow probably occurs in an upper shallow weathered zone. Below this, in the deeper zones, water-bearing fractures and fissures are less frequent and less well connected. The water table is generally within 10m of the surface with an average annual fluctuation of up to 6 metres occurring across the GWB. Groundwater in this GWB is generally unconfined. Local groundwater flow is towards the rivers and streams, and the flow paths will not usually exceed a few hundred metres in length. Owing to the generally poor productivity of the aquifers in this body, it is unlikely that any major groundwater surface water interactions occur. The poorly permeable aquifer can support only local scale flow systems. Baseflow to rivers and streams is likely to be relatively low. There are no known karst features recorded in close proximity to the Site nor along the grid connection route.
(*GSI (2004) Knockmealdown GWB: Summary of Initial Characterisation*)

The closest evidence of karstification to the Site is recorded within a series of swallow holes and springs located east of Cappoquin, approximately 5km south of the Site. The locations of the GWBs relative to the Site and grid connection route are outlined in Figure 8. The GWB status for the 2013-2018 WFD cycle is presented in Table 5.



Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: GSI Groundwater Body Mapping of the Site and Grid Connection Route.	
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Legend

- Turbine Locations
- Grid Connection Route
- EIAR Boundary
- Land Excluded From EIAR Boundary

WFD Groundwater Bodies

- Ballyknock
- Cappoquin Kiltorcan
- Comeragh
- Dungarvan
- Glenville
- Helvick Head
- Industrial Facility (P0156-01)
- Kilrion
- Knockmealdown
- Lismore
- Waste Facility (W0032-02)

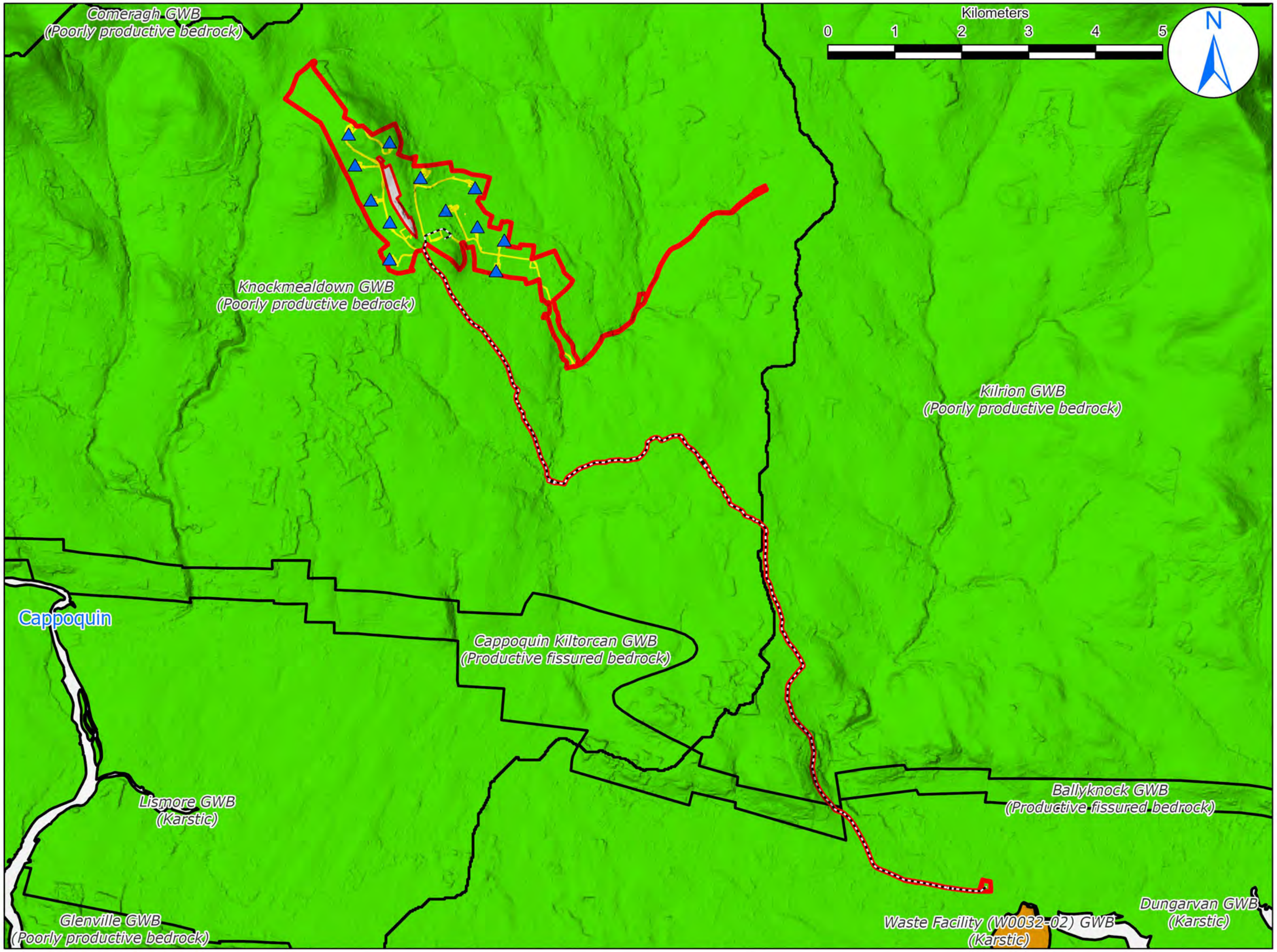
4.4 Groundwater Body Status

The Knockmealdown groundwater body which underlies the main Site boundary and the wider region is assigned "*Good*" status under the current cycle of the WFD. This classification is based on an assessment of the chemical and quantitative status of the GWB. The Kilrion, Ballyknock and Dungarvan GWBs which underlie sections of the grid connection route have also all been assigned "*Good*" status under the WFD. The status is derived from representative monitoring points selected specifically for the WFD groundwater monitoring programme. The Knockmealdown GWB is currently assigned "*Review*" status in terms of risk of not achieving at least "*Good*" status by 2027. Waterbodies may be categorised as "*Review*" either because additional information is needed to determine their status before resources and more targeted measures are initiated or measures have already been undertaken although the outcome hasn't yet been measured/monitored. The Kilrion, Ballyknock and Dungarvan GWBs are classified as "*Not at Risk*" of meeting their WFD objectives by 2027.

A review of the *3rd Cycle Draft Blackwater (Munster) Catchment Report (HA 18),* (EPA, 2022) and the *3rd Cycle Draft Colligan-Mahon Catchment Report (HA 17)* (EPA, 2021) has confirmed that no significant pressures have been idented within any of the GWBs that underlie the proposed Development. The status of each GWB that underlies the proposed Development, for the 2013 – 2018 WFD cycle, is presented in Table 5.

Table 5 – Groundwater Body Status 2013 – 2018

Surface Waterbody ID Code	Groundwater Body Name	2013 - 2018 Status	2013 - 2018 Significant Pressure	Risk Status of Not Meeting WFD Objectives by 2027	Location Relative to the Development
IE_SW_G_047	Knockmealdown	Good	None	Review	Main Site, TDR and Grid Connection Route
IE_SE_G_085	Kilrion	Good	None	Not at Risk	Grid Connection Route
IE_SE_G_014	Ballyknock	Good	None	Not at Risk	Grid Connection Route
IE_SE_G_052	Dungarvan	Good	None	Not at Risk	Grid Connection Route



Client: Jennings O'Donovan & Partners	
Project: Dyrick Hill Wind Farm	
Map Title: WFD Groundwater Body Status 2013 - 2018	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	
Figure Number: 9	Page Size: A3
Date Exported: 22/03/2023	Scale: 1:60,000
Revision Number: 1	Prepared By: DP
Tel: +353 (91) 897 583	Checked By: AG
Email: info@ecoquest.ie	EcoQuest Environmental
Web: www.ecoquest.ie	

Legend

Ground Waterbody WFD Status 2013-2018

- Good
- Poor

- WFD Groundwater Body Boundaries
- Turbine Locations
- Grid Connection Route
- EIAR Boundary
- Land Excluded From EIAR Boundary
- Road Alignment

5. Water Framework Directive Assessment

5.1 WFD Assessment Analysis

An analysis of the surface waterbodies and groundwater bodies that could potentially be impacted by the proposed Development has been carried out in order to determine which waterbodies required further assessment.

5.1.1 Source-Pathway-Receptor Model for Surface Water Runoff

To assess potential surface water impacts, such as sediment laden runoff or chemical spills from each individual turbine and hardstand area, a LIDAR sourced digital elevation model (DEM) was utilised with GIS software to map the generalised runoff flow direction from the proposed Development areas to the nearest surface waterbodies. This type of analysis is a form of Source-Pathway-Receptor (SPR) modelling and is useful when applying the risk concept to waterbody protection and vulnerability.

The source is the development and activity that pose a threat to waterbodies, namely, the construction, operation and decommissioning of the proposed Dyrick Hill Windfarm in this case. Determining the most likely source points of release is a critical reference point for waterbody vulnerability assessment and mapping. All turbine locations, hardstand areas, substation, site access roads, and horizontal directional drilling locations along the grid connection route have been identified in the SPR model as the most likely source points for release of potential contaminants to SWBs. Minor road improvement works along the TDR and short duration shallow trenching works along the existing roadway of the grid connection route, that are considerably distant from surface waters, have been screened out as these locations are considered to be unlikely point sources in the SPR model.

The pathway includes all surface features and land uses between the source and the receptor such as the drainage networks which act as vector and the surrounding topography which dictates the fate of the runoff flow direction. The pathway is from the point of release of contaminants across overland flows to the downstream surface waterbody (receptor). Under real-time physical conditions, the runoff pathway is influenced by factors such as groundwater recharge rates and evapotranspiration. The SPR modelling for the purpose of this WFD assessment assumes that groundwater recharge and evapotranspiration does not occur as a precautionary worst-case scenario in assessing potential impacts on WFD surface waters. In simple terms, this SPR model assumes that after or during heavy rainfall events, contaminants would flow downstream from a point source at the site via the path of least resistance as runoff to the nearest WFD surface waterbody without being recharged to groundwater or undergoing evapotranspiration.

The receptor in this instance is the WFD surface waterbody which could potentially be impacted by pollutants contained in runoff and which must be identified for protection. The results from the SPR surface water runoff modelling is visually represent in Figure 5 and are outlined in tabular form in Table 6. The results of the SPR surface water runoff analysis have infirmed the assessment of the potential impacts on WFD surface waterbodies which is outlined in Table 7.

Table 6 – Source-Pathway-Receptor Model for Surface Water Runoff

Potential Surface Water Runoff Source Location	Potential Pathway Description	WFD Surface Water Receptor
Turbine 1 (T1)	South-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T1 Hardstand Area	South-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T1 Access Road	South-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
Turbine 2 (T2)	Easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T2 Hardstand Area	South-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T2 Access Road	South-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
Turbine 3 (T3)	North-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T3 Hardstand Area	North-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T3 Access Road	Easterly and north-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
Turbine 4 (T4)	Northernly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T4 Hardstand Area	Easterly and north-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
T4 Access Road	North-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
Turbine 5 (T5)	South-easterly runoff flow direction via forestry drainage across lightly sloping relatively flat terrain.	Finisk_020
T5 Hardstand Area	South-easterly runoff flow direction via forestry drainage across lightly sloping relatively flat terrain.	Finisk_020
T5 Access Road	South-easterly runoff flow direction via field and forestry drainage across lightly sloping relatively flat terrain.	Finisk_020
Turbine 6 (T6)	South to south-easterly runoff flow direction via field and forestry drainage across moderately sloping terrain.	Finisk_020
T6 Hardstand Area	South to south-easterly runoff flow direction via field and forestry drainage across moderately sloping terrain.	Finisk_020
T6 Access Road	East to north-easterly runoff flow direction via field and forestry drainage network across moderately sloping terrain.	Finisk_020
Turbine 8 (T8)	North-easterly runoff flow direction via field and road drainage across steep terrain.	Finisk_010
T8 Hardstand Area	North-easterly runoff flow direction via field and road drainage across steep terrain to Finisk_10. South-easterly flow direction via field and forestry drainage across steep terrain to Finisk_20.	Finisk_010 & Finisk_020
T8 Access Road	South-westerly runoff flow direction via field and forestry drainage across steep terrain.	Farnane_010
Turbine 9 (T9)	South-westerly runoff flow direction via field drainage across moderately sloping terrain.	Farnane_010
T9 Hardstand Area	South-westerly runoff flow direction via field drainage across moderately sloping terrain.	Farnane_010
T9 Access Road	South-westerly runoff flow direction via field and forestry drainage across moderately sloping terrain.	Farnane_010
Turbine 10 (T10)	South-westerly runoff flow direction via field drainage across moderately sloping terrain.	Farnane_010

Potential Surface Water Runoff Source Location	Potential Pathway Description	WFD Surface Water Receptor
T10 Hardstand Area	South-westerly runoff flow direction via field drainage across moderately sloping terrain.	Farnane_010
T10 Access Road	South-westerly runoff flow direction via field drainage across moderately sloping terrain.	Farnane_010
Turbine 11 (T11)	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010
T11 Hardstand Area	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010
T11 Access Road	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010
Turbine 12 (T12)	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010
T12 Hardstand Area	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010
T12 Access Road	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010
Turbine 13 (T13)	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010 & Finisk_010
T13 Hardstand Area	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain to Farnane_010. Initial north-westerly run-off flow direction before veering to the north-west to via field drainage to Finisk_010	Farnane_010 & Finisk_010
T13 Access Road	South-westerly runoff flow direction via upland heath and field drainage across steep to moderate sloping terrain.	Farnane_010
Substation	North-easterly runoff flow direction via field and forestry drainage across moderate to relatively flat sloping terrain.	Finisk_020
Temporary Site Compound	South-easterly runoff flow direction via field drainage across lightly sloping relatively flat terrain.	Finisk_020
HDD Location 1	Direct release of sediment or chemicals to Finisk_020 during HDD at Mountain Castle Bridge, Millstreet, Co. Waterford	Finisk_020
HDD Location 2	Direct release of sediment or chemicals to Finisk_020 in the townland of Knockaunnaglokee, Co. Waterford	Finisk_020
HDD Location 3	Direct release of sediment or chemicals to Colligan_040 at Kildangan Bridge in the townland of Killadangan, Co. Waterford	Colligan_040

5.2 WFD Screening Analysis

The results of the SPR surface water runoff modelling outlined in Table 6 have been utilised to further refine and identify the surface waterbodies which do and do not require further assessment. This screening analysis and the accompanying justification for each determination is outlined in Table 7.

Table 7 – Analysis of WFD Surface Waterbodies Requiring Further Assessment

Surface Waterbody ID Code	Surface Waterbody Name	Screening Outcome	Rationale
IE_SW_18F060300	Farnane_010	Screened In	Five turbine positions (T09, T10, T11, T12 and a portion of T13) are located within the drainage basin of the Farnane River. Further assessment is required to determine the extent of potential impacts on the Farnane_010 waterbody which could occur as a consequence of the proposed Development.
IE_SW_18F020100	Finisk_010	Screened In	The closest surface runoff flow path to the Finisk_010 waterbody from the development is a 1.1km path to the north-east from the T8 location. A small portion of the T13 hardstand area also drains to the Finisk_010. An area of dense forestry, multiple fields and the Broemountain Road (L5058) also separate the T8 position from the nearest Farnane_010 watercourse. Further assessment is required to determine the extent of potential impacts on the Finisk_010 waterbody which could occur as a consequence of the proposed development.
IE_SW_18F020300	Finisk_020	Screened In	Six turbine positions, hardstand areas and access roads (T1, T2, T3,T4,T5 and T6), the substation, T8 hardstand area, the temporary site compound and HDD locations 1/2 all fall within the drainage basin of the Finisk_020. The main site access road also intersects the Finisk_020 waterbody at the Aughkilladoon Stream. Further assessment is required to determine the extent of potential impacts on the Finisk_020 waterbody which could occur as a consequence of the proposed Development.
IE_SW_18F020500	Finisk_030	Screened Out	The nearest component of the Development to the Finisk_030 waterbody is located approximately 710m downstream and west of the grid connection route. Due to this considerable distance, and the relatively minor nature of the shallow trenching works along the grid connection route on an existing roadway, the Finisk_030 waterbody is not considered further in this WFD assessment.
IE_SW_18G110300	Glenshelane _010	Screened Out	None of the proposed Development's components fall within the drainage basin of the Glenshelane_010 waterbody. As a result, the Glenshelane_010 waterbody is not considered further in this assessment.
IE_SE_17C010180	Colligan_030	Screened Out	The nearest component of the Development to the Colligan_030 waterbody is located approximately 230m downstream and east of the grid connection route. Due to this considerable distance, and the relatively minor nature of the short duration shallow trenching works along the grid connection route on an existing road, the Colligan_030 waterbody is not considered further in this WFD assessment.
IE_SE_17C010300	Colligan_040	Screened In	The grid connection route does intersect the Colligan_040 on the N72 Road at the Kildangan Bridge across the Colligan River where HDD will be carried out. Further assessment is required to determine the extent of potential impacts on the Colligan_040 waterbody which could occur as a consequence of the proposed development.

In terms of WFD GWBs, the location of the various components of the development have been assessed against the locations of the underlying GWBs to establish which GWBs required further assessment. The results of this analysis are outlined in Table 8.

Table 8 – Analysis of WFD Groundwater Bodies Requiring Further Assessment

GWB ID Code	GWB Name	Screening Outcome	Rationale
IE_SW_G_047	Knockmealdown	Screened In	The Knockmealdown GWB underlies all turbine locations, access roads, hardstand areas, the TDR located within the EIAR boundary and approximately 54% of the grid connection route. Further assessment is required to determine the extent of potential impacts on the Knockmealdown GWB which could occur as a consequence of the proposed development.
IE_SE_G_085	Kilrion	Screened In	Approximately 28% of the grid connection route is underlain by the Kilrion GWB. Further assessment is required to determine the extent of potential impacts on the Knockmealdown GWB which could occur as a consequence of the proposed development.
IE_SE_G_014	Ballyknock	Screened In	Approximately 1% of the grid connection route is underlain by the Ballyknock GWB. Further assessment is required to determine the extent of potential impacts on the Ballyknock GWB which could occur as a consequence of the proposed development.
IE_SE_G_052	Dungarvan	Screened In	Approximately 17% of the grid connection route is underlain by the Dungarvan GWB. Further assessment is required to determine the extent of potential impacts on the Dungarvan GWB which could occur as a consequence of the proposed development.

6. Assessment of WFD Compliance in an Unmitigated Scenario

6.1 Description of Proposed Works

The proposed Development includes the construction of 12 wind turbines with associated hardstand areas, a permanent met mast, 110Kv on-site substation, TDR works and all ancillary works and the construction of an underground ~16.8km grid connection to Dungarvan 110Kv Substation, Co. Waterford. The proposed Development will also require the construction of crane hardstand areas and turbine foundations, construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage. One on-site borrow pit, a temporary construction compound and soil storage area would be developed during the construction phase. Ancillary forestry felling to facilitate construction and operation of the Development and onsite forestry replanting would also be carried out.

6.2 Potential Sources of Impacts on Surface Waters

The potential for adverse impacts on SWBs to arise could potentially occur due to the following activities:

- The potential release of elevated suspended solids to surface waters during earthworks and forestry felling in the form of sediment laden runoff;
- Increased hydraulic loading due to replacement of natural surfaces with impermeable materials resulting in the potential for increased erosion and associated sedimentation within the localised surface water network;
- Potential accidental release of highly alkaline cementitious materials to surface waters resulting in physicochemical alterations to the surface water network with potential for associated adverse effects on sensitive downstream receptors;
- Potential accidental release of hydrocarbons or other chemicals to SWBs resulting in physicochemical alterations to the surface water network with potential for associated adverse effects on sensitive downstream receptors.

6.3 Potential Impacts During Construction Without Mitigation

6.3.1 Surface Water Quality

In the absence of mitigation measures, there is potential for a reduction in surface water quality to occur primarily due to the earthwork activities and forestry felling activities that will be required for the construction of the proposed Development. There is also potential for accidental spillages of hydrocarbon-based fuels and oils, wastewater, other liquid chemicals or sanitation products, paints or sealants and/or the accidental release of cementitious materials. In the absence of mitigation measures, HDD works could also potentially result in a temporary WFD status change to the Finisk_020 and the Colligan_040 WFD waterbodies. It is considered that there is a viable surface water pathways from the proposed work areas to the Farnane_010, although not to the Finisk_010 which is too distant from the proposed word areas. The requirement for HDD on the Finisk_020 and Colligan_040 watercourses could potentially result in temporary short duration changes to these WFD SWBs in the absence of mitigation measures. An overview of the potential WFD status changes that could potentially occur within the surrounding surface water network during construction in the unmitigated scenario is outlined in Table 9.

Table 9 – Assessment of Potential WFD Surface Water Body Status Changes in the Absence of Mitigation Measures During Construction

Surface Waterbody ID Code	Surface Waterbody Name	2013 - 2018 Water Quality Status	Assessment of Potential WFD Status Change
IE_SW_18F060300	Farnane_010	High	Good
IE_SW_18F020100	Finisk_010	Good	Good
IE_SW_18F020300	Finisk_020	Moderate	Poor
IE_SE_17C010300	Colligan_040	Good	Moderate

6.3.2 Groundwater Quality and Quantity

The nature of the proposed Development is such that deep excavation works will not be required. Potential adverse impacts on groundwater are generally not expected to arise with surface waters being the most likely receptor for potential adverse impacts due to the near surface nature of the proposed Development. Nevertheless, the potential for adverse impacts on groundwater could potentially arise due to an accidental surface spill(s) of hydrocarbons or other liquid chemicals and/or the potential seepage of cementitious materials into the underlying GWB. Although considerably less likely to occur, the potential impacts on groundwater are therefore similar to the potential impacts on surface waters with the exception of increased sediment loading which is not expected to be a likely potential impact on groundwater.

The proposed Development will not require the installation of boreholes for groundwater extraction purposes during the construction, operational or decommissioning phases. All fresh water required during the construction phase of the project will be delivered to the Site via tank trucks. There will be no impacts on groundwater quantity at any stage across the lifecycle of the proposed Development.

An overview of the potential WFD status changes that could potentially occur within the WFD GWBs in the unmitigated scenario during construction is outlined in Table 9. The potential for adverse impacts to occur within each individual GWB is discussed in the following sections.

6.3.1 Knockmealdown GWB

Approximately 8.8km (~54%) of the grid connection route is located within an area underlain by the Knockmealdown GWB. Given that the underlying Knockmealdown Formation is not typically highly permeable, groundwater flow direction to the underlying aquifer is expected to strongly mimic the local topography. In other words, the groundwater flow paths are expected to be from topographic high points to lower elevated discharge points at streams, springs and rivers. Utilising this conceptual model of groundwater flow, the generalised flow direction of groundwater flow can be modelled and will be similar to that of runoff flow directions outlined on Figure 5. The western extent of the Site is dominated by an area of upland heath in an area known as Broemountain. Similar to most upland areas, Broemountain exhibits steep terrain, and its underlying geology dictates that the area has limited capacity for storing groundwater.

Five trial pits were excavated as close as possible to turbine positions T9, T10, T11, T12 and T13 on July 1st and 2nd, 2022. Bedrock was encountered at depths of up to two metres at Broemountain. Groundwater was not encountered in any of the trial pits at Broemountain, it is anticipated that groundwater typically circulates rapidly and discharges to the upland slopes where the water table intersects the ground surface or to upland streams such as the upper reaches of Farnane River (Farnane_010). As a result, the western extent of the Site is anticipated to have groundwater flows that predominantly flow westward to south-westward where they discharge to the Farnane River. Further east on Broemountain, groundwater from the T8 position is expected to flow in a north-easterly direction to the Boolahallagh River (Finisk_010) with flows from the southern extent of the T8 hardstand aera expected to flow in a south-easterly direction and discharge to the Lisleagh Stream (Finisk_020).

During the field investigations in early July 2022, groundwater was also not encountered at any of the trial pit locations at the central and eastern extents of the site at depths of up to 3 metres. Similar to the western extent of the site, the topography in the central portion of the site is likely to significantly influence the groundwater flow direction. As a result, groundwater flow directions from the T3 and T4 positions are likely to flow in a north-easterly direction and discharge to the Lisleagh Stream (Finisk_020). Similarly, groundwater flow directions from the T5 and T6 positions are likely to flow in a south-easterly direction and discharge to the Lisleagh Stream (Finisk_020). At the eastern extent of the Site, groundwater flow directions from the T1 and T2 positions are likely to flow in a south-easterly direction and discharge to the Aughkilladoon Stream (Finisk_020).

Horizontal directional drilling is a drilling technique whereby a hole is drilled under a feature so that the cable installation avoids disturbance of the feature. Horizontal directional drilling will be carried out at two locations along the grid connection route within the Knockmealdown GWB. These locations are at the Finisk River at Millstreet, Co. Waterford and at the Killeagh Stream in the townland of Knockaunnaglokee, Co. Waterford. Both of these waterbodies form part of the collective Finisk_020 WFD SWB. The HDD methodology requires the excavation of two pits; a launch pit and a reception pit. Approximate dimensions for the excavations would be 4m long x 3m wide x 2m deep. During the HDD process, there is potential for groundwater to be encountered. However, given the anticipated shallow depths of the HDD at just 2 metres deep, and the HDD location at rivers, any groundwater flows that may be momentarily encountered during the HDD process is expected to rapidly discharge to the river network. Therefore, potential adverse impacts to groundwater within the Knockmealdown GWB resulting from HDD are not expected to occur.

6.3.2 Kilrion GWB

Approximately 4.6 km (~28%) of the grid connection route is located within an area underlain by the Kilrion GWB. Shallow trenching which will be backfilled will be carried out along the grid connection route within the Kilrion GWB. The shallow trenching is not expected to breach the groundwater table and will be excavated upon the overburden. HDD will also be carried out at a cattle underpass on the L5068 local road, in the townland of Garryclone, Co. Waterford. However, the HDD depths is expected to be to approximately 2m deep and is not expected to breach the groundwater table. There are also no surface waterbodies located in close proximity to the cattle underpass location which further indicates that the groundwater table is not shallow at this location. As a result of the above, no impacts on the Kilrion GWB are anticipated as a result of the proposed Development.

6.3.3 Ballyknock GWB

A small portion of the grid connection route, approximately 187m (~1%) is located within an area underlain by the Ballyknock GWB. Shallow trenching which will be backfilled will be carried out along the grid connection route within the Ballyknock GWB. The shallow trenching is not expected to breach the groundwater table and will be excavated upon the overburden. HDD will not be carried out within the Ballyknock GWB. As a result of minor nature of the works within Ballyknock GWB, no impacts on the Ballyknock GWB are anticipated.

6.3.4 Dungarvan GWB

Approximately 2,795m (~17%) of the grid connection route is located within an area underlain by the Dungarvan GWB. The same methodology will be applied whereby shallow trenching which will be backfilled will be carried out. The shallow trenching is not expected to breach the groundwater table and will be excavated upon the overburden. HDD will be carried out at one location along the grid connection route within the Dungarvan GWB, namely, at the Colligan River (Colligan_040) at Kildangan Bridge in the townland of Killadangan, Co. Waterford.

The HDD methodology carried out at this location will be same as that described in section 6.4.1 for areas underlain by the Knockmealdown GWB. These works will require the excavation of a launch pit and a reception pit, both will have approximate dimensions of 4m long x 3m wide x 2m deep. During the HDD process, there is potential for groundwater to be encountered. However, given the anticipated shallow depths of the HDD at just 2 metres deep, and the HDD location at the Colligan River, any groundwater flows that may be momentarily encountered during the HDD process is expected to rapidly discharge to the river network. Therefore, potential impacts to groundwater within the Dungarvan GWB resulting from HDD are not expected to occur.

Table 10 – Assessment of Potential WFD GWB Status Changes in the Absence of Mitigation Measures During Construction

Surface Waterbody ID Code	Groundwater Body Name	2013 - 2018 Water Quality Status	Assessment of Potential WFD Status Change
IE_SW_G_047	Knockmealdown	Good	Moderate
IE_SE_G_085	Kilrion	Good	Moderate
IE_SE_G_014	Ballyknock	Good	Moderate
IE_SE_G_052	Dungarvan	Good	Moderate

6.4 Potential Impacts During Operation Without Mitigation on Surface Water Quality

Upon completion of construction works, impermeable surfaces could be partially in place at the site which would replace the baseline environment surfaces of soil, forestry and vegetation. This replacement has the potential to result in increased hydraulic loading to the surrounding surface water network which in turn has the potential to result increased erosion of riverbanks and associated sedimentation in the downstream surface water network. In an unmitigated scenario, increased hydraulic loading also has the potential to increase the potential for flooding downstream of the site. The presence of impermeable surfaces during the operational phase is referenced as a worst-case scenario in accordance with the precautionary principle. The actual surfaces that will be in place during the operational phase will generally have a permeability that will be similar to or greater than that of the pre-existing baseline soil and vegetated surfaces at the Site.

Multiple turbine positions and hardstand and associated hardstand areas are located within the drainage basin of the Farnane_010 and Finisk_020 WFD SWBs. In the absence of mitigation measures, the WFD status of the Farnane_010 and the Finisk_020 could potentially be reduced from "*High*" to "*Good*" and "*Moderate*" to "*Poor*" respectively during the operational phase. The potential for the reduction in surface water quality during the operational phase is primarily due to the potential for increased hydraulic loading resulting from the replacement of existing natural surfaces with impermeable surfaces. This same potential does not exist for the Finisk_010 and Colligan_040 which are considered to be too distant from potential impermeable surfaces associated with the Development.

The potential for accidental hydrocarbon spills or elevated sediment laden runoff to be released to the surface network during the operational phase is greatly reduced as earthworks will have been completed during the construction phase. Occasional and infrequent routine minor maintenance works to ensure that access roads and hardstand areas are maintained may be required during the operational phase. It is considered that the potential for hydrocarbon spills or sediment laden runoff to surface waters to occur during such works is most unlikely. An overview of the potential WFD status changes that could potentially occur within the surrounding surface water network during the operational phase in the unmitigated scenario is outlined in Table 11.

Table 11 – Assessment of Potential WFD Surface Water Body Status Changes in the Absence of Mitigation Measures During Operation

Surface Waterbody ID Code	Surface Waterbody Name	2013 - 2018 Water Quality Status	Assessment of Potential WFD Status Change
IE_SW_18F060300	Farnane_010	High	Good
IE_SW_18F020100	Finisk_010	Good	Good
IE_SW_18F020300	Finisk_020	Moderate	Poor
IE_SE_17C010300	Colligan_040	Good	Good

6.5 Potential Impacts During Operation Without Mitigation on Groundwater Quality

The potential for accidental hydrocarbon, wastewater or chemical spills to be released to GWBs during the operational phase is greatly reduced as all mobile plant and construction equipment will be demobilised from site following the construction phase. Occasional and infrequent routine minor maintenance works to ensure that access roads, wind turbines and hardstand areas are maintained may be required during the operational phase. It is considered that the potential for hydrocarbon or chemical spills to GWBs during such works is most unlikely. An overview of the potential WFD status changes that could potentially occur within the underlying GWBs during the operational phase in the unmitigated scenario is outlined in Table 12.

Table 12 – Assessment of Potential WFD GWB Status Changes in the Absence of Mitigation Measures During Operation

Surface Waterbody ID Code	Groundwater Body Name	2013 - 2018 Water Quality Status	Assessment of Potential WFD Status Change
IE_SW_G_047	Knockmealdown	Good	Good
IE_SE_G_085	Kilrion	Good	Good
IE_SE_G_014	Ballyknock	Good	Good
IE_SE_G_052	Dungarvan	Good	Good

7. Mitigation Measures

The Development has associated potential impacts as described in the previous sections of this report. The following sections outline mitigation measures to be implemented during the design, construction, operational and decommissioning phases of the Development.

7.1 Mitigation by Avoidance

The fundamental mitigation measure to be implemented during each stage of the proposed Development will be avoidance of sensitive hydrological or hydrogeological receptors wherever possible, this key principle is referred to as "mitigation by avoidance". This principle has been adopted during the design of the turbine and associated infrastructure layout across multiple design iterations. Hydrological constraints maps have been developed which identified areas of the Site where surface water, groundwater and drainage constraints resulted in areas of the Site being deemed less suitable for development. The final Site layout plan has been identified as the optimal layout design available for protecting the existing hydrological regime of the Site, while at the same time incorporating and overlaying engineering and other environmental constraints.

7.2 Constraints

As part of mitigation by avoidance principles applied during the design phase of the Development, a self-imposed 50m buffer zone around surface waters and significant drainage features was implemented. The 50m buffer zone is intended to inform the design process by minimising or avoiding the risk to surface water receptors and by restricting construction disturbance to outside these zones. The buffer zone will in turn provide enhanced potential for filtering capacity of runoff and will protect riparian zone vegetation. The implementation of 50m surface water buffer zones is not a legislative requirement, particularly for unmapped surface water features. However, it has been employed for identified areas of the Development which pose an elevated risk in terms of sensitive surface water receptors. A self-imposed 50m buffer zone can therefore be viewed as a conservative approach.

The layout of the Development itself is inherently restricted due to the proposed infrastructure requirements, such as the proposed turbines require a minimum distance from each other to ensure the potential for wind turbulence impacting on downwind locations is minimised. The vast majority of the proposed Development features will be situated outside of the 50m buffer zone, with the exception of the following unique and unavoidable circumstances:

- Three horizontal direction drilling locations along the grid connection route;
- Shallow cable trenching along the grid connection route where the existing road network is already located within the 50m buffer zone of multiple rivers and streams.
- Small unmapped artificial and natural channels and field drains.

Careful consideration and special attention to planning is required for the identified locations within the surface water 50m buffer zone. The **Surface Water Management Plan** attached as **Appendix 2.1** to the EIAR details multiple mitigation measures for works proposed within the 50m buffer zone. Each proposed construction location will possess unique characteristics and will require assessment on a case-by-case basis to ensure adequate measures are implemented.

7.3 Earthworks Mitigation Measures

Mitigation measures to reduce the potential for adverse impacts arising from earthworks and management of spoil include the following:

- Management of excavated material will adhere to the measures related to the management of temporary stockpiles outlined in **Chapter 8: Soils and Geology** of the EIAR;
- No permanent or semi-permanent stockpiles will remain on the Site during the construction or operational phase of the Development. Excess spoil is to be taken to the designated borrow pit and/or soil storage area at the Site;
- Suitable locations for temporary stockpiles will be identified on an individual basis. The suitability of any particular location will consider Site specific characteristics, including;
    - The location of drainage networks in the vicinity;
    - The slope, incline and topography of the downgradient area;
    - Any other relevant characteristics which are likely to facilitate or increase the potential for entrainment by surface water runoff; and

  - Construction activities will not be carried out during periods of sustained significant rainfall events, or directly after such events. This will allow sufficient time for work areas to drain excessive surface water loading and discharge rates to be reduced;
- Following heavy rainfall events, and before construction works recommence, the Site will be inspected and any required corrective measures implemented;
- An emergency response plan will be developed for the construction phase of the project. The plan, at a minimum, will involve 24-hour advance meteorological forecasting linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded such as a very heavy rainfall at >25mm/hr, planned responses will be undertaken. These responses will include cessation of construction until the storm event, including storm runoff, has ceased;
- Sediment fencing will be erected along proximal and paralleling areas of watercourses, channels and drains spanned by the works to reduce the potential for sediment laden run-off to reach sensitive receptors;
- No direct flow paths between stockpiles and watercourses will be permitted at the Site; and
- Excavated material will be backfilled to the excavation area or transported to the spoil storage area as soon as is reasonably practicable to prevent long duration storage at the Site which increases the risk of adverse effects on aquatic environments;

7.4 Dewatering Mitigation Measures

Mitigation measures to reduce the potential for adverse impacts arising from dewatering activities include the following:

- Management of excavations will adhere to the measures outlined in **Chapter 8: Soils and Geology** of the EIAR. Areas of subsoils to be excavated will be drained ahead of excavation works. This will reduce the volumes of water encountered during excavation works and will therefore reduce the volume of water that is required to be dewatered whilst excavations are being carried out;
- Engineered drainage and attenuation features outlined in the S**urface Water Management Plan** attached as **Appendix 2.1** of the EIAR will be established ahead of excavation works;
- Dewatering pumping rates will be controlled by an inline gate valve or similar infrastructure which will facilitate a reduction of loading on the receiving environment, thus enhancing the attenuation and settlement of suspended solids;
- The direct discharge of dewatered loads to surface waters will not be permitted under any circumstances;
- All dewatering will follow a strict procedure of pumping to a settlement tank and then to a dewatering bag, or settlement ponds prior to discharging to receiving environment for overland flow;
- Geofabric lined settlement ponds will buffer the run-off discharging from the drainage system which will reduce the hydraulic loading to watercourses. Settlement ponds will be designed to reduce flow velocity to 0.3 m/s at which velocity silt settlement generally occurs. In areas of the Site where the placement of settlement ponds is not feasible, other mitigation measures described below will be implemented;
- Check dams will be constructed across drains and will reduce the velocity of run-off which will in turn promote settlement of solids upstream of potential surface water receivers. An additional benefit of check dams is that they will reduce the potential for erosion of drains. Rock filter bunds may be used for check dams. Wood or hay bales can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately down gradient of construction areas;
- Overland flow paths of the final dewatered discharge will be maximised to the greatest practical extent to avoid prematurely draining to drainage channels or surface waters. This approach will allow for enhanced settling out of suspended solids entrained in the run-off;
- All pumps, tanks, settlement ponds, dewatering bags and check dams used in the dewatering process will be regularly inspected and maintained as necessary to ensure surface water run-off is appropriately treated;
- Sediment fencing will be installed up gradient of water courses which may receive the final overland flow;
- The final treated dewatered discharge will be directed towards heavily vegetated areas to allow for further natural filtration of suspended solids;
- A programme of water quality monitoring will be implemented during the construction phase;

- No extracted or pumped water will be discharge directly to the surface water network associated with the Site (this in accordance with the *Local Government (Water Pollution) Act 1977* as amended); and
- Any discharges of sediment treated water should meet the requirements of the *Surface Water Regulations 2009*, as amended.

7.5 Release and Transport of Suspended Solids Mitigation Measures

The following mitigation measures to reduce potential impacts from the release of suspended solids to the surface waters will be implemented:

- Collector drains and soil berms will be implemented to direct and divert surface water runoff from construction areas such as temporary stockpiles into established settlement ponds, buffered discharge points and other surface water runoff control infrastructure. This planning and placement of these control measures will be of fundamental importance, especially for the areas where works within the 50m buffer zone will be unavoidable;
- Sediment control fences will be implemented significantly upgradient of potential receiving waters and as part of the drainage network. Sediment control fences will also be established upgradient of the Site's pre-existing natural and artificial drains. This practice will reduce the potential for elevated suspended solids entrained in surface water runoff to discharge to surface waters;
- Multiple silt fences will be used in drains discharging to the surface water network. This will be especially important for the areas where works within the 50m buffer zone will be unavoidable;
- The drainage, attenuation and other surface water runoff management systems will be installed prior to the commencement of construction activities. Whenever possible, drainage and attenuation control measures will be installed during seasonally dry conditions to limit the potential for sediment laden run-off to discharge to surface waters during the installation of these measures;
- Surface water runoff will be discharged to land via buffered drainage outfalls that will contain hardcore material of similar composition to the geology of the bedrock at the Site. This mitigation measure will promote the capture and retention of suspended sediment;
- Buffered drainage outfalls also promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to adjacent watercourses and avoiding direct discharge to the watercourse;
- Buffered drainage outfalls will be placed outside of the 50m buffer zone and will not be positioned in areas with extensive erosion and degradation;
- A relatively high number of discharge points will be established to decrease the loading on any one particular outfall;
- Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points;
- A site-specific Construction Environmental Management Plan (CEMP) appended to the EIAR in **Technical Appendix 2.1** has been developed which mandates regular inspections and maintenance of pollution control measures. Contingency measures outlining urgent protocols to repair or backup any breaches of designed mitigation measures are incorporated into the site-specific CEMP;
- In the event that mitigation measures are failing to reduce suspended solids to acceptable levels, construction works will cease until remediation works are completed;
- If fine solids or colloidal particles are very slow to settle out of waters, coagulant or flocculant will be used to promote the settlement of finer solids prior to discharging to surface water networks. Flocculant gel blocks can be placed in drainage channels, these are passive systems that are self-dosing, self-limiting and are environmentally friendly. Flocculant gel blocks bind elevated levels of silt and associated contaminants into masses that are easily separated, captured and then removed from the water; and
- Surface water runoff controls will be checked and maintained on a regular basis and as soon as any signs of deterioration become visible. Surface water runoff controls, check dams and settlement ponds will be maintained and emptied on a regular basis and as soon as any signs of deterioration become visible.

7.6 Horizontal Directional Drilling Mitigation Measures

The following mitigation measures to reduce potential impacts associated with horizontal directional drilling will be implemented:

- A drilling fluid that is not toxic to aquatic organisms and is biodegradable will be the drilling fluid used;
- Mud mixing will be monitored to suit the ground conditions encountered and will initially be based on a mud programme developed by the specialised HDD Contractor, the drilling fluid supplier and an Environmental Clerk of Works;
- The drilling fluids will be constantly monitored, any changes required to the mix will be performed on site by a specialised HDD Contractor upon consultation with the drilling fluid supplier and Environmental Clerk of Works;
- Mud testing equipment will be available at all times during drilling operations to monitor key mud parameters;
- All equipment will be carefully checked on a daily basis by the Site Supervisor prior to use to ensure plant and machinery is in good working order with no leaks or potential for spillages;
- Spill kits, including an appropriate hydrocarbon boom, will be available on the site in the event of any unforeseen hydrocarbon spillages and all staff shall be trained in their use;
- All plant, materials and wastes will be removed from site following the HDD works;
- The launch pit will be reinstated to the original land surface condition and the normal duct trench will continue from this point;
- Should any dewatering be required, it will be carried out in accordance with the site-specific CEMP; and
- Test pits and boreholes will not be located directly on, or extend through, the proposed alignment, as these weak points may serve as conduits where inadvertent fluid returns or frac outs occur. At least a 3m offset will be provided between the boreholes and pipe alignment.

7.7 Release of Hydrocarbons Proposed Mitigation Measures

The following mitigation measures to reduce potential impacts from the environmental release of hydrocarbons and other harmful chemicals to the surface waters will be implemented:

- Refuelling of vehicles will be carried out off site to the greatest practical extent. This refuelling policy will mitigate the potential for impacts by avoidance. Due to the remote location and nature of the Site, it is unlikely that implementation of this refuelling policy will be practical in all circumstances. In instances where refuelling of vehicles on Site is unavoidable, a designated and controlled refuelling area will be established at the Site. The designated refuelling area will enable low risk refuelling and storage practices to be carried out during the works. The designated refuelling area will contain the following attributes and mitigation measures as a minimum requirement:
    - The designated refuelling area will be located a minimum distance of 50m from any surface waters or Site drainage features;
    - The designated refuelling area will be bunded to 110% volume capacity of fuels stored at the Site;
    - The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund;
    - Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis;
    - Any oil contaminated water will be disposed of at an appropriate oil recovery plant or licensed tip site;
    - Any minor spillage during this process will be cleaned up immediately;
    - Vehicles will not be left unattended whilst refuelling; and
    - All machinery will be checked regularly for any leaks or signs of wear and tear;
    - Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.

Notwithstanding the management of refuelling and fuel storage at the designated refuelling area, the potential risk of hydrocarbon spills from plant and equipment or other general chemical spills at other areas of the Site remains. To mitigate against potential spills at other areas of the Site, the following mitigation measures will be implemented:

- Oil absorbent booms and spill kits will be available adjacent to all surface water features associated with the Development. The controls will be positioned downstream of each construction area and at principal surface water drainage features. Oil booms deployed will have sufficient absorbency relative to the potential hazard;
- Spill kits will also be available at construction areas such as at turbine locations, the temporary site compound, on-site substation, spoils storage areas and met mast location etc.;
- Spill kits will contain a minimum of oil absorbent pads, oil absorbent booms, oil absorbent granules, and heavy-duty refuse bags for collection and appropriate disposal of contaminated matter;
- Should an accidental spill occur during the construction or operational phase of the Development, such incidents will be addressed immediately, this will include the cessation of works in the area of the spillage until the issue has been resolved;
- Spill kits will be kept in each vehicle at the Site and will be readily available to all operators;
- No materials, contaminated or otherwise will be left on the Site; and
- Suitable receptacles for hydrocarbon contaminated materials will also be available at the Site; and
- A detailed spill response plan forms part of the site-specific CEMP appended to **Technical Appendix 2.1** of this EIAR.

Implementation of the above mitigation measures will significantly reduce the risk of hydrocarbon contamination being released to the surface water network. Nevertheless, the potential risk cannot be entirely eradicated. Therefore, precautionary measures and emergency response protocols will be established and are included in the site-specific CEMP appended to the EIAR in **Technical Appendix 2.1**.

7.8 Construction and Cementitious Materials Mitigation Measures

The following mitigation measures to reduce potential impacts posed by the use of concrete and the associated effects on surface water in the receiving environment are proposed:

- The procurement, transport and use of any cement or concrete will be planned fully in advance and supervised by appropriately qualified personnel at all times;
- Vehicles transporting cement or concrete to the Site will be visually inspected for signs of excess cementitious material prior to being granted access to the Site. This will prevent the likelihood of cementitious material being accidentally deposited on the Site Access Tracks or elsewhere at the Site;
- Drivers of such vehicles will be instructed to ensure that all vehicles are washed down in a controlled environment prior to the departure of the source site, such as at concrete batching plants;
- Precast concrete will be used wherever possible, although the use of pre-cast concrete is not a viable option for large structures such as turbine foundations and so concrete will be delivered to the Site;
- Concrete will not be poured during periods of rainfall or if any kind of precipitation is forecast. This policy will limit the potential for freshly poured concrete to adversely impact on surface water runoff;
- Raw or uncured waste concrete will be disposed of by removal from the Site;
- Washout of concrete trucks shall be strictly confined to the batching facility and shall not be located within the vicinity of watercourses or drainage channels. Only the chutes will be cleaned prior to departure from Site and this will take place at a designated area at the temporary site compound;
- Spill kits will be readily available to Site personnel, and any spillages or deposits will be cleaned up immediately and disposed of appropriately;
- Pouring of concrete into standing water within excavations will be avoided;
- Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place;
- Any surplus concrete will not be stored or deposited anywhere on Site and will be returned to the source location or disposed of appropriately at a suitably licensed facility; and

- Any required shuttering installed to contain the concrete during pouring will be fully secured around its perimeter to minimise any potential for leaks.

7.9 Watercourse Crossings Mitigation Measures

The following mitigation measures will be implemented as minimum requirements to ensure any potential impacts of drainage feature crossings are minimised:

- The design of the proposed crossings and a method statement for the proposed construction will be prepared in advance of works taking place;
- This design of all crossings will adhere to relevant available guidance and will be reviewed through consultation with the OPW which will mitigate against any significant impact on surface water flow and in turn the risk of localised or downstream flooding;
- Crossings will be designed to minimise, in so far as practical and to the extent deemed acceptable by the competent authority, the disturbance or alteration of water flow, erosion and sedimentation patterns and rates;
- A Construction Environmental Management Plan has been prepared and is appended to the EIAR in **Technical Appendix 2.1**. Adherence to this plan, which will be mandatory throughout the construction of the watercourse crossings, will include comprehensive details of the culvert design and construction methodology, including the environmental risk/s involved which have been identified and assessed in this EIAR. Detailed site-specific mitigation measures and best practice techniques will be contained in the construction management plan and Risk Assessment Method Statement (RAMS) for any proposed crossings of small unmapped drains;
- Vehicles used in the construction of small drain crossings will only be refuelled at the Site's bunded and designated refuelling area. No refuelling will be permitted within 50m of any watercourse at the Site; and
- To mitigate against the potential risk of accidental leaks or spillages from plant and equipment, an emergency response plan for such incidents is contained in the CEMP appended to the EIAR in **Technical Appendix 2.1**. Multiple spill kits will be maintained on the Site at all times within the cabs of vehicles and placed strategically at environmentally sensitive locations across the Site. Spill kits will be routinely inspected to ensure that they are fully stocked with oil absorbent booms and pads at all times. Oil absorbent booms will be installed downstream of channel crossing work areas within 25m of the works location, prior to the commencement of works.

7.10 Groundwater Contamination Mitigation Measures

In order to mitigate against potential groundwater contamination by hydrocarbons, implementation of the following mitigation measures is proposed:

- In the first instance, no fuel storage will occur at the Site whenever feasible and refuelling of plant and equipment will occur off site at a controlled fuelling station;
- In instances where on Site refuelling is unavoidable, then the bunded on-Site designated refuelling area must be used. The designated refuelling area must be bunded to 110% volume capacity of fuels stored at the Site;
- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund;
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis;
- Any oil contaminated water will be disposed of at an appropriate oil recovery plant or licensed tip site;
- Any minor spillage during this process will be cleaned up immediately;
- Vehicles will not be left unattended whilst refuelling;
- A site-specific CEMP appended to the EIAR in **Technical Appendix 2.1** will be enforced to ensure that equipment, materials and chemical storage areas are inspected and maintained as required on a regular basis; and
- The mitigation measures outlined for the protection of surface waters as set out above will be also implemented which will inadvertently serve to protect groundwater from potential hydrocarbon contamination.

The following mitigation measures are proposed in relation to non-hydrocarbon potential contamination of groundwater:

- All other liquid-based chemicals such as paints, thinners, primers and cleaning products etc. will be stored in locked and labelled bunded chemical storage units;
- Temporary sanitation facilities such as portaloos used during the construction phase will be self-contained and supplied with water by tank trucks. Portaloos will contain water storage tanks and separate wastewater storage tanks which will be routinely emptied by vacuum removal for offsite disposal via a tank truck. All temporary sanitation facilities will be removed from the Site following the completion of the construction phase;
- The controlled attenuation of suspended solids in settlement ponds and check dams etc. will result in inorganic nutrients (if present in elevated concentrations) such as phosphorus and nitrogen being absorbed and retained by the solids in the water column. This will allow for a reduction of peak inorganic discharges in a controlled and stable run off rate. It is noted that the presence of elevated contaminants were not detected during any of the three surface water quality monitoring rounds;
- It is considered that there is a low risk of mobilising trace metals that may naturally be present in low concentrations in the baseline environment. The potential for mobilising trace metals is most likely to result from enhanced water percolation associated with excavated bedrock substrate. To mitigate against this potential impact, water quality will be monitored for trace metal concentrations prior to, during and after the construction phase; and
- The potential for livestock such as cattle and sheep which have been observed grazing at the Site to cause bacteriological contamination of groundwater will be controlled through the implementation of strict grazing control zones, site perimeter fencing and exclusion zones around all open excavations.

The mitigation measures outlined for the protection of surface waters as set out above will also be implemented which will inadvertently serve to protect groundwater from potential non-hydrocarbon contamination.

7.11 Water Quality Monitoring Mitigation Measures

The following Site monitoring recommendations will be implemented to mitigate against potential impacts on the surface water and groundwater receiving environment:

- A programme of water quality monitoring outlining the selected parameters and monitoring frequency should be agreed with Inland Fisheries Ireland and Waterford City and County Council prior to the commencement of construction;
- In order to assist in the detection of any deviations from the baseline hydrochemistry conditions at the Site, regular periodic monitoring of the Site's surface waters will be carried out prior to and during construction;
- It is proposed that a programme of operational phase water quality monitoring is also implemented at a monitoring frequency agreed with the competent authority in order to aid the detection of any potential operational phase impacts on surface water quality;
- As a minimum requirement, field-measured parameters such as pH, conductivity, total dissolved solids (TDS), temperature, dissolved oxygen (DO) and turbidity will be included in the water quality monitoring programme. The results should be compared to the applicable EQS to determine if adverse impacts on water quality are occurring;
- It is also recommended that laboratory analyses for parameters such as total suspended solids, nitrogen, phosphorous, biochemical oxygen demand and trace metals etc. is implemented during and after the construction phase;
- Water quality monitoring locations will include both upstream and downstream points relative to the works locations. The locations of the water quality monitoring points will be flexible and will be moved as the construction phase progresses so that monitoring points remain representative of the most likely construction impact receptor points;
- The downstream monitoring locations will be positioned as close as possible downstream of the works location and another positioned further downstream. This approach will allow for an assessment of the dilution of potential contaminations (if present) as the distance from the point of diffuse source location increases;
- Watercourses which do not have year-round flows such as artificial drains, ditches or ephemeral streams will be avoided as water quality monitoring locations;

- During the construction phase, daily visual inspections of excavations, dewatering procedure, settlement ponds, silt traps, buffered outfalls and drainage channels etc. will be carried out by a suitably qualified person. Any excess build-up of sediment at settlement ponds, drains or at any other drainage features that may decrease the effectiveness of the drainage feature will be promptly removed;
- During the construction phase of the Development, all development areas will be monitored on a daily basis for evidence of groundwater seepage, water ponding and wetting of previously dry spots;
- Following the completion of the construction phase, silt traps, buffered outfalls and drainage channels will be periodically inspected during maintenance visits to the Site when the operational phase water quality monitoring will also be carried out;
- Any proposed crossings of small unmapped drains will be monitored daily during construction and during each Site visit during the operational phase. These small culvert crossings will be monitored in terms of their impacts (if any) on the receiving watercourses and in terms of their structural integrity to identify any signs of erosion or potential for sediment release;
- It is proposed that a handheld turbidity meter is available at the Site to accurately measure the quality of water discharging from the Site. The meter will be maintained and calibrated before each use by a qualified Environmental Clerk of Works; and
- Any discharges of sediment treated water should meet the requirements of the *Surface Water Regulations 2009*, as amended.

7.12 Emergency Response Mitigation Measures

The following is a non-exhaustive list of potential emergencies and respective emergency responses:

- Spill or leak of hazardous substances (less than 20 litres);
  - All spill incidents will be dealt with immediately as they arise;
  - Spill kits will be prepared and available in vehicles associated with the construction phase of the Development;
  - Spill kits will also be prepared and made available at primary work areas such as at proposed turbine, hardstand, substation, met mast and construction compound locations;
  - Disposal receptacles for hydrocarbon contaminated materials will also be available at the Site.
- Major spill of hazardous or toxic substance off Site or to environmentally sensitive areas;
  - Immediate escalation measures will be implemented for all major spill events;
  - Escalation measures may include installation of temporary sumps or drains to control the flow or migration of hydrocarbons or other chemicals;
  - Attempts to be made to limit or contain the spill using sandbags to construct a bund wall, use of absorbent material, temporary sealing of cracks or leaks in containers, use of geotextile or silt fencing to contain the spill;
  - Excavation and disposal of contaminated material will be immediately carried out following any such incidents;
  - Evacuation procedures will be implemented to remove non-essential personnel from the area;
  - Data gathering and an investigation will commence immediately after the emergency is contained;
  - If a significant hydrocarbon spillage does occur, the contractor on behalf of the developer must have an approved and certified clean-up consultancy available on 24-hour notice to contain and clean-up the spill;
  - All major spills of this nature will be reported to the competent authority immediately following such instances;
- Flooding of low lying areas of the Site;
  - Immediately remove all chemicals, fuels and other hazardous substances from low lying areas of the Site;
  - Immediately remove plant and equipment from low lying areas;
  - Recover materials washed from Site including sediment and other waste;
  - Review and address the potential for excess water entering the Site;
  - Review and maintain erosion and sedimentation controls;

- Spills of cementitious material;
    - Cement / concrete contamination incidents will be cleaned up immediately as they arise;
    - Spill kits will also be established at key construction areas and they will also be readily available in the cabs of plant and equipment; and
    - Suitable receptacles for cementitious materials will also be available at the Site.

Emergency responses, including methodologies and all relevant contact details are specified in the site-specific CEMP appended to the EIAR in **Technical Appendix 2.1**.

7.13 Operational Phase Mitigation Measures

In a worst-case scenario, the proposed Development will lead to an increase in impermeable surface area through the construction of hard stand areas within the Site. This in turn would lead to an increase in hydraulic loading by surface water runoff. However, preliminary water balance calculations outlined in **Chapter 9** of the EIAR indicate that the worst-case net increase in surface water runoff volumes will be result in an imperceptible, or not significant impact.

As a consequence of the estimated low significance of the impact of hydraulic loading during the operational phase, mitigation measures to facilitate a reduction in surface water runoff are limited to ensuring that pre-existing and newly established drainage infrastructure is sufficiently maintained for the discharge rates associated with all areas of the Site. Once identified, any and all blockages which may adversely impact upon the drainage regime at the Site will be immediately removed during the operational phase of the proposed Development. No other additional impacts are anticipated during the operational phase of the Development.

7.14 Decommissioning Phase Mitigation Measures

The decommissioning phase of the project will result in the removal of Site infrastructure such as wind turbines and the Met Mast etc. No new additional mitigation measures are required for the decommissioning phase of the proposed Development. The decommissioning phase and associated removal of major infrastructure components is anticipated to result in similar potential risks to surface water and groundwater as those that will be encountered during the construction phase of the proposed Development.

The excavation of soil is not expected to be required during the decommissioning phase. In addition, the movement of plant, vehicles and equipment on any unpaved surfaces is not expected to be required minimal during the decommissioning phase since all of the project's hardstand areas will be pre-existing by the time the decommissioning phase is being carried out. As a result, the risk of elevated suspended solids being discharged in surface water run-off to the downstream receiving environmental is expected to be low. However, the potential risk remains for spills of fuels or hazardous chemicals which is a common risk to all developments. The mitigation measures outlined in this chapter for the construction phase will be implemented during the decommissioning phase to reduce the potential for such impacts.

8. Assessment of WFD Compliance with Mitigation Measures in Place

An overview of the potential WFD status changes that could potentially occur within the surrounding SWBs during construction and operation in the mitigated scenario is outlined in Table 13. An overview of the potential WFD status changes that could potentially occur within the underlying GWBs during construction and operation in the mitigated scenario is outlined in Table 14. It is considered that the mitigation measures described in Section 7 are sufficient to meet the WFD Objectives.

Table 13 – Assessment of Potential WFD Surface Water Body Status Changes With Mitigation Measures in Place During Construction and Operational Phases

Surface Waterbody ID Code	Surface Waterbody Name	2013 - 2018 Water Quality Status	Assessment of Potential WFD Status Change
IE_SW_18F060300	Farnane_010	High	High
IE_SW_18F020100	Finisk_010	Good	Good
IE_SW_18F020300	Finisk_020	Moderate	Moderate
IE_SE_17C010300	Colligan_040	Good	Good

Table 14 – Assessment of Potential WFD GWB Status Changes With Mitigation Measures in Place During Construction and Operational Phases

Surface Waterbody ID Code	Groundwater Body Name	2013 - 2018 Water Quality Status	Assessment of Potential WFD Status Change
IE_SW_G_047	Knockmealdown	Good	Good
IE_SE_G_085	Kilrion	Good	Good
IE_SE_G_014	Ballyknock	Good	Good
IE_SE_G_052	Dungarvan	Good	Good

9. Conclusion

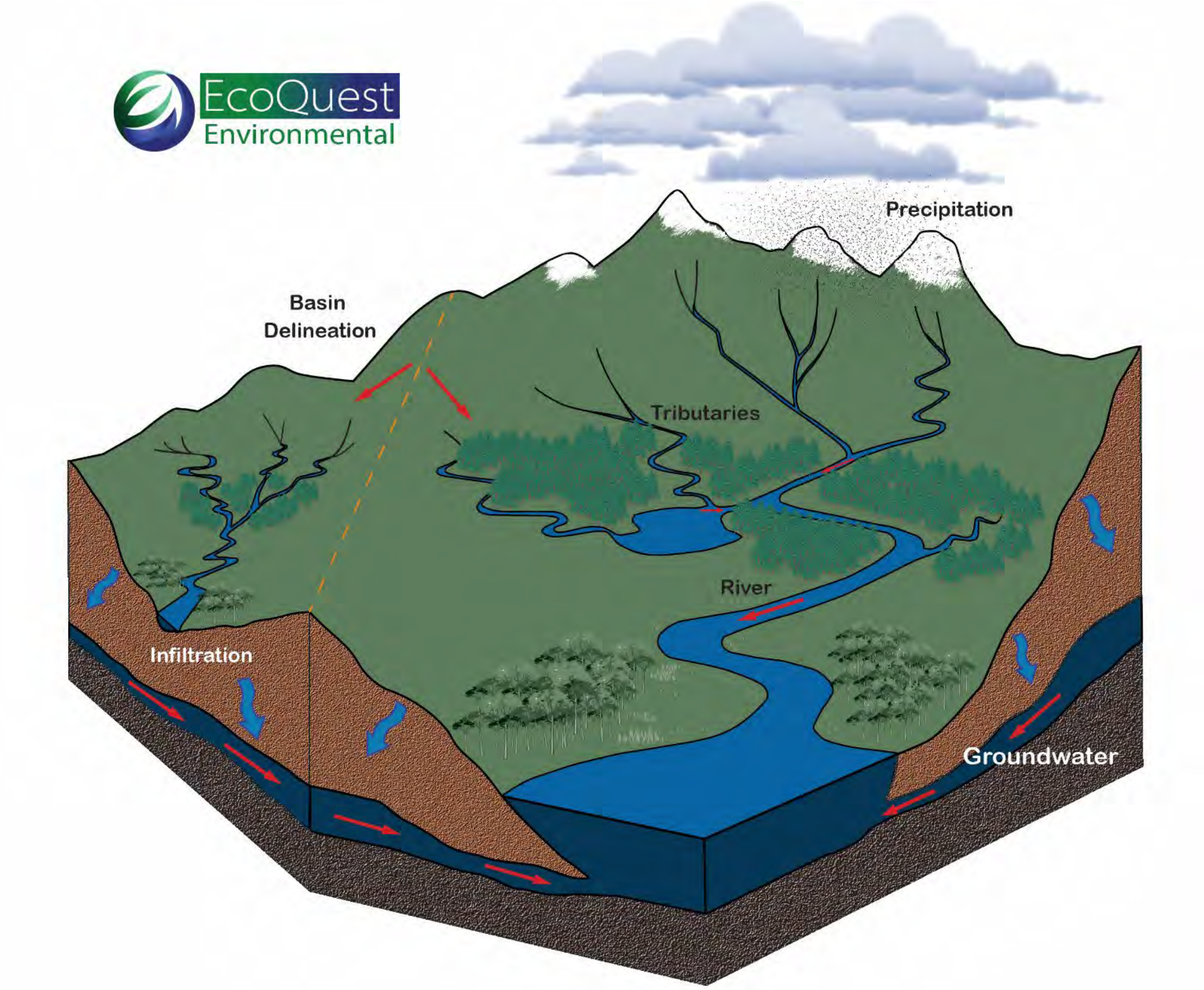
The WFD current status for surface water bodies and groundwater bodies with hydrological connectivity to the site have been reviewed and are described in this report. The potential impacts on the identified WFD waterbodies have been assessed in terms of potential adverse effects to occur in unmitigated and mitigated scenarios.

Directed discharges to groundwater or surface waters will not occur during the construction, operational or decommissioning phases of the Development. The implementation of mitigation measures outlined in Section 7 for the protection of SWBs and GWBs during the construction, operation and decommissioning phases will ensure that the qualitative status of the receiving waters at and further downstream of the Site will not be changed as a consequence of the proposed Development. For SWB's that are already classified as "*moderate*" water quality, such as the Finisk_020, the mitigation measures outlined in Section 7 will ensure that such waterbodies are not prevented from achieving at least "*Good*" status as a consequence of the proposed Development.

The proposed Development will not require the abstraction of groundwater. Stream diversion works or the alteration of pre-existing natural or artificial drainage patters will not occur. The increase in hydraulic loading as a consequence of the Development will be negligible. As a result, the quantitative status to the receiving waters will not change during the construction, operational and decommissioning phases of the proposed Development.

In conclusion, the proposed development will not impact upon any WFD surface waterbody or groundwater body to an extent that would cause a deterioration of the status of the WFD body in question.

Appendix 1 – Drainage Basin Delineation Overview



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