Proposed Ballynalacken Windfarm Project

Environmental Impact Assessment Report

Chapter 8: Water

Topic Chapter Authors:

HYDRO ENVIRONMENTAL SERVICES

March 2025

Table of Contents

CHAPTER 8 WATER 8-6

EIAR 8.1 INTRODUCTION 8-6

EIAR 8.1.1 The Authors of this Chapter (Competent Experts) 8-6

EIAR 8.1.2 Overview of Water in the Local Environment 8-6

EIAR 8.1.3 Sources of Information 8-7

EIAR 8.1.4 Legislation, Regulations & Guidance Documents 8-8

EIAR 8.1.5 Methodology Used 8-10

EIAR 8.2 WATER PART 1: SCOPING FOR SENSITIVE ASPECTS OF WATER 8-11

EIAR 8.2.1 Introduction to Scoping for Sensitive Aspects of Water (Receptors) 8-11

EIAR 8.2.2 Identification of the Sources, Pathways and Receptors of Impacts 8-12

EIAR 8.2.3 Scoping of the Study Areas (Zone of Influence of the Project) 8-14

EIAR 8.2.4 Scoping of Sensitive Aspects 8-15

EIAR 8.3 WATER PART 2: EVALUATION SECTION 8-18

EIAR 8.3.1 SENSITIVE ASPECT: RIVER WATERBODIES 8-18

EIAR 8.3.2 SENSITIVE ASPECT: GROUNDWATER BODIES (HYDROGEOLOGY) 8-59

EIAR 8.3.3 SENSITIVE ASPECT: WATER SUPPLY 8-69

EIAR 8.3.4 SENSITIVE ASPECT: DESIGNATED SITES 8-79

EIAR 8.3.5 Statement on Certainty and Sufficiency of Information Provided 8-98

EIAR 8.3.6 WATER FRAMEWORK DIRECTIVE STATUS 8-99

EIAR 8.4 Summary Conclusion 8-101

EIAR 8.5 Reference List for Water 8-103

EIAR 8.6 List of Figures for Water 8-104

EIAR 8.7 List of Appendices for Water 8-104

Figures for Water 8-105

Appendix 8.1 Surface Water Monitoring Results 8-107

Appendix 8.2 Inventory Watercourses and Wet Drainage Channels 8-109

Appendix 8.3 Flood Risk Assessment Report 8-111

Appendix 8.4 Water Framework Directive Assessment Report 8-113

Appendix 8.5 Methodology for the evaluation of Water 8-115

List of Figures

Figure No.	Figure Title	Location
Figure 8.1	Hydrometric Area and Sub-Catchments	End of Chapter 8
Figure 8.2	Local River Waterbodies (Divided into Sub-Basins)	End of Chapter 8
Figure 8.3	Site Drainage Map	End of Chapter 8
Figure 8.4	OPW Past Flood Zone Event Map	End of Chapter 8
Figure 8.5	Groundwater Bodies	End of Chapter 8
Figure 8.6	Aquifers	End of Chapter 8
Figure 8.7	Public Water Supply - Abstractions	End of Chapter 8
Figure 8.8	Local Private Water Supplies	End of Chapter 8
Figure 8.9	Designated Sites	End of Chapter 8
Figure 8.10	Projects within Surface Water Cumulative Study Areas	End of Chapter 8
Figure 8.11	Other Projects within Groundwater Cumulative Study Areas	End of Chapter 8

List of Appendices

Appendix No.	Appendix Title	Location
Appendix 8.1	Surface Water Quality Monitoring Results	End of Chapter 8
Appendix 8.2	Inventory of Watercourses and Wet Drainage Channels	End of Chapter 8
Appendix 8.3	Flood Risk Assessment Report	End of Chapter 8
Appendix 8.4	Water Framework Directive Assessment Report	End of Chapter 8
Appendix 8.5	Methodology for the evaluation of Water	End of Chapter 8

Glossary of Terms

Term	Definition
Aquifer	A permeable geological stratum or formation that can both store and transmit water in significant quantities.
Ballynalacken Windfarm Project	Ballynalacken Windfarm including 12 No. turbines, turbine foundations and hardstanding areas, Windfarm Site Roads, Internal Windfarm Cabling, Windfarm Control Building, Site Entrances, ancillary works at and for the windfarm, along with the Internal Cable Link, Tinnalintan Substation and ancillary works, and Ballynalacken Grid Connection and grid connection works to the Eirgrid Ballyragget Substation. The Project also involves works and activities along the turbine component haul route remote from the site, including the construction of a temporary Blade Transfer Area at HR8.
Baseflow	Water which enters streams/rivers from groundwater flow and maintains streamflow during dry periods.
Groundwater	Water under a pressure greater than atmospheric pressure which is present in the saturated zone of the soil.
Groundwater Body	A distinct volume of groundwater within an aquifer or system of aquifers, which is hydraulically isolated or partially isolated from nearby groundwater bodies.

Permeability	The rate at which a fluid flows through a porous medium under the hydraulic head operating within the medium. Usually, the greater the porosity, the greater the permeability.
Surface Water Runoff	Overland flow of water as a result of rainfall
Saturated Zone	The zone below the groundwater table in which all the soil pores and rock fractures are filled with water. It underlies the unsaturated zone (see below).
Spring	A flow of groundwater on the ground surface that occurs where the water table intercepts the ground surface.
Surface Water Catchment	The surface area determined by topographic features within which falling rain will contribute to run-off at a particular point under consideration.
Suspended Sediments	Particulate solids (i.e. sand, clay, silt) entrained in surface water flow.
Unsaturated Zone	The zone below the land surface and above the groundwater table which contains water and air in the open spaces, or pores.

List of Abbreviations

Abbreviation	Full Term
AAR	Annual Average Rainfall
AE	Actual Evaporation
BOD	Biological Oxygen Demand
CFRAM	Catchment Flood Risk Assessment and Management
DWPA	Drinking Water Protected Area
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ER	Effective Rainfall
FT	Fehily Timoney and Company
GSI	Geological Survey of Ireland
HA	Hydrometric Area
HDD	Horizontal Directional Drilling
HES	Hydro-Environmental Services
IFI	Inland Fisheries Ireland
OHL	Overhead Line
OPW	Office of Public Works
NHA	Natural Heritage Area
PE	Potential Evapotranspiration
pNHA	Proposed Natural Heritage Area
PWS	Public Water Supply
SAC	Special Areas of Conservation
SPA	Special Protection Area
SWB/GWB	Surface Water Bodies / Groundwater Bodies

Abbreviation	Full Term
SWMP	Surface Water Management Plan
TSS	Total Suspended Solids
WFD	Water Framework Directive
WWTP / WTP	Wastewater Treatment Plant

CHAPTER 8 WATER

EIAR 8.1 INTRODUCTION

EIAR 8.1.1 The Authors of this Chapter (Competent Experts)

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include upland hydrology and wind farm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types, including wind farms and associated grid connections.

This chapter was prepared by Michael Gill and David Broderick.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael was involved in the EIS/EIAR for Oweninny WF, Cloncreen WF, Derrinlough WF, and over 100 no. other wind farm related projects.

David Broderick P.Geo (BSc, H.Dip Env Eng, MSc.) is a Hydrogeologist with over 17 years' experience in both the public and private sectors. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into Environmental Impact Assessment Reports/Environmental Impact Statements (EIAR/EIS) for a range of commercial developments. For example, David has worked on the EIS/EIAR for Oweninny WF, Cloghan WF, Drumlins Park WF, Arderroo WF and Yellow River WF, and over 80 other wind farm related projects across the country.

EIAR 8.1.2 Overview of Water in the Local Environment

Water relates to the hydrology and hydrogeology in the area of the Proposed Ballynalacken Windfarm Project site.

Hydrology is the term used for surface water drainage within regional and local catchments. Hydrogeology is the distribution and flow of groundwater within aquifers in the local groundwater bodies and aquifers. Hydrology and hydrogeology are assessed with respect to river waterbodies, groundwater bodies (and local aquifers), water dependant designated sites (i.e. SACs, NHAs, SPAs etc.), drinking water supplies, local water dependent habitats, flood risk and WFD status.

With respect to surface water, Ireland is divided into 40 hydrometric areas. Each Hydrometric Area comprises a single large river basin, or a group of smaller ones, and neighbouring coastal areas. The proposed Ballynalacken Windfarm Project is located within the regional River Nore surface water catchment in Hydrometric Area (HA) 15, – see Figure 8.1 Hydrometric Area and Sub-Catchments. The regional Nore catchment (HA15) comprises 21 sub-catchments with 123 river water bodies. The Ballynalacken Windfarm is spread over three sub-catchments in the River Nore; Nore_SC_060, Dinin[North]_SC_010 and the Nore_SC_080 (Dinin River), the Internal Cable Link, Tinnalintan Substation and the Ballynalacken Grid

Connection are located in the Nore_SC_060. The majority of the Ballynalacken Windfarm site drains into the River Nore via the Dinin River, whereas the Internal Cable Link, Tinnalintan Substation and Ballynalacken Grid Connection drain into the main channel of the Nore. Haul route works extend into the Nore_SC_100 sub-catchment.

In respect of receiving groundwater environment, the River Nore regional catchment (Hydrometric Area 15) comprises 28 groundwater bodies. The proposed Ballynalacken Windfarm Project is located within 3 of these; the Ballynalacken Windfarm site is located in the Ballingarry Groundwater Body (GWB) while the Tinnalintan Substation and the majority of the Ballynalacken Grid Connection is located in the Durrow GWB, with the final section of the Ballynalacken Grid Connection in the Kilkenny – Ballynakill Gravels GWB.

Hydrometric Area 15 contains two Natura 2000 and one proposed nationally designated site immediately downstream of the Ballynalacken Windfarm Project; namely the River Barrow and River Nore SAC, the River Nore SPA, and the River Nore/Abbeyleix Woods Complex pNHA.

Public and private water supplies comprise surface water abstractions from local streams or rivers; groundwater abstractions using groundwater wells from the underlying bedrock aquifers or springs discharging from shallow groundwater flow along the subsoil and bedrock interface.

Flood risk relates to the potential for fluvial (streams/rivers), pluvial (rainfall/surface water runoff) and groundwater flooding at the project site and also further downstream.

EIAR 8.1.3 Sources of Information

Consultation, desktop studies and fieldwork were carried out in order to gather information on the baseline environment.

Table 8-1: Sources of Baseline Information for Water

Type	Source
Consultation	Feedback was received from: Uisce Eireann: In January 2024, Uisce Eireann advised that there is an existing abstraction point in the vicinity of the proposed windfarm to the north west of Castlecomer and that the EIAR must include and consider all direct, indirect and cumulative effects on the abstraction point. It was confirmed in follow up e-mail correspondence from Uisce Eireann that the source is a spring from which groundwater is abstracted. Geological Survey of Ireland (GSI): "The Groundwater Vulnerability map indicates the range of groundwater vulnerabilities within the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your assessments, as any groundwater-surface water interactions that might occur would be greatest in these areas" See Chapter 3: Consultation for further details.
Desktop	Environmental Protection Agency database (www.epa.ie); Geological Survey of Ireland - Groundwater Database (www.gsi.ie); Met Eireann Meteorological Databases (www.met.ie); National Parks & Wildlife Services Public Map Viewer (www.npws.ie); Water Framework Directive/EPA Catchments Map Viewer (www.catchments.ie); Bedrock Geology 1:100,000 Scale Map Series, Sheet 19 (Geology of Carlow - Wexford); Geological Survey of Ireland (2004); Groundwater Body Initial Characterization Reports; OPW Past Flood Event Mapping (www.floodinfo.ie); CFRAM Flood Extents Mapping and National Indicative Fluvial Mapping (www.floodinfo.ie); Ordnance Survey Ireland (OSI) – 6 inch and 1;5000 scale basemaps; and,

Type	Source
	Aerial photography (www.bing.com/maps, www.geohive.ie, www.google.com/maps); Kilkenny City and County Development Plan 2021-2027 (Consolidated Strategic Flood Risk Assessment 2021-2027).
Fieldwork	Walkover survey, hydrological mapping and baseline monitoring of the proposed Ballynalacken Windfarm Project site; Mapping and characterisation of all watercourse crossings along construction works areas; Hydrological mapping of the project site and the surrounding area were undertaken whereby water flow directions and drainage patterns were recorded; A trial pit investigation by HES to determine subsoil depth and lithology along with groundwater conditions (i.e. potential groundwater inflows). 24 no. trial pits in total were completed at the windfarm site; 140 no. soil probe locations along with slope angle measurements were carried out by Fehily Timoney (FT) as part of the geotechnical assessment; Field hydrochemistry measurements (electrical conductivity, pH, dissolved oxygen and temperature) were taken to determine the origin and nature of surface water flows; Surface water sampling (16 no. locations over 4 no. rounds, 51 samples in total) was undertaken to determine the baseline water quality in the receiving waters at the project site.

EIAR 8.1.4 Legislation, Regulations & Guidance Documents

The following legislation and regulations have been taken into account in this EIA Report:

- S.I. No. 293/1988: Quality of Salmon Water Regulations, resulting from EU Directive 78/659/EEC on the Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life;
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 and S.I. No. 722/2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive (2000/60/EC) and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC). Since 2000 water management in the EU has been directed by the Water Framework Directive (WFD). The key objectives of the WFD are that all water bodies in member states achieve (or retain) at least 'good' status by 2015. Water bodies comprise both surface and groundwater bodies, and the achievement of 'Good' status for these depends also on the achievement of 'good' status by dependent ecosystems. Phases of characterisation, risk assessment, monitoring and the design of programmes of measures to achieve the objectives of the WFD have either been completed or are ongoing. In 2015 it will fully replace a number of existing water related directives, which are successively being repealed, while implementation of other Directives (such as the Habitats Directive 92/43/EEC) will form part of the achievement of implementation of the objectives of the WFD;
- S.I. No. 41/1999: Protection of Groundwater Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 249/1989: Quality of Surface Water Intended for Abstraction (Drinking Water), resulting from EU Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (repealed by 2000/60/EC in 2007);
- S.I. No. 439/2000: Quality of Water intended for Human Consumption Regulations and S.I. No. 278/2007 European Communities (Drinking Water No. 2) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);

- S.I. No.106/2007: European Communities (Drinking Water) Regulations and S.I. No. 122/2014: European Union (Drinking Water) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010; and,
- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.

The recommendations in the guidelines listed below, have been considered during the preparation of this chapter:

- European Commission (2020) Guidance Document on Wind Energy Developments and EU Nature Legislation;
- European Commission (2017) Environmental Impact Assessment of Projects – Guidance on Scoping
- European Commission (2017) Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2009) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Transport Infrastructure Ireland (2015) Road Drainage and the Water Environment
- DOE/NIEA (2015) Wind Farms and Groundwater Impacts – A guide to EIA and Planning Considerations;
- Department of Housing, Planning & Local Government (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;
- Department of the Environment, Heritage, and Local Government (2006) Wind Energy Development Guidelines for Planning Authorities 2006;
- Department of the Housing, Planning, and Local Government (2019) Draft Revised Wind Energy Development Guidelines;
- Forestry Commission (2004) Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009) Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000) Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004) Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters;
- EPA (2024) Cycle 3 HA 15 Nore Catchment Report;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) 2006 Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- CIRIA 2006 Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

EIAR 8.1.5 Methodology Used

The evaluation for Water in Section EIAR 8.3 has been carried out in accordance with the National Roads Authority 2009 *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* and the EPA 2022 document *Guidelines on the information to be contained in Environmental Impact Reports*. This methodology has been used to determine the importance and sensitivity of receptors, and the magnitude and significance of potential impacts. The methodology can be found in full in Appendix 8.5: Methodology for the evaluation of Water.

EIAR 8.2 WATER PART 1: SCOPING FOR SENSITIVE ASPECTS OF WATER

The assessment of significant effects (or impacts) is an essential concept of the EIA Directive, and the primary objective of this EIA Report is to identify and evaluate the significant effects of the Project. Scoping has been carried out in accordance with the *Guidance on Scoping* (EC 2017) in order to focus the consideration of the impacts the Ballynalacken Windfarm Project may have on the environment to those which are significant or important enough to merit assessment, review and decision-making.

Scoping for the Environmental Topic – Water has been carried out by the chapter authors, throughout the preparation of this Chapter, and includes scoping for the sensitive aspects of Water (this Section EIAR 8.2), and later in this Chapter - scoping of impacts (see Section EIAR 8.3).

EIAR 8.2.1 Introduction to Scoping for Sensitive Aspects of Water (Receptors)

The purpose of the scoping exercise, which comprises this Section EIAR 8.2, is to identify the relevant Sensitive Aspects (receptors) of Water. In order to identify the relevant Sensitive Aspects, the scoping exercise is carried out as follows:

1. An examination is carried out, in Section EIAR 8.2.2, of the potential sources of impacts resulting from the Project and the pathways for Impacts which link the sources of impacts to the receptors (Sensitive Aspects) of the impacts;

2. The zone of influence of the Project, within which the impacts of the Project could occur, is set out, with justification for same. The zone of influence is also called the 'Study Area' herein. The zones of influence are set out in Section EIAR 8.2.3 for the various Sensitive Aspects which occur in the environment.

3. A scoping examination of Sensitive Aspects which occur within the Study Area(s) is carried out in Section EIAR 8.2.4. The scoping examination results in a Sensitive Aspect being either scoped-in for detailed evaluation in **Part 2: Sensitive Aspect Evaluation Section (i.e. Section EIAR 8.3)** of this chapter or scoped-out from further consideration, the rationale for scoping-out is provided in Section EIAR 8.2.4.

EIAR 8.2.2 Identification of the Sources, Pathways and Receptors of Impacts

The evaluations within the EIAR identify potential impact sources and pathways between the Project and receptors (Sensitive Aspects) of the environment.

EIAR 8.2.2.1 Identification of Impact Sources

The 'source' is an origin of an impact and is associated with the Project. In order to identify the potential 'sources' of impact, the characteristics of the Ballynalacken Windfarm Project, i.e. the size and design, works, activities, use of materials and natural resources, and the emissions and wastes, associated with the construction, operation and decommissioning of the Project, as described in Chapter 5 of this EIA Report, have been examined, and it is considered that the following Project characteristics have potential to act as a 'source' of impact to the sensitive aspects of Water:

Construction Stage Sources of Impact

- Excavations, earthworks and groundworks (associated with the excavation of soils and bedrock to construct turbine bases (foundations) and crane hardstanding areas, substation compound base, control building base, met mast base, new and upgraded site access roads, site entrances, temporary hardstanding areas, and the opening, excavation and reinstatement of the borrow pits);
- Dewatering of excavations;
- Movement and storage of overburden (both temporary and permanent);
- Watercourse and wet drain crossing works (including instream works and works in close proximity);
- Installation of site drainage network;
- Forestry felling;
- Use of cementitious material (concrete);
- Use of machinery and vehicles run on hydrocarbons;
- Storage of oils, fuels and wastes (including wastewater) at the temporary site compound.

Operational Stage Sources of Impact

- New/upgraded permanent access roads and hardstanding areas;
- New/upgraded permanent watercourse crossing structures;
- Use of machinery and vehicles run on hydrocarbons;
- Use of hydrocarbons (e.g. lubricating oils) at the turbines, control building and Tinnalintan Substation;
- Storage of oils, fuels and wastes at the control building and Tinnalintan Substation compound;
- Groundworks for access road/hardstand/drainage maintenance;
- Groundworks to facilitate transport of large turbine components during major maintenance;
- Inspection, testing and maintenance of underground cabling.

Decommissioning Stage Sources of Impact

- Use of machinery and vehicles run on hydrocarbons;
- Removal of small volumes of hydrocarbons (e.g. lubricating oils) from turbines;
- Groundworks to facilitate transport of large turbine components during major maintenance;
- Groundworks to reinstate the turbine hardstand areas using soils stored in adjacent berms;
- Groundworks to remove cabling from underground ducts (via jointing chambers).

EIAR 8.2.2.2 Identification of Impact Pathways

The 'pathway' is the means by which an impact can reach and affect a receptor. The characteristics of the baseline environment have been examined and it is considered that the following pathways could form a link between the Project (sources of impact) and the Sensitive Aspects (receptors):

- Runoff, drainage and surface water discharge routes
- Direct excavations
- Soil/subsoil pore space
- Groundwater flow paths

EIAR 8.2.2.3 Identification of Receptors

Any receptor in the environment which could be affected by a development is referred to as a 'Sensitive Aspect' in this EIA Report. The following Sensitive Aspects are relevant to the receiving environment and are subject to scoping in Section EIAR 8.2.3:

- River Waterbodies
- Groundwater Bodies
- Water Supplies (surface water and groundwater)
- Bathing Waters
- Designated Sites
- Local Water Dependent Habitats

The zone of influence in relation to these Sensitive Aspects is examined in Section EIAR 8.2.3 below, with a scoping exercise for each of the Sensitive Aspects presented in Section EIAR 8.2.4.

EIAR 8.2.3 Scoping of the Study Areas (Zone of Influence of the Project)

The scoping and evaluation focus on the area or zone of influence around the Ballynalacken Windfarm Project within which the impacts of the Project could occur. This area/zone is referred to as the Study Area. The Study Areas for the Sensitive Aspects of the Water environment is set out in the table below.

Table 8-2: Study Area of the Project in relation to sensitive aspects of the Water environment

Sensitive Aspect	Ballynalacken Windfarm Project Zone of Influence/Study Area	Justification
River Waterbodies	WFD River Sub-catchments (as defined by river water catchments) within which the Ballynalacken Windfarm Project is located. Defined by local topography, flow patterns and drainage, as defined by the EPA mapping on www.catchments.ie for WFD River Sub-catchments.	Only river waterbodies in sub-catchments downstream of the site can be affected by the Ballynalacken Windfarm Project (refer to Section EIAR 8.3.1.1.3 below for sub-catchments).
Groundwater Bodies	All aquifers within 500m of the project site (conservative distance in excess of the GSI estimated groundwater flowpath distance which is 300m).	Defined by bedrock lithology, local topography and groundwater flow. Groundwater flow paths at the wind farm site are considered to be short by the GSI (~300m) because the bedrock is not considered to constitute a major aquifer. Therefore, it is likely that most groundwater flow circulates in the upper tens of metres, recharging and discharging in local zones. The age of the groundwater is considered to be young. Groundwater will discharge locally to streams downslope of the site and also to small springs and seeps.
Water Supply – groundwater and surface water abstractions	Groundwater abstractions within 500m of construction works (conservative distance in excess of the GSI estimated groundwater flowpath distance which is 300m). Surface water abstractions from downstream river waterbodies.	Groundwater abstractions: Due to the shallow depth and temporary nature of the excavations associated with the construction works, and the characteristics of groundwater flow paths at the wind farm site (which are considered to be short (~300m), the potential for impacts to local wells/springs is limited to physical contact with the well head/source or changes to groundwater flow or localized contamination of the source by fuel/oil spills/cement-based compounds. Surface water abstractions downstream of the project site are potential receptors and are scoped in for further assessment.
Water Supply – Uisce Eireann piped supply	Local water mains pipe along the regional R432 and local L58442 road from the existing EirGrid Ballyragget Substation at Moatpark to Site Entrance No.11 in Tinnalintan and connected pipes feeding off this mains.	Piped Supply can only be affected by direct damage during trenching works, the extent of the impact is limited to the length of water mains and connecting water mains downflow of the point of damage which could be affected.

Sensitive Aspect	Ballynalacken Windfarm Project Zone of Influence/Study Area	Justification
Bathing Waters	WFD River Sub-catchments (as defined by river water catchments) within which the Ballynalacken Windfarm Project is located. Defined by local topography, flow patterns and drainage, as defined by the EPA mapping on www.catchments.ie for WFD River Sub-catchments.	Only river waterbodies in sub-catchments downstream of the site can be affected by the Ballynalacken Windfarm Project (refer to Section EIAR 8.3.1.1.3 below for sub-catchments). All downstream coastal Bathing Waters are remote from the site and have been scoped out below.
Designated Sites	Designated Sites downstream of the Ballynalacken Windfarm Project within the Nore_SC_060, Dinin[North]_SC_010, Nore_SC_80 and Nore_SC_100 sub-catchments of the River Nore Catchment in which the Project is located. Sub-catchments downstream of the Nore_SC_100 are not included in the zone of influence. Within local groundwater catchments within 500m of the construction works areas.	Defined by local topography and regional drainage. These are the sub-catchments within which the Ballynalacken Windfarm Project is located. Upstream sub-catchments are excluded as there is no hydrological connectivity for water quality impacts. Sub-catchments further downstream of these sub-catchments, are excluded due to substantial dilution factors – i.e. the large up-stream catchment of the River Nore upstream of the Nore_SC_100 (1,745km^2) and high flows (50%ile – 19m^3/sec) means no likelihood of perceptible / measurable effects of the Ballynalacken Windfarm Project downstream of the Nore_SC_100. As per Groundwater Bodies above, defined by bedrock lithology, local topography and groundwater flow.
Local Water Dependent Habitats	Water dependant habitats within 50m of construction works area as identified by the ecological surveys	Due to the shallow depth and temporary nature of the excavations associated with the construction works, the potential for impacts to local Water Dependent Habitats is limited to localised changes to surface water runoff/groundwater flow.

EIAR 8.2.4 Scoping of Sensitive Aspects

Any receptor in the local environment which could be affected by a development is a Sensitive Aspect. The various sensitive aspects of the Water environment are scoped in the table below for potential to be affected by the Ballynalacken Windfarm Project. The scoping examination results in a Sensitive Aspect being either scoped-in for detailed evaluation in **Part 2: Sensitive Aspect Evaluation Section (i.e. Section EIAR 8.3)** of this chapter or scoped-out from further consideration, for the following reasons:

a) Where it is considered that a Sensitive Aspect is likely, or has potential, to be significantly affected by the Project, that Sensitive Aspect has been scoped in for detailed evaluation in Part 2 (Section EIAR 8.3).

b) Where it is considered that there is no potential for a Sensitive Aspect to be affected, or where the likely/potential impacts to that Sensitive Aspect will be Neutral (i.e. No impact/imperceptible impact) then that Sensitive Aspect has been scoped out from further consideration, and the rationale for scoping-out is provided in the table.

c) An exception is made for Sensitive Aspects which are not likely to be significantly affected but may be of particular or local concern and merit a detailed examination, these Sensitive Aspects are also scoped in for detailed evaluation in Part 2 (Section EIAR 8.3).

Table 8-3: Scoping of Sensitive Aspects

Sensitive Aspect	**Is there a Pathway between the Project and the Sensitive Aspect?**	**Likely (or have potential) to be Significant?**	**Scope In/ Out**	**Scoping Result & Rationale *(scoped out only)***
River Waterbodies	Yes	Yes	Scope In	See Section EIAR 8.3.1 Part 2 Evaluation
Groundwater Bodies (and local aquifers)	Yes	Yes	Scope In	See Section EIAR 8.3.2 Part 2 Evaluation
Water Supply: Surface Water and Groundwater Abstractions	Yes	Not likely to be Significant – but of local importance	Scope In	See Section EIAR 8.3.3 Part 2 Evaluation
Designated Site: River Barrow and River Nore SAC	Yes	Yes, potential	Scope In	See Section EIAR 8.3.4 Part 2 Evaluation
Designated Site: River Nore SPA	Yes	Yes, potential	Scope In	See Section EIAR 8.3.4 Part 2 Evaluation
Designated Site: River Nore/Abbeyleix Woods Complex pNHA	Yes	Yes, potential	Scope In	See Section EIAR 8.3.4 Part 2 Evaluation
Designated Site Ardaloo Fen pNHA Inchbeg pNHA Dunmore Complex pNHA	Yes	No	Scope In	See Section EIAR 8.3.4 Part 2 Evaluation
Water Supply: Piped Uisce Eireann supply	Yes	n/a	Scope Out	Scoped Out: Evaluated in Chapter 16: Material Assets as part of Built Services.
Bathing Waters & Amenity Use	Yes	No	Scope Out	Scoped Out: The outdoor pool in Ballinakill village to the north of the Ballynalacken Windfarm is upstream on the Owveg River, and therefore has no potential to be affected by the windfarm construction works. According to EPA/WDF mapping (www.catchments.ie) all mapped bathing waters downstream of the Ballynalacken Windfarm Project are coastal and >60km from the proposed site. Therefore, no perceptible effects on bathing waters are likely and therefore are scoped out.
Designated Site: Lisbigney Bog SAC Lisbigney Bog pNHA	No	No	Scope Out	Scoped Out: Sites are located 3.0km from closest works. No hydrological connectivity for water quality effects – upstream in the downstream catchment.
Designated Site: Cullahill Mountain SAC	No	No	Scope Out	Scoped Out: Due to no hydrological connectivity for water quality effects – upstream in the downstream catchment.

Sensitive Aspect	**Is there a Pathway between the Project and the Sensitive Aspect?**	**Likely (or have potential) to be Significant?**	**Scope In/ Out**	**Scoping Result & Rationale *(scoped out only)***
Spahill and Clomantagh Hill SAC Galmoy Fen SAC The Loughans SAC Coan Bogs NHA Cullahill Mountain pNHA Dunmore Cave pNHA Esker Pits pNHA The Curragh and Goul River Marsh pNHA				
Local Water Dependent Habitats – Dry Heath, Ballyouskill (Biodiversity Protection Area)	No	No	Scope Out	Scoped Out: Habitat is upslope from the construction works areas, with an existing drainage channel between this habitat and the Project works. No additional drainage is expected as a result of the Project due to the location of the works downslope of the existing drainage and the shallow nature of works in proximity to the habitat.
Local Water Dependent Habitats – Marsh Fritillary	No	No	Scope Out	Scoped Out: The nearest habitat supporting Marsh Fritillary butterfly is c.>1.5km from the works areas. There is no potential for the Project to drain or otherwise affect the water content of soils at this separation distance.

EIAR 8.3 WATER PART 2: EVALUATION SECTION

This Evaluation Section examines the scoped-in Sensitive Aspects in greater detail, and comprises a baseline description and impact evaluation for each of the Sensitive Aspects, presented in the following order:

Section EIAR 8.3.1: River Waterbodies

Section EIAR 8.3.2: Groundwater Bodies

Section EIAR 8.3.3: Water Supply

Section EIAR 8.3.4: Designated Sites

EIAR 8.3.1 SENSITIVE ASPECT: RIVER WATERBODIES

This detailed evaluation section for River Waterbodies (i.e. hydrology) is presented as follows:

- Section EIAR 8.3.1.1 - description of the baseline environment of River Waterbodies;
- Section EIAR 8.3.1.2 - evaluation of the impacts of Ballynalacken Windfarm Project on River Waterbodies; and
- Section EIAR 8.3.1.3 – evaluation of cumulative impacts.

EIAR 8.3.1.1 Baseline Environment – River Waterbodies

The context, characteristics, importance and sensitivity of *River Waterbodies* are described in the subsections below. The trends and likely evolution (i.e. Do-Nothing scenario) for this Sensitive aspect are also considered.

EIAR 8.3.1.1.1 Rainfall, Evapotranspiration and Recharge/Runoff

Long term Average Annual Rainfall (AAR) and evaporation data was sourced from Met Éireann. The 30 year annual average rainfall (AAR) recorded at Coon, 11km southeast of the windfarm site is 1,056mm/yr.

The closest synoptic[1] station where the average potential evapotranspiration (PE) is recorded is at Kilkenny, approximately 17km south of the proposed Ballynalacken Windfarm site. The long-term average PE for this station is 459mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the proposed project site is estimated as 436mm/yr (which is 0.95 × PE).

The effective rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the project site is calculated as follows:

Effective rainfall (ER) = AAR – AE

= 1,056 mm/year – 436mm/year

ER = 620mm/year

Based on the GSI mapping, a groundwater recharge cap of 100mm/year is applied to aquifers in the area of the windfarm site. Therefore, surface water runoff rates for the wind farm site are estimated to be 520mm/yr.

[1] Meteorological station at which observations are made for synoptic meteorology and at the standard synoptic hours of 00:00, 06:00, 12:00, and 18:00.

This suggests that surface water runoff rates at the Ballynalacken Windfarm site (~85%) are significantly higher than recharge rates (~15%). Hydrogeology and site drainage are discussed in Sections EIAR 8.3.1.1.3 and EIAR 8.3.1.1.4 below.

EIAR 8.3.1.1.2 Baseline Runoff Assessment

This section undertakes a long-term water balance assessment and surface water runoff assessment for the baseline conditions at the proposed project area (300ha in area).

The rainfall depths used in this water balance assessment, are long term averages. Please note the long term averages are not used in the design of the sustainable drainage system for the proposed development as extreme rainfall depths (10-year return period) will be the basis of the proposed hydraulic design for the windfarm settlement ponds. The Windfarm drainage system is described in the Surface Water Management Plan which includes drawings of the drainage network. The Surface Water Management Plan is included with the Planning Documentation as part of the Environmental Management Plan for the project. The site drainage network is also included in the Volume B: Planning Drawings (see Drawings 101 to 106 and 501 to 503).

The water balance calculations are carried out for the month with the highest average recorded rainfall minus evapotranspiration, for the current baseline site conditions (Table 8-4). It represents therefore, the long term average wettest monthly scenario in terms of volumes of surface water runoff from the proposed project landholding pre-development. The surface water runoff co-efficient for the area is estimated to be 85% based on the local geological and hydrogeological conditions.

The highest long term average monthly rainfall recorded at the Coon station over the period 1981- 2010 occurred in October, at 114mm. The average monthly evapotranspiration for the synoptic station at Kilkenny over the same period in October was 16.8mm. The water balance indicates that a conservative estimate of surface water runoff for the project landholding during the highest rainfall month is 249,900m^3/month or 8,061m^3/day for the site as outlined in Table 8-5.

Table 8-4: Water Balance and Baseline Runoff Estimates for Wettest Month (October)

Water Balance Component	Depth (m)
Estimated Average October Rainfall (R)	0.114
Average October Potential Evapotranspiration (PE)	0.0168
Actual Evapotranspiration = PE x 0.95	0.0160
Effective October Rainfall (ER = R - AE)	0.098
Recharge (15% of ER)	0.0147
Runoff (85% of ER)	0.0833

Table 8-5: Baseline Runoff for Project Site

Proposed Project Site Area (ha)	Baseline Runoff per month (m^3) in wettest month	Baseline Runoff per day (m^3) in wettest month
300	249,900	8,061

EIAR 8.3.1.1.3 Regional & Local Hydrology

A summary of regional and local hydrology with regard the proposed Ballynalacken Windfarm infrastructure is shown in Table 8-6 below.

The proposed Ballynalacken Project site is located in County Kilkenny, approximately 4.2km northwest of the town of Castlecomer and approximately 4.3km northeast of the small town of Ballyragget, Co. Kilkenny. The Project is located to the south of the Kilkenny-Laois County boundary. The Ballynalacken Windfarm site generally consists of agricultural fields and coniferous forestry with the latter being more dominant on the southern section of the windfarm site. The route of the proposed Internal Cable Link is through agricultural grassland, while the route of the proposed Ballynalacken Grid Connection is along the Tinnalintan Substation site access road and along public road network.

Regionally the proposed Ballynalacken Wind Farm project site is located in the River Nore regional surface water catchment within Hydrometric Area 15 of the South Eastern River Basin District. The River Nore flows in a southerly direction approximately 4 - 5km to the west of the proposed Ballynalacken Windfarm site, and approximately 0.4km west of the proposed Tinnalintan Substation location. The majority of the Ballynalacken Windfarm site drains to the River Nore via the Dinin River.

On a sub-catchment scale, the southern half of the Ballynalacken Windfarm is located in the Nore_SC_080 sub-catchment, draining southerly into the Cloghnagh Stream, while the central section of the Ballynalacken Windfarm mainly drains easterly into Castlecomer Stream in the Dinin(North)_SC_010. Both the Cloghnagh Stream and the Castlecomer Stream drain into the Dinin River which flows to the east and south of the Ballynalacken Windfarm site. The northern and western sections of the Ballynalacken Windfarm site along with the Internal Cable Link, Tinnalintan Substation and the Ballynalacken Grid Connection are located in the Nore_SC_060 sub-catchment which drains into the furthest downstream reach of the Owveg (Owenbeg) River to the north and into River Nore channel to the west of the Project site.

On a local sub-basin scale, the main construction works associated with the Ballynalacken Windfarm site (including road widening works and Haul Route Works HR12 and HR13), the Internal Cable Link, Tinnalintan Substation and the Ballynalacken Grid Connection; will take place within one sub-basin Cloghnagh_010 within the Nore_SC_080 sub-catchment; one sub-basin Castlecomer Stream_010 within the Dinin[North]_SC_010; with works spread over two sub-basins, the Owveg(Nore)_040 and the Nore_120, within the Nore_SC_060.

The downstream distance from the wind farm site to the River Nore in the 4 no. sub-basins is as follows- Cloghnagh_010 (~16.2km), Castlecomer Stream_010 (~23.4km), Owveg(Nore)_040 (~10.5km) and Nore_120 (0.2km). Refer to Table 8-6 below for a summary of the main elements of the proposed infrastructure within each WFD mapped sub-catchment and sub-basin, along with an overview of spread of the Project over the various local catchments. This is also illustrated on Figure 8.2: Local River Waterbodies (Divided into Sub-Basins).

Please note that the WFD mapping for certain areas of the wind farm site does not accurately reflect the existing surface water drainage regime with regard catchments. For example, turbine T9 does not drain into the sub-catchment in which it is mapped by the WFD. Refer to Table 8-6 below for further details.

Table 8-6: Summary of Regional and Local WFD Mapped Hydrology and Proposed Infrastructure

Regional Catchment	Sub-catchment	Local River Water Body (Sub-basin)	Proposed Infrastructure	Works Area (ha) in the sub-basin	% of works area in the sub-basin
Nore	Nore_SC_080 (Dinin River)	CLOGHNAGH_010	6 no. turbines (T1, T2, T3, T4, T5, T7), borrow pit no. 1, windfarm control building, windfarm site roads and drainage network, Internal Cable Link, construction compound no.1, road widening works, Haul route works (HR13) and watercourse works W1, and works at wet drainage channels (D1, D2, D3).	24.5	47%
		DININ (MAIN CHANNEL)_010	Blade Transfer Area HR8	1.3	2%
		NORE_160	Haul route works (HR7)	0.04	>1%
	Dinin[North]_SC_010	CASTLECOMER STREAM_010	3 no. turbines (T6, T8, T9)[Note 1], borrow pit no. 2, windfarm site roads and drainage network, construction compound no.1, and Haul route works (HR10, HR11),	7.2	14%
		DININ(NORTH)_040	Haul route works (HR9)	0	-
	Nore_SC_060	OWVEG (NORE)_040	3 no. turbines (T10, T11, T12)[Note 1], met mast, windfarm site roads and drainage network, works at wet drainage channel D4 and road widening works	7.6	15%
		NORE_120	Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection, construction compounds no. 2 and 3, Haul route works (HR12), telecom relay pole, windfarm site roads and drainage network, road widening works and watercourse crossing works W2 and W3.	11.3	22%
	Nore_SC_100	RATHGARVAN OR CLIFDEN_010	Haul route works (HR1)	0	-
		BROWNSTOWN(POCOCKE)_010	Haul route works (HR2, HR3, HR4, HR5)	0.09	>1%
		NORE_170	Haul Route Works HR6	0	-

[1] Turbine T9 is mapped in the Castlecomer Stream_010 by the WFD but actually drains into the Owveg (Nore)_040.

EIAR 8.3.1.1.4 Existing Site Drainage Regime

The following local streams and rivers are located downstream of the main construction works:

Sub-Basin & (*Sub-catchment*)	**Watercourse Name Stream Order**	**EPA /EU Code**	**Survey Site ID**	**Downstream Distance from nearest works**
CLOGHNAGH_010 *Nore_SC_080*	Cloghnagh 1st Order	15C04 IE_SE_15C040400)	B6, B7	Crosses under Windfarm Site Road between T3 & T4, culvert crossing at W1, culvert crossing and drain diversion at D1
	Ballymartin_15 1st Order	15B72 IE_SE_15C040400		134m from Windfarm Site Road at site entrance 2, culvert crossing works at D2 and D3
CASTLECOMER STREAM_010 *Dinin[North]_SC_010*	Castlecomer Stream 1st Order Stream	15C01 IE_SE_15C010100	B2, B4, B5	358m from deposition area at borrow pit no.2
	Unnamed tributary 1st Order	- IE_SE_15C010100	B3	313m from hardstand of T5
	Unnamed tributary 1st Order	- IE_SE_15C010100		932m from hardstand of T1
Dinin(North)_040 *Dinin[North]_SC_010*	Dinin River 3rd Order	15D07 IE_SE_15D070400		B9 570m from HR10
OWVEG (NORE)_040 *Nore_SC_060*	Kilcronan 1st Order	15K29 IE_SE_150010280	A1, A2, A3	209m from Windfarm Site Road to T12, culvert crossing works at D4
NORE_120 *Nore_SC_060*	Nore River	15N01 IE_SE_15N011400		140m from Ballynalacken Grid Connection on the R432
	Loughill 1st Order	15L13 IE_SE_15N011400	C3, C5	1.1km from T12
	Castlemarket_East 1st Order	15C89 IE_SE_15N011400	C1, C4	1km from public road widening works on the L5840
	Ballyoskill 1st Order	15B67 IE_SE_15N011400		951m from public road widening works on the L5840
	Ballynalacken_15 1st Order	15B69 IE_SE_15N011400		956m from public road widening works on the L5840
	Nicholastown_15 1st Order	15N06 IE_SE_15N011400	C2	824m from Internal Cable Link
	Sraleagh 1st Order	15S17 IE_SE_15N011400		161m from Internal Cable Link
	Rathduff_15 1st Order	15R24 IE_SE_15N011400	C6, C7	Crosses through the Internal Cable Link, works in public road at W2, works in deck of bridge (includes works to parapet walls) or crossing by direction drill method at W3
Haul Route Works HR1 to HR9				
DININ(NORTH)_040	Donaguile, Glenmagoo_or_Firoda_Lower (1st Order)	15D35, 15G37 IE_SE_15C010100		HR11 -72m
DININ(NORTH)_040	Castlecomer Stream (3rd Order)	15C01		HR10 -242m

		IE_SE_15C010100		
DININ(NORTH)_040	Castlecomer Stream (3rd Order))	15C01 IE_SE_15C010100		HR9 -222m
DININ (MAIN CHANNEL)_010	Damerstown West 2nd Order	15D37 IE_SE_15D020700		HR8 – 72m
NORE_160	Dunmore_15 2nd order	15D43 IE_SE_15N011750		HR7 – 527m
NORE_170	Nore_Trib1 1st order	15N11 IE_SE_15N011950		HR6 – 309m
BROWNSTOWN (POCOCKE)_010	Brownstown River 4th Order	15B04 IE_SE_15B041100		HR2 – 44m, HR3 - 142m, HR4 – 108m, HR5 – 350m
RATHGARVAN OR CLIFDEN_010	Rathgarvan_or_Clifden 1st Order	15R37 IE_SE_15R370950		HR1 – 581m

** Stream order is a measure of the relative size of streams. The smallest tributaries are referred to as first-order streams*

See Figure 8.2: Local River Waterbodies (Divided into Sub-Basins) and Figure 8.3: Site Drainage Map

Drainage on the southern half of the proposed Ballynalacken Windfarm drain towards two headwater streams (Cloghnagh and Ballymartin_15) of the Cloghnagh River, where the streams emerge on the slopes below proposed turbine T3 and below the Windfarm Site Road into the turbines the area (T1 to T4). Drainage towards the headwater streams of the Cloghnagh River within the proposed windfarm site is largely facilitated by a network of forestry drains in the area of T1, T2 and T3 and a network of field drains to the east and south of proposed turbine T4, and to the west of the site access road via Site Entrance No.1.

The central section of the proposed Ballynalacken Windfarm site drains in an easterly direction towards a headwater stream of the Castlecomer Stream. The forestry in the area of proposed turbine T8 drains to this waterbody via network of forestry drains. There is a main forestry drain located 100m to the northeast of proposed turbine T8 and south of Borrow Pit No.2, that delivers the majority of the flow to the small waterbody. The forestry in the area of turbine T9 is mapped in the Castlecomer Stream but actually drains northerly into the Owveg(Nore)_040 sub-basin (Kilcronan stream) via a northerly flowing drain.

The northern section of the proposed Ballynalacken Windfarm site drains into a wet drainage channel which in turn drains into a headwater (1st order) stream, the Kilcronan stream, of the Owveg(Nore)_040 sub-basin where the stream flows in a northerly direction approximately 0.21km to the northeast of the proposed windfarm site at its closest point. The stream flows through a valley that is located downslope of proposed turbine locations T10 to T12. This stream flows into the Owveg River at Loughill Bridge approximately 2.5km downstream of the proposed windfarm site. Drainage within the northern section of the proposed development itself is facilitated by two main land drains. The first drain and larger of the two originates in forestry to the east (and downslope) of proposed turbine location T9 and then flows northerly in a straight fashion for approximately 0.6km until at a location east of turbine T10 where it turns east before discharging into the Kilcronan stream. The second drain flows in a northerly direction through grassland to the northwest of the proposed turbine T11 and to the west and north of turbine T12 and discharges into the Kilcronan stream approximately 0.8km to the north of the proposed windfarm site.

The western extents of the Ballynalacken Windfarm site including the construction compound near T7, the road widening works north of Ballymartin Crossroads drain directly to the River Nore via a network of local stream catchments (Loughill and Castlemarket_East) within the Nore_120 sub-basin. The Internal Cable Link, Tinnalintan Substation and the route of the Ballynalacken Grid Connection are drained by the headwater streams (Rathduff_15 and Sraleagh) of the Rathduff_15 stream that flows into the River Nore approximately 0.4km to the west of the proposed Tinnalintan Substation location.

There is 1 no. natural watercourse crossing (new bottomless culvert crossing installed at W1 at a 1st order stream) and four crossings of wet drainage channels (D1 to D4) within the Ballynalacken Windfarm site. With the exception of D4, all located in the Cloghnagh river catchment (Cloghnagh_010). D4 is over a wet drainage channel which drains into the Kilcronan stream in the Owveg catchment.

There are two natural watercourse crossings (W2, W3) on the Rathduff_15 stream within the Nore_120 sub-basin – W2 is a crossing point along the Internal Cable Link on the upper reaches of the Rathduff_15 where it is classed as a 1st order stream, while W3 along the Ballynalacken Grid Connection route occurs further downstream where the Rathduff_15 is classed as a 2nd order stream. No instream works will be required at W2 or W3. W2 will involve installing cables in the public road above an existing culvert and W3 will involve the installation of the grid connection cables either under the bridge by directional drilling, or in the public road in the deck of the bridge – the installation of the cables in the deck will require works to raise the height of the parapet walls.

The location of natural watercourses and drainage channels at the site are illustrated on Figure 8.2 and Figure 8.3. An Inventory of Watercourses and Wet Drainage Channel crossing points are provided in Appendix 8.2.

EIAR 8.3.1.1.5 Existing Water Quality – WFD & EPA Waterbody Status

EPA Q-Values[2] are available for surface waters bodies downstream of the project site. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High). Q-rating status data for EPA monitoring points in the Nore and Dinin catchments are shown on Table 8-7 below.

The southern section of the windfarm site drains into the Cloghnagh_010 sub-basin. The closest EPA monitoring point on the Cloghnagh_010 is located approximately 6.6km downstream of the project, where the Q-rating for the Cloghnagh_010 was reported to be of Good status (Q4) in 2022.

The majority of the central section of the Ballynalacken Windfarm site is located in the Dinin River sub-catchment. The closest EPA monitoring point on the Castlecomer Stream is located approximately 5.7km downstream of the windfarm site and upstream of its confluence with the Dinin River. Here the Castlecomer Stream was reported to be of Good status (Q4) in 2022. Downstream of its confluence with the Castlecomer Stream, the Dinin River is also reported to be of Good status at Dysert Bridge.

[2] This record represents near real time River Ecology Monitoring Results. National surveys of Irish rivers have taken place on a continuous basis since 1971, when 2,900 km of river channel was surveyed. The National Rivers Monitoring Programme was replaced by the Water Framework Monitoring Programme from 22 December 2006. As part of the Water Framework Directive (WFD) Monitoring Programme approximately one third of our major rivers and their more important tributaries are surveyed and assessed each year by EPA ecologists. A complete survey cycle is completed every three years. The sites are scored on a five point system developed by the EPA called the Biological Q rating system.

The most recent data available (2022) shows that the Q-rating for the Owveg[Nore] River upstream of the Nore – Moneycleare confluence at a bridge WNW of Boleybawn is of Good status (Q4). Meanwhile downstream of this confluence, the Owveg[Nore] also achieved Good status at Castlemarket Bridge and at a bridge east of Attanagh.

The western parts of the proposed Ballynalacken Windfarm site along with the Internal Cable Link, Tinnalintan Substation and Ballynalacken Grid Connection are located in the Nore River sub-catchment (Nore_SC_060) and drain into the Nore River, either directly or via streams (Loughill, Rathduff_15, Sraleagh) that drain the western slopes of the ridge. In 2022, 0.5km upstream of Ballyragget village, the Nore River was reported to be of Moderate status (Q3-4). The 2022 Q-ratings for the Nore River between Ballyragget village and Kilkenny City (Nore_130 – Nore_160) range between Moderate status (Q3-4) and Good status (Q4). The latest Q-ratings (2022) for this stretch of the Nore River between Ballyragget and Kilkenny City are Good for the Nore_130 at Bridge in Ballyragget and Moderate for the Nore_150 at Threecastles Bridge.

Below in Table 8-7 is a summary of the WFD information for river waterbodies from the WFD Compliance Assessment undertaken for the proposed project site. The full WFD Compliance Assessment Report is attached as Appendix 8.4

Table 8-7: EPA Q-Rating and WFD River Waterbody Status

River Waterbody	EPA Q-Rating Location Description	Q-Rating Year	Q-Rating Status	WFD Status (2016 – 2021)	Risk Result (3rd Cycle)
Cloghnagh_010	Bridge U/S Dinin River Confluence	2022	Good	Moderate	Under Review
Castlecomer Stream_010	Bridge at northern end of Castlecomer	2022	Good	Moderate	At Risk
Dinin (North)_040	Dysart Bridge (North Channel)	2022	Good	Moderate	At Risk
Owveg(Nore)_030	Bridge west northwest of Boleybawn (Cloghoge)	2022	Good	Good	Not at Risk
Owveg(Nore)_040	Castlemarket Bridge	2022	Good	Good	Not at Risk
Nore_120	0.5km upstream Ballyragget	2020	Moderate	Moderate	At Risk
Nore_130	Bridge in Ballyragget	2022	Good	Good	Not at Risk
Nore_130	1.5km downstream of Ballyragget	1991	Moderate	Good	Not at Risk
Nore_140	Lismaine Bridge	2004	Good	Good	Not at Risk
Nore_150	Threecastles Br	2022	Moderate	Good	Not at Risk
Nore_160	East northeast of Troyswood House	1991	Good	Good	Not at Risk

EIAR 8.3.1.1.6 Surface Water Sampling Results

Refer to Appendix 8.1 for all tabulated surface water sampling results.

Surface water quality monitoring was completed at 16 no. monitoring locations in downstream sub-basins to the Ballynalacken Windfarm Project site on 3 no. occasions over a six month period (September 2021 – February 2022). The results provide a baseline set of results which can be used for comparative studies during the lifetime of the proposed Ballynalacken Windfarm.

An additional fourth round of sampling was conducted in April 2022 for three sites (A1, A2 & C6) which did not have samples taken during one or more of the previous rounds of sampling: Site A2 moved location after Round 1 sampling in September 2021 and Sites A1 and C6 were dry during Round 1 sampling.

A summary of the sampling data for each of the sub-basins is provided below.

Cloghnagh_010 Sub-Basin

Surface water quality monitoring in the Cloghnagh_010 sub-basin was completed at 2 no. water sampling locations – on the Cloghnagh 1st order stream (B6), and further downstream on the Cloghnagh (B7). 6 no. samples were taken over 3 no. Rounds.

BOD ranged from <1-4mg/l from the 6 no. samples. 1 no. sample was below the "High" status threshold with regard S.I. No. 272/2009 and the remaining 5 no. exceeded the "Good" status threshold.

For ammonia 3 no. samples were below the "High" status threshold, whilst the remaining 3 no. exceeded both the "Good" and "High" status.

All Ortho-phosphate samples within the Cloghnagh river sub basin exceeded the "Good" status threshold with samples ranging from 0.07mg/l – 0.48mg/l.

At Site B6, Round 1, TSS recorded were relatively high at 1757mg/l and according to the lab reports, this result is not INAB accredited. Therefore, it may be the case that the detection was due to a laboratory/sampling error. All other samples taken within the river sub basin were below the threshold value of 25mg/l.

Nitrate levels within the river sub basin averaged at 5.94mg/l, whilst nitrite levels ranged from 0.03 to 0.1mg/l.

The highest Total Phosphorous level recorded within the Cloghnagh river sub basin is 1.68mg/l recorded during Round 1 at Site B6. However, according to the lab report this result is not INAB accredited. Therefore, it may be the case that the detection was due to a laboratory/sampling error. Excluding this result, the measured Total Phosphorus ranged from 0.05 – 0.3mg/l, with an average value of 0.108mg/l.

Turbidity levels were high for Round 1 at Site B6 (641 NTU). For the remaining 5 no. samples turbidity levels were much lower at an average of 3.1 NTU.

Castlecomer_010 Sub-Basin

Surface water quality monitoring in the Castlecomer_010 sub-basin was completed at 4 no. water sampling locations – three on the Castlecomer Stream (B2, B4 and B5), and one on a headwater stream upstream of the Castlecomer Stream but not hydrologically connected to the Ballynalacken Project (B3). 12 no. samples were taken over 3 no. Rounds.

BOD was reported to range from 3mg/l to 23mg/l throughout the 3 no. Rounds within this river sub basin, and consistently exceeded the "Good Status" threshold.

Throughout all rounds ammonia nitrogen levels ranged from 0.02 to 2.14mg/l. 3 no. samples were below the "High" status threshold, 5 no. were below the "Good" status threshold and 4 no. exceeded the "Good" status.

For Ortho-phosphate, 2 no. samples were below the "High" status threshold, 2 no. samples were below the "Good" status threshold, whilst all other samples exceeded the "High" and "Good" status thresholds.

Throughout Round 1, total suspended solids (TSS) recorded at the 4 no. locations (B2, B3, B4 & B5) were relatively high, ranging from 41 – 432mg/l, and all above the threshold value of 25mg/l. During Round 2, the highest recorded TSS value was at Site B3 at 89mg/l. All other recorded TSS values were under the threshold value during Round 2. TSS levels during Round 3 were below the threshold value.

Nitrate levels within the samples ranged between 2.33 mg/l to 16.59mg/l. Nitrite levels at Site B2 were consistently higher than other sample locations within the Castlecomer Stream_010 River sub basin with 0.23mg/l during Round 1, and 0.07mg/l recorded at Round 2 and Round 3 respectively. Nitrite levels of 0.07mg/l were recorded at Site B4 during Round 2. Otherwise, nitrite levels were at or less than 0.03mg/l during all 3 no. Rounds.

The 2 no. highest Total Phosphorous levels within Castlecomer Stream river sub basin were both recorded during Round 1 at Site B5 (at 9.77mg/l) and Site B4 (3.09mg/l). However, these results are very high and according to the lab reports not INAB accredited. Therefore, it may be the case that the detection was due to a laboratory/sampling error. Excluding these results, the measured Total Phosphorus ranged from 0.03 – 0.51mg/l, with an average value of 0.1mg/l.

Turbidity levels were at their highest during Round 1, with an average measure of 69.88 NTU. Whereas for the remaining Rounds (2,3,) turbidity levels within the Castlecomer Stream_010 river sub basin averaged at 8.86 NTU.

Chloride levels throughout sampling Rounds averaged at 16.95mg/l.

Owveg (Nore)_040 Sub-Basin

Surface water quality monitoring in the Owveg(Nore)_040 sub-basin was completed at 3 no. water sampling locations – two on the Kilcronan stream (A1, A2) and one at the confluence of the Kilcronan stream with the Owveg River at Loughill Bridge (A3). 9 no. samples were taken in total.

BOD ranged from 1-10mg/l with an average of 3mg/l. The BOD sample from Site A1 on the Kilcronan stream, Round 2, was recorded at 10 mg/l, significantly above the EQS values set out in in S.I. No. 272/2009. 3 no. samples were below the "High" status threshold with regard S.I. No. 272/2009 and 6 no. exceeded the "Good" status threshold. The average BOD of 3mg/l exceeded the "Good" status threshold.

For ammonia 5 no. samples were below the "High" status threshold, 2 no. were below the "Good" status threshold and 2 no. exceeded both the "Good" and "High" status. The average ammonia of 0.059mg/l was below the good status threshold. Throughout all sampling Ammonia ranged from 0.01 – 0.22mg/l at Site A1 during Round 4.

Ortho-phosphate ranged between <0.01 to 0.23mg/l with an average of 0.083mg/l. 5 no. samples were below "High" status threshold, 2 no. were below the "Good" status threshold and 2 no. exceeded both the "Good" and "High" status

Total suspended solids at all sampling locations were generally below the threshold value of 25mg/l, the water quality standards required by S.I. No. 293/1988. During Round 2 sampling, Site A1 was over the threshold value at 69mg/l, significantly higher than those recorded during other sampling rounds, possibly a reflection of high flows in the stream following heavy rainfall.

Nitrate levels within the samples ranged between <2.2 mg/l to 20.9mg/l. Within the Owveg (Nore)_040 river sub basin the majority of samples recorded nitrite levels at or less than 0.03mg/l.

Total Phosphorous from the 11 no. samples ranged from 0.01mg/l to 0.1mg/l at Site A1 (During Round 2).

Turbidity was at its highest at Site A1 during Round 2 with 34.09 NTU. Generally, turbidity levels were much lower within the river basin, ranging from 0.96 to 4.05 NTU.

Chloride ranged from 8.09 to 42.73 mg/l.

Nore_120

Surface water quality monitoring in the Nore_120 sub-basin was completed at 7 no. water sampling locations – two on the Loughill stream (C3, C5), two of the Castlemarket_East stream (C1, C4), one on the Nicholastown_15 stream (C2); and two on the Rathduff_15 stream (C6, C7). C7 was taken at the location of W3. 19 no. samples were taken over 4 no. Rounds.

BOD was reported to range from <1mg/l to 424mg/l (Site C1) throughout the 4 no. Rounds within this river sub basin. 4 no. samples were below the "High" status threshold, meanwhile all other samples (15 no.) exceeded the "Good Status" threshold.

Throughout all sampling ammonia nitrogen levels ranged from 0.01 – 4.22mg/l, with highest recorded sample at Site C1 during Round 2. Overall, 8 no. samples were below the "High" status threshold whereas the remaining 11 no. samples all exceeded the "Good Status" threshold with regard S.I. No. 272/2009.

For Ortho-phosphate, 11 no. samples were below the "High" status threshold, whilst all other samples exceeded the "High" and "Good" status thresholds.

During Round 1, TSS levels were above the threshold value of 25mg/l on 2 no. occasions, at Site C1 (4437mg/l) and C5 (51mg/l). According to the lab reports, the result obtained at Site C1 is not INAB accredited and it may be the case that the detection was due to a laboratory/sampling error.

Similarly, TSS results during Round 2 for Site C1 were very high at 9790mg/l and again were not INAB accredited. All sampled TSS results for Round 2 were generally above the threshold value of 25mg/l, except at Site C6 (21mg/l). Site C1 and Site C2 TSS levels exceeded the threshold value at 100mg/l and 34mg/l respectively during Round 3 sampling.

Nitrate levels within the river sub basin averaged at 13.1mg/l, whilst nitrite levels ranged from <0.03 to 0.23mg/l.

The highest Total Phosphorous levels throughout all sampling were recorded at C1 for Round 1 and Round 2 at 19.9mg/l and 11.9mg/l respectively. However, these results are not INAB accredited and it may be the case that the detection was due to a laboratory/sampling error. Excluding these results, the Total Phosphorous samples at all locations averaged at 0.10mg/l.

Throughout all sampling Turbidity levels ranged from <0.02 – 462.5mg/l, with highest recorded sample at Site C1 during Round 1.

Chloride levels throughout sampling Rounds averaged at 19.63mg/l.

EIAR 8.3.1.1.7 Existing Sources of Impacts to River Waterbodies

The occurrence of existing pollution or environmental damage in the areas on or downstream the location of the Project has also been considered for potential to act as an existing source of impacts to waterbodies. Based on the WFD/EPA mapping, the Dinin (Main Channel)_020 and has pressures relating to agriculture, the extractive industry and abstractions. While the Dinin(North)_040 has pressures relating to agriculture, domestic wastewater, urban runoff and urban wastewater pressures.

EIAR 8.3.1.1.8 Flood Risk Information – Summary of Findings

This section is a summary of the site-specific flood risk assessment undertaken for the proposed project site. The full flood risk assessment report is attached as Appendix 8.3.

OPW's River Flood Extents Mapping, National Indicative Fluvial Mapping, Past Flood Event mapping (https://www.floodinfo.ie/map/floodmaps/) and historical mapping (i.e. 6" & 25" base maps) were consulted to identify those areas of the proposed project site potentially at risk of fluvial flooding.

No recurring flood incidents within the proposed project site boundary including along the Ballynalacken Grid Connection and Tinnalintan Substation were identified from OPW's Past Flood Event Mapping.

The closest mapped recurring flooding event downstream of the proposed development is on the River Nore at Ballyragget, approximately 1.8km to the southwest of the proposed Tinnalintan Substation, and 13.8km downstream of the Ballynalacken Windfarm site. There is also a mapped flood event south of Castlecomer approximately 6.8km downstream of the proposed windfarm site on the Dinin River where OPW flood reports records localised road flooding.

Identifiable map text on local available historical 6" or 25" mapping for the project site area do not identify any lands that are "liable to flood". There is no OPW River Flood Extents Mapping available for the area of the project site and therefore the National Indicative Fluvial Mapping (NIFM) was consulted which has estimated fluvial flood zones for the Owveg River and Castlecomer Stream.

Based on the National Indicative Fluvial Mapping (Figure 8.4), the mapped flood zones for the Owveg River and Castlecomer Stream do not encroach the proposed project site. There are fluvial flood zones associated with the Owveg River approximately 2.5km downstream of the northern site boundary. The closest mapped flood zone on the Castlecomer Stream is 2.3km downstream of the Ballynalacken Windfarm site.

Therefore, all proposed wind farm infrastructure is located above the mapped 1000-year flood level and therefore all infrastructure is located in Flood Zone C (Low Risk).

According to the CFRAM Rainfall (pluvial) mapping, no area of the proposed development site is likely to be directly flooded by rainfall during an extremely severe rainfall event and this would be expected given the elevated and sloping nature of the project site.

EIAR Figures: (included at the end of this chapter)

Figure 8.1: Hydrometric Area and Sub-Catchments
Figure 8.2: Local River Waterbodies (Divided into Sub-Basins)
Figure 8.3: Site Drainage Map
Figure 8.4: OPW Past Flood Zone Event Map

EIAR Appendices: (included at the end of this chapter)

Appendix 8.1: Surface Water Quality Monitoring Results
Appendix 8.2: Inventory of Watercourses and Wet Drainage Channels
Appendix 8.3: Flood Risk Assessment Report
Appendix 8.4: Water Framework Directive Assessment Report

EIAR 8.3.1.1.9 Importance of River Waterbodies & Sensitivity to Change

Importance: The local river waterbodies within the immediate receiving environment have been assigned Moderate to Good Status by the WFD (2016 – 2021), with an aim under the WFD of achieving at least Good Status by 2027. Also, due the fact that all of the local river waterbodies eventually drain into the River Barrow and River Nore SAC/SPA they are evaluated as having Very High Importance.

Sensitivity to Change: The primary sensitivities with respect to the local river waterbodies will be sedimentation, contamination, eutrophication and changes to morphology which will be important to protect in terms of the overall WFD status of the waterbody.

EIAR 8.3.1.1.10 Evolution of the Baseline Environment (the 'Do-Nothing' scenario)

The "At Risk" surface waterbodies suggest a downward trend or steady poor trend with regard baseline surface water quality and ecological attributes and are at increased risk of not achieving Good Status by 2027. As a result, these waterbodies are more sensitive to on-going reductions in water quality.

The "Not At Risk" surface waterbodies suggests at least a sustained Good status trend with baseline surface water quality and ecological attributes, these waterbodies are more robust and less sensitive to impacts on water quality. Refer to Section EIAR 8.3.1.1.5 for WFD risk result.

In relation to the Q-Rating Status, where a Good to High Status has been assigned there will be a requirement to prevent deterioration and maintain at least a Good status. However, regardless of existing status, there will also be a requirement to protect, enhance and restore all waters with an aim to achieve at least Good Status for all river waterbodies. Therefore, it is assumed that the status of the surface water bodies within the study area will be the same as present or at least Good during the timeline of the proposed Ballynalacken Windfarm development. This is based on the assumption that surface waterbodies will have to achieve at least Good Status by 2027.

Studies suggest that a variety of anthropogenic factors such as agricultural activity, forestry cover, landfills and septic tank density affect river water quality. While the agricultural sector continues to have a negative effect on river water quality, results from this study indicate that this effect has declined in recent times. A combination of geomorphological and climatic variables was also found to affect river water quality.

Climate Change: Recent research has showed that rocky road medium/high emissions scenario by the end of the century (2080s). Under this scenario, winter flows are likely to increase on average by about 13%, but up to 30% for some rivers. Reductions in summer flows of about 20% on average are simulated, reaching more than 35% for some rivers. Simulated changes in low flows would likely pose the greatest headaches, with an average reduction of 21% simulated, reaching -38% for some rivers.

Results suggest that deep cuts in greenhouse gas emissions globally will be key to moderating the worst impacts of climate change on Irish rivers. If the world is successful at realising the goals of the Paris Agreement and keeping global temperature change to no more than 2 degrees Celsius above preindustrial levels, there are likely to be significant avoided impacts on Irish rivers and water resources.

This is particularly the case for summer and low flows. For low flows under a sustainable future scenario, the average reduction across rivers is likely to be within 5% (up to about 20% for some rivers). This is a much different proposition than outlined for a world that breaches the Paris targets, but would still require careful adaptation to ensure sustainable use of water resources.

EIAR 8.3.1.2 Impact Evaluation – River Waterbodies

This Section comprises an evaluation of the likely significant impacts of the proposed Ballynalacken Windfarm Project on the receiving environment. Moderate, Slight, Imperceptible and Neutral Impacts are also taken into consideration.

The impacts are presented/evaluated as follows:

a) Significant Impacts which are likely or have potential to occur, are subject to detailed evaluation;

b) Moderate or Slight Impacts, which are likely or have potential to occur, are subject to detailed evaluation;

c) Non-significant impacts of local concern or considered important enough to merit detailed evaluation;

d) Neutral or Imperceptible Impacts are scoped out from detailed evaluation, and a short evaluation is provided in the table below. Unlikely Impacts are also scoped out.

Table 8-8: Impacts to River Water Bodies

Likely/Potential Impact	**Evaluation**
Significant Impacts which are likely or have potential to occur – see detailed evaluation	
Construction Phase: Reduction in Surface Water Quality due to suspended solid entrainment in surface waters	*See Section EIAR 8.3.1.2.1*
Moderate or Slight Impacts, which are likely or have potential to occur - see detailed evaluation	
Construction Phase: Reduction in Surface Water Quality due to of the potential release of hydrocarbons, cement-based compounds or nutrients	*See Section EIAR 8.3.1.2.2*
Decommissioning Phase: Reduction in Surface Water Quality during decommissioning works	*See Section EIAR 8.3.1.2.6*
Non-significant impacts considered important enough (or of local concern) – see detailed evaluation	
Construction Phase: Hydromorphological effects due to watercourse crossing works	*See Section EIAR 8.3.1.2.3*
Construction, Operational & Decommissioning Phases: Changes to Surface Water Quantities due increased site runoff rates and/or changes to drainage patterns	*See Section EIAR 8.3.1.2.4*
Operational Phase: Reduction in Surface Water Quality during the operational phase	*See Section EIAR 8.3.1.2.5*

EIAR 8.3.1.2.1	**Reduction in Surface Water Quality due to suspended solid entrainment in surface waters**
Sensitive Aspect:	River Waterbodies
Importance:	**Very High** (as per Section EIAR 8.3.1.1)
Impact Source(s)	Excavations, earthworks and groundworks, excavation dewatering, movement and storage of overburden, wind/physical erosion of soils, watercourse crossing works, installation of site drainage system, forestry felling
Impact Pathway(s)	Runoff, drainage, and surface water discharge routes
Project Stage	Construction Phase

Overview of Impact (general):

Suspended solids are small particles in water that neither dissolve nor settle by gravity, such as clay, silt, sand or organic matter and can lead to water turbidity. Although harmless in themselves, an increased content of suspended solids makes water cloudier and limits the sunlight reaching aquatic plants, can affect visibility for predatory fish and birds and can cause damage to fish gills. Furthermore, substances such as phosphorus, heavy metals, pesticides and other organic compounds can bind themselves to soil particles and potentially can enter water bodies via suspended solids.

As per Chapter 13: Biodiversity, the best quality salmonid habitat, and highest salmonid densities, were present on the larger watercourses including the Owveg River, Dinin River and Castlecomer Stream. These watercourses, along with the Loughill also supported Lamprey species. European Eel were recorded in low densities on the Kilcronan and Cloghnagh, as well as the River Nore.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

Groundworks, Excavations, Overburden: Due to the extent of groundworks and excavations for proposed project, the extent of forestry felling and the volumes of overburden to be stored during construction works , it is considered that there is high runoff potential at the proposed project site and, as a result, if mitigation is not put in place - downstream river waterbodies will be potentially at risk from indirect surface water quality effects.

Indirect surface water quality effects on the identified downstream River Waterbodies will be likely, temporary and reversible in nature. The duration of the effects will be rainfall dependant, but could potentially be the entire construction phase depending on seasonal and local weather patterns (i.e. rainfall events).

As outlined in the table below, if unmitigated, the effects on downstream watercourses (Listed in the table below) could range from No Effect to Large Adverse.

Sub-Basin	**Proposed Infrastructure**	**Downstream distance to EPA watercourse**	**Impact Significance (pre-mitigation) & Justification**
CLOGHNAGH_010	6 no. turbines (T1 – T5 & T7), 1 no. borrow pit, windfarm control building, windfarm site roads and drainage network, watercourse works W1, wet drainage channel works D1 to D3, construction compound, Internal Cable Link, road widening works and haul route works (HR13)	0m to Cloghnagh stream at W1, 116m to Cloghnagh stream from T3 150m to Ballymartin_15 Stream, downstream of D2	**Potentially Significant**: Downstream distance, presence of main windfarm construction works within catchment including borrow pits and turbine foundations.
CASTLECOMER STREAM_010	2 no. turbines (T6 & T8), 1 no. borrow pit, construction compound, windfarm site roads and drainage network and Haul	Turbines & Borrow Pit: 350m to Castlecomer (Stream)	**Potentially Significant**: Downstream distance, presence of main windfarm construction works within catchment including borrow pits and turbine foundations, pollution already

	route works (HR9, HR10, HR11)		occurring in watercourse (At Risk).
OWVEG (NORE)_040	4 no. turbines (T9 – T12), & met mast, windfarm site roads and drainage network and road widening works	Windfarm Site Road to T12 (includes new bottomless culvert at D4), 690m to Kilcronan stream	**Potentially Significant**: Downstream distance, presence of main windfarm construction works within catchment including turbine and met mast foundations.
NORE_120	windfarm site roads and drainage network, construction compounds, telecom relay pole, road widening works, haul route works (HR12), Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection and watercourse works W2 and W3.	Site Entrance No.8 to T9, 2.0km to Ballynalacken 15 Stream. Internal Cable Link: 0m to Rathduff_15 stream at W2 Substation: 340m to Rathduff_15 stream Grid Connection 0m to Rathduff_15 stream at W3	**Potentially Significant**: Downstream distance, presence of main windfarm construction works within catchment including turbine foundations, Grid Connection, Internal Cable Link, substation and haul route.
DININ (MAIN CHANNEL)_010	Blade Transfer Area Haul route works HR8	70m to Damerstown West stream	**Potentially Imperceptible:** Due to the localised and small scale nature of the works.

Dewatering: There is also potential for suspended solid entrainment in water pumped from excavations such as from the turbine foundations, cable trenches and the on-site borrow pits. The pumping/dewatering requirement at the Ballynalacken Windfarm Project site will be localised, intermittent and low volume. Due to the poorly productive classification of the underlying bedrock, the shallow and unsaturated nature of subsoils, along with the elevation of the Ballynalacken Windfarm site above local watercourses, no significant groundwater inflows will occur at excavation locations. Inflows are more likely to be localised surface water runoff or locally recharged/infiltrated rainfall. Due to the shallow nature of the cable trenches for the internal windfarm cabling, Internal Cable Link and the Ballynalacken Grid Connection and the fact that the trenches will be mainly within existing tracks/roads or in well drained grassland, no significant groundwater or surface water inflows are likely to occur in these excavations.

In relation to the Haul Route Works along the public road around Kilkenny City, in Castlecomer town and along the regional R694 road to Site Entrance No.1, it is evaluated that due to the small scale and nature of these works, which will all take place within the road corridor, with no works to bridges required, that worst case impacts will not be greater than Imperceptible.

Castlecomer Stream_010	Haul route works HR10, HR11	c.220m and c.120m to Castlecomer Stream_010 from HR10 and HR11 respectively	**Potentially Imperceptible:** Due to the localised and small scale nature of the works
Dinin(North)_040	Haul route works HR9	c.210m to Castlecomer Stream_010	**No Effect**: Street furniture removal only – no impact
NORE_160	Haul route works HR7	530m to Dunmore_15	**Potentially Imperceptible:** Due to the localised and small scale nature of the works.
NORE_160	Haul route works HR6	320m to tributary of the River Nore, Nore Trib 1	**No Effect**: Street furniture removal only – no impact
BROWNSTOWN (POCOKE)_010	Haul route works (HR5, HR4, HR3, HR2)	50m to Pococke River from HR2	**Potentially Imperceptible:** Due to the localised and small scale nature of the works.
RATHGARVAN OR CLIFDEN_010	Haul route works HR1	c.500m to Rathgarvan_or_Clifden	**No Effect**: Street furniture removal only – no impact

In relation to the impact of the proposed Ballynalacken Windfarm Project on the River Nore, all 12 no. turbine locations and site infrastructure and ancillary works at the windfarm site are located within the River Nore catchment along with the Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection and the haul route works and activities.

It needs to be stated that the 12 no. proposed turbines are distributed across 3 no. sub-catchments (i.e. Nore_SC_060 has 4 no. turbines, Dinin(North)_SC_010 has 2 no. turbines and Nore_SC_080 has 6 no. turbines) within the River Nore catchment. The downstream distance from the Ballynalacken Windfarm site to the River Nore is ~11km in the Nore_SC_060, ~16km in the Nore_SC_080 and ~23km in the Dinin(North)_SC_010. The distributed nature of the windfarm site along with the significant downstream distances to the River Nore means the potential for the various elements of the proposed project to cumulatively contribute to hydrological effects is significantly lessened. Also, these three sub-catchments discharge into the River Nore over a 15km stretch and this also lessens the potential for significant cumulative effects in the River Nore.

The Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection, Haul Route Works remote from the main construction areas (i.e. HR1 to HR11) are located across four sub-catchments (i.e. Nore_SC_060, Dinin(North)_SC_010, Nore_SC_080 and Nore_SC_100).

In terms of cumulative hydrological effects arising only from elements of the proposed project (Ballynalacken Windfarm site infrastructure and ancillary works, Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection, and haul route works and activities), no likely significant effects are expected as the majority of the proposed Ballynalacken Windfarm site (including all 12 no. turbines) are located in different sub-catchments to that of the Tinnalintan Substation and Ballynalacken Grid Connection.

This means the potential for significant hydrological effects is reduced considerably. Also, the haul route works and activities are generally remote from the Ballynalacken Windfarm site, Tinnalintan Substation and the grid connection locations.

Impact Magnitude	No Effect to Large Adverse	**Impact Significance: *(pre-mitigation)***	**No Effect to Potentially Significant**

Mitigation and Monitoring Measures: which will be implemented are presented along with a brief description of their effectiveness in avoiding, reducing or otherwise ameliorating the potential for Significant impact. **See Chapter 19: Mitigation and Monitoring Arrangements for full wording of mitigation measure*	
Design	Avoidance of on-site sensitive hydrology features by constraints mapping (i.e. watercourse buffer zones)
Design	Avoidance of areas of peat
Design	No temporary storage of overburden in the Owveg_Nore_040 Catchment
Design	Construction and installation of the site drainage network *(see Volume B: Planning Drawings: 101 to 106 and 501 to 503)*
Design	Implementation of the Surface Water Management Plan *(see* Environmental Management Plan*)*
Design	At D1, the existing wet drainage channel will be permanently diverted for a short distance so that it is at least 25m away from the turbine foundation, an interceptor drain will be constructed between the works area and the diverted section of the watercourse.
Design	Use of wheel washes at selected site entrances
SM02*	Pre-construction confirmatory surface water quality monitoring and recording.
SM11	The construction Method Statements to be developed by the construction contractors will take full account of the EMP including the mitigation and monitoring measures and will be reviewed by the Environmental Manger prior to the commencement of construction works.
SM12	All construction works will be monitored for compliance with the Environmental Management Plan by the project Environmental Management Team which will include an Environmental Clerk of Works, the Project Ecologist and specialists such as a hydrologist, who are independent of the site contractors. The Environmental Management Team will report to the owner's Project Manager.
SM14	A suitably qualified engineer will supervise all windfarm site excavations and construction works.
SM15*	Regular inspection of the windfarm drainage network by the Contractor and Project Hydrologist.

SM16*	Regular surface water quality monitoring and recording during the Construction Phase in accordance with the Surface Water Management Plan *(the SWMP is included in the Environmental Management Plan for the Project, which accompanies the planning application).*
SM27	The construction of the Ballynalacken Windfarm Project will be carried out in accordance with an Environmental Management Plan (EMP). The EMP will include all of the mitigation measures and monitoring arrangements for the Project. An Environmental Clerk of Works will be appointed, independent of the main construction Contractor, and will carry out weekly audits on EMP compliance. If non-compliance is detected, then, prompt corrective action will be agreed and committed to by the Contractor, with a view to the swift and effective resolution of any deviations from the EMP requirements. The EMP will be an important contract document for the main construction contractor (Contractor) who will be contractually obliged to comply with the EMP and the requirements of the Environmental Clerk of Works. Furthermore, if a significant unforeseen environmental effect takes place, then, the Environmental Clerk of Works will have a 'stop-works' authority to temporarily stop works at the works location until the issue is resolved.
MM01	The boundaries of the Construction Works Area will be fenced to prevent the encroachment of construction phase personnel, machinery or materials beyond this boundary. In agricultural lands, livestock proof fencing will be used, with landowner access maintained through the provision of gates along the boundary fences.
MM02	Construction traffic, personnel and materials will be restricted to within the Construction Works Area Boundary fence. Machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from advancing excavations, will avoid moving onto areas not delineated on the site drawings
MM03	Land reinstatement will not be carried out during very wet weather or when the soil is waterlogged. If any compaction has occurred along the construction works area, these areas will be ploughed with a sub-soiler to loosen the subsoil layer.
MM05	During windfarm construction works, excavations will be backfilled as soon as is possible.
MM06	During windfarm construction works, excavated material will be removed for temporary or permanent storage at designated berms and with the exception of T3 and Borrow Pit No.2, will be placed more than 50m away from any watercourse or wet drainage feature. Temporary silt control methods such as silt fencing will be placed around all overburden storage areas and the existing vegetative between the berms and watercourse / drainage features will be left in place.
MM07	All storage berms will be graded and sealed following emplacement. Topsoil and subsoil will be stockpiled separately. The upper vegetative layer (where still present) of excavated soil will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored spoil within the storage areas. Re-seeding will also be carried out in these areas. Measures such as interceptor ditches around the bases of these areas, sediment traps, covering of berms will also be incorporated to prevent runoff of suspended solids, dust and soil erosion.
MM08	Along the cable route on the public road, there will be no storage of overburden and all excavations from road trenches will be removed to licensed waste facilities in accordance with the Waste Management Plan. The excavated material will be covered during transportation to prevent spillages and reduce dust.
MM09	All excavations which are unsuitable for use as construction/reinstatement material which arise within the catchment of the Owveg River (T9, T10, T11 and T12 and associated Windfarm Site Roads) will not be stored within the catchment, instead these arisings will be transported to the temporary deposition area at Borrow Pit No.2 and at Turbine T7 (both located outside of the Owveg River catchment). In addition, a Siltbuster or other suitable treatment train will be used to remove fine silt particles from site runoff in this catchment. The Siltbuster will be set up at works locations and used during groundworks and earthmoving activities.
MM10	At the windfarm site, at works locations within 50m of watercourses or existing drainage features there will be additional mitigation measures deployed including double silt fencing prior to the commencement of the works, temporary drain blocking in existing drains, placement of silt trapping arrangements along preferential surface water flowpaths and, where necessary, the use of matting to prevent ground erosion and rutting. Works will not take place within this zone during prolonged heavy or exceptional rainfall events.

MM11	Weather forecasts will be consulted in advance of works. If there is heavy prolonged rainfall or if an exceptional rainfall event occurs, then construction works will cease until peak flows have subsided.
MM12*	Site roads and hardstanding areas have a permanent surface water drainage network, the borrow pits will have a temporary surface water drainage network in place during works. The site drainage network will include check dam, settlement ponds and buffered outfall weirs.
MM13	It is proposed that bedrock won from the on-site borrow pits during the construction phase (i.e. sandstones) will only be used to construct the sub-base layer of proposed upgraded and new access roads and hardstand areas. Once installed the sub-base layer will be overlain by a capping layer of clean high-grade bedrock, such as limestone, which will be sourced from local quarries. This will be ongoing during the operational phase as during road maintenance.
MM14	At the windfarm site, where dewatering of excavations is required, no freshly pumped water will be permitted to enter the existing drainage network directly or be pumped out onto adjacent habitat. Rather, all pumped water will be treated prior to discharge using an infiltration trench or settlement pond or suitable water treatment train such as a Siltbuster, as appropriate.
MM15	Along the cable routes, where dewatering of trenches or excavations is required, there will be no direct discharge of treated water into any watercourse or drain. Rather, all pumped water will be discharged via a silt bag.
MM17	New culverts which will be installed at watercourses or wet drainage channels will be bottomless or clear spanning.
MM18	In-stream works will not be undertaken without isolation of flow within the watercourse. A pre-works survey will be carried out by the Project Ecologist and any fish, if present, within the isolated section will be removed using electrofishing and transferred immediately downstream of the crossing point and placed back in the water. The water will be isolated from the works by over pumping, flume (pipe) or channel diversion methods.
MM19	At wet drainage channels, instream works will be followed by site-specific reinstatement measures to ensure the restoration of flow character and morphology within the affected reach. Measures will include: bank stabilisation using boulder armour or willow/brush bank protection; reinstatement of bank slope and character, creation of compound channels where necessary; reinstatement of instream flow features such as boulder substrates, pool / riffle sequences, or spawning cobbles; and planting along the riparian margin to stabilise banks, add flood protection and provide riparian buffer.
MM27	In-stream works in wet drainage channels (D1, D2) will only be undertaken during the IFI specified period (July, August and September) and will be carried out in accordance with the *Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters* (IFI, 2016).
MM28	Works at W2 and W3 will take place when the Rathduff_15 is in its dry state and the works at W2 or W3 will be planned for periods of dry weather.

Effectiveness of Mitigation and Monitoring Measures:

The above measures are proven and effective best practice measures which will avoid and minimise the risk of sediment or contaminant release by:

- reducing the potential pathway for sediment release (limestone capping, weather related restrictions, management of overburden and use of 50m watercourse buffer zones),
- capturing and treating runoff that is released thereby reducing sediment loading (silt fencing, Siltbuster, drainage system, wheel washes),
- thereby breaking or limiting the pathway between the potential sources and the receptor.

Furthermore, the ongoing monitoring of water quality in downstream watercourses and the inspection of drainage systems and of the construction works by an Environmental Clerk of Works (with 'stop works' authority) will ensure that any decreases in water quality are identified and rectified at an early stage.

Residual Impact Significance *(post-mitigation)*: Due to the transient nature of the works over across several sub-basins and sub-catchments, the construction methodologies, the surface water control measures to be put in place and the general adherence to the 50m hydrological buffer, significant surface water quality effects are not anticipated as a result of	**Imperceptible**

the construction of the Ballynalacken Windfarm Project and the residual impact to downstream river waterbodies will be Imperceptible.	

EIAR 8.3.1.2.2	**Reduction in Surface Water Quality due to the potential release of hydrocarbons, cement-based compounds or nutrients**
Sensitive Aspect:	River Waterbodies
Importance:	**Very High** (as per Section EIAR 8.3.1.1)
Impact Source(s)	Use/presence of fuels, oils & chemicals, use of machinery on site, refuelling, cement/concrete for foundations and cable trenches, forestry felling, contaminated soils
Impact Pathway(s)	Runoff and surface water flow paths, groundwater flow paths
Project Stage	Construction Phase

Overview of Impact (general):

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of ± 0.5 of a pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to the aquatic environment.

Nutrient losses may arise as a result of forestry felling and may give rise to eutrophication in downstream water bodies. Phosphorus losses from forestry can arise from the decomposition of brash left on former conifer clear-fell sites. Nutrient enrichment caused by the breakdown of deadwood can also impact water bodies.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

Contamination by Hydrocarbons: Only relatively small volumes of fuels / oils will be on-site at any one time and therefore any impacts that do arise (worst case) will be very localised to the source / works activity area, limited to small, isolated, low volume spills of oils/fuels and therefore it is considered that the magnitude will be Negligible to locally Small Adverse.

Contamination by Cement-Based Compounds: Most cementitious material will be used for turbine base construction. The magnitude of impact is reduced as a result of the nature of this process whereby turbine bases will be poured over a period of several days and not all at once. In addition, all cement poured at the turbine base area, as well as at the met mast, control building and Tinnalintan substation will be contained by an underlying binding layer and temporary shuttering. Once the cement is set/cured it will no longer be a source of contamination. With regard the Ballynalacken Grid Connection cable trench, the magnitude of impact is reduced as a result of the nature of this process whereby cement and possible runoff will be contained within the excavation by nature of a 1.3m deep trench, and the cable trench will be backfilled before the next section (100m or so) of the trench works commence and therefore is low risk of cement washout from the trench. Therefore, impacts that do arise (worst case) will largely be limited to small, isolated, low volume spills of cement/concrete and, any effects that do occur will be very localised to the source / works activity area. Therefore, it is considered that the magnitude will be Negligible to locally Small Adverse.

Contamination by Nutrients due to Forestry Felling: Due to the spread out nature of the proposed tree felling area within 3 no. sub-catchments and the fact that all felling operations must conform to current best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte and DAFM guidance documents, the overall, the magnitude of impact is considered to be Small Adverse, in the absence of any additional mitigation measures.

Impact Magnitude	Negligible to Small Adverse	**Impact Significance: *(pre-mitigation)***	**Imperceptible - Moderate**

Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

**See Chapter 19: Mitigation and Monitoring Arrangements for full wording of mitigation measure*

SM18	The plant and machinery will be regularly inspected for leaks and maintained in good working order for the duration of the works.
SM19	Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage.
MM21*	Concrete control procedures will be implemented including no batching; ready mixed concrete will be used for all foundations; work scheduled for dry days; experienced operators; run-off will be settled out and no concrete truck washing on-site.
MM22*	Fuel/oil control procedures will be implemented including control of on-site refuelling of plant and machinery; provision of spill kits. trained operatives, use of double-skinned mobile bowsers. Emergency Response Plan in place.
MM23	There will be no refuelling of vehicles or plant permitted within 100m of a watercourse or wet drainage channel or local spring/well.
MM24	All fuels or oils, required during construction, will be stored in a designated, bunded, locked storage area within the temporary compounds. All fuel storage areas will be bunded appropriately to 110% of the volume of oils/fuels each area contains for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area. Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage. Safety data sheets for all chemicals used will be kept on-site. An emergency response plan for the construction phase to deal with accidental spillages is contained within the Environmental Management Plan.
MM25	Overnight parking of plant and machinery will only be permitted at locations which are greater than 50m from watercourse/drainage features and at an existing hard-core surface. Drip trays and fuel traps will be used under and around parked plant and machinery to contain any leaks.
MM26	All associated tree felling will be undertaken using good working practices as outlined by the Forest Service in their 'Forestry Harvesting and Environment Guidelines' (2000) and the 'Forestry and Water Quality Guidelines '(2000). Measures will include the protection of the riparian zones, installation of buffered drainage outfalls, installation of drains and silt traps as soon as possible once felling has been completed, and a regime of continued monitoring of silt traps and drainage outfalls will be implemented. All excess felled brash will be removed off site to avoid release and runoff of phosphorous into sensitive watercourses.
SM27	The construction of the Ballynalacken Windfarm Project will be carried out in accordance with an Environmental Management Plan (EMP). The EMP will include all of the mitigation measures and monitoring arrangements for the Project. An Environmental Clerk of Works will be appointed, independent of the main construction Contractor, and will carry out weekly audits on EMP compliance. If non-compliance is detected, then, prompt corrective action will be agreed and committed to by the Contractor, with a view to the swift and effective resolution of any deviations from the EMP requirements. The EMP will be an important contract document for the main construction contractor (Contractor) who will be contractually obliged to comply with the EMP and the requirements of the Environmental Clerk of Works. Furthermore, if a significant unforeseen environmental effect takes place, then, the Environmental Clerk of Works will have a 'stop-works' authority to temporarily stop works at the works location until the issue is resolved.

Effectiveness of Mitigation and Monitoring Measures: The potential for the release of hydrocarbons, cement-based compounds or nutrients to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors.

The above measures are proven and effective best practice measures which will avoid and minimise the risk of contaminant release by:

- reducing the potential pathway for release (proposed best practice oil, fuel storage/containment, emergency response and use of watercourse buffer zones),
- capturing, containing and removal off-site any spills and leaks;
- Best practice measures with regard fuels, oils and tree felling; and,
- thereby breaking or limiting the pathway between the potential sources and the receptor.

The residual effect will be – Negative, imperceptible, indirect, short term, unlikely impact to surface water quality.
Residual Impact Significance *(post-mitigation)*: Imperceptible

EIAR 8.3.1.2.3	**Hydromorphological effects due to watercourse crossing works**
Sensitive Aspect:	River Waterbodies
Importance:	**Very High** (as per Section EIAR 8.3.1.1)
Impact Source(s)	Excavation of watercourse banks and bed, culvert placement/extension
Impact Pathway(s)	Physical modification
Project Stage	Construction Phase

Overview of Impact (general):

Hydromorphology refers to the physical character of the river and includes the flow of water in the river, the course the river takes or the form and shape of the river channel. It stems from the term 'fluvial geomorphology', a subject that focuses on the processes of water and sediment movement and the features that these processes create in a river such as pools, riffles and glides. These processes and features create and maintain habitats for invertebrates, fish and plants.

Diversion and culverting of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats. Please refer to Section EIAR 8.3.1.2.1 for impacts relating to sediment.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

There are 3 no. natural watercourses and 4 no. wet drainage channel crossing locations in total at Ballynalacken Windfarm project – these are identified as W1 to W3, and D1 to D4 as shown on Figure 8.3.

W1 is a 1st order stream located on the Cloghnagh_010 1st order stream in forestry plantation, D1 is wet drainage channel which drains directly upslope of the Cloghnagh_010 stream. D2 is located at an existing culvert crossing on a wet drainage channel which drains into the Ballymartin_15, which in turn drains into the Cloghnagh_010. D3 is located further upslope of D2 at a wet drainage channel in agricultural lands.

D4 is a wet drainage channel through agricultural lands which drains into the Kilcronan stream.

W2 is on the Rathduff_15, which is a 1st order headwater stream in agricultural grassland, while W3 is further downstream on the Rathduff_15 at an existing bridge along the regional road, where this waterbody is classed as 2nd order.

- W1 is c.1.0m in width and will require the installation of a new bottomless culvert to facilitate the construction of a Windfarm Site Road over this watercourse;
- W2 is 1.0m in width with cables being installed in the public road above the existing culvert to install the Internal Cable Link, no new culvert or instream works will be required; no instream works, and
- W3 is 2.3m in width, no instream works will occur at this location as the Ballynalacken Grid Connection will be installed either in the deck of the bridge or under the bridge by directional drill at this location.
- Wet drainage channel D1 is c.0.5m in width and will require a diversion of the channel for 50m and the installation of a new bottomless culvert to facilitate the construction of a Windfarm Site Road over this drain;
- D2 is 0.7m in width and will require the extension of the existing culvert by 8m to facilitate the widening of the existing forestry track over this culvert;
- D3 is 1.0m in width and will require the installation of a new bottomless culvert to facilitate the construction of a Windfarm Site Road over this drain;
- D4 is 1.0m in width and will require the installation of a new bottomless culvert to facilitate the construction of a Windfarm Site Road over this drain

Magnitude of Impact: The streams and drains which require in-stream/crossing works have typically low flows or no flows (season dependant) as they are typically 1st order headwater streams. The watercourse crossings will be completed over several months in conjunction with the access roads works or cable trenching works and therefore will not be completed at one time. The watercourse crossings required for the proposed project are distributed across two sub-basins – Cloghnagh_010 and Nore_120, with crossings of wet drainage channels in the Cloghnagh_010 and Owveg(Nore)_040. Bottomless culverts will be used for all new crossing structures. The works will therefore not have a significant effect on surface water quality or hydromorphology; and all effects will be localised, brief in nature and reversible.

The magnitude of pre-mitigation impacts is considered to be Negligible

Impact Magnitude	Negligible	**Impact Significance: *(pre-mitigation)***	**Imperceptible**
Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.			
MM11	Weather forecasts will be consulted in advance of works. If there is heavy prolonged rainfall or if an exceptional rainfall event occurs, then construction works will cease until peak flows have subsided.		
MM16	All new watercourse crossing structures will be sized to cope with a minimum 100-year flood event. In all cases, culverts will be oversized to allow mammals to pass through the culvert. The construction of new watercourse crossing structures will be carried out in accordance with the Office of Public Works (OPW) Guidelines Construction, Replacement or Alteration of Bridges and Culverts (2013), and also with the Department of Transport, Tourism & Sport Guidelines for Managing Openings in Public Roads (April 2017).		
MM17	New culverts which will be installed at watercourses or wet drainage channels will be bottomless or clear spanning.		
MM18	In-stream works will not be undertaken without isolation of flow within the watercourse. A pre-works survey will be carried out by the Project Ecologist and any fish, if present, within the isolated section will be removed using electrofishing and transferred immediately downstream of the crossing point and placed back in the water. The water will be isolated from the works by over pumping, flume (pipe) or channel diversion methods.		
MM19	At wet drainage channels, instream works will be followed by site-specific reinstatement measures to ensure the restoration of flow character and morphology within the affected reach. Measures will include: bank stabilisation using boulder armour or willow/brush bank protection; reinstatement of bank slope and character, creation of compound channels where necessary; reinstatement of instream flow features such as boulder substrates, pool / riffle sequences, or spawning cobbles; and planting along the riparian margin to stabilise banks, add flood protection and provide riparian buffer.		
MM27	In-stream works in wet drainage channels (D1, D2) will only be undertaken during the IFI specified period (July, August and September) and will be carried out in accordance with the *Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters* (IFI, 2016).		
MM28	Works at W2 and W3 will take place when the Rathduff_15 is in its dry state and the works at W2 or W3 will be planned for periods of dry weather.		
SM17	At D1 and D2, monitoring of Q values and sediment build up will be carried out immediately downstream of the dam locations at D1 and D2. This monitoring will be conducted throughout the construction works at D1 and D2, and also conducted as part of surface water monitoring in order to confirm that the Q values and sediment levels return to baseline levels. Prior to dam being removed at D1 or D2, where sediment build up poses significant downstream effects on the watercourse, this sediment will be removed.		
MM71	The horizontal directional drilling works at W3 will be carried out when the Rathduff_15 is in its dry state, to ensure that the works are carried out under a dry stream bed. The drilling works will be carried out by an experienced Drilling Contractor and supervised and managed by a competent and experienced Mud Engineer who understands the technicalities and challenges of drilling works. The Mud Engineer will advise the Construction Manager on the selection of competent drillers for the HDD works; monitor the watercourse bed during drilling works, and will supervise the drilling works including the drilling pressures and the implementation of any contingency measures. From a surface water quality protection perspective, the area around the launch/reception pit, bentonite batching, pumping and recycling plant will be bunded using appropriate terram geotextile and/or sandbags in order to contain any spillages. Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area. Spills of drilling fluid will be cleaned up immediately and stored in an adequately sized watertight skip before being taken off-site to a suitably licensed waste facility. In the event of a break-out occurring, the Environmental Emergency Response Procedure for Frac-Out will be implemented which includes the following contingency measures;		

	• In the event of break-out occurring in the stream bed, the rig will immediately shut off the pumps and the drilling assembly will be pulled off to reduce annular pressures; • In the event of break-out on the road an excavator will be available to dig a pit to contain fluid with vacuum trucks/pumps available to transfer drill fluid from the containment point back to the recycling point; and in either scenario, drilling fluid additives designed to plug the formation will be introduced to the circulation system and let set. Environmental Emergency Response Procedures are included in the Ballynalacken Grid Connection Environmental Management Plan.

Effectiveness of Mitigation and Monitoring Measures:

The above measures are proven and effective best practice measures which will avoid and minimise the risk of hydromorphology effects by:

- Reducing direct effects on watercourses (i.e. using bottomless or clear spanning structures);
- IFI (2016) best practice measures for protection of watercourses and water quality during any instream works
- Timing of instream works (in wet drains) to reducing the effect on watercourses and water quality (i.e. IFI specified period - i.e. July, August, September which flows are likely to be low or absent).

The residual effect will be – Negative, imperceptible, indirect, short term, unlikely effect to surface water quality.

Residual Impact Significance *(post-mitigation)*:	**Imperceptible**

EIAR 8.3.1.2.4	**Changes to Surface Water Quantities due increased site runoff rates and/or changes to drainage patterns**
Sensitive Aspect:	River Waterbodies
Importance:	**Very High** (as per Section EIAR 8.3.1.1)
Impact Source(s)	New permanent access roads, access road upgrades and hardstanding areas, site drainage network
Impact Pathway(s)	Runoff, drainage routes and surface water flow paths
Project Stage	Construction and Operational and Decommissioning Phases

Overview of Impact (general):

Progressive replacement of vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the site and increase flood risk downstream of the development. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems. In reality, the access roads will have a similar permeability to the underlying soils. However, it is conservatively assumed in this assessment that the proposed access roads and other hardstand areas are impermeable.

The construction of drainage channels could potentially result in changes to local drainage regimes, if not designed appropriately.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

The emplacement of the proposed permanent hardcore (~6.1ha at the windfarm site, 1.3ha at Tinnalintan Substation), as described in Chapter 5 of the EIAR, could (assuming emplacement of impermeable materials as a worst-case scenario) result in an average total site increase in surface water runoff of approximately 1,077m^3/month or 34.7m^3/day (see table below). This represents a potential increase of only approximately 0.43% in the average daily/monthly volume of runoff from the site area in comparison to the baseline pre-development site runoff conditions.

This is a very small increase in average runoff and results from a relatively small area of the overall study area being developed. Specifically, the proposed permanent development footprint represents only 2% of the total project landholding area of 300ha (development redline boundary).

The additional runoff volume is low due to the fact that the runoff potential from the project site is already relatively high (85% runoff coefficient) due to the prevailing baseline hydrogeological conditions at the site. Also, this calculation assumes that all hardstanding areas will be impermeable which is a conservative approach given that access tracks and crane hardstands will be constructed of aggregates which will facilitate the permeation/recharge of rainfall.

Baseline Site Runoff v Development Runoff

Site Baseline Runoff/month (m^3)	249,900
Baseline Runoff/day (m^3)	8,061
Permanent Hardstanding Area (m^2)	73,249
Hardstanding Area 100% Runoff (m^3)	7,178
Hardstanding Area 85% Runoff (m^3)	6,101
Net Increase/month (m^3)	1,077
Net Increase/day (m^3)	34.7
% Increase from Baseline Conditions (%)	0.43%

In relation to the impact of the site drainage network on existing drainage patterns or surface water flow paths, the design of the drainage network has been carried out by Hydro Environmental Services and has taken full account of the existing drainage regimes and surface water flow paths at the site. There will be no change to the existing drainage regimes as a result of the Project because the surface water drainage system, which forms

part of the Project design, incorporates regular clean water cross drains, check dams, settlement ponds, regular buffered outfalls and natural vegetation filters which will ensure that there will be no change to existing drainage regimes or flow paths. The impact will be Neutral and is scoped out from further examination.

Impact Magnitude	Negligible	**Impact Significance: *(pre-mitigation)***	**Imperceptible**

Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

Design	Use of aggregate (gravel) to construct and surface windfarm site roads, compounds and turbine hardstanding areas.
Design	Construction and installation of the site drainage network *(see Volume B: Planning Drawing 101 to 106 and 501 to 503)*
Design	Implementation of the Surface Water Management Plan *(see* Environmental Management Plan*)*
MM11	Weather forecasts will be consulted in advance of works. If there is heavy prolonged rainfall or if an exceptional rainfall event occurs, then construction works will cease until peak flows have subsided.
MM12	Windfarm site roads and hardstanding areas are designed to have a permanent surface water drainage network in place. Temporary works areas, including the borrow pits and temporary compounds will have a temporary surface water drainage network in place during works. The drainage infrastructure will not be installed during heavy or prolonged rainfall events or when the soil is waterlogged. The site drainage network will ensure that all surface water runoff from upgraded roads and new road surfaces (including hardstand areas) will be captured and treated prior to discharge/release. Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains; The site drainage network will include check dams and settlement ponds which will settle suspended solids in water runoff while also slowing down the rate of water run-off from these areas. Water will be released to surrounding vegetation at regular intervals via buffered outfall weirs, which also form part of the drainage network.
MM16	All new watercourse crossing structures will be sized to cope with a minimum 100-year flood event. In all cases, culverts will be oversized to allow mammals to pass through the culvert. The construction of new watercourse crossing structures will be carried out in accordance with the Office of Public Works (OPW) Guidelines Construction, Replacement or Alteration of Bridges and Culverts (2013), and also with the Department of Transport, Tourism & Sport Guidelines for Managing Openings in Public Roads (April 2017).

Effectiveness of Mitigation and Monitoring Measures:

It is a key mitigation measure of the proposed development to ensure that all surface water runoff is treated (water quality control) and attenuated (water quantity control) prior to diffuse discharge at pre-existing Greenfield rates. As such, the mechanism by which downstream flooding, as a result of the proposed development, is prevented and controlled is through avoidance by design.

The Drainage Plan will deploy proven and effective measures to attenuate runoff and mitigate the risk of flooding. The proposed integration of the windfarm drainage with the existing forestry/land drainage is a key component of the proposed drainage management within the development. By integration we mean maintaining surface water flowpaths where they already exist, avoid creation of new or altered surface water flowpaths, and maintaining the drainage regime (i.e. normal flow) within each forestry and land parcel compartment. Critically, there will be no alteration of the catchment size contributing to each of the main downstream watercourses. All development drainage water captured within individual site sub-catchments/sub-basins will be attenuated and released within the same sub-catchment/sub-basin that it was captured.

As outlined in the Surface Water Management Plan we have designed settlement ponds for a 1 in 10 year return flow. This approach is conservative given that the project will likely be built over a much shorter period (12-18 months), and therefore this in-built redundancy in the drainage design more than accounts for any potential short term climate change rainfall effects.

The residual effect will be - Neutral, imperceptible indirect, long term, likely effect on down gradient streams/rivers.

Residual Impact Significance *(post-mitigation)*:	**Imperceptible**

EIAR 8.3.1.2.5	**Reduction in Surface Water Quality during the Operational Phase**
Sensitive Aspect:	River Waterbodies
Importance:	**Very High** (as per Section EIAR 8.3.1.1)
Impact Source(s)	Development site runoff (access roads, hardstands and reinstated areas), excavations, movement and storage of overburden, soil erosion, use of machinery, fuels & oils
Impact Pathway(s)	Runoff and surface water flow paths, groundwater flow paths
Project Stage	Operational Phase

Overview of Impact (general):

Effects on downstream surface water quality from suspended sediment entrained and hydrocarbon contaminants in runoff from the development footprint including access roads, hardstands and reinstated/concealed areas. There is no requirement for concrete emplacement or further forestry felling during the operational phase and therefore no potential for contamination of waters from these sources.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be completed.

Some minor maintenance works will be required periodically, such as maintenance of site entrances, internal roads and hardstand areas. These works would be of a very minor scale, brief duration and infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works. It is considered that the levels of suspended sediment in surface water runoff will be negligible.

Where major component replacement (e.g. blade replacement) is required during the operational phase, this may involve the reopening of widened site entrances or haul route works locations, and potentially parts of the concealed turbine hardstands. These works areas are of very small scale, generally set in agricultural grassland fields, with any reopening of concealed turbine hardstand taking place inside the site drainage network, as a result, volumes suspended sediment in surface water runoff will be negligible.

During either routine maintenance works or major component replacement works, due to the very small number of vehicles associated with operational phase works, there is a very low risk associated with release of hydrocarbons from site vehicles, and it is not envisaged that any refuelling works will be undertaken on site during the operational phase. Therefore, the potential for significant fuel spillages is negligible.

Overall, the magnitude of potential decreases in water quality during the operational phase are evaluated as Negligible.

Impact Magnitude	Negligible	**Impact Significance: *(pre-mitigation)***	**Imperceptible**

Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

**See Chapter 19: Mitigation and Monitoring Arrangements for full wording of mitigation measure*

MM12	Windfarm site roads and hardstanding areas are designed to have a permanent surface water drainage network in place. Temporary works areas, including the borrow pits and temporary compounds will have a temporary surface water drainage network in place during works. The drainage infrastructure will not be installed during heavy or prolonged rainfall events or when the soil is waterlogged. The site drainage network will ensure that all surface water runoff from upgraded roads and new road surfaces (including hardstand areas) will be captured and treated prior to discharge/release. Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains; The site drainage network will include check dams and settlement ponds which will settle suspended solids in water runoff while also slowing down the rate of water run-off from these areas. Water will be released to surrounding vegetation at regular intervals via buffered outfall weirs, which also form part of the drainage network.
OMM01	Surface water quality monitoring of watercourses downstream of the works will be carried out monthly for the first six months post construction, and thereafter annually during the Operational Years 1, 2, 3, 4 and 5, and then every 5 years thereafter, to record any change to baseline trends.

	Samples will be collected by the Environmental Clerks of Works/Asset Manager and analysed by an appropriately certified laboratory and the resulting report submitted to Kilkenny County Council.
OMM02	The Asset Manager will inspect the windfarm site drainage system during quarterly site inspections, and any necessary repairs or maintenance works carried out promptly.
OMM09	Operational phase traffic, personnel and materials will be restricted to within the Operational Works Area Boundary fence. Machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from advancing excavations, will avoid moving onto areas not delineated on the site drawings
OMM11*	Fuel/oil control procedures will be implemented including control of on-site refuelling of plant and machinery; provision of spill kits. trained operatives, use of double-skinned mobile bowsers. Emergency Response Plan in place. No refuelling permitted within 100m of watercourses, wet drains or wells/springs. Drip trays and fuel traps will be used.

Effectiveness of Mitigation and Monitoring Measures:

The above measures are proven and effective best practice measures which will avoid and minimise the risk of sediment or contaminant release by:

- reducing the potential pathway for sediment and contaminant release;
- capturing and treating runoff that is released in the windfarm drainage network, thereby reducing sediment loading,
- thereby breaking or limiting the pathway between the potential sources and the receptor.

With the implementation of the proposed drainage measures as outlined above, and based on the post-mitigation assessment of runoff, we consider that residual effects are - Negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality.

Residual Impact Significance *(post-mitigation)*:	**Imperceptible**

EIAR 8.3.1.2.6	**Reduction in Surface Water Quality during Decommissioning Works**
Sensitive Aspect:	River Waterbodies
Importance:	**Very High** (as per Section EIAR 8.3.1.1)
Impact Source(s)	Excavations, Earthworks and groundworks, soil erosion, use of machinery, oils
Impact Pathway(s)	Runoff and surface water flow paths, groundwater flow paths
Project Stage	Decommissioning Phase

Overview of Impact (general):

Impacts on downstream river waterbodies due to suspended sediment entrainment and oil/fuel residues in site runoff during decommissioning works. There is no requirement for concrete emplacement or further forestry felling during decommissioning works and therefore no potential for contamination of waters from these sources.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

During decommissioning, it is intended to limit groundworks other than to rehabilitate, constructed areas such as turbine bases and hard standing areas. This will be done by covering with topsoil (stored during the operational phase on the concealed section of the turbine hardstand) to encourage vegetation growth and reduce run-off and sedimentation.

The turbines will be removed by disassembling them in a reverse order to their erection. The disassembly of the turbines will require the reopening of parts of the concealed turbine hardstands. The concrete turbine foundations will remain in the ground and the topsoil which will have been stored in a berm on the hardstand during the operation phase will be used to backfill the turbine foundation and hardstanding area. The turbines will then be transported off-site along their original delivery route. The removal of the turbine blades and tower sections may require the reopening of widened site entrances or haul route works locations. These works areas are of very small scale, generally set in agricultural grassland fields, located at discrete areas spread over several sub-basins, with any reopening of concealed turbine hardstand taking place inside the site drainage network, as a result, volumes suspended sediment in surface water runoff will be negligible.

It is proposed that any of the Windfarm Access Roads that are of use to the landowners will remain in place, and it is expected that these roadways will continue to be maintained by the landowners following decommissioning of the wind farm infrastructure, as part of normal ongoing forestry and farm management activities.

The electrical cabling connecting the site infrastructure to the Tinnalintan Substation will be removed by pulling the cable from the ducts from the turbine locations, and from cable jointing chambers along the Internal Cable Link route. The ducting itself will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

Other impacts such as possible contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site.

Overall, the magnitude of impacts to water quality during decommissioning works is evaluated as Negligible to Small Adverse

Impact Magnitude	Negligible to Small Adverse	**Impact Significance: *(pre-mitigation)***	**Imperceptible to Moderate**

Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

DMM01	Prior to the commencement of decommissioning works, these protective measures listed herein, will be reviewed to ensure that the most up-to-date measures are implemented during decommissioning works to comply with best practice at the time.
DMM03	During any reopening/re-widening of site entrances or haul route works locations, the topsoil removed to reveal the hardcore underneath will be stored in an adjacent temporary deposition area, covered to protect it from weathering, and a silt fence will be erected around this deposition area.

DMM04	Continuous silt fencing will be installed down slope of any decommissioning or reinstatement works areas that occur within a 50m zone of a watercourse or wet drainage channel prior to the commencement of the reinstatement works.
DMM05	Weather forecasting warnings will be consulted in advance of works, and decommissioning works will not take place during periods of prolonged heavy rain or exceptional rainfall events.
DMM06	Decommissioning traffic, personnel and materials will be restricted to within the Decommissioning Works Area Boundary fence. Machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from reinstatement works, will avoid moving off the hardstanding areas.
DMM07	Overnight parking of plant and machinery will only be permitted at the turbine locations. There will be no refuelling of vehicles or plant permitted within 100m of a watercourse, wet drainage channel or private well/spring. Any re-fuelling of machinery on site will be carried out using a mobile double skinned fuel bowser which will carry fuel absorbent material and pads in the event of any accidental spillages In addition, spill response apparatus including spill-kits and hydrocarbon absorbent packs will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment.
DMM08	Following the completion of decommissioning, the hardcore areas at the turbines and at widened site entrances and haul route works locations will be covered over, using the soil in the deposition area. The area will be reseeded/replanted as appropriate to the location. And if in agricultural lands, the area will we fenced from livestock until revegetation has occurred. Land reinstatement works will not take place during periods of prolonged heavy rain or exceptional rainfall events or when the soil is waterlogged.
DMM09	The Asset Manager will check the rate of re-vegetation of exposed soils and reinstated areas quarterly for a period of 2 years following decommissioning works. Where revegetation is slower than expected, that area will be prepared and re-seeded or replanted in an appropriate manner.

Effectiveness of Mitigation and Monitoring Measures:

The above measures are proven and effective best practice measures which will avoid and minimise the risk of contaminant release by:

- reducing the potential pathway for release (temporary drainage measures, emergency response and use of watercourse buffer zones),
- capturing, containing and removal off-site any spills and leaks,
- Best practice measures with regarding use of fuels; and,
- thereby breaking or reducing the pathway between the potential sources and the receptor.

With the implementation of the decommissioning phase drainage measures as outlined above, the residual effects will be negative, imperceptible, indirect, short term, temporary likely effect on downstream water quality.

Residual Impact Significance *(post-mitigation)*:	**Imperceptible**

EIAR 8.3.1.3 Cumulative Impact on River Waterbodies with Other Projects

The Ballynalacken Windfarm Project (*whose effects range from Neutral to Potentially Significant, as per Section EIAR 8.3.1.2*) was examined for potential to have cumulative effects on River Waterbodies with other existing and permitted projects, and projects advanced in the planning system. These projects are referred to as 'Other Projects' herein.

A Cumulative Study Area is set out below and Other Projects located within this Study Area are identified and examined for in-combination effects with the Ballynalacken Windfarm Project. The potential for off-site and secondary consequential development is also considered.

EIAR 8.3.1.3.1 Cumulative Study Areas

Firstly, a hydrological cumulative impact assessment is carried out on a regional catchment scale for other large projects such as other wind farm developments and large-scale infrastructure developments located inside the River Nore catchment. Other smaller developments have been excluded at this regional scale as cumulative effects are likely to be Neutral at this (regional) scale. This is described below.

Regional Cumulative Study Area: This area comprises all sub-catchments of the River Nore as far as south of Kilkenny City (Nore SC_100) The large up-stream catchment of the River Nore at Kilkenny City (1,745km^2) and high flows (50%ile – 19m^3/sec) means potential cumulative effects downstream of the Nore SC_100 will not be perceptible.

The Regional Cumulative Study Area comprises the following sub-catchments:

- Nore_SC_010
- Nore_SC_020
- Nore_SC_030
- Nore_SC_040
- Nore_SC_050
- Nore_SC_060
- Nore_SC_070
- Nore_SC_080
- Nore_SC_090
- Nore_SC_100
- Dinin[North]_SC_010
- Dinin[South]_SC_010
- Erkina_SC_010
- Goul_SC_010

Local Cumulative Study Area: A hydrological cumulative impact assessment is then undertaken on a more local scale using WFD sub-catchments (in which the Ballynalacken Windfarm Project is located) as the Cumulative Study Area. Other smaller private and commercial developments are considered at this more sub-catchment scale. The sub-catchments occupied by the project site include the Nore_SC_060, Dinin(North)_SC_010, Nore_SC_080 and Nore_SC_100. The Nore_SC_070 is also included in the Local Cumulative Study Area due the close downstream proximity to the Ballynalacken Grid Connection and Tinnalintan Substation.

EIAR 8.3.1.3.2 Evaluation of Cumulative Effects

The Other Projects which occur within the Cumulative Study Area are identified in the table below and in Figure 8.10: Projects within Surface Water Cumulative Study Area *(included at end of this chapter).*

The Ballynalacken Windfarm Project is examined below for cumulative effects with each of the Other Projects within the Cumulative Study Area. An evaluation of the collective cumulative impact of the Ballynalacken Windfarm Project in-combination with all the Other Projects then follows. The evaluation takes into account any existing sources of pollution or damage identified in Section EIAR 8.3.1.1.7.

Table 8-9: Evaluation of Ballynalacken Windfarm Project cumulatively with Other Projects

Other Project	Sub-catchment	Status	Evaluation of Cumulative Impact
Laois-Kilkenny Grid Reinforcement Project Moatpark - Loan 38kV overhead line Telecom Masts, Ballyouskill	*Nore_SC_060* *Nore_SC_080* *Nore_SC_100* *Nore_SC_060* *Dinin[North]_ _SC_010* *Nore_SC_060*	Under Construction Existing Existing	Neutral Cumulative Impacts at Local scale: The Laois-Kilkenny Grid Reinforcement Project OHL passes through both the Regional and Local cumulative study areas, while the Moatpark-Loan OHL and the Telecom Masts at Ballyouskill occur within the Local cumulative study area. The Laois-Kilkenny Reinforcement Project is currently under construction with works spread across a large however groundworks within the Study Area will be completed by the time the Ballynalacken Project commences construction. The Moatpark-Loan OHL and the Telecom Masts are already constructed, with no new works expected to occur. Taken the status of these Other Projects into account and considering that any areas of exposed soil (source of sediment run) will/already have revegetated before Ballynalacken commences constructed, and that any operational activities/maintenance for these Other Project will have negligible impacts on surface water, therefore it is evaluated that any cumulative impacts with the Ballynalacken Windfarm Project will be Neutral. In relation to the recently approved extension to the Ballyragget Substation, effects will be negligible due to the small footprint of works. No cumulative impacts at regional scale *due to the size and scale of these Other Projects, cumulative impacts at regional scale will not be perceptible.*
Farranrory Wind Farm Grid Connection Ballyragget & Parksgrove Solar Farm and Grid Connection Two Battery Energy Storage System applications at Moatpark	*Nore_SC_070* *Nore_SC_060* *Nore_SC_070* *Nore_SC_060* *Nore_SC_060*	Consented Consented Consented	See Section EIAR 8.3.1.3.2.1 for cumulative assessment at local scale only. Neutral cumulative impacts at regional scale due to the size and scale of these Other Projects, cumulative impacts at regional scale will not be perceptible.
Mixed Use Development, Castlecomer	*DInin[North}_ _SC_010*	Consented	Neutral Cumulative Impact at local scale: Development works will take place adjacent to the Castlecomer Stream _010 in Castlecomer town. Nearest Ballynalacken project works (haul route works HR10) will involve small scale and very shallow excavation of soils at HR10, which

Other Project	Sub-catchment	Status	Evaluation of Cumulative Impact
			will have negligible effects on the river waterbody, and no potential for significant cumulative impacts at a local scale with the haul route works. The potential for significant cumulative impacts (at local level) with the main Ballynalacken construction works at the windfarm site can be excluded due to separation distances and dilution factors. No Cumulative Impact at regional scale; Due to the size and scale of this project, cumulative impacts with the Ballynalacken Windfarm Project at regional scale will not be perceptible.
Hebron House Hotel	*Nore_SC_100*	Consented	See Section EIAR 8.3.1.3.2.1 *for cumulative assessment with Haul Route Works only.* No cumulative impacts with the windfarm at local scale: Due to the small size and scale of this project and the distance from the wind farm site, cumulative impacts with the Ballynalacken Windfarm Project at local scale will not be perceptible. No cumulative impacts *at regional scale due to the size and scale of this project, cumulative impacts at regional scale will not be perceptible.*
Pinewood Wind Farm	*Nore_SC_060* *Dinin[North]_SC_010*	Consented	See Sections EIAR 8.3.1.3.2.1 and EIAR 8.3.1.3.2.2
Cullenagh Wind Farm	*Nore_SC_040* *Nore_SC_060*	Consented	See Sections EIAR 8.3.1.3.2.1 and EIAR 8.3.1.3.2.2
Lisdowney Wind Farm	*Nore_SC_070*	Existing	See Sections EIAR 8.3.1.3.2.1 and EIAR 8.3.1.3.2.2
Lisheen Wind III (part)	*Erkina_SC_010*	Existing	See Section EIAR 8.3.1.3.2.2
Bruckana Wind Farm (part)	*Erkina_SC_010*	Existing	See Section EIAR 8.3.1.3.2.2
Gortahile Windfarm	*Dinin[South]__SC_010*	Existing	See Section EIAR 8.3.1.3.2.2
Bilboa Wind Farm	*Dinin[South]__SC_010*	Consented	See Section EIAR 8.3.1.3.2.2
White Hills Wind Farm	*Dinin[South]__SC_010*	Consented	See Section EIAR 8.3.1.3.2.2
Monaincha Wind Farm	*Nore_SC_010*	Existing	See Section EIAR 8.3.1.3.2.2
Tirlán Milk Processing Plant, Water Treatment Plant, Solar Farm, Anaerobic Digester	*Nore_SC_070*	Existing, Consented	See Section EIAR 8.3.1.3.2.1 for cumulative assessment at local scale only. Neutral cumulative impacts *at regional scale due to the size and scale of this project, cumulative impacts at regional scale will not be perceptible.*

Other Project	Sub-catchment	Status	Evaluation of Cumulative Impact
Wastewater Treatment Plants (including upgrade works*) Tirlan – Ballyconra* Ballyroan* Ballyragget* Castletown Sion Road Purcellsinch Freshford Castlecomer Coan Bilboa Deerpark Clogh-Moneenroe Newtown-Doonane Swan Ballinakill Durrow Ballacolla Clogh Abbeyleix Mountrath Coolrain Camross Borris-in-Ossory	*Nore_SC_010* *Nore_SC_020* *Nore_SC_030* *Nore_SC_040* *Nore_SC_050* *Nore_SC_060* *Nore_SC_070* *Nore_SC_080* *Dinin[South]_SC_010* *Dinin[North]__SC_010,* *Nore_SC_100*	Existing	Neutral Cumulative Impacts: Existing WWTPs are considered to form part of the baseline environment – i.e. they are already included in water quality measurements which contribute to WFD status and risk assessments. In any case, when the separation distances (dilution factor) between the subject development and the WWTPs and the water quality protection which would form part of their discharge licenses, are taken into account, it is considered that the potential for perceptible cumulative impacts with the Ballynalacken Windfarm Project can be excluded.
Existing Quarries Quarry at Bennetsbridge Limestone Abbeyleix Sand Pit Shiel Sand & Gravel Killeany Ballymaddock Booth Concrete Kilsaran Ballinakill Spink Quarry Ironmills or Kilrush Inchmore Conahy Esker Brenstone Lismaine McKeon Stone	*Erkina_SC_010* *Nore_SC_020* *Nore_SC_040* *Nore_SC_050* *Nore_SC_060* *Dinin[South]_SC_010* *Dinin[North]__SC_010,* *Nore_SC_070* *Nore_SC_080* *Nore_SC_090* *Nore_SC_100*	Existing	Neutral Cumulative Impacts: This activity is considered to form part of the baseline environment. Also, if quarries are discharging to local watercourses, they will do so under a discharge license, and therefore significant impacts from quarries to river waterbodies is unlikely to occur. Limited pressure on water quality with one quarry in a sub-basin also associated with windfarm works, and while there are two quarries in the Nore_160 the subject development works in this sub-basin relate to haul route works on roundabouts along the national public road network. When considered with the separation distances (dilution factors) between the subject development and these quarries, the potential for perceptible cumulative impacts with the Ballynalacken Windfarm Project can be excluded.

Other Project	Sub-catchment	Status	Evaluation of Cumulative Impact
Kilkenny Block Holdensrath Roadstone Bennettsbridge Dowling Quarries, Abbeyleix Ringstone Quarry, Coan East Hennessy Concrete Manor Stone, Oldglass Murphys Quarry, Firoda Carroll Quarries Lagan Quarries Mounthall Dowling Quarries, Campions, Lisduff			
Offsite Project – Forestry Replant Lands	Outside of cumulative geographical boundary	Future activity	No Cumulative Impact: The afforestation of 19.9ha of lands will only be carried out on licenced lands, which were subject to an afforestation license application. The application would have examined the potential for significant impacts to water, appropriate mitigation measures and constraints would have been proposed and the license would only have issued where there would be no likely significant impacts on the environment, including on the water environment, as a result of the afforestation. Therefore, it can be assumed that the afforestation of the Replant Lands will not cause significant impacts to Water on its own. In relation to cumulative impacts, The Promoter of Ballynalacken Windfarm Project is committed to replanting 19.9ha of forestry on lands outside of the River Nore and River Barrow catchments, therefore there is no potential cumulative impact to surface waters within the study area.
Secondary Projects / Consequential Developments – Other Energy Projects connecting to Tinnalintan Substation	Nore_SC_060	Future project, unknown	No Likely/Imperceptible Cumulative Impact: Future connections of other energy projects, which may arise due to the existence of the Ballynalacken Tinnalintan Substation (if built), are currently not known/planned and in any case are likely to be constructed after the Ballynalacken Tinnalintan Substation exists – i.e. during the operational phase of the Ballynalacken Windfarm Project, therefore it is considered that there will be no overlap of construction periods, and the potential for cumulative construction phase effects can be excluded. In the unlikely scenario where such a connection takes place during the construction phase of the Ballynalacken Project, the other connection would likely involve the installation of underground cabling - either trenching across agricultural lands or under or alongside public and/or private access roads, or overhead line mounted on wooden poles. These other works would likely be small scale and short duration, and it is evaluated that when considered

Other Project	Sub-catchment	Status	Evaluation of Cumulative Impact
			together with the proposed works at the Tinnalintan Substation or along the Ballynalacken Grid Connection route, which will also have limited potential to affect water quality, that cumulative impacts will be Imperceptible.

EIAR 8.3.1.3.2.1 Local Sub-catchment Assessment

This section assesses the potential cumulative effects of the proposed Ballynalacken Windfarm Project in combination with the Other Projects on sub-catchments in which the project is located. In terms of potential cumulative effects on a sub-catchment scale, the key factor for limiting hydrological effects is that the 12 no. proposed turbines are distributed across 3 no. sub-catchments (i.e. Nore_SC_060 has 4 no. turbines, Dinin(North)_SC_010 has 2 no. turbines and Nore_SC_080 has 6 no. turbines). The Tinnalintan Substation and Ballynalacken Grid Connection are also drained by local river waterbodies in which no turbines are proposed. This significantly reduces the potential for cumulative effects to occur on a sub-catchment scale. In relation to Other Projects, the highest number of turbines within the Local Sub-Catchment study area are located in the Nore_SC_060 which has 19 no. turbines. Other wind farm developments within these catchments are:

Wind Farm name	Status	*Sub-catchment*	No. Turbines in Sub-catchment
Pinewood Wind Farm	Consented	*Nore_SC_060*	11
Cullenagh Wind Farm	Consented	*Nore_SC_060*	8

Within **Nore_SC_060**, which has 4 no. turbines from the Ballynalacken project site (T9 – T12), there are also 2 no. other windfarms, Cullenagh Wind Farm and Pinewoods Windfarm, which are consented, but not yet built. Collectively, these two windfarms could have 19 no. turbines operating in the Nore_SC_060 sub-catchment. Including the Ballynalacken Wind Farm, this is a total of potentially 23 no. turbines in the sub-catchment with an area of 107km^2, which equates to 1 no. turbine per 4.65km^2. This is considered not significant in terms of likely cumulative hydrological effects.

As described in the river waterbody impact assessment section (Section EIAR 8.3.1.2), the proposed Ballynalacken Windfarm Project includes additional treatment in the form of a water treatment train (such as Siltbuster) is proposed in the Nore_SC_060 (Owveg River catchment) due to the short downstream distance to the Owveg River which is a designated SAC. Also, there is no proposed overburden storage or borrow pits in the Nore_SC_060 in order to reduce the potential for hydrological and water quality effects in the Owveg River.

The Nore_SC_060 also includes other projects which are located close to Ballynalacken Grid Connection works – namely the grid connections for the Farranrory Windfarm and the Parksgrove & Ballyragget Solar Farms, and two Battery Energy Storage System projects which are consented in locations adjacent to the existing Moatpark Substation. It is evaluated that due to the linear nature of the grid connections and the dispersed nature of the solar and Battery Energy Storage System projects, it's unlikely they will contribute to measurable water quality effects. Potential secondary development at the Tinnalintan Substation could also occur within this sub-catchment, while the Laois-Kilkenny Grid Reinforcement Project, Moatpark-Loan 38kV OHL, Telecom Masts at Ballyouskill, and a number of water treatment plants and quarries occur within the Nore_SC_060. Due to discharge licence requirements, and the existing status of these Other Projects, it is considered that collectively cumulative hydrological effects will not be Significant.

With regard the **Nore_SC_080**, which has 6 no. turbines from the Ballynalacken Wind Farm (T1 – T5 & T7, and 1 no. borrow pit), there are no other wind energy developments existing or proposed in the sub-catchment. The Laois-Kilkenny Grid Reinforcement Project is partially located in in the Nore_SC_080, and works areas will have revegetated by the time the Ballynalacken Project commences construction. There are also several quarries and waste water treatment plants located in this sub-catchment, but due to discharge licence requirements and discharge limits quarries or WWTPs are unlikely to contribute to significant cumulative effects. Overall, proposed Ballynalacken Windfarm Project development in the Nore_SC_080 is minimal and collective cumulative hydrological effects with the Other Projects are unlikely.

Within the **Dinin(North)_SC_010**, which has 2 no. turbines from the project site (T6 and T8) and 1 no. borrow pit, there are no turbines from other wind energy developments existing or proposed in the sub-catchment. There are several quarries and wastewater treatment plant discharges, but due to discharge licence requirements, it is evaluated that they are not likely to contribute to cumulative effects. The mixed-use development in Castlecomer, and the existing Moatpark-Loan OHL are also located in this sub-catchment. Overall, proposed Ballynalacken Windfarm Project development in the Dinin(North)_SC_010 is minimal and it is considered that collective cumulative hydrological effects with the Other Projects are unlikely to occur.

Nore_SC_070: The proposed Ballynalacken Windfarm Project is not located within the Nore_SC_070, and the contribution to cumulative impacts from projects in this sub-catchment only relates to Other Projects.

The Tirlán Milk Processing Plant along with its associated WWTP, and recently approved solar farm is located on the western side of the River Nore in Nore_SC_070. An anaerobic digester plant at the site of the Tirlán WWTP is also consented. Two more solar farms (Ballyragget Solar Farm and Parksgrove Solar Farm) are also consented in the Nore_SC_070. The grid connections for these solar farms and for the Farranrory Wind Farm are also consented within this catchment. These grid connections each involve directional drilling under the River Nore. Farther from the River Nore, the existing Lisdowney Windfarm, and several quarries and WWTPs are also located within the sub-catchment.

Due to the fact that the Tirlán Milk Processing Plant and the Lisdowney Windfarm are existing, these Other Projects are unlikely to contribute to surface water quality effects, namely TSS in surface waters. The WWTPs will be operating under a discharge licence with strict threshold limits, and works associated with the anaerobic digester development will not contribute to significant cumulative effects due to the relatively localised nature of the works within the confines of the existing Tirlán Milk WWTP and Milk Processing sites.

With regard solar farms, by their nature they require minimal earthworks works as the solar panels are mounted on poles that are either inserted into the ground or mounted on concrete blocks. Directional drilling will prevent any direct effects on the River Nore. Thereby, these projects within the Nore_SC_070 are not likely contribute to cumulative effects.

Nore_SC_100:

One Other Project is scoped in for the Nore_SC_100 - the consented Hebron House hotel development. Due to the small size and scale of this development in the context of the size of the Nore_SC_100 catchment, and the separation distance between the hotel development works and the haul route works HR2 to HR5, and due to the very small scale of works associated with the Ballynalacken haul route works which will take place within the public road corridor and involve very minor volumes of excavations, it is evaluated that there is no potential for perceptible cumulative impacts with this Other Project, even in the worst case scenario where all projects are being developed during the same period. In addition, there is no potential for the Hebron House hotel development and the haul route works to cause cumulative effects with the main Ballynalacken construction works due to their remoteness from the wind farm site.

Overall, it is evaluated that the **collective cumulative impact on River Waterbodies at a local sub-catchment scale will not be significant.**

EIAR 8.3.1.3.2.2 Regional (Nore) Catchment Assessment

This section evaluates the cumulative impact of the proposed Ballynalacken Windfarm Project in combination with the Other Projects on the River Nore at a regional catchment level. The hydrological impact assessment carried out below initially assess the potential for cumulative effects in the absence of mitigation at the project site and at the other developments. The assessment considers various hydrological, geographical and development type factors that influence the magnitude for potential hydrological cumulative effects.

With regard other wind farm developments, the total number of wind turbines that could potentially be operating within the Regional Cumulative Study Area is 80 no. (12 no. from the proposed project site and 68 no. other turbines from 9 no. other wind farms as shown in **Table 8-10** below).

Table 8-10: Other Windfarm Developments in the Regional Cumulative Study Area

Catchment Area	Wind Farm Name	Status	Potential No. of Turbines in Nore Catchment
Nore	Pinewood	Consented	11
	Cullenagh	Consented	13
	Lisdowney	Constructed	4
	Lisheen	Constructed	4
	Bruckana	Constructed	2
	Gortahile	Constructed	8
	Bilboa	Consented	4
	White Hills	Consented	7
	Monaincha	Constructed	15
Potential Total			**68**

The total area of the Regional Cumulative Study Area is c. 1,745km^2 which equates to 1 no. turbine per ~21.8km^2 which is considered not significant in terms of likely cumulative hydrological effects on the regional River Nore.

Other large projects which occur within the Nore river catchment (upstream of Bennettsbridge/Nore_SC_100) include the Tirlán development which is located within the Nore_SC_070 subcatchment.

Due to the size of the regional cumulative study area (1,745km^2) and subsequent large flows in the Nore river itself, significant hydrological effects are unlikely. For example, the proposed project site drains to the River Nore via 4 no. sub-catchments (Nore_SC_060, Dinin(North)_SC_010, Nore_SC_080 and Nore_SC_ 100) which have respective catchment areas of 107, 149, 109 and 92km^2. Individually, these sub-catchment areas only account for between 5.3% and 8.5% of River Nore catchment with the cumulative study area. Overall, the potential for dilution effects is very high considering the relatively small size of the individual the sub-catchments (compared to the regional study area) and the regional flows in the River Nore Itself.

Considering the above hydrological and geographical factors, even in the absence of mitigation, worst case hydrological cumulative effects will not be significant.

Therefore, with the implementation of the proposed mitigation measures (both for the proposed project and for the other developments) there will be no cumulative effects associated with the construction, operation or decommissioning phases of the proposed Ballynalacken Windfarm Project when considered collectively in combination with other wind farms and large scale infrastructure developments within the regional River Nore catchment.

Overall, it is evaluated that the **collective cumulative impact on River Waterbodies at a regional scale will not be significant.**

EIAR 8.3.2 SENSITIVE ASPECT: GROUNDWATER BODIES (HYDROGEOLOGY)

This detailed evaluation section for Groundwater Bodies is presented as follows:

- Section EIAR 8.3.2.1 – description of the baseline environment of Groundwater Bodies;
- Section EIAR 8.3.2.2 – evaluation of the impacts of Ballynalacken Windfarm Project on Groundwater Bodies; and
- Section EIAR 8.3.2.3 – evaluation of cumulative impacts.

EIAR 8.3.2.1 Baseline Environment – Groundwater Bodies

The context, characteristics, importance and sensitivity of *Groundwater Bodies* are described in the subsections below. The trends and likely evolution (i.e. Do-Nothing scenario) for this Sensitive aspect are also considered.

EIAR 8.3.2.1.1 Regional Hydrogeology and GWB Descriptions

The Ballynalacken Windfarm site is located in the Ballingarry Groundwater Body (GWB) (Code: IE_SE_G_009) while the proposed Tinnalintan Substation is located in the Durrow GWB (Code: IE_SE_G_156). The proposed Ballynalacken Grid Connection is also located in the Durrow GWB with the exception of the final 1km at the EirGrid Ballyragget Substation at Moatpark which is located in the Kilkenny-Ballynakill Gravels GWB (Code: IE_SE_G_163).

The Ballingarry GWB is described as poorly productive and comprises Westphalian Sandstones, Westphalian Shales and Namurian Sandstones and Shales.

Within the Ballingarry GWB, groundwater will discharge locally to streams and rivers crossing the GWB and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major deep groundwater – surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low as there is no groundwater storage in the bedrock.

The majority of the Durrow GWB comprises Dinantian Pure Bedded Limestones which are classified as a Regionally Important Aquifer – Karstified (diffuse). This GWB reportedly discharges via numerous large springs close to the main river channels or directly into the rivers within the overall GWB.

The Kilkenny-Ballynakill Gravels are a Regionally Important Gravel Aquifer. The sand and gravel deposits associated with the Nore are fluvio-glacial in origin, deposited by the large quantities of meltwater associated with ice-retreat. This means that coarse sands and gravels are likely to predominate. Lenses of finer material occur, and some parts are overlain by till.

Refer Figure 8.5 for Groundwater Bodies and Figure 8.6 for Aquifers which underlie the project site.

EIAR 8.3.2.1.2 Local Hydrogeology

The proposed Ballynalacken Windfarm site is underlain by Westphalian Sandstones, Westphalian Shales and Namurian Sandstones and Shales. The Geological Survey of Ireland (GSI) classifies the Westphalian Sandstones as a Locally Important Aquifer – Bedrock which is Generally Moderately Productive (Lm) and the Westphalian Shales as a Poor Aquifer – Bedrock which is Generally Unproductive (Pu). Meanwhile the Namurian Sandstones and Shales are classed as being a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl).

The Westphalian and Namurian rocks generally have an absence of inter-granular permeability, and most groundwater flow is expected to be in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3m thick, a zone of interconnected fissuring 10m thick, and a zone of isolated poorly connected fissuring typically less than 15m.

Groundwater levels in this bedrock typically have been measured mainly 0-5m below ground level. Groundwater flowpaths are likely to be short (30-300m), with groundwater discharging to nearby streams and small springs. Water strikes deeper than the estimated interconnected fissure zone suggests a component of deep groundwater flow, however shallow groundwater flow is thought to be dominant. Groundwater flow directions are expected to follow topography and therefore groundwater directions within the site are expected to be towards the primary streams within the valleys of the site (GSI, 2004). Groundwater catchments at the Ballynalacken Windfarm site will closely mirror the catchments to local river waterbodies that emerge downslope of the site.

The Durrow GWB is expected to discharge via numerous large springs close to the main river channels (i.e. Nore) or directly into the rivers. Similarly, the Kilkenny-Ballynakill Gravels also discharge into the River Nore locally as the deposits are very permeable.

The GSI mapped groundwater vulnerability rating of the Ballynalacken Windfarm site ranges from Moderate to Extreme (X), with the majority of the windfarm site mapped as Extreme which means overburden depths of less than 3m. The GSI mapped groundwater vulnerability is consistent with the depths of overburden determined by the trial pit investigations. All trial pits carried out on the northern portion of the windfarm site encountered bedrock at depths of less than 3m. Overburden depths of up to 4m were encountered on parts of the southern portion of the windfarm site where there are areas with lower vulnerability ratings (i.e. Moderate to High).

A total of 24 no. trial holes were carried out at the Ballynalacken Windfarm and Tinnalintan Substation over three separates dates (5th July 2022, 22nd September 2022 and 8th March 2023). With the exception of 5 no. trial pit locations, holes were dry. Minor seepages along the top of bedrock were noted in the trial pits carried out at turbine location T7 and T8, where seepages were noted at depths of between 1.4m and 3m below ground level (mbgl). The presence of shallow groundwater flow along the top of bedrock is characteristic of poorly productive aquifers. This shallow groundwater flow is driven by local rainfall recharge and therefore volumes will always be small due to the sites position close to the top of a hill and hence the very small groundwater catchments.

As described in more detail in Chapter 7: Soils, the soil subsoil and bedrock conditions were consistent with EPA/GSI mapping (i.e. poorly draining soils over shallow SILTs/CLAYs subsoils on SANDSTONE, SILTSTONE or SHALE bedrock.

The Tinnalintan Substation and Ballynalacken Grid Connection are mapped to be underlain by Dinantian Pure Bedded Limestones which are classified as a Regionally Important Karstified Aquifer. There are no GSI mapped karst features within 1km of the Tinnalintan Substation. Also trial pitting at the Tinnalintan Substation encountered limestone tills (SILT/CLAY) over sand and gravel deposits down to 2mbgl.

EIAR 8.3.2.1.3 Groundwater Body WFD Status (2016-2021)

Local Groundwater Body (GWB) WFD status information is available (www.catchments.ie).

The Ballynalacken Windfarm Project site exists within three separate Groundwater Bodies (GWBs) which are the Durrow GWB, Ballingarry GWB and the Kilkenny-Ballynakill Gravels GWB.

In the 2016 – 2021 WFD cycle, the Ballingarry GWB and Kilkenny-Ballynakill Gravels GWB are assigned Good status while the Durrow GWB has a Poor Status. The Durrow GWB is assigned a Poor status due to rising trends in nutrients such as nitrate and ortho-phosphate and ammonia.

EIAR 8.3.2.1.4 Existing Sources of Impacts to Groundwater Bodies

The occurrence of existing pollution or environmental damage in the areas on or around the location of the Project have also been considered. As stated above, nutrients from agricultural activities in the Durrow GWB are affecting the quality of water in this GWB.

EIAR Figures: (included at the end of this Chapter)

Figure 8.5: Groundwater Bodies
Figure 8.6: Aquifers

EIAR 8.3.2.1.5 Importance of Groundwater Bodies & Sensitivity to Change

Importance: All GWBs in the study area are required to achieve at least Good status in terms of meeting the long term requirements of the WFD. Also, groundwater is likely to be used locally as a drinking water supply and therefore good groundwater quality is important from a human and animal health perspective. Therefore, GWBs have a High importance.

Sensitivity to Change: The primary sensitivities in respect of the subject development will be groundwater quality and to a lesser extent, quantity (i.e. flows). Due to the nature of the local groundwater flow regime at the wind farm site (*i.e.* relatively short groundwater flow-paths discharging locally to streams), there is expected to be rapid shallow groundwater discharge to local river waterbodies. This means that any significant impact on groundwater quality locally is likely to result in indirect impacts on local surface water quality nearby.

EIAR 8.3.2.1.6 Evolution of the Baseline Environment (the 'Do-Nothing' scenario)

The Ballingarry GWB and Kilkenny-Ballynakill Gravels GWB have been assigned 'Good Status' and the reported WFD risk result in respect of groundwater quality, and quantity is "Not At Risk". Therefore, no trends (*i.e.* reduction in groundwater quality or groundwater levels) have been reported. On the other hand, The Durrow GWB is assigned a Poor status and also "At Risk" due to rising trends in nutrients such as nitrate and ortho-phosphate and ammonia which is a common issue with regionally important karstified aquifers which are typically more vulnerable to contamination.

It is assumed that the status of all groundwater bodies within the receiving environment will be at least Good status during the timeline of the Ballynalacken Windfarm Project Works. This is based on the assumption that groundwater bodies will have to achieve at least Good Status.

Changes in agriculture and forestry landuse management, which may arise from government regulation or policy, have the most potential to affect groundwater quality trends, either positively or negatively. Climate change could result in increased rainfall followed by periods of drought, potentially resulting in increased groundwater level variations and wider seasonal ranges. Groundwater quality rather than quantity is more likely to be affected by worsening or improving trends.

EIAR 8.3.2.2 Impact Evaluation – Groundwater Bodies

This Section comprises an evaluation of the likely significant impacts of the proposed Ballynalacken Windfarm Project on the receiving environment. Moderate, Slight, Imperceptible and Neutral Impacts are also taken into consideration.

The impacts are presented/evaluated as follows:

a) Significant Impacts which are likely or have potential to occur, are subject to detailed evaluation;

b) Moderate or Slight Impacts, which are likely or have potential to occur, are subject to detailed evaluation;

c) Non-significant impacts of local concern or considered important enough to merit detailed evaluation;

d) Neutral or Imperceptible Impacts are scoped out from detailed evaluation, and a short evaluation is provided in the table below. Unlikely Impacts are also scoped out.

Table 8-11: Impacts to Groundwater Bodies

Likely/Potential Impact	**Evaluation**
Moderate or Slight Impacts, which are likely or have potential to occur - see detailed evaluation	
Construction Phase: Reduction in Groundwater Quality due to sedimentation, and/or contamination by hydrocarbons and/or cement-based compounds	*See Section EIAR 8.3.2.2.1*
Non-significant impacts considered important enough (or of local concern) – see detailed evaluation	
Construction Phase: Alteration of groundwater levels and/or flow paths	*See Section EIAR 8.3.2.2.2*
Neutral or Imperceptible Impacts, or where no impact is likely to occur – evaluation below	
Operational & Decommissioning Phases: Reduction in Groundwater Quality due to Contamination by hydrocarbons	Neutral Impact: Due to the minimal groundworks (limited to the annual maintenance of hardstanding areas/roads and the drainage network, and very infrequent re-opening of widened junctions, bends and concealed hardstand area, if required, to facilitate turbine component replacements), small volumes of oils which will be on site, and due to the very low numbers of vehicles and machinery on site, it is considered that any impacts will be Neutral. It is noted that regardless of the likely Neutral significance of any impacts, best practice fuel and oil control measures will be implemented during the operational and decommissioning phases (as per Section EIAR 8.3.1.2.3).
Operational & Decommissioning Phases: Alteration of groundwater levels and/or flow paths	No Likely Impact: No dewatering is anticipated during the operational phase or during decommissioning works as any excavations will be minimal and very shallow (limited to the re-opening of widened entrances, junctions and bends, and if necessary concealed areas at turbine hardstands, to facilitate infrequent turbine component replacements). Additionally, earthworks during the decommissioning phase will also involve reinstating the turbine hardstand and foundation areas, and associated drainage network, so that the area can be returned to its existing landuse. This will involve covering the hardstand areas using the soils stored in the long-term storage berms on each turbine hardstand. No impacts to groundwater levels or flow paths are expected to occur.

EIAR 8.3.2.2.1	**Reduction in Groundwater Quality due to sedimentation, and/or contamination by hydrocarbons and/or cement-based compounds**
Sensitive Aspect:	Groundwater Bodies
Importance:	**High** (as per Section EIAR 8.3.2.1)
Impact Source(s)	Excavation works and erosion of soils (sediment/turbid waters), presence of machinery, oils and fuels, cement-based compounds
Impact Pathway(s)	Groundwater flow paths
Project Stage	Construction Phase

Overview of Impact (general):

The primary risk to groundwater at the proposed project site would be from hydrocarbon spillage, leakages at excavation areas. These are potential impacts common to all construction sites (such as road works and industrial sites). Increased turbidity levels in groundwater is another potential groundwater quality effect where bedrock excavations are carried out (i.e. borrow pits and turbine foundations). Cement based compounds also have the potential to alter groundwater hydrochemistry with regard alkalinity.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

The proposed Ballynalacken Windfarm site is underlain by bedrock which is poorly productive and is characterised by localised, short groundwater flowpaths (30 – 300m). In addition, the site is overlain by poorly drained soils and relatively low permeability SILT subsoils which acts as a protective cover to the underlying aquifer. Any contaminants, such as sediment, hydrocarbons or cement-based compounds which may be accidently released at the Ballynalacken Windfarm site (where the majority of excavations will occur) are more likely to travel to nearby streams within surface runoff. The low permeability of the bedrock means that any contaminant that may reach the bedrock would not disperse and would remain localised to the source or would be removed as runoff during wet periods. The Tinnalintan Substation and a section of the Internal Cable Link are underlain by a regionally important bedrock aquifer while the grid connection is underlain by a regionally important sand and gravel aquifer. Albeit groundwater recharge is higher in the regionally important aquifers, the shallow nature of the works and the spread out, linear nature of the infrastructure means any effects would be negligible. Similar, the HR3 works will have very low potential to affect the groundwater environment

Horizontal Directional Drilling (HDD) is a method routinely used for installing cabling below watercourses, bridges and roads. HDD poses no more of a risk to groundwater than water well drilling, where drilling fluids and bentonite are also commonly used. The drilling fluids and bentonite used will be non-toxic. There is likely to be some localised turbidity effects in the groundwater during the drilling works (similar to water well drilling) but these effects will be temporary and brief. Risks posed by Fuel/oil are no greater than other construction activities. The pre-mitigation effects of HDD to local groundwater is negligible with no likely effects on downstream receptors such as the River Nore SAC.

In terms of cumulative hydrogeological effects arising only from elements of the proposed project with deeper excavations (i.e. turbine foundations and borrow pits), no likely significant effects are expected due to the spread-out nature of the 12 no. turbine locations and 2 no. borrow pits within the project site and across several river waterbody catchments. Turbine locations are at least 330m apart while the borrow pits are 1km apart. The 12 no. turbine locations and 2 no. borrow pits are distributed across several local river waterbody catchments with all having localised groundwater flow regimes (~300m) and no groundwater flow interactions.

Overall, the pre-mitigation impact will be Negligible to Small Adverse

Impact Magnitude	Negligible to Small Adverse	**Impact Significance: *(pre-mitigation)***	**Imperceptible to Slight**

Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

**See Chapter 19: Mitigation and Monitoring Arrangements for full wording of mitigation measure*

SM18	The plant and machinery will be regularly inspected for leaks and maintained in good working order for the duration of the works.
SM19	Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage.

MM20	Only precast concrete culverts will be used for new watercourse crossing structures on the windfarm site. Only precast concrete chambers will be used at Joint Bay locations.
MM21*	Concrete control procedures will be implemented including no batching; ready mixed concrete will be used for all foundations; work scheduled for dry days; experienced operators; run-off will be settled out and no concrete truck washing on-site.
MM22*	Fuel/oil control procedures will be implemented including control of on-site refuelling of plant and machinery; provision of spill kits. trained operatives, use of double-skinned mobile bowsers. Emergency Response Plan in place.
MM23	There will be no refuelling of vehicles or plant permitted within 100m of a watercourse or wet drainage channel or local spring/well.
MM24*	All fuels or oils will be stored in designated, bunded, locked storage areas and fitted with a storm drainage system and an appropriate oil interceptor. Emergency Response Plan in place.
MM25	Overnight parking of plant and machinery will only be permitted at locations which are greater than 50m from watercourse/drainage features and at an existing hard-core surface. Drip trays and fuel traps will be used under and around parked plant and machinery to contain any leaks.
MM09	All excavations which are unsuitable for use as construction/reinstatement material which arise within the catchment of the Owveg River (T9, T10, T11 and T12 and associated Windfarm Site Roads) will not be stored within the catchment, instead these arisings will be transported to the temporary deposition area at Borrow Pit No.2 and at Turbine T7 (both located outside of the Owveg River catchment). In addition, a Siltbuster or other suitable treatment train will be used to remove fine silt particles from site runoff in this catchment. The Siltbuster will be set up at works locations and used during groundworks and earthmoving activities.
MM10	At the windfarm site, at works locations within 50m of watercourses or existing drainage features there will be additional mitigation measures deployed including double silt fencing prior to the commencement of the works, temporary drain blocking in existing drains, placement of silt trapping arrangements along preferential surface water flowpaths and, where necessary, the use of matting to prevent ground erosion and rutting. Works will not take place within this zone during prolonged heavy or exceptional rainfall events.
MM27	In-stream works in wet drainage channels (D1, D2) will only be undertaken during the IFI specified period (July, August and September) and will be carried out in accordance with the *Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters* (IFI, 2016).
MM28	Works at W2 and W3 will take place when the Rathduff_15 is in its dry state and the works at W2 or W3 will be planned for periods of dry weather.
SM17	At D1 and D2, monitoring of Q values and sediment build up will be carried out immediately downstream of the dam locations at D1 and D2. This monitoring will be conducted throughout the construction works at D1 and D2, and also conducted as part of surface water monitoring in order to confirm that the Q values and sediment levels return to baseline levels. Prior to dam being removed at D1 or D2, where sediment build up poses significant downstream effects on the watercourse, this sediment will be removed.

Effectiveness of Mitigation and Monitoring Measures:

The potential for the release of contaminants to groundwater receptors is a risk to groundwater quality. This a common potential impact on all construction sites (such as road works and industrial sites). These potential contamination sources are to be carefully managed at the project site during the construction phase of the development and mitigation measures are proposed below to deal with these potential minor impacts.

The above measures are proven and effective best practice measures which will avoid and minimise the risk of contaminant release by:

- reducing the potential pathway for release (best practice measures with regard storage, use and handling of oils, fuels and cement-based compounds);
- Strict controls during the handling of concrete;
- Drainage controls;
- Emergency response with regard spills and leaks; and,
- thereby breaking or limiting the pathway between the potential sources and the receptor.

The residual effect will be – negative, imperceptible, indirect, short term, unlikely effect to local groundwater quality.	
Residual Impact Significance *(post-mitigation)*:	**Imperceptible**

EIAR 8.3.2.2.2	**Alteration of groundwater levels and/or flow paths**
Sensitive Aspect:	Groundwater Bodies (and Local Aquifers)
Importance:	**High** (as per Section EIAR 8.3.2.1)
Impact Source(s)	Excavation dewatering
Impact Pathway(s)	Groundwater flow paths
Project Stage	Construction Phase

Overview of Impact (general):

Dewatering of borrow pits (as required) and other deep excavations (i.e., turbine bases) have the potential to impact on local groundwater levels and flows by creating a temporary groundwater level depression in the area of the excavation or by altering groundwater flowpaths.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

The topographical and hydrogeological setting of the proposed Ballynalacken Windfarm site location means no significant groundwater dewatering will be required during the works to the borrow pits or turbine foundations during the construction phase. Moreover, rainfall and surface water runoff will be the main inflows that will require water volume and water quality management.

For the avoidance of doubt, we would generally define dewatering as a requirement to permanently drawdown the local groundwater table by means of over pumping, e.g. as would be required for the operation of a bedrock quarry in a valley floor. We consider that this example is very different in scale and operation from the proposed operation of a temporary shallow borrow pit on the side/top of a hill. In order to explain this thoroughly we will outline our reasoning in a series of bullet points as follows:

- Firstly, the 2 no. borrow pit areas are located on the side or top of local hills where the ground elevations are between approximately 270 and 300m OD and there are existing rock subcrops (i.e. bedrock close to the surface);
- These elevations are above the elevations of nearby local river valleys and streams;
- The proposed borrow pits will be between approximately 8 – 12m below ground level which is notable. However, in the context of the topographical/elevated setting of the borrow pits, this depth range is relatively shallow;
- The local bedrock comprises sandstone, shales and siltstone which are generally unproductive. This means that groundwater flows will be relatively minor;
- The flow paths (i.e., the distance from the point of recharge to the point of discharge) in these types of geological settings is short, localised, and will also be relatively shallow;
- No regional groundwater flow regime, i.e. large volumes of groundwater flow, will be encountered at these elevations; and
- Therefore, inflows will largely be fed by recent rainfall, and possibly by limited groundwater seepage from localised shallow bedrock.

Impact Magnitude	Negligible	**Impact Significance:** ***(pre-mitigation)***	**Imperceptible**

Mitigation and Monitoring Measures: None required.

Due to the relatively shallow nature of the proposed borrow pit/turbine base works, the site elevation and also the prevailing hydrogeology of the proposed project site and the temporary nature of the works, the potential for water level drawdown impacts at off-site receptor locations is considered not likely to occur and therefore no mitigation is required.

Residual Impact Significance *(post-mitigation)*:	**Imperceptible**

EIAR 8.3.2.3 Cumulative Impact on Groundwater Bodies with Other Projects

EIAR 8.3.2.3.1 Introduction to the Cumulative Evaluation for Groundwater Bodies

The Ballynalacken Windfarm Project (*whose effects range from Neutral to Slight Significance, as per Section EIAR 8.3.2.2*) was examined for potential to have cumulative effects on Groundwater Bodies with other existing and permitted projects, and projects advanced in the planning system. These projects are referred to as 'Other Projects' herein.

A Cumulative Study Area is set out below and Other Projects located within this Study Area are identified and examined for in-combination effects with the Ballynalacken Windfarm Project. The potential for off-site and secondary consequential development is also considered.

EIAR 8.3.2.3.2 Cumulative Study Areas

The main likelihood of cumulative effects due to the proposed project are assessed to be hydrological (surface water quality) rather than hydrogeological (groundwater). Due to the hydrogeological setting of the wind farm site (i.e. poorly productive bedrock with localised groundwater flowpaths of approximately 300m) and the near surface nature of construction activities - cumulative effects with regard groundwater quality or quantity arising from the proposed development are assessed as being unlikely to occur. Due to the localised nature of groundwater flow at the windfarm site, with estimated groundwater flowpaths to be in the order of 300m, the Cumulative Study Area for groundwater bodies is localised to the project site itself. Groundwater flow directions are expected to mimic topography and therefore groundwater catchments within the project site will closely mirror local river waterbody catchments. Groundwater flowpaths in the regionally important aquifers are potentially longer, but due to the close proximity of the River Nore (which acts a groundwater discharge zone) groundwater flow are unlikely to extend beyond the River Nore.

A conservative scoping distance of 500m is used for cumulative effects on local aquifers within the GWB. The proposed development does not have the potential to affect the GWB as a whole or alter the WFD status.

Due to the shallow nature of the Internal Cable Link, Tinnalintan Substation and Ballynalacken Grid Connection, and the shallow and minor nature of haul route works, no perceptible effects to groundwater are expected to occur and as a result these elements are scoped out with regard cumulative hydrogeological effects.

EIAR 8.3.2.3.3 Evaluation of Cumulative Impacts

The Other Projects which occur within the Cumulative Study Area are identified in the table below and in Figure 8.11: Other Projects within Groundwater Cumulative Study Areas *(included at end of this chapter).*

The Ballynalacken Windfarm Project is examined below for cumulative effects with each of the Other Projects within the Cumulative Study Area. An evaluation of the collective cumulative impact of the Ballynalacken Windfarm Project in-combination with all the Other Projects then follows. The evaluation takes into account any existing sources of pollution or damage identified in Section EIAR 8.3.2.1.4.

Table 8-12: Evaluation of Ballynalacken Windfarm Project cumulatively with Other Projects

Other Project	Status	Evaluation of Cumulative Impact
Laois-Kilkenny Grid Reinforcement Project Moatpark-Loan 38kV OHL Telecom Masts, Ballyouskill	Under Construction & Existing	Neutral Cumulative Impact: the Laois-Kilkenny Grid Reinforcement Project is currently under construction and groundworks within the Study Area will be completed by the time the Ballynalacken Project commences construction, the 38kV OHL and telecom masts already exist, and the operation of these utility projects will have Neutral effects on groundwater bodies. In relation to the recently approved extension to the Ballyragget Substation, effects will be negligible due to the small footprint of works.

Other Project	Status	Evaluation of Cumulative Impact
Grid Connections for Farranrory Wind Farm, and Parksgrove & Ballyragget Solar Farms Two Battery Energy Storage System (BESS) applications at Moatpark	Consented	Neutral Cumulative Impact: Due to the shallow nature of the excavations associated with the grid connection project and with the BESS projects, and the shallow nature of the Ballynalacken Windfarm Project works within 500m (Internal Cable Link, Ballynalacken Grid Connection, Tinnalintan Substation and access road),
Tirlán Water Treatment Plant	Existing	No Cumulative Impact: Due to the fact that's it's an existing controlled operation
Mixed Use Development, Castlecomer	Consented	No Cumulative Impact: Due to the shallow nature of the excavations associated with these projects, and the shallow nature of the Ballynalacken Windfarm Project works within 500m (haul route works)
Hebron House (Hotel) Development	Consented	No Cumulative Impact t: Due to the shallow nature of the excavations associated with these projects, and the shallow nature of the Ballynalacken Windfarm Project works within 500m (haul route works)
Offsite Project – Forestry Replant Lands	Future activity	No Cumulative Impact: Afforestation of lands is expected to involve shallow excavations to form the drainage network, and as a result significant impacts to groundwater would not be expected to occur. In relation to cumulative impacts, the Promoter of Ballynalacken Windfarm Project is committed to replanting 19.9ha of forestry on lands outside of the River Nore and River Barrow catchments, which will also put this activity outside of the geographical cumulative study area for groundwater.
Secondary Project – Other Energy Projects connecting to Tinnalintan Substation	Future project, unknown	Unlikely/Neutral Cumulative Impact: Future connections of other energy projects, which may arise due to the existence of the Ballynalacken Tinnalintan Substation (if built), are currently not known. However, in the unlikely scenario where a future connection is built into Tinnalintan, then excavations which may be required (e.g. for cabling or foundations) are likely to be shallow and it would be expected that any impacts to groundwater would be negligible. Therefore, it is considered that the potential for significant cumulative effects can be excluded.

As detailed in the evaluations in the table above, the Ballynalacken Windfarm Project will not result in significant cumulative impacts with any of the Other Projects within the Cumulative Study Area.

The main likelihood of cumulative effects with other projects or activities is assessed to be hydrological (surface water quality) rather than hydrogeological (groundwater). Due to the hydrogeological setting of the project site (i.e. mainly poorly productive bedrock with localised groundwater flowpaths) and the near surface nature of construction activities, collective cumulative impacts with regard groundwater quality or quantity arising from the proposed Ballynalacken Windfarm Project in-combination with Other Projects are assessed as being **Neutral or unlikely to occur**.

EIAR 8.3.3 SENSITIVE ASPECT: WATER SUPPLY

This detailed evaluation section for Water Supply is presented as follows:

- Section EIAR 8.3.3.1 - description of the baseline environment of Water Supply;
- Section EIAR 8.3.3.2 - evaluation of the impacts of Ballynalacken Windfarm Project on Water Supply; and
- Section EIAR 8.3.3.3 – evaluation of cumulative impacts.

EIAR 8.3.3.1 Baseline Environment – Water Supply

The context, characteristics, importance and sensitivity of *Water Supply* are described in the subsections below. e trends and likely evolution (i.e. Do-Nothing scenario) for this Sensitive aspect are also considered.

EIAR 8.3.3.1.1 Surface Water Abstractions

Ballyragget water supply uses an abstraction near the River Nore (Nore_120), which is located 1.5km downstream of the nearest Project works (the nearest Project works being the Ballynalacken Grid Connection works at the existing EirGrid Ballyragget Substation in Moatpark). The source of the raw water is an infiltration gallery adjacent to the River Nore. Raw water is pumped from the infiltration gallery to a collection chamber/pump sump beside the Water Treatment Plant. There is no direct surface water abstraction from the River Nore itself. The stretch of the River Nore (Nore_120) is a Drinking Water Protected Area under the WFD.

Further downstream, the Kilkenny City Public Water Supply comprises a surface water abstraction point from the Nore River at Troyswood which is located approximately 17km downstream of the Project site. Upgrade works are currently underway at Troyswoods WTP which include a new connection to link the Reservoir at Radestown to Troyswood. All of the Ballynalacken Windfarm Project site is located in the same surface water catchment to Kilkenny City PWS (i.e. River Nore), and the stretch of the Nore River upstream of Kilkenny City as far as Threecastles village (Nore_160) is mapped as a Drinking Water Protected Area (DWPA) with regard Article 7 Abstraction for Drinking Water under WFD. Dinan(main channel)_020 DWPA is also associated with the Kilkenny City PWS.

Local Springs: There is a spring marked on historic 6" mapping on the Loughill, just upstream of its confluence with the Owveg River. This spring is upstream of the Project works and is scoped out from further consideration herein.

Refer Figure 8.7: Public Water Supply - Abstractions, which shows the location of Kilkenny City PWS surface water abstraction, and the abstraction points for the Castlecomer and Ballyragget Uisce Eireann supplies.

EIAR 8.3.3.1.2 Groundwater Abstractions

Groundwater Source Protection Areas: The proposed Ballynalacken Windfarm Project site is not located within the groundwater catchment (i.e. (groundwater source protection area) of any mapped Public Water Supply (PWS) or National Federation of Group Water Schemes (NFGWS) registered groundwater source.

Castlecomer water supply: As per feedback received from Uisce Eireann in January 2024, there is an abstraction point in the vicinity of the Ballynalacken Windfarm –1.7km to the northwest of Castlecomer town. Uisce Eireann confirmed in follow up correspondence in July 2024 that the source is a spring known as Nanny's Well. The spring source is located 3km to the southeast of the wind farm site as identified on mapping received from Uisce Eireann. The underlying sandstone bedrock at the spring location is mapped as locally important and is therefore not karstic in nature.

Uisce Eireann/Group Water Scheme Wells: There are no Uisce Eireann wells or Group Water Scheme wells located within 500m of wind turbines or borrow pits. Therefore, these types of wells will not be affected by the development and are scoped out from further consideration herein.

Local groundwater supplies via wells and springs in the study area were identified using the following methods:

- GSI Well Database for wells within 500m of construction works areas (mapped accuracy of <50m); and,
- Locations of private dwellings (houses/property) within 500m of construction works areas).

As the GSI well database is not exhaustive in terms of the locations of all wells in the area (as the database relies on the submission of data by drillers and the public etc), a very conservative approach was adopted and a worst-case assumption has been made where it is assumed that every private dwelling in the vicinity of the project site has a well water supply associated with it, regardless of the presence of public water pipes along the adjacent public road. As described in Section EIAR 8.2.3 Scoping of Study Areas, the potential for impacts to local wells/springs is limited to physical contact with the well head/source or changes to groundwater flow or localized contamination of the source by fuel/oil spills/cement-based compounds. Groundwater flow paths at the wind farm site are considered to be short (~300m) and therefore, to allow for slightly longer flow paths a conservative study area of 500m is considered appropriate. The key development components from local well perspective would be turbine foundation locations and borrow pits, which require the deepest excavations within bedrock.

Local Wells within 500m of turbine and borrow pit excavations: As outlined on the table below and illustrated on Figure 8.8: Local Private Water Supplies, there are no residences within 500m of a turbine, and only one local residence within 500m of a borrow pit. This house is c.457m to the east of Borrow Pit No.2 and is owned by the landowner of the borrow pit site. This residence is located upslope on the opposite side of the stream valley to the Borrow Pit location.

There are nine wells, used to supply drinking water to livestock, within 500m of a wind turbine or borrow pit eight of these wells are on lands involved in the Project, one well GW_10 is owned by a 3rd party. Many of these are marked on historic mapping and still in use today.

Well ID	Identification Source	Type of Supply	Locational Context	Potential connectivity	Landowner / 3rd party
GW_01	25" Historic Mapping	Livestock	370m downslope of T12	Yes	Project Landowner
GW_02	25" Historic Mapping	Livestock	196m downslope of T12	Yes	Project Landowner
GW_03	25" Historic Mapping	Livestock	310m downslope of T12	Yes	Project Landowner
GW_04	25" Historic Mapping	Livestock	475m from T12	No, upslope on opposite side of Kilcronan stream – Scoped Out	Project Landowner
GW_05	25" Historic Mapping	Livestock	127m upslope from T10	No, upslope of T10 – Scoped Out	Project Landowner
GW_06	Local consultation	Residential	457m from Borrow Pit No.2	No, upslope on opposite side of valley – Scoped Out	Project Landowner
GW_07	GSI database	Disused	358m downslope of T8	Within forestry plantation – Not in Use, Scoped Out.	Project Landowner
GW_08	Local consultation	Livestock	45m upslope from T8	Yes	Project Landowner
GW_09	25" Historic Mapping	Livestock	227m downslope of T8	Yes	Project Landowner
GW_10	GSI database	Livestock	354m downslope of T4	Yes	3rd party
Wells located outside the 500m Study Area					
GW_11	25" Historic Mapping	Livestock	562m downslope of T1	Yes	3rd party
GW_12	Local Consultation	Residential	575m downslope of T4.	Yes.	3rd party
GW_13	25" Historic Mapping	Residential	518m downslope of T6	Yes	Project Landowner

GW_14	GSI database	Assumed residential	615m downslope of T10	No, upslope on opposite side of Kilcronan stream	3rd party

Local Wells within 500m of construction works areas: In order to address local concerns, confirmed or potential wells within the wider area (i.e. 500m around all works areas at the Ballynalacken Windfarm, Internal Cable Link, Tinnalintan Substation and from the Ballynalacken Grid Connection) are also taken into account. 85 no. wells were identified within this additional study area. These wells comprise wells identified on the GSI well database (www.gsi.ie), wells that were identified through landowner/local consultation, and wells that were assumed to occur at local residences, regardless of the presence of public water pipes along the adjacent public road, and are marked with an orange dot on Figure 8.8.

EIAR Figures: (included at the end of this Chapter)

Figure 8.7: Public Water Supply - Abstractions
Figure 8.8: Local Private Water Supplies

EIAR 8.3.3.1.3 Existing Sources of Impacts to Water Supply

The occurrence of existing pollution or environmental damage in the areas on or around the location of the Project have also been considered. No existing pollution is occurring at the Project site which is, or has, affected local Water Supply (either surface water abstractions or groundwater wells).

EIAR 8.3.3.1.4 Importance of Water Supply (Local Wells & Springs) & Sensitivity to Change

Importance: The abstractions relating to the **Ballyragget and Castlecomer** public water supplies are considered to have a **High** importance, as they both supply between 1000 and 2500 homes with drinking water. The **Kilkenny City Public Water Supply** is considered to be a regionally important potable water source and of **Very High** Importance.

Local groundwater wells which are used for domestic supply are considered to have **Medium** importance, while farm supplies, which is not for human consumption, are considered to have **Low** importance.

Sensitivity to Change: Surface water abstractions and groundwater wells can be sensitive to surface water and groundwater quality impacts from potential spills and leaks of oils and fuels as well as increased turbidity depending on the setback distance and local hydrogeological regime (i.e. location of well in relation to groundwater flow). Water supply sources can be affected by alterations to surface water/groundwater flows, particularly during low flow conditions.

EIAR 8.3.3.1.5 Evolution of the Baseline Environment (the 'Do-Nothing' scenario)

In relation to the Kilkenny City PWS surface water abstraction point at Troywsood, the WFD status of the Nore River waterbody (Nore_160) is Good with a risk result of "Not at Risk" and this suggests steady or improving water quality trends. At Ballyragget WTP, the WFT status of the Nore_130 is "Not at Risk".

No trends are known in respect of water quality or quantity of the individual well sources identified, however, the raw water quality of the sources is expected to reflect the groundwater quality in the local aquifer. The overall status of the local GWBs is Good in the Ballingarry GWB (which includes the Ballynalacken Windfarm site area), and Poor in the Durrow GWB (which includes the Tinnalintan Substation site). The Durrow GWB is assigned a Poor status due to rising trends in nutrients such as nitrate and ortho-phosphate and ammonia.

Climate change has the potential to cause reductions in quality and quantity of surface water and groundwater sources. However, it will be an ongoing objective to ensure compliance with threshold values

and maximum allowable concentrations of pesticides and other substances set under the EU Drinking Water regulations.

EIAR 8.3.3.2 Impact Evaluation – Water Supply (Surface Water and Groundwater Abstractions)

This Section comprises an evaluation of the likely significant impacts of the proposed Ballynalacken Windfarm Project on the receiving environment. Moderate, Slight, Imperceptible and Neutral Impacts are also taken into consideration.

The impacts are presented/evaluated as follows:

a) Significant Impacts which are likely or have potential to occur, are subject to detailed evaluation;

b) Moderate or Slight Impacts, which are likely or have potential to occur, are subject to detailed evaluation;

c) Non-significant impacts of local concern or considered important enough to merit detailed evaluation;

d) Neutral or Imperceptible Impacts are scoped out from detailed evaluation, and a short evaluation is provided in the table below. Unlikely Impacts are also scoped out.

Table 8-13: Scoping of Impacts to Water Supply *(surface water and groundwater abstractions)*

Likely/Potential Impact	**Evaluation**
Non-significant impacts of local concern or considered important enough to merit detailed evaluation;	
Construction Phase: Reduction in Groundwater Quality or Quantity at local wells within 500m of turbine foundation locations and borrow pits	*See Section EIAR 8.3.3.2.1*
Neutral or Imperceptible Impacts, or where no impact is likely to occur – evaluation below	
Construction Phase: Reduction in Water Quality for the Kilkenny Public Water Supply	Neutral Impact: due to the separation distance between the main construction works at the windfarm site and the abstraction point at Troyswood (c.29km downstream via the Owveg, c.21km downstream via Cloghnagh, and c.25km downstream via the Castlecomer Stream), and the size of the Nore River surface water catchment upstream of the Kilkenny City PWS abstraction point at Troyswood (1,645km^2), and the very small scale of the Ballynalacken Windfarm Project construction works area (51ha in the context of the size of the catchment (the Project footprint is 0.031% of the PWS surface water catchment area), it is considered that at these separation distances and dilution ratios, that any impacts, even in worst-case unmitigated scenarios, will be negligible with Neutral impacts to the Kilkenny Public Water Supply.
Construction Phase: Reduction in Water Quality for the Ballyragget Public Water Supply	Neutral Impact: due to the separation distance between the main windfarm construction works areas at the Ballynalacken Windfarm and the abstraction point on the River Nore (c.15km from main windfarm construction works via the Owveg River catchment, c.2.4km from W3 on the Ballynalacken Grid Connection, and c.1.6km from the existing EirGrid Ballyragget Substation in Moatpark). The surface water catchment upstream of the Ballyragget abstraction point is 1050km^2. The total construction works area within the Nore_SC_060 is approximately 18.9ha (0.189 km^2) which only accounts for 0.018% of the PWS surface water catchment area. Also, the source of the raw water source is an infiltration gallery adjacent to the River Nore. There is no direct surface water abstraction from the River Nore and therefore the source is less sensitive to water quality in the River Nore. It is considered that at these separation distances, dilution ratios and the nature of the source (i.e. infiltration gallery) any impacts, even in worst-case unmitigated scenarios, will be imperceptible with Neutral impacts to the Ballyragget Public Water Supply.

Construction Phase: Reduction in Water Quality for the Castlecomer Public Water Supply	Neutral Impact: due to (1) the 3km distance between the spring and the wind farm site, (2) the locally important aquifer in the area of the spring which only allow localised groundwater flows, (3) the spring location and wind farm site are separated by a series of poor aquifers (4) no proposed wind farm infrastructure is located upslope/up-gradient of the spring, nor within the locally important which feeds the spring.
Construction Phase: Reduction in Surface Water Quantities at Abstraction Points due to changes in drainage regimes	No Likely Impact: Due to the relatively shallow nature of the turbine foundation and borrow pit excavations, and the shallow nature of all other excavations for the Project, and the absence of significant dewatering requirement, and taking into account that the location of the Ballynalacken Windfarm, Tinnalintan Substation and the Ballynalacken Grid Connection are all outside of drinking water protection areas, it is evaluated that reductions in surface water quantities at the Ballyragget, Castlecomer or Troyswood abstraction points are not likely to occur.
Construction Phase: Reduction in Groundwater Quality or Quantity at local wells not within 500m of turbine foundations or borrow pits but within 500m of other construction works areas for the Project	No Likely Impact: Due to the relatively shallow nature of the other works for the Project, the expected short groundwater flow paths of 300m, and the separation distances to local dwellings and assumed associated wells, effects to groundwater quality or groundwater levels or flow in wells servicing local residences are not likely to occur.
Operation & Decommissioning Phases: Reductions in surface water *quality* at surface water abstraction points or at local groundwater wells	Neutral Impact: Due to the due to the absence of excavations into bedrock during the operational or decommissioning phases, the nature of the operational and decommissioning works and activities, the very small numbers of machinery or vehicles onsite, and the minimal disturbance of ground, limited mainly to bi-annual maintenance of the windfarm roads and drains, and very infrequent reopening of concealed site entrances, haul route works and turbine hardstand areas (if required) for turbine component replacements or during decommissioning, it is evaluated that no changes to surface water quality will occur at the downstream abstraction points or downslope wells during the operational or decommissioning phases of the Project. Impacts will be Neutral.
Operation & Decommissioning Phases: Reductions in surface water *quantity* at surface water abstraction points or at local groundwater wells	Neutral Impact: In relation to surface flows and drainage regimes, no dewatering will be required during the operational or decommissioning phases, the windfarm drainage network will remain in place for the operational phase, maintaining drainage regimes, while during decommissioning, the drainage network will be left in place along any infrastructure which is not removed during decommissioning (such as the Windfarm Site Roads). Overall, no impacts to water quantities or flows at abstraction points or at local groundwater wells will occur. Impacts will be Neutral.

EIAR 8.3.3.2.1	**Reduction in Groundwater Quality or Quantity at local wells**
Sensitive Aspect:	Water Supply (Local Wells)
Importance:	**Medium to Low** (as per Section EIAR 8.3.3.1)
Impact Source(s)	Oils, fuels, cement-based compounds and excavations (turbidity)
Impact Pathway(s)	Recharge and Groundwater flow paths
Project Stage	Construction Phase

Overview of Impact (general):

Groundwater is an important natural resource in Ireland providing between 20-25% of the drinking water supplies. In rural areas, as is the case in the rural area surrounding the Ballynalacken Windfarm site, groundwater is the only source of drink water due to lack of access to public or group water schemes. The main risk to rural wells is contamination from human or animal waste from septic tanks, slurry spreading, grazing animals and also oil and fuel spills/leaks from oil tanks.

Sources of contamination from the Ballynalacken Windfarm Project include oil, fuel or cement leaks or spills, and turbidity in groundwater caused by excavations. Contamination can occur as a result of overland surface flow or underground through the soil layers.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

As outlined in Section EIAR 8.3.2.1, the Ballynalacken Windfarm site is underlain by a poorly productive aquifer of low permeability, groundwater flowpaths are therefore typically very short (~300m maximum). Consequently, it is expected that the majority of groundwater flows within the site emerge as springs/baseline along streams/rivers and leave the site as surface water flows and not groundwater flows. It is considered that the potential for impacts to local wells/springs is limited to physical contact with the well head/source or localized contamination of the source by fuel/oil spills/cement-based compounds or by sediment.

Feedback during the public information event was that local wells are generally shallow and this is an indication of low permeability bedrock.

A study area of 500m from turbine and borrow pit excavation areas has been used (see Figure 8.8). Ten wells have been identified within this zone. Only one well supplies potable drinking water (GW_06), while one well is located within forestry plantation and no longer in use (GW_07). The remaining 8 wells supply drinking water to livestock.

Residential Wells within 500m of turbine/borrow pit excavations: There are no third party wells supplying potable drinking water within 500m of a turbine. There is one well, GW_06 (on Figure 8.8) which is within 500m of Borrow Pit No.2. This well is owned by the landowner of the borrow pit site, and furthermore is upslope on the opposite side of the Kilcronan stream valley. Given the location of this well, and the separation distance (457m) involved, no impacts to the GW_06 well are likely to occur.

Farm/Livestock Wells within 500m of turbine/borrow pit excavations: There are 8 wells within 500m of a turbine/borrow pit which supply drinking water to livestock. 7 of these 8 wells are on lands owned by a landowner involved in the Project - only GW_10 is owned by a 3rd party. Two of these wells are located upslope of the turbine excavation works, GW_04 and GW_05, and therefore are not likely to be affected by turbidity or contamination effects. Of the remaining 6 wells, three wells (GW_02, GW_08, GW_09) are located within 300m of turbine/borrow pit excavations, these wells are 196m downslope of T12, and 45m/227m downslope of T8, all on lands owned by landowners involved with the Project. Without mitigation in place, these wells could be adversely affected (Negligible/Small Adverse) by the excavation works and presence of hydrocarbons in site machinery and vehicles. At the remaining three wells, GW_01, GW_03 and GW_10 (3rd party), it is considered that the magnitude of impacts will be no greater than Negligible/Small Adverse due to the separation distances (>300m) from the turbine/borrow pit works. Furthermore, it is noted that the 3rd party well, GW_10, is located 100m from the works at the Windfarm Control Building, where a shallow foundation will be excavated and concrete foundation will be poured for the new control building. Due to the separation distance (~100m), it is considered that there is potential, without mitigation, for Negligible/Small Adverse impacts to this well.

In relation to wells within 500m of any construction works (excluding turbine bases and borrow pits), it is evaluate that due to the shallow nature of the other Project works, along with location of the majority of these works on elevated lands (i.e. above local wells) and the expected short groundwater flow paths of 300m, the separation distances to houses (and assumed wells), that effects to groundwater levels or flow in wells servicing local residences are not likely to occur, Therefore, it is considered that the potential for the proposed development (even in the absence of the proposed pollution prevention mitigation measures) to impact on local wells is extremely low as the pathways for potential contaminants is very limited and impact magnitude is considered to be Negligible.

Cement based compounds mainly only used at turbine foundations and Tinnalintan Substation foundations with substantial separation distance between these locations and local wells. Smaller volumes of concrete will be used in the Ballynalacken Grid Connection cable trench, and for the foundations for the Windfarm Control Building and the Met Mast. The potential impact magnitude is Negligible.

Due to the relatively shallow nature of the proposed Ballynalacken Windfarm Project along with the elevated position of the Ballynalacken Windfarm site (above local wells), the expected short groundwater flow paths of 300m, and the required minimum setback distance of 500m for turbines from private dwellings, effects to groundwater levels or flow in wells servicing local residences are not likely to occur, while effects to livestock/farm supply will be no greater than Small Adverse.

Impact Magnitude	Negligible to Small Adverse	**Impact Significance: *(pre-mitigation)***	**Imperceptible**

Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

**See Chapter 19: Mitigation and Monitoring Arrangements for full wording of mitigation measure*

MM20	Only precast concrete culverts will be used for new watercourse crossing structures on the windfarm site. Only precast concrete chambers will be used at Joint Bay locations.
SM18	The plant and machinery will be regularly inspected for leaks and maintained in good working order for the duration of the works.
SM19	Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage.
MM21*	Concrete control procedures will be implemented including no batching; ready mixed concrete will be used for all foundations; work scheduled for dry days; experienced operators; run-off will be settled out and no concrete truck washing on-site.
MM22*	Fuel/oil control procedures will be implemented including control of on-site refuelling of plant and machinery; provision of spill kits. trained operatives, use of double-skinned mobile bowsers. Emergency Response Plan in place.
MM23	There will be no refuelling of vehicles or plant permitted within 100m of a watercourse or wet drainage channel or local spring/well.
MM24*	All fuels or oils will be stored in designated, bunded, locked storage areas and fitted with a storm drainage system and an appropriate oil interceptor. Emergency Response Plan in place.
MM25	Overnight parking of plant and machinery will only be permitted at locations which are greater than 50m from watercourse/drainage features and at an existing hard-core surface. Drip trays and fuel traps will be used under and around parked plant and machinery to contain any leaks.
MM09*	Additional sediment control for construction works within the catchment of the Owenbeg River, including storage of unsuitable overburden outside the catchment, and the use of a Siltbuster or other suitable sediment treatment system
MM10*	Additional silt trapping and flow control measures at works locations within 50m of watercourses or existing drainage features
MM27	In-stream works in wet drainage channels (D1, D2) will only be undertaken during the IFI specified period (July, August and September) and will be carried out in accordance with the *Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters* (IFI, 2016).
MM28	Works at W2 and W3 will take place when the Rathduff_15 is in its dry state and the works at W2 or W3 will be planned for periods of dry weather.

SM17	At D1 and D2, monitoring of Q values and sediment build up will be carried out immediately downstream of the dam locations at D1 and D2. This monitoring will be conducted throughout the construction works at D1 and D2, and also conducted as part of surface water monitoring in order to confirm that the Q values and sediment levels return to baseline levels. Prior to dam being removed at D1 or D2, where sediment build up poses significant downstream effects on the watercourse, this sediment will be removed.
SM13	A Landowner Liaison Officer (LLO) will be appointed and will monitor the erection and maintenance of the Construction Works Area boundary fences and will liaise with the landowners regarding the location of access gateways along the fence, and of livestock water supply pipes and livestock water supply sources (agricultural landowners only). The LLO will keep the landowners up to date with relevant construction work schedules.
MM49	A Community Liaison Officer (CLO) will be appointed. The CLO will liaise with and keep the local community up-to-date with relevant construction work schedules, through the use of signage at selected Site Entrances, letter drops to nearest neighbours and through the Project website which will be kept up-to date. The CLO will be the point of contact for local residents for matters relating to noise and vibration. The Environmental Clerk of Works will liaise with the CLO and will be the point of contact between the contractor/developer and the Local Authority regarding any matters relating to noise or vibration from the construction works.

Effectiveness of Mitigation and Monitoring Measures:

The potential for the release of contaminants to groundwater receptors is a risk to groundwater quality. Proven and effective measures to mitigate the risk of releases of sediment and other contaminants have been proposed above and will break the pathway between the potential sources and the receptor. Based on our hydrogeological assessment of the site with regard to groundwater user risk and the proposed mitigation measures, we can robustly say the potential to impact on local wells/water supply sources at the Ballynalacken Windfarm site is very low; and due to the shallow nature of the Windfarm Control Building, Internal Cable Link, Tinnalintan Substation and Ballynalacken Grid Connection, no effects on private wells will occur.

Residual Impact Significance *(post-mitigation)*:	**Neutral**

EIAR 8.3.3.3 Cumulative Impact on Water Supply (Local Wells & Springs) with Other Projects

EIAR 8.3.3.3.1 Introduction to the Cumulative Evaluation for Water Supply (Local Wells & Springs)

The Ballynalacken Windfarm Project (*whose effects range from Neutral to Imperceptible, as per Section EIAR 8.3.3.2*) was examined for potential to have cumulative effects on Water Supply with other existing and permitted projects, and projects advanced in the planning system. These projects are referred to as 'Other Projects' herein.

A Cumulative Study Area is set out below and Other Projects located within this Study Area are identified and examined for in-combination effects with the Ballynalacken Windfarm Project. The potential for off-site and secondary consequential development is also considered.

EIAR 8.3.3.3.2 Cumulative Study Areas

Within the underlying aquifer, groundwater flow paths are expected to be relatively short, typically from 30-300m before groundwater discharges locally into streams. Therefore, for cumulative effects to occur on groundwater, other projects or activities will have to be within 300m of the Ballynalacken Windfarm Project. A conservative scoping in distance of 500m is used for cumulative effects on local wells. 500m exceeds the GSI estimated groundwater flow path distance of 300m.

EIAR 8.3.3.3.3 Evaluation of Cumulative Impacts

The Other Projects which occur within the Cumulative Study Area are identified in the table below and in Figure 8.11: Other Projects within Groundwater Cumulative Study Areas *(included at end of this chapter).*

The Ballynalacken Windfarm Project is examined below for cumulative effects with each of the Other Projects within the Cumulative Study Area. An evaluation of the collective cumulative impact of the Ballynalacken Windfarm Project in-combination with all the Other Projects then follows. The evaluation takes into account any existing sources of pollution or damage identified in Section EIAR 8.3.3.1.3.

Table 8-14: Evaluation of Ballynalacken Windfarm Project cumulatively with Other Projects

Other Project	Status	Evaluation of Cumulative Impact
Laois-Kilkenny Grid Reinforcement Project Overhead 38kV line between Moatpark and Loan Telecom Masts at Ballyouskill	Consented, under Construction Existing Existing	No Cumulative Impact: the groundworks for the Laois-Kilkenny Grid Reinforcement Project will be completed by the time the Ballynalacken Project commences construction, and the 38kV OHL and Telecom Masts are already built, and the operation of these utility projects will have no effects on local groundwater and surface water abstraction points, and it is considered that cumulative impacts to local water supplies are unlikely to occur. In relation to the recently approved extension to the Ballyragget Substation, effects will be negligible due to the small footprint of works.
Grid Connections associated with Farranrory Wind Farm, and the Parksgrove & Ballyragget Solar Farms	Consented	No Likely Cumulative Impact: there are no houses within 50m of the Ballynalacken Grid Connection and the Farranrory Windfarm Grid Connection, or within 50m of both the Ballynalacken Windfarm Grid Connection and the grid connection for the solar farms, in addition, the residences along the Regional R432 road are likely receiving their water from the Uisce Eireann network which services this section of the Regional Road. Therefore, the potential for cumulative impacts can be excluded.
Two Battery Energy Storage System applications at Moatpark	Consented	No Cumulative Impacts: Due to the shallow nature of the excavations associated with these projects, and the shallow nature of the Ballynalacken Grid Connection, it is considered that no cumulative impacts to local water supplies will occur.

Other Project	Status	Evaluation of Cumulative Impact
Tirlán Water Treatment Plant	Existing	No Cumulative Impact: Due to the fact the project is already constructed.
Tirlán Water Treatment Plant & proposed Anaerobic Digester	Existing & Consented	No Cumulative Impacts: As groundwater is expected to discharge into the River Nore, due to the location on the western side of the River Nore, and the location of the Ballynalacken Windfarm Project on the eastern side of the river, no groundwater interaction will occur, no potential for cumulative impacts.
Mixed Use Development, Castlecomer	Consented	No Cumulative Impacts: Closest Ballynalacken Windfarm Project works relate to haul route works HR9 and HR10 which will involve street furniture and overhead line removal in Castlecomer town, and small scale and very shallow excavation of soils (HR10), with no impact on local abstraction points at these locations, and therefore no potential for cumulative effects with the Mixed-Use project. In addition, it is expected that water supply to local residences in Castlecomer town is via the Uisce Eireann public supply.
Hebron House (Hotel) Development	Consented	No Cumulative Impacts: Due to the shallow nature of the excavations associated with these projects, and the shallow nature of the Ballynalacken haul route works, it is considered that no cumulative impacts to local water supplies will occur.
Offsite Project – Forestry Replant Lands (outside of cumulative geographical boundary)	Future project	No Cumulative Impacts: The Promoter of Ballynalacken Windfarm Project is committed to replanting 19.9ha of forestry on lands outside of the River Nore and River Barrow catchments, which will also put this activity outside of the geographical cumulative study area.
Secondary Project – Other Energy Projects connecting to Tinnalintan Substation	Future activity, unknown	No Likely/Neutral Cumulative Impact: Future connections of other energy projects, which may arise due to the existence of the Ballynalacken Tinnalintan Substation (if built), are currently not known/planned and in any case are likely to be constructed after the Ballynalacken Tinnalintan Substation exists – i.e. during the operational phase of the Ballynalacken Windfarm Project, therefore it is considered that there will be no overlap of timeframe boundaries, and the potential for cumulative effects can be excluded. In the unlikely scenario where such a connection takes place during the construction phase of the Ballynalacken Project, the other connection would likely involve the installation of underground cabling - either trenching across agricultural lands or under or alongside public and/or private access roads, or overhead line mounted on wooden poles. These other works would likely be small scale and short duration, and it is evaluated that when considered together with the proposed works at the Tinnalintan Substation or along the Ballynalacken Grid Connection route, which will also have limited potential to affect water quality or quantities in local water supplies, and the high likelihood that most local houses are connected to the Uisce Eireann network, that cumulative impacts will be Neutral.

As detailed in the evaluations in the table above, the Ballynalacken Windfarm Project will not result in cumulative impacts with the majority of the Other Projects within the Cumulative Study Area. The only potential for cumulative impacts relates to the potential secondary development at Tinnalintan, which is considered unlikely to occur during the construction phase of the Ballynalacken Windfarm Project. Overall, it is evaluated that the **collective cumulative impact on Public Water Supply will not be significant.**

EIAR 8.3.4 SENSITIVE ASPECT: DESIGNATED SITES

This detailed evaluation section for Designated Sites is presented as follows:

- Section EIAR 8.3.4.1 - description of the baseline environment of Designated Sites;
- Section EIAR 8.3.4.2 - evaluation of the impacts of Ballynalacken Windfarm Project on Designated Sites; and
- Section EIAR 8.3.4.3 – evaluation of cumulative impacts.

EIAR 8.3.4.1 Baseline Environment – Designated Sites

The context, characteristics, importance and sensitivity of *Designated Sites* are described in the subsections below. The trends and likely evolution (i.e. Do-Nothing scenario) for this Sensitive aspect are also considered.

EIAR 8.3.4.1.1 Context and Characteristics

Designated sites scoped in for assessment in this EIAR Water Chapter include two Natura 2000 sites (River Barrow and River Nore SAC, and the River Nore SPA) and four proposed Natural Heritage Areas (River Nore/Abbeyleix Woods Complex pNHA, Inchbeg pNHA, Ardaloo Fen pNHA, and Dunmore Complex pNHA). These Designated Sites are all located downstream of the Ballynalacken Windfarm Project, with the SPA, and three of the pNHAs overlapping with the boundary of the SAC (exception being Dunmore Complex).

The River Barrow & River Nore SAC (site Code 002162) consists of the freshwater stretches of the Barrow and Nore River catchments as far upstream as the Slieve Bloom Mountains, and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The SAC is very important for the presence of a number of E.U. Habitats Directive Annex II animal species including Freshwater Pearl Mussel, White-clawed Crayfish, Salmon, Twaite Shad, three lamprey species – Sea Lamprey, Brook Lamprey and River Lamprey, the whorl snail *Vertigo moulinsiana* and Otter.

The River Nore SPA (Site Code 004233) stretches the River Nore from Borris-in-Ossory, County Laois to Inistioge, County Kilkenny, and also includes sections of the tributary rivers Delour, Erkina and Goul. The SPA is protected for Kingfisher, which is distributed along riparian habitats, where they nest in burrows along sandy river banks and feed on small fish.

The River Nore/Abbeyleix Woods Complex pNHA (Site Code 002076) stretches from Shanahoe in County Laois southwards along the River Nore to Ballyragget, County Kilkenny. This site overlaps with the River Barrow and River Nore SAC, although the pNHA designation is more extensive and takes in more of the woodland around Abbeyleix. It contains many features of scientific importance including the Freshwater Pearl Mussel, several species of flora including Summer Snowflake and Meadow Saffron, and Abbeyleix Woods.

Inchbeg pNHA (Site Code 000836) is located in the floodplain of the River Nore, 4km downstream of Ballyragget town, and extends as far as the confluence of the Nuenna River with the River Nore. This main habitat of interest is lowland wet grassland with some ponds, streams, and freshwater marshes. Much of the site is under water during the winter. This pNHA is primarily of ornithological interest because of its value to birdlife, though the area is also of local flora importance.

Ardaloo Fen pNHA (Site Code 000821) is a wetland area in the floodplain of the River Nore, 10km downstream of Ballyragget, and upstream of the confluence point of the Dinin River with the River Nore. The site encompasses a diverse wetland flora and is of ornithological value.

Dunmore Complex pNHA (Site Code 001859) is a series of natural depressions in the gravels and boulder clays of the northern outskirts of Kilkenny city supports an interesting diversity of wetland and woodland and old meadow habitats.

Downstream Context: The Ballynalacken Windfarm Project is located in four sub-catchments of the River Nore, with the footprint of the development draining into the Nore via a number of local streams and rivers, as outlined in the table below and illustrated on See Figure 8.9: Designated Sites.

Subcatchment	Project Infrastructure	Hydrological Connectivity	Separation Distance
Nore_SC_060	4 turbines, met mast, windfarm site roads and drainage network, crossing of wet drainage channel D4	Via Owveg River (Owveg(Nore)_040)	2km to SAC 4km to SPA 10.7km, 18.6km, 24.8km, 29.6km to pNHAs
	Road widening, HR12, construction compound no.2, telecom relay pole	Via Loughill stream, which drains to Owveg River (Nore_120)	4.2km to SAC/SPA/pNHA at the confluence point of the Loughill Stream with the Owveg River 11.8km, 18km, 22.8km to Inchbeg, Ardaloo Fen and Dunmore Complex pNHAs
	Internal Cable Link, Tinnalintan Substation, construction compound no.3, Ballynalacken Grid Connection, watercourse crossing points W2, W3	Via Rathduff_15 (Nore_120)	Closest point is at W3 along Ballynalacken Grid Connection Route (90m to SAC and pNHA, 180m to SPA) W2 is c.3.3km further upstream on the Rathduff stream 6.5km, 12.7km, 17.5km to Inchbeg, Ardaloo Fen and Dunmore Complex pNHAs
Nore_SC_080	6 turbines, borrow pit, windfarm control building, windfarm site roads and drainage network, Internal Cable Link, construction compound no.1, HR13, road widening, watercourse crossing points W1, and wet drainage crossing points D1 to D3	Via Cloghnagh (Cloghnagh_010), which drains into the Dinin River c.8.5km upstream of its confluence with the River Nore	1.1km to SAC 16km to SPA 19.6km to pNHA (Dunmore Complex) Not connected to River Nore/Abbeyleix Woods, Inchbeg and Ardaloo Fen pNHAs
	HR8 (Damerstown)	Drains into the Damerstown_West Stream which drains into the main Dinin River channel. (Dinin(Main Channel)_010)	HR8: 0.2km (HR8) to SAC, 11.8km to SPA
	HR7 (Hennebry's Cross)	Via local streams into the main River Nore channel (Nore_160)	HR7: 1.8km to SAC/SPA
Dinin (North)_SC_010	2 turbines, 1 no. borrow pit, construction compound no.1, windfarm site roads and drainage network, HR10, HR11	Via Castlecomer Stream (Castlecomer Stream_010), which drains into the Dinin River in Castlecomer town.	from windfarm: 6.5km to SAC 23.8km to SPA 26km to pNHA (Dunmore Complex) Not connected to River Nore/Abbeyleix Woods, Inchbeg and Ardaloo Fen pNHAs

	HR9 (Castlecomer town)	Drains into the main Dinin River channel. (Dinin(North)_040)	HR9: 0.3km to SAC, 17km to SPA, 20.5km to pNHA (Dunmore Complex) Not connected to River Nore/Abbeyleix Woods, Inchbeg and Ardaloo Fen pNHAs
Nore_SC_100	Haul Route Works – HR6	No groundworks at this location, runoff captured by road drainage system or via overland flow into the main River Nore channel	0.1km to SAC 0.5km to SPA 0.1km to pNHA (Dunmore Complex)
	Haul Route Works – HR1	No groundworks at this location, runoff captured by road drainage system	
	Haul Route Works HR1 to HR5	runoff captured by road drainage system, drainage into River Nore via Pococke River	Works within SAC boundary at HR3, c.40m to Pococke River

EIAR Figures: (included at the end of this Chapter)

Figure 8.9: Designated Sites

EIAR 8.3.4.1.2 Existing Sources of Impacts to Designated Sites

The occurrence of existing pollution or environmental damage in the areas on or around the location of the Project have also been considered. As per Chapter 13: Biodiversity (Section EIAR 13.3.8), a number of Water-related pressures or threats have been identified for the Designated Sites:

River Barrow & River Nore SAC: high inputs of nutrients into the river system from agricultural run-off and several sewage plants, drainage leading to flash-floods.

River Nore SPA: landfill, land reclamation, drying out, and pressures from port areas. The site is also susceptible to alterations in hydrology.

River Nore/Abbeyleix Woods Complex pNHA: The water quality of the River Nore has been affected by agricultural and some industrial pollution. The river is maintained by the local angling club who are interested in preserving its water quality but the threat from agricultural activities in this region is high.

Dunmore Complex pNHA: A large area in the centre of the cluster has been infilled and now accommodates a concrete works; careless disposal of wastewater from this industry also threatens the site.

EIAR 8.3.4.1.3 Importance of Designated Sites & Sensitivity to Change

Importance: The River Barrow and River Nore SAC and River Nore SPA are Natura 2000 sites as established under the Habitats Directive and therefore they have an Extremely High importance. The pNHAs are not statutorily designated and has limited protection, nonetheless, are considered to have High importance.

Sensitivity to Change: The River Barrow and River Nore SAC, River Nore SPA, River Nore and Abbeyleix Woods pNHA, Inchbeg pNHA and Ardaloo Fen pNHA have water dependant habitats and species. While, the Dunmore Complex pNHA does not overlap the River Nore, it also contain some wetland habitats.

Water quality impacts, particularly sedimentation or contamination, can affect species for which the Sites are designated such as Freshwater Pearl Mussel or White Clayed Crayfish, fish species including Lamprey and Salmon, and the predators who depend on them including Otter and Kingfisher. In addition, Kingfisher and Otter require clear waters in which to hunt, and both species can be affected by physical works to, or erosion of, river banks, in which they create their nests and holts. Habitats and flora within riparian and wetland habitats or within flood plains could be affected by significant reductions to water quality.

EIAR 8.3.4.1.4 Evolution of the Baseline Environment (the 'Do-Nothing' scenario)

Climate change will contribute to the drying out of the watercourses in the summer months followed by isolated flooding in winter months, resulting in greater risk of sediment run-off and contamination flowing downstream.

EIAR 8.3.4.2 Impact Evaluation – Designated Sites

This Section comprises an evaluation of the likely significant impacts of the proposed Ballynalacken Windfarm Project on the receiving environment. Moderate, Slight, Imperceptible and Neutral Impacts are also taken into consideration.

The impacts are presented/evaluated as follows:

a) Significant Impacts which are likely or have potential to occur, are subject to detailed evaluation;

b) Moderate or Slight Impacts, which are likely or have potential to occur, are subject to detailed evaluation;

c) Non-significant impacts of local concern or considered important enough to merit detailed evaluation;

d) Neutral or Imperceptible Impacts are scoped out from detailed evaluation, and a short evaluation is provided in the table below. Unlikely Impacts are also scoped out.

Table 8-15: Scoping of Impacts to Designated Sites

Likely/Potential Impact	**Evaluation**	
Significant Impacts which are likely or have potential to occur – see detailed evaluation		
Construction Phase: Reduction in Water Quality in the River Barrow and River Nore SAC, the River Nore SPA and the River Nore/Abbeyleix Woods pNHA		*See Section EIAR 8.3.4.2.1*
Non-significant impacts considered important enough (or of local concern) – see detailed evaluation		
Construction & Operational Phases: Potential erosion and flow regime effects to the River Barrow and River Nore SAC, River Nore SPA and River Nore/ Abbeyleix Woods Complex pNHA		*See Section EIAR 8.3.4.2.2*
Neutral or Imperceptible Impacts, or where no impact is likely to occur – evaluation below		
Construction Phase: Physical alteration of river banks	No Likely Impact: Due to an absence of works within the boundary of the SAC or SPA. No potential for damage to riverbanks within the designated site.	
All Phases: Changes to drainage regimes and water quantities in all downstream Designated Sites	No Likely Impact: Due to the elevated nature of the Ballynalacken Windfarm site, the absence of deep excavations and the characteristics of the underlying bedrock, the very small footprint of the development in the context of the size of the catchments, it is considered that even in the absence of the site drainage network, no changes to the volumes of water runoff reaching downstream Designated Sites will occur.	
Operational and Decommissioning Phases Reduction in Water Quality in the River Barrow and River Nore SAC, the River Nore SPA and the River Nore/Abbeyleix Woods pNHA	Imperceptible: Ballynalacken Grid Connection is the closest element of the Project to the SAC, SPA and pNHA, however, once constructed the requirement for disturbance to ground during its operation will be minimal, infrequent and will be carried out at joint bay locations along the road. No works are expected to be required at the bridge crossing at W3 during the operation of the grid connection. In relation to the Ballynalacken Windfarm, groundworks during the Operational Phase or during Decommissioning will be limited to minor upkeep of the site roads, hardstands and drainage system during the operational phase, and the re-opening and subsequent reinstatement of widened junctions and bends, site entrances and concealed areas at wind turbines to facilitate infrequent large component replacements during the operational phase and to facilitate the removal of the turbines during decommissioning, and the reinstatement of the turbine foundations/hardstands using soils in the long-term storage berms at each turbine. Due to the brief duration of works, the small extent of groundworks, the very small number of vehicles/machinery present onsite, negligible use of oils, the discrete locations of works spread over several sub-catchments, and the separation distances from the windfarm site (and subsequent dilution factors) to the SAC	

	(closest point 2km), SPA/pNHA (closest point 4km), potential impacts to water quality will be Imperceptible.
All Phases: Reduction in Water Quality in the Inchbeg pNHA, Ardaloo Fen pNHA	Neutral Impact: The Inchbeg pNHA and Ardaloo Fen pNHA are c.18.6km and c.24.8km from the closest turbine works and c.6.6km and c.12.8km downstream of Ballynalacken Grid Connection works at W3. These pNHA sites are designated for wetland habitats, and flora and are of importance to bird species. Due to the separation distance between the Project - by the time water runoff from the Project reaches these Sites, any sediments or contaminants in runoff from the Project will be substantially diluted and will not have any noticeable effect on water quality at these downstream distances. Any haul route works remote from the windfarm site will be infrequent and of minor scale and brief duration. No perceptible impacts are expected to occur to these pNHA sites during the construction, operation or decommissioning of the Ballynalacken Windfarm Project.
All Phases: Reduction in Water Quality in Dunmore Complex pNHA	Neutral Impact: Dunmore Complex pNHA is on the northern outskirts of Kilkenny City and at a substantial distance downstream of the Ballynalacken Windfarm (19.6km) and furthermore does not overlap the main River Nore channel – no impacts are likely to occur as a result of works at the windfarm/substation/grid connection locations. The closest Project works relate to Haul Route Works HR6 which involves the removal of street furniture at the roundabout. No excavation or storage of soils is planned at this location, any works (for example the replacement of signage) will be very minor in nature and no impact to water quality is expected.

EIAR 8.3.4.2.1	**Reduction in Water Quality in the River Barrow and River Nore SAC, the River Nore SPA and the River Nore/Abbeyleix Woods pNHA**
Sensitive Aspect: Importance:	Designated Site – River Barrow & River Nore SAC **Extremely High** (as per Section EIAR 8.3.4.1)
Impact Source(s)	Excavations, earthworks and groundworks, excavation dewatering, movement and storage of overburden, watercourse crossing works, installation of site drainage system, forestry felling, use/presence of fuels, oils & chemicals, use of machinery on site, refuelling, cement/concrete for foundations and cable trenches,
Impact Pathway(s)	Surface water/groundwater flow paths and downstream watercourses
Project Stage	Construction Phase

Overview of Impact (general): The construction of the Ballynalacken Windfarm Project could potentially result in the release of suspended solids, hydrocarbons, concrete, and nutrients into downstream Designated Sites via site run-off. An increase in these pollutants in downstream waterbodies could potentially result in a decrease in water quality in Designated Sites. It is noted that secondary effects on water-dependant species and habitats is examined in Chapter 13: Biodiversity.

Suspended solids are small particles in water that neither dissolve nor settle by gravity, such as clay, silt, sand or organic matter and can lead to water turbidity. Although harmless in themselves, an increased content of suspended solids makes water cloudier and limits the sunlight reaching aquatic plants, can affect visibility for predatory fish and birds and can cause damage to fish gills. Silt has the effect of smothering streambeds and decreasing oxygen levels in the water which can greatly affect the fish and micro invertebrate life and even change the structure of the physical habitat. Furthermore, substances such as phosphorus, heavy metals, pesticides and other organic compounds can bind themselves to soil particles and potentially can be enter water bodies via suspended solids. Drilling fluid will use Bentonite which is non-toxic.

Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and are persistent in the environment. They are also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of ± 0.5 of a pH unit.

Nutrient run-off can also be caused by forest felling. When trees are felled, the timber is removed but the brash (foliage and branches) is usually left on the ground. As the brash decays nutrients are released and being highly mobile can be transported into streams and rivers through the site drainage system. This nutrient run-off can contribute to eutrophication in downstream waterbodies. The effect of eutrophication is to promote excessive plant and algal growth, which depletes the water of available oxygen causing the death of other organisms such as micro-invertebrates and fish.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

The main works at the Ballynalacken Windfarm Project relate to the construction of 12 turbines and access roads and ancillary works at the Ballynalacken Windfarm site, the construction of the Internal Cable Link, Tinnalintan Substation, and the construction of Ballynalacken Grid Connection to Moatpark. These works are upstream of, and hydrologically connected to the River Barrow and River Nore SAC, the River Nore SPA and the River Nore and Abbeyleix Woods Complex pNHA.

Project works in the Dinin River catchment and any haul route works in the Nore catchment downstream of Ballyragget are downstream of the River Nore and Abbeyleix Woods Complex pNHA, and therefore are not hydrologically connected to the pNHA, the potential for impacts can be excluded.

The Ballynalacken Windfarm site is proposed for a location upstream of the River Barrow and River Nore SAC, spread over a number of riverbody catchments – and is 2km from the SAC in the Owveg(Nore)_040 catchment, 6.7km from the SAC in the Castlecomer Stream_010 catchment, 4.4km from the SAC in the Cloghnagh_010 catchment. The boundary of the SPA is generally further downstream from the Ballynalacken Windfarm – 4m, 22.5km, and 16km respectively. In relation to Tinnalintan Substation and the Ballynalacken Grid Connection which are located to the southwest of the windfarm, the SAC is c.600m from the Tinnalintan Substation site

and c.90m from the Ballynalacken Grid Connection at W3 where it crosses over/drills under an existing bridge on the regional road. The SPA is 90m further downstream – i.e. 690m and 180m. The River Nore/Abbeyleix Woods Complex pNHA overlaps the boundary of the SAC, with hydrological connectivity to the Project in the Nore_120 catchment.

Due to the close proximity of the SAC/SPA/pNHA to the main elements of the Ballynalacken Windfarm Project, the potential magnitude is Large Adverse (worst-case scenario only)

The construction and installation of ancillary works such as the Haul Route Works remote from the site (with the exception of HR8) will have no effect on water quality in the SAC or SPA due to the very small extent and brief duration of works, and the location of these works either within or immediately adjacent to the public road network.

Impact Magnitude	Potential for Large Adverse	**Impact Significance: *(pre-mitigation)***	**Potential for Significant impacts**

Mitigation and Monitoring Measures which will be implemented are presented along with a brief description of their effectiveness in avoiding, reducing or otherwise ameliorating the potential Significant impact.

**See Chapter 19: Mitigation and Monitoring Arrangements for full wording of mitigation measure*

Design	Avoidance of on-site sensitive hydrology features by constraints mapping (i.e. buffer zones)
Design	Avoidance of areas of peat
Design	No temporary storage of overburden in the Owveg_Nore_040 Catchment
Design	Construction and installation of the site drainage network *(see Volume B: Planning Drawing 101 to 106 and 501 to 503)*
Design	Implementation of the Surface Water Management Plan *(see* Environmental Management Plan*)*
Design	Use of es at selected site entrances
SM02*	Pre-construction confirmatory surface water quality monitoring and recording.
SM11	The construction Method Statements to be developed by the construction contractors will take full account of the EMP including the mitigation and monitoring measures and will be reviewed by the Environmental Manger prior to the commencement of construction works.
SM12	All construction works will be monitored for compliance with the Environmental Management Plan by the project Environmental Management Team which will include an Environmental Clerk of Works, the Project Ecologist and specialists such as a hydrologist, who are independent of the site contractors. The Environmental Management Team will report to the owner's Project Manager.
SM14	A suitably qualified engineer will supervise all windfarm site excavations and construction works.
SM15*	Regular inspection of the windfarm drainage network by the Contractor and Project Hydrologist.
SM16*	Regular surface water quality monitoring and recording during the Construction Phase in accordance with the Surface Water Management Plan. *(the SWMP is included in the Environmental Management Plan for the Project, which accompanies the planning application).*
SM17*	Monitoring of Q values and sediment build up immediately downstream of instream works dam locations (D1, D2).
SM20	The Project Ecologist will liaise with the Contractors on a weekly basis regarding the upcoming schedule of works and will advise the Contractors of any particular ecological protection requirements at specific locations on site.
SM27	The construction of the Ballynalacken Windfarm Project will be carried out in accordance with an Environmental Management Plan (EMP). The EMP will include all of the mitigation measures and monitoring arrangements for the Project. An Environmental Clerk of Works will be appointed, independent of the main construction Contractor, and will carry out weekly audits on EMP compliance. If non-compliance is detected, then, prompt corrective action will be agreed and committed to by the Contractor, with a view to the swift and effective resolution of any deviations from the EMP requirements. The EMP will be an important contract document for the main construction contractor (Contractor) who will be contractually obliged to comply with the EMP and the requirements of the Environmental Clerk of Works. Furthermore, if a significant unforeseen environmental effect takes place, then, the Environmental Clerk of Works will have a 'stop-works' authority to temporarily stop works at the works location until the issue is resolved.

MM01	The boundaries of the Construction Works Area will be fenced to prevent the encroachment of construction phase personnel, machinery or materials beyond this boundary. In agricultural lands, livestock proof fencing will be used, with landowner access maintained through the provision of gates along the boundary fences.
MM02	Construction traffic, personnel and materials will be restricted to within the Construction Works Area Boundary fence. Machinery will be kept on the windfarm site roads and hardstanding areas, and, aside from advancing excavations, will avoid moving onto areas not delineated on the site drawings
MM03	Land reinstatement will not be carried out during very wet weather or when the soil is waterlogged. If any compaction has occurred along the construction works area, these areas will be ploughed with a sub-soiler to loosen the subsoil layer.
MM05	During windfarm construction works, excavations will be backfilled as soon as is possible.
MM06	During windfarm construction works, excavated material will be removed for temporary or permanent storage at designated berms and with the exception of T3 and Borrow Pit No.2, will be placed more than 50m away from any watercourse or wet drainage feature. Temporary silt control methods such as silt fencing will be placed around all overburden storage areas and the existing vegetative between the berms and watercourse / drainage features will be left in place.
MM07	All storage berms will be graded and sealed following emplacement. Topsoil and subsoil will be stockpiled separately. The upper vegetative layer (where still present) of excavated soil will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored spoil within the storage areas. Re-seeding will also be carried out in these areas. Measures such as interceptor ditches around the bases of these areas, sediment traps, covering of berms will also be incorporated to prevent runoff of suspended solids, dust and soil erosion.
MM08	Along the cable route on the public road, there will be no storage of overburden and all excavations from road trenches will be removed to licensed waste facilities in accordance with the Waste Management Plan. The excavated material will be covered during transportation to prevent spillages and reduce dust.
MM09	All excavations which are unsuitable for use as construction/reinstatement material which arise within the catchment of the Owveg River (T9, T10, T11 and T12 and associated Windfarm Site Roads) will not be stored within the catchment, instead these arisings will be transported to the temporary deposition area at Borrow Pit No.2 and at Turbine T7 (both located outside of the Owveg River catchment). In addition, a Siltbuster or other suitable treatment train will be used to remove fine silt particles from site runoff in this catchment. The Siltbuster will be set up at works locations and used during groundworks and earthmoving activities.
MM10	At the windfarm site, at works locations within 50m of watercourses or existing drainage features there will be additional mitigation measures deployed including double silt fencing prior to the commencement of the works, temporary drain blocking in existing drains, placement of silt trapping arrangements along preferential surface water flowpaths and, where necessary, the use of matting to prevent ground erosion and rutting. Works will not take place within this zone during prolonged heavy or exceptional rainfall events.
MM11	Weather forecasts will be consulted in advance of works. If there is heavy prolonged rainfall or if an exceptional rainfall event occurs, then construction works will cease until peak flows have subsided.
MM12*	Site roads and hardstanding areas have a permanent surface water drainage network, the borrow pits will have a temporary surface water drainage network in place during works. The site drainage network will include check dam, settlement ponds and buffered outfall weirs.
MM13	It is proposed that bedrock won from the on-site borrow pits during the construction phase (i.e. sandstones) will only be used to construct the sub-base layer of proposed upgraded and new access roads and hardstand areas. Once installed the sub-base layer will be overlain by a capping layer of clean high-grade bedrock, such as limestone, which will be sourced from local quarries. This will be ongoing during the operational phase as during road maintenance.
MM14	At the windfarm site, where dewatering of excavations is required, no freshly pumped water will be permitted to enter the existing drainage network directly or be pumped out onto adjacent

	habitat. Rather, all pumped water will be treated prior to discharge using an infiltration trench or settlement pond or suitable water treatment train such as a Siltbuster, as appropriate.
MM15	Along the cable routes, where dewatering of trenches or excavations is required, there will be no direct discharge of treated water into any watercourse or drain. Rather, all pumped water will be discharged via a silt bag.
MM17	New culverts which will be installed at watercourses or wet drainage channels will be bottomless or clear spanning.
MM18	In-stream works will not be undertaken without isolation of flow within the watercourse. A pre-works survey will be carried out by the Project Ecologist and any fish, if present, within the isolated section will be removed using electrofishing and transferred immediately downstream of the crossing point and placed back in the water. The water will be isolated from the works by over pumping, flume (pipe) or channel diversion methods.
MM19*	At wet drainage channels, instream works will be followed by site-specific reinstatement measures to ensure the restoration of flow character and morphology within the affected reach.
MM20	Only precast concrete culverts will be used for new watercourse crossing structures on the windfarm site. Only precast concrete chambers will be used at Joint Bay locations.
SM18	The plant and machinery will be regularly inspected for leaks and maintained in good working order for the duration of the works.
SM19	Fuel, oil and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage.
MM21*	Concrete control procedures will be implemented including no batching; ready mixed concrete will be used for all foundations; work scheduled for dry days; experienced operators; run-off will be settled out and no concrete truck washing on-site.
MM22*	Fuel/oil control procedures will be implemented including control of on-site refuelling of plant and machinery; provision of spill kits. trained operatives, use of double-skinned mobile bowsers. Emergency Response Plan in place.
MM23	There will be no refuelling of vehicles or plant permitted within 100m of a watercourse or wet drainage channel or local spring/well.
MM24*	All fuels or oils will be stored in designated, bunded, locked storage areas and fitted with a storm drainage system and an appropriate oil interceptor. Emergency Response Plan in place.
MM25	Overnight parking of plant and machinery will only be permitted at locations which are greater than 50m from watercourse/drainage features and at an existing hard-core surface. Drip trays and fuel traps will be used under and around parked plant and machinery to contain any leaks.
MM26	All associated tree felling will be undertaken using good working practices as outlined by the Forest Service in their 'Forestry Harvesting and Environment Guidelines' (2000) and the 'Forestry and Water Quality Guidelines '(2000). Measures will include the protection of the riparian zones, installation of buffered drainage outfalls, installation of drains and silt traps as soon as possible once felling has been completed, and a regime of continued monitoring of silt traps and drainage outfalls will be implemented. All excess felled brash will be removed off site to avoid release and runoff of phosphorous into sensitive watercourses.
MM27	In-stream works in wet drainage channels (D1, D2) will only be undertaken during the IFI specified period (July, August and September) and will be carried out in accordance with the *Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters* (IFI, 2016).
MM28	Works at W2 and W3 will take place when the Rathduff_15 is in its dry state and the works at W2 or W3 will be planned for periods of dry weather.
MM71	The horizontal directional drilling works at W3 will be carried out when the Rathduff_15 is in its dry state, to ensure that the works are carried out under a dry stream bed. The drilling works will be carried out by an experienced Drilling Contractor and supervised and managed by a competent and experienced Mud Engineer who understands the technicalities and challenges of drilling works. The Mud Engineer will advise the Construction Manager on the selection of competent drillers for the HDD works; monitor the watercourse bed during drilling works, and will supervise the drilling works including the drilling pressures and the implementation of any contingency measures. From a surface water quality protection perspective, the area around the launch/reception pit, bentonite batching, pumping and recycling plant will be bunded using

	appropriate terram geotextile and/or sandbags in order to contain any spillages. Drilling fluid returns will be contained within a sealed tank / sump to prevent migration from the works area. Spills of drilling fluid will be cleaned up immediately and stored in an adequately sized watertight skip before being taken off-site to a suitably licensed waste facility. In the event of a break-out occurring, the Environmental Emergency Response Procedure for Frac-Out will be implemented which includes the following contingency measures; • In the event of break-out occurring in the stream bed, the rig will immediately shut off the pumps and the drilling assembly will be pulled off to reduce annular pressures; • In the event of break-out on the road an excavator will be available to dig a pit to contain fluid with vacuum trucks/pumps available to transfer drill fluid from the containment point back to the recycling point; and in either scenario, drilling fluid additives designed to plug the formation will be introduced to the circulation system and let set. Environmental Emergency Response Procedures are included in the Ballynalacken Grid Connection Environmental Management Plan.

Effectiveness of Mitigation and Monitoring Measures:

The above measures are proven and effective best practice measures which will avoid and minimise the risk of sediment or contaminant release by:

- reducing the potential for sediment/hydrocarbon/cementitious material/nutrient release (limestone capping, weather related restrictions, management of overburden, concrete controls, refuelling controls, inspection of plant and machinery, removal of brash),
- capturing and treating any sediment, hydrocarbons/cementitious material/nutrients that is released (silt fencing, Siltbuster, drainage system, emergency response oil kits, wheel washes, designated concrete wash out area, bunds on oil/fuel storage areas/tanks),
- thereby breaking or reducing the pathway between the potential sources and the receptor.

Furthermore, the ongoing monitoring of water quality in downstream watercourses and the inspection of drainage systems and of the construction works by an Environmental Clerk of Works (with 'stop works' authority) will ensure that any decreases in water quality are identified and rectified at an early stage.

Following the implementation of mitigation measures, no significant impacts are likely to occur and the residual impact to downstream Designated Sites will be Imperceptible.

Residual Impact Significance *(post-mitigation)*:	**Imperceptible**

EIAR 8.3.4.2.2	**Potential erosion and flow regime effects to the River Barrow and River Nore SAC, River Nore SPA and River Nore/ Abbeyleix Woods Complex pNHA**
Sensitive Aspect: Importance:	Designated Site – River Barrow & River Nore SAC **Extremely High** (as per Section EIAR 8.3.4.1)
Impact Source(s)	New permanent access roads, access road upgrades and hardstanding areas, site drainage network
Impact Pathway(s)	Runoff, drainage routes and surface water flow paths, downstream watercourses
Project Stage	Construction and Operational Phases

Overview of Impact (general):

Progressive replacement of vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the site and increase flood risk downstream of the development. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems. In reality, the access roads will have a similar permeability to the underlying soils. However, it is conservatively assumed in this assessment that the proposed access roads and other hardstand areas are impermeable.

The construction of drainage channels could potentially result in changes to local drainage regimes, if not designed appropriately.

Examination of the Impact of the Proposed Ballynalacken Windfarm Project:

The emplacement of the proposed permanent hardcore (~6.1ha at the Ballynalacken Windfarm site, 1.3ha at Tinnalintan Substation), as described in Chapter 5 of the EIAR, could (assuming emplacement of impermeable materials as a worst-case scenario) result in an average total site increase in surface water runoff of approximately 1,077m^3/month or 35m^3/day (*see Section EIAR 8.3.1.2.4*). This represents a potential increase of only approximately 0.43% in the average daily/monthly volume of runoff from the site area in comparison to the baseline pre-development site runoff conditions.

This is a very small increase in average runoff and results from a relatively small area of the overall site area being developed. Specifically, the proposed permanent development footprint represents only 2% of the total project landholding area of 300ha (development redline boundary), and 0.004% of the River Nore catchment as far downstream as (and including) the Nore_SC_100 subcatchment.

The additional runoff volume is low due to the fact that the runoff potential from the project site is already relatively high (85% runoff coefficient) due to the prevailing baseline hydrogeological conditions at the site. Also, this calculation assumes that all hardstanding areas will be impermeable which is a conservative approach given that access tracks and crane hardstands will be constructed of aggregates which will facilitate the permeation/recharge of rainfall. No perceptible changes in water quantities in the downstream SAC, SPA or pNHA will occur.

In relation to the impact of the site drainage network on existing drainage patterns or surface water flow paths: the design of the drainage network has been carried out by Hydro Environmental Services and has taken full account of the existing drainage regimes and surface water flow paths at the site. There will be no change to the existing drainage regimes as a result of the Project because the surface water drainage system, which forms part of the Project design, incorporates regular clean water cross drains which will ensure that there will be no change to existing drainage regimes or flow paths. The impact will be Neutral and is scoped out from further examination.

Impact Magnitude	Negligible	**Impact Significance:** ***(pre-mitigation)***	**Imperceptible**

Mitigation and Monitoring Measures: Even though Significant impacts are not predicted; the following mitigation and monitoring measures will be implemented as best practice environmental management.

Design	Use of aggregate (gravel) to construct and surface windfarm site roads, compounds and turbine hardstanding areas.

Design	Construction and installation of the site drainage network *(see Volume B: Planning Drawings 101 to 106 and 501 to 503)*
Design	Implementation of the Surface Water Management Plan
MM11	Weather forecasts will be consulted in advance of works. If there is heavy prolonged rainfall or if an exceptional rainfall event occurs, then construction works will cease until peak flows have subsided.
MM12	Windfarm site roads and hardstanding areas are designed to have a permanent surface water drainage network in place. Temporary works areas, including the borrow pits and temporary compounds will have a temporary surface water drainage network in place during works. The drainage infrastructure will not be installed during heavy or prolonged rainfall events or when the soil is waterlogged. The site drainage network will ensure that all surface water runoff from upgraded roads and new road surfaces (including hardstand areas) will be captured and treated prior to discharge/release. Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains; The site drainage network will include check dams and settlement ponds which will settle suspended solids in water runoff while also slowing down the rate of water run-off from these areas. Water will be released to surrounding vegetation at regular intervals via buffered outfall weirs, which also form part of the drainage network.
MM16	All new watercourse crossing structures will be sized to cope with a minimum 100-year flood event. In all cases, culverts will be oversized to allow mammals to pass through the culvert. The construction of new watercourse crossing structures will be carried out in accordance with the Office of Public Works (OPW) Guidelines Construction, Replacement or Alteration of Bridges and Culverts (2013), and also with the Department of Transport, Tourism & Sport Guidelines for Managing Openings in Public Roads (April 2017).

Effectiveness of Mitigation and Monitoring Measures:

The Drainage Plan will deploy proven and effective measures to attenuate runoff and mitigate the risk of flooding. The proposed integration of the windfarm drainage with the existing forestry/land drainage is a key component of the proposed drainage management within the development. By integration we mean maintaining surface water flowpaths where they already exist, avoid creation of new or altered surface water flowpaths, and maintaining the drainage regime (i.e. normal flow) within each forestry and land parcel compartment. Critically, there will be no alteration of the catchment size contributing to each of the main downstream watercourses. All development drainage water captured within individual river/stream sub-basins and will be attenuated and released within the same sub-catchments that it was captured.

As outlined in Section 3.5 of the Surface Water Management Plan we have designed settlement ponds for a 1 in 10 year return flow. This approach is conservative given that the project will likely be built over a much shorter period (12-18 months), and therefore this in-built redundancy in the drainage design more than accounts for any potential short term climate change rainfall effects.

The residual effect will be - Neutral, imperceptible indirect, long term, likely effect on down gradient streams/rivers.

Residual Impact Significance *(post-mitigation)*:	**Neutral**

EIAR 8.3.4.3 Cumulative Impact on Designated Sites with Other Projects

EIAR 8.3.4.3.1 Introduction to the Cumulative Evaluation for Designated Sites

The Ballynalacken Windfarm Project (*whose effects range from Neutral to potentially Significant, as per Section EIAR 8.3.4.2*) was examined for potential to have cumulative effects on Designated Sites with other existing and permitted projects, and projects advanced in the planning system. These projects are referred to as 'Other Projects' herein.

A Cumulative Study Area is set out below and Other Projects located within this Study Area are identified and examined for in-combination effects with the Ballynalacken Windfarm Project. The potential for off-site and secondary consequential development is also considered.

EIAR 8.3.4.3.2 Cumulative Study Areas

The upper catchment of the River Nore– i.e. Nore_SC_010, Nore_SC_020, Nore_SC_030, Nore_SC_040, Erkina_SC_010, Nore_SC_050, Nore_SC_060, Goul_SC_010, Nore_SC_070, Nore_SC_080, Nore_SC_090, Dinin[North]_SC_010, Dinin[South]_SC_010, and the Nore_SC_100.

This Cumulative Study Area includes the sub-catchments in which the Ballynalacken Windfarm Project is located (i.e. Nore_SC_060, Nore_SC_080, Dinin[North]_SC_010 and Nore_SC_100). The study area does not extent downstream beyond the Kilkenny City/Bennettsbridge (Nore_SC_100) because beyond this sub-catchment, dilution factors exclude any potential for perceptible cumulative effects with the Ballynalacken Windfarm Project.

In relation to groundwater dependant habitats in Designated Sites, a conservative scoping distance of 500m is used for cumulative effects on groundwater. As per Section EIAR 8.3.2, the proposed development does not have the potential to affect the GWB as a whole or alter the WFD status. Due to the shallow nature of the Internal Cable Link, Tinnalintan Substation and Ballynalacken Grid Connection, and the shallow and minor nature of haul route works, no perceptible effects to groundwater are expected to occur and as a result these elements are scoped out with regard cumulative hydrogeological effects. In relation to the Ballynalacken Windfarm, no other projects are located within the 500m study area, and Designated Sites are located further than 500m from the windfarm site, therefore the potential for cumulative groundwater effects to Designated Sites can be excluded.

EIAR 8.3.4.3.3 Evaluation of Cumulative Impacts

The Other Projects which occur within the Cumulative Study Area are identified in the table below and in Figure 8.10: Projects within Surface Water Cumulative Study Areas *(included at end of this chapter).*

The Ballynalacken Windfarm Project is examined below for cumulative effects with each of the Other Projects within the Cumulative Study Area. An evaluation of the collective cumulative impact of the Ballynalacken Windfarm Project in-combination with all the Other Projects then follows. The evaluation takes into account any existing sources of pollution or damage identified in Section EIAR 8.3.4.1.2.

Table 8-16: Evaluation of Ballynalacken Windfarm Project cumulatively with Other Projects

Other Project	Status	Evaluation of Cumulative impact
Laois-Kilkenny Grid Reinforcement Project Overhead 38kV Line between Moatpark and Loan	Under Construction Existing	No Likely Cumulative Impact: the groundworks within the Cumulative Study Area for the Laois-Kilkenny Grid Reinforcement Project will be completed by the time the Ballynalacken Project commences construction, while the Moatpark-Loan OHL and the Telecom Masts at Ballyouskill already exist, any areas of exposed soil (source of sediment run) will have revegetated. In relation to the recently approved extension to the Ballyragget Substation, effects will be negligible due to the small footprint of works. Any operational

Other Project	Status	Evaluation of Cumulative impact
Telecom Masts at Ballyouskill	Existing	activities will have negligible impacts to water in Designated Sites, and the potential for significant cumulative impacts can be excluded.
Farranrory Wind Farm Grid Connection Ballyragget & Parksgrove Solar Farm and Grid Connection Two Battery Energy Storage System applications at Moatpark	Consented	See Section EIAR 8.3.4.3.3.1 and Section EIAR 8.3.4.3.3.2
Mixed Use Development, Castlecomer	Consented	Neutral Cumulative Impacts: Retail development works will take place adjacent to the Castlecomer Stream_010 in Castlecomer town. With regard to the River Barrow & River Nore SAC, the nearest Ballynalacken Windfarm Project works (haul route works HR9 and HR10) will take place on hard surfaces, involve street furniture and overhead line removal in Castlecomer town along with small scale and very shallow excavation of soils at HR10, while there will be substantial separation distance to the main Ballynalacken Windfarm works, with negligible effects on water quality in the downstream SAC at the River Dinin (c.220m from HR10). It is therefore considered that the potential for perceptible cumulative impacts on water quality in the River Barrow and River Nore SAC can be excluded.
Hebron House (Hotel) Development	Consented	See Section EIAR 8.3.4.3.3.1 and Section EIAR 8.3.4.3.3.2
Lisdowney Wind Farm Gortahile Wind Farm Lisheen Wind Farm (part) Bruckana Wind Farm (part) Monaincha Wind Farm	Existing	See Section EIAR 8.3.4.3.3.2
Pinewood Wind Farm Cullenagh Wind Farm White Hills Wind Farm Bilboa Wind Farm	Consented	See Section EIAR 8.3.4.3.4.2
Tirlán Milk Processing Plant, Water Treatment Plant & Solar Farm, Anaerobic Digester Plant	Existing, Consented	Not Significant Cumulative Impact: due to the existing nature of the process plant and the localised nature of the proposed anaerobic digester plant works that will be confined within the existing Tirlán WWTP and Milk Processing Plant sites.
Wastewater Treatment Plants (including upgrade works*) a.Ballyroan* b.Ballyragget* c.Castletown i.Sion Road j.Purcellsinch l.Freshford	Existing	No Significant Cumulative Impacts: Existing WWTPs are considered to form part of the baseline environment. The upgrade works at Ballyragget WWTP will occur downstream of Ballyragget town; upgrade works at Ballyroan will occur at a substantial distance upstream of Ballynalacken. In addition, water protection measures are/will form part of the planning conditions for the existing WWTPs and will form part of any upgrade works. Considering the separation distances and dilution factors, the potential for significant cumulative impacts with the Ballynalacken Windfarm Project to water quality within the Designated sites can be excluded.

Other Project	Status	Evaluation of Cumulative impact
m.Castlecomer n.Coan o.Bilboa p.Deerpark q.Clogh-Moneenroe r.Newtown-Doonane s.Swan t.Ballinakill u.Durrow v.Ballacolla w.Clogh x.Abbeyleix y. Mountrath z. Coolrain aa. Camross ab. Borris-in-Ossory		
Existing Quarries Bennetsbridge Limestone Abbeyleix Sand Pit Shiel Sand & Gravel Killeany Ballymaddock Booth Concrete Kilsaran Ballinakill Spink Quarry Ironmills or Kilrush Inchmore Conahy Esker Brenstone Lismaine McKeon Stone Kilkenny Block Holdensrath Roadstone Bennettsbridge Dowling Quarries, Abbeyleix Ringstone Quarry, Coan East Hennessy Concrete Manor Stone, Oldglass Murphys Quarry, Firoda Carroll Quarries Lagan Quarries Mounthall Campions Quarry, Lisduff	Existing	No Significant Cumulative Impacts: This activity is considered to form part of the baseline environment. In addition, if quarries are discharging to local watercourses, they will do so under a discharge license, and therefore significant impacts from quarries to river waterbodies is unlikely to occur. Considering the separation distances and dilution factors between the quarries and the Ballynalacken Windfarm Project works, the potential for perceptible cumulative impacts with the Ballynalacken Windfarm Project to water quality within the Designated sites can be excluded.
Offsite Project – Forestry Replant Lands (outside of cumulative geographical boundary)	Future activity	No Cumulative Impact: The afforestation of 19.9ha of lands will only be carried out on licenced lands, which were subject to an afforestation license application. The application would have examined the potential for significant impacts to water in Designated Sites and appropriate mitigation measures and constraints would have been proposed, and the license would only have issued where there would be no likely significant impacts on the environment, including on the water environment or on Designated Sites, as a result of the afforestation. Therefore, it can be assumed that the Replant Lands will not cause significant impacts to water in Designated Sites on its own.

Other Project	Status	Evaluation of Cumulative impact
		In relation to cumulative impacts, The Promoter of Ballynalacken Windfarm Project is committed to replanting 19.9ha of forestry on lands outside of the River Nore and River Barrow catchments, therefore there is no potential cumulative impact to surface waters in Designated Sites within the study area.
Secondary Project – Other Energy Projects connecting to Tinnalintan Substation	Future project, unknown	No Likely/Neutral Cumulative Impact: Future connections of other energy projects, which may arise due to the existence of the Ballynalacken Tinnalintan Substation (if built), are currently not known/planned and in any case are likely to be constructed after the Ballynalacken Tinnalintan Substation exists – i.e. during the operational phase of the Ballynalacken Windfarm Project, therefore it is considered that there will be no overlap of construction periods, and the potential for cumulative construction phase effects can be excluded. In the scenario where such a connection takes place during the construction phase of the Ballynalacken Project, the other connection would likely involve the installation of underground cabling - either trenching across agricultural lands or under or alongside public and/or private access roads, or overhead line mounted on wooden poles. These other works would likely be small scale and short duration, and it is evaluated that when considered together with the proposed works at the Tinnalintan Substation or along the Ballynalacken Grid Connection route, which will also have limited potential to affect water quality, that cumulative impacts will not be significant.

The cumulative evaluation is presented in two parts, firstly at a sub-catchment scale with a focus on the sub-catchments within which the project is located, and secondly at the scale of the Nore catchment upstream of the Nore_SC_100 (i.e. the catchment upstream of Bennettsbridge).

EIAR 8.3.4.3.3.1 Designated Sites - Cumulative Evaluation at Sub-Catchment scale

In terms of potential cumulative effects on a sub-catchment scale, the key factor for limiting hydrological effects is that the 12 no. proposed turbines are distributed across 3 no. sub-catchments (i.e. Nore_SC_060 has 4 no. turbines, Dinin(North)_SC_010 has 2 no. turbines and Nore_SC_080 has 6 no. turbines). The Tinnalintan Substation and Ballynalacken Grid Connection are also drained by local river waterbodies in which no turbines are proposed. The haul route works are spread across 4 no. sub-catchments.

This significantly reduces the overall potential for cumulative effects to occur on the downstream River Barrow and River Nore SAC, River Nore SPA and the River Nore/Abbeyleix Woods Complex pNHA.

Nore_SC_080: The highest number turbines from the Ballynalacken Windfarm Project site are located in the Nore_SC_080 which has 6 no. turbines and 1 no. borrow pit. With regard the Nore_SC_080, there are no other wind energy developments existing, consented or proposed in the sub-catchment. There are several quarries and water treatment plants located in the Nore_SC_080, but due to discharge licence requirements and discharge limits quarries are unlikely to contribute to significant cumulative effects. No significant cumulative effects on the River Barrow & River Nore SAC in the Nore_SC_080 are likely.

Dinin(North)_SC_010: Within the Dinin (North)_SC_010, which has 2 no. turbines and 1 no. borrow pit from the Project site, there are no other wind energy developments existing, consented or proposed in the sub-catchment. There are several quarries and wastewater treatment plant discharges, but due to discharge licence requirements, it is evaluated that they are not likely to contribute to cumulative effects. Similarly, due to the minor nature of the proposed Haul Route Works and the relatively small scale of the consented Mixed-Use retail development in Castlecomer town, these works are not likely to contribute to cumulative effects.

Overall, development in the Dinin(North)_SC_010 is minimal and collective cumulative hydrological effects on the River Barrow & River Nore SAC are unlikely.

Nore_SC_060: The potential for significant cumulative effects on the River Barrow & River Nore SAC is highest in the Nore_SC_060. In the Owveg River catchment, 4 no. turbines are proposed from the Ballynalacken Windfarm Project site, due to the proximity of the SAC (2km downstream at Loughill Bridge) and also due to fact that 2 no. other windfarms - Cullenagh Wind Farm and Pinewood Windfarm, have received planning consent, but are not yet built. Collectively these two other windfarms could have 19 no. turbines operating in the Owveg River catchment within the Nore_SC_060 sub-catchment. However additional mitigation is proposed for the Ballynalacken Windfarm Project in the form of water treatment train technology (i.e. Siltbuster) and removal of all unsuitable excavated material from the catchment at the Ballynalacken Windfarm site which will ensure that any impacts from Ballynalacken will be negligible and that no significant cumulative effects will occur to water quality within the SAC even in an worst case scenario (i.e. construction phase overlap of the Pinewood Windfarm, Cullenagh Wind Farm and Ballynalacken Windfarm). It is noted that both Pinewood Wind Farm and Cullenagh Wind Farm include measures to prevent significant impacts to downstream waterbodies.

At a wider scale, cumulative impacts in the Nore_SC_060 are considered in relation to projects located in proximity to Tinnalintan Substation and Ballynalacken Grid Connection works, where a number of other grid connections and battery energy storage projects could also potentially be constructed during the same time as Ballynalacken. The works for these other projects will involve trenching along public roads and across agricultural grassland and two directional drill crossings of the River Nore to connect the Farranrory Windfarm and the Ballyragget & Parksgrove Solar Farms to the existing EirGrid Ballyragget Substation at Moatpark. Should these projects be constructed during the same period as the Tinnalintan Substation and Ballynalacken Grid Connection (which also connects into Moatpark Substation).it is evaluated that due to the linear nature of the grid connection projects and the dispersed nature of the solar and Battery Energy Storage System projects, it's unlikely they will contribute cumulatively to measurable water quality effects. It is noted that mitigation measures which are proposed for protection of Kingfisher relate to the bridge crossing over the Rathduff_15 stream, which is immediately upstream of the SAC, SPA and pNHA site boundaries. This mitigation measures requires that the grid connection works at the bridge crossing on the public road (W3) are carried out when the Rathduff_15 is in its dry state (the Rathduff_15 is dry for at least part of the year) – this mitigation measure, will also remove the pathway for impacts between the Ballynalacken works at W3 and the Designated Sites, and no cumulative impacts are likely to occur.

Therefore, with the implementation of the proposed mitigation measures (both for the proposed development and the other developments) there will be no cumulative effects associated with the construction, operational or decommissioning phases of the proposed Ballynalacken Windfarm Project and Other Projects on the River Barrow & River Nore SAC, the River Nore SPA, or the River Nore/Abbeyleix Woods Complex pNHA.

Nore_SC_100: Due to the fact that proposed Ballynalacken Wind farm development inside the Nore_SC_100 is limited to haul route works (which are not expected to cause any perceptible effects due to proposed minor arrangement works on existing roundabouts), the potential for cumulative effects to arise with other developments such as the Hebron House (hotel) Development are less than perceptible. The localised nature of the Hebron House works, which are confined within the hotel site, is not likely to cause any perceptible effects.

EIAR 8.3.4.3.3.2	Designated Sites - Cumulative Evaluation at Upper Nore Catchment scale

When all of the Projects within the Nore River catchment upstream of Bennettsbridge (i.e. the Nore_SC_100 and all upstream catchments), it is considered that the effects will be imperceptible.

This is assessed due to the size of the River Nore catchment downstream of the proposed project size (1,745km^2) and subsequent large flows in the river itself.

Due to the size of the regional cumulative study area (1,745km^2) and subsequent large flows in the Nore river itself, significant hydrological effects on designated sites will not occur. For example, the proposed project site drains to the River Nore via 4 no. sub-catchments (Nore_SC_060, Dinin(North)_SC_010, Nore_SC_080 and Nore_SC100) which have respective catchment areas of 107, 149, 109 and 92km^2. Individually, these sub-catchment areas only account for between 5.3% and 8.5% of River Nore catchment with the cumulative study area. Overall, the potential for dilution effects is very high considering the relatively small size of the individual the sub-catchments (compared to the regional study area) and the regional flows in the River Nore Itself.

Considering the above hydrological and geographical factors, even in the absence of mitigation, worst case hydrological cumulative effects on designated sites will not be significant.

Therefore, with the implementation of the proposed mitigation measures (both for the proposed project and for the other developments) there will be no cumulative effects associated with the construction, operation or decommissioning phases of the proposed Ballynalacken Windfarm Project when considered collectively in combination with other wind farms and large scale infrastructure developments within the regional River Nore catchment and its associated Designated Sites.

EIAR 8.3.5 Statement on Certainty and Sufficiency of Information Provided

A clear documentary trail is provided throughout this chapter and chapter appendices to the competency of data and methods used and the rationale for selection of same. The information used to compile this chapter is collated from site-specific investigations, data and documents generated by public bodies and statutory agencies. The online baseline data was verified in the field.

The criteria used for water (hydrology and hydrogeology) appraisals are derived from the National Roads Authority (2008) guidance document. All documentation used is referenced at the end of the chapter.

In respect of Water, no material limitations or difficulties were encountered during the course of the studies carried out to inform the assessment of impacts of the Ballynalacken Windfarm Project on the Environmental Factor - Water.

EIAR 8.3.6 WATER FRAMEWORK DIRECTIVE STATUS

The purpose of the Water Framework Directive (WFD) compliance assessment (attached as **Appendix 8.4**) is to determine if any specific components or activities associated with the project will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment determines the water bodies with the potential to be impacted, describe the proposed mitigation measures and determine if the project is in compliance with the objectives of the WFD.

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

The WFD Water Action Plan (2024) requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

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

The River Basin Management Plan (2022 - 2027)/Water Action Plan 2024 objectives, which have been integrated into the design of the proposed wind farm development, include:

- Ensure full compliance with relevant EU legislation.
- Prevent deterioration.
- To protect, enhance and restore water bodies with the aim of achieving at least good status.
- Meet the water standards and objectives for designated protected areas.
- Protect high-status waters.
- Implement targeted actions and pilot schemes in focus sub-catchments aimed at (i) targeting water bodies close to meeting their objective and (ii) addressing more complex issues that will build knowledge for future cycles.

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

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

There is potential for effects on the WFD qualitive status, however due to the distribution of the windfarm and grid connection site within 3 no. sub-catchment and 4 no. sub-basins the potential for negative effects on the WFD status is significantly diminished.

There is no direct discharge from the proposed Ballynalacken Windfarm Project to downstream receiving surface waters or the underlying groundwater bodies.

Mitigation for the protection of surface and groundwater during the construction phase of the proposed development will ensure the qualitative and quantitative status of the receiving waters will not be altered by the proposed project.

There will be no change in groundwater body or river waterbody status in the underlying groundwater bodies or downstream river waterbodies resulting from the proposed Ballynalacken Windfarm Project development.

There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying groundwater bodies and downstream surface waterbodies are protected from any potential deterioration.

In summary, there will be **no residual effect on Groundwater Body WFD status or River Waterbody WFD status** as a result of the development of the Ballynalacken Windfarm Project.

EIAR 8.4 Summary Conclusion

SURFACE WATER BODIES:

Regionally, the Ballynalacken Windfarm Project site is located in the River Nore surface water catchment and locally the windfarm is located within the Cloghnagh river, Castlecomer Stream and Owveg River sub-catchments.

During each phase of the proposed Ballynalacken Windfarm Project (construction, operation, and decommissioning) a number of activities will take place at the proposed development site, some of which will have the potential to affect the hydrological regime or water quality at the proposed site or downstream of the proposed site. These potential effects generally arise from sediment input from runoff and other pollutants such as hydrocarbons and cement-based compounds.

Surface water drainage measures, pollution control and other preventative measures have been incorporated into the project design and proposed as mitigation to minimise significant impacts on surface water quality. The surface water drainage plan will be the principal means of significantly reducing sediment runoff arising from construction activities and to control runoff rates. The key surface water control measure is that there will be no direct discharge of wind farm runoff into local watercourses or into the existing drainage networks. This will be achieved by avoidance methods (i.e. stream buffers) and design methods (i.e. surface water drainage plan). Preventative measures also include fuel and concrete management and a waste management plan which will be incorporated into the Surface Water Management Plan.

In terms of cumulative hydrological effects arising only from elements of the proposed project (Ballynalacken Windfarm site infrastructure and ancillary works, Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection, and haul route works and activities), no likely significant effects are expected as the majority of the proposed Ballynalacken Windfarm site (including all 12 no. turbines) are located in different sub-catchments to that of the Tinnalintan Substation, Ballynalacken Grid Connection and haul route works.

Due to the size of the regional cumulative study area used in the EIAR (1,745km^2), subsequent large flows in the River Nore itself and the fact that the proposed project site drains to the River Nore via 4 no. sub-catchments, significant cumulative hydrological effects with other proposed developments (such as other wind farms) will not occur.

GROUNDWATER BODIES:

Due to the nature of wind farm developments and associated grid connections, being near surface construction activities, effects on groundwater bodies are generally imperceptible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater would be from oil spillage and leakages at turbine foundations or during construction plant refuelling. These are common potential impacts to all construction sites (such as road works and industrial sites). These potential contamination sources will be carefully managed at the proposed site during the construction, operational and decommissioning phases of the development and measures are proposed within the EIAR to deal with these potential minor local impacts. Also, the aquifers that underlie the majority of the proposed Ballynalacken Windfarm Project site are generally unproductive with localised groundwater flow patterns and therefore hydrogeological cumulative effects between elements of the proposed Project and other developments locally will not occur.

WATER SUPPLY:

Surface water abstractions downstream of the Ballynalacken Windfarm Project site on the River Nore include the Ballyragget Public Water Supply and Kilkenny City Public Water Supply. Due to the separation distance between the main construction works at the windfarm site and these abstraction points, the dispersed nature of

the proposed windfarm site within 4 no. sub-catchments, the very small scale of the Project construction works area in the context of the size of the River Nore catchment upstream of the abstractions, it is considered that any impacts, even in worst-case unmitigated scenarios, will be imperceptible.

The proposed Ballynalacken Windfarm Project site is not located within the groundwater catchment (i.e. (groundwater source protection area) of any mapped Public Water Supply (PWS) or National Federation of Group Water Schemes (NFGWS) registered groundwater source.

The Ballynalacken Windfarm site is underlain mainly by poorly productive aquifers and groundwater flowpaths are therefore typically very short (300m). Consequently, it is expected that the majority of groundwater flows within the site emerge as springs/baseline along streams/rivers and leave the site as surface water flows and not groundwater flows. It is considered that the potential for impacts to local wells/springs is limited to physical contact with the well head/source or localized contamination of the source by fuel/oil spills/cement-based compounds or by sediment.

Due to the relatively shallow nature of the proposed Ballynalacken Windfarm Project along with the elevated position of the Ballynalacken Windfarm site (above local wells), the expected short groundwater flow paths of 300m, and the required minimum setback distance of 500m for turbines from private dwellings, effects to groundwater levels or flow in wells servicing local residences are not likely to occur.

DESIGNATED SITES:

A hydrological assessment of potential impacts on local designated sites was undertaken. Designated sites scoped in for assessment in this EIAR Water Chapter include two Natura 2000 sites (River Barrow and River Nore SAC, and the River Nore SPA) and four proposed Natural Heritage Areas (River Nore/Abbeyleix Woods Complex pNHA, Inchbeg pNHA, Ardaloo Fen pNHA, and Dunmore Complex pNHA). These Designated Sites are all located downstream of the Ballynalacken Windfarm Project.

Considering the spread out nature of the Ballynalacken Windfarm Project site over 4 no. sub-catchments, the large dilution effects in the River Nore and following implementation of the appropriate mitigation measures as outlined in the EIAR, no significant impacts on these designated sites will occur as a result of the Proposed Ballynalacken Windfarm Project.

Considering the above hydrological and geographical factors, even in the absence of mitigation, worst case hydrological cumulative effects on designated sites will not be significant.

Overall, it is evaluated that the impact on the Environmental Factor, Water, will be Imperceptible.

EIAR 8.5 Reference List for Water

Altmayer, A. (2017) *Freshwater protection – EU policy and the status of freshwater systems*, European Parliament, available: https://www.europarl.europa.eu/RegData/etudes/IDAN/2017/599280/EPRS_IDA(2017)599280_EN.pdf [accessed 02 July 2024].

Cause Water (n.d.) epa.ie, available: https://www.epa.ie/our-services/monitoring--assessment/assessment/irelands-environment/water/cause-water/ [accessed 02 July 2024].

Environmental Protection Agency (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports*, available: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf.

Forestry and Water Quality (n.d.) forestryfocus.ie, available: https://www.forestryfocus.ie/social-environmental-aspects/forests-and-water/forestry-and-water-quality/ [accessed 02 July 2024].

Maynooth University (n.d.) *What does climate change mean for Irish rivers?*, available: https://www.maynoothuniversity.ie/research/spotlight-research/what-does-climate-change-mean-irish-rivers [accessed 01 July 2024].

National Roads Authority (2009) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*.

Waters of Life (n.d.) *Hydromorphology*, available: https://www.watersoflife.ie/pressures/hydromorphology/#:~:text=Hydromorphology%20is%20a%20relatively%20new,shape%20of%20the%20river%20channel [accessed 01 July 2024].

EIAR 8.6 List of Figures for Water

FIGURES (overleaf)

Figure 8.1	Hydrometric Area and Sub-Catchments
Figure 8.2	Local River Waterbodies (Divided into Sub-Basins)
Figure 8.3	Site Drainage Map
Figure 8.4	OPW Past Flood Zone Event Map
Figure 8.5	Groundwater Bodies
Figure 8.6	Aquifers
Figure 8.7	Public Water Supply - Abstractions
Figure 8.8	Local Private Water Supplies
Figure 8.9	Designated Sites
Figure 8.10	Projects within Surface Water Cumulative Study Areas
Figure 8.11	Other Projects within Groundwater Cumulative Study Areas

EIAR 8.7 List of Appendices for Water

APPENDICES (overleaf)

Appendix 8.1	Surface Water Quality Monitoring Results
Appendix 8.2	Inventory of Watercourses and Wet Drainage Channels
Appendix 8.3	Flood Risk Assessment Report
Appendix 8.4	Water Framework Directive Assessment Report
Appendix 8.5	Methodology for the evaluation of Water

Figures for Water

EIAR Chapter 8: Water

Figure 8.1 - Hydrometric Area and Sub-Catchments

Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)
- Hydrometric Area HA15 - Nore Catchment

WFD SubCatchments:

- Nore_SC_080
- Dinin(North)_SC_010
- Nore_SC_060
- Nore_SC_100

Source: Environmental Protection Agency

BALLINAKILL
Nore_SC_060
DURROW
Internal Cable Link
HR12
HR13
Ballynalacken Grid Connection
Tinnalintan Substation
Eirgrid Ballyragget Substation
Ballynalacken Windfarm
Dinin(North)_SC_010
HR11
HR9
HR10
CASTLECOMER
BALLYRAGGET
Nore_SC_080
River Nore
HR8
HR7
HR6
HR5
HR4
HR2
HR3
KILKENNY CITY
Nore_SC_100
HR1
BAGENALSTOWN
Muine Bheag
Leighlinbridge
Leithghlinn an Droichid
N

Hydrometric Area HA15 - Nore Catchment

EIAR Chapter 8: Water

Figure 8.2 - Local River Waterbodies (Divided into Sub-Basins)

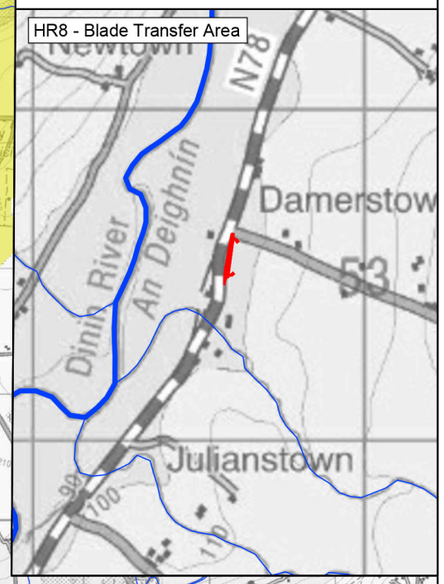
Legend:

- Ballynalacken Windfarm Project
- W2 Watercourse Crossing
- W2 Wet Drainage Channel Crossing
- Water Sampling Locations
- A6 Water Sampling Identification
- EPA Waterbodies

WFD River Sub Basins:

- Cloghnagh_010
- Castlecomer Stream_010
- Owveg(Nore)_040
- Nore_120
- Dinin(North)_040

Source: Environmental Protection Agency



EIAR Chapter 8: Water

Figure 8.3 - Site Drainage Map

Legend:

- Ballynalacken Windfarm Project
- EPA waterbody, including direction of flow
- Drainage channel, including direction of flow
- W2 Watercourse Crossing
- W2 Wet Drainage Channel Crossing

WFD River Sub Basins:

- Cloghnagh_010
- Castlecomer Stream_010
- Owveg(Nore)_040
- Nore_120

Source: Environmental Protection Agency

T12
Kilcronan
T11
T10
D4
Castlecomer Stream
T9
T8
T6
T7
T5
T4
Internal Cable Link
D1
D3
T3
W1
T2
D2
T1
Owveg River
Loughill
W2
Sraleagh
Ballymartin 15
Cloghnagh
River Nore
W3
Tinnalintan Substation
Ballynalacken Grid Connection
Rathduff 15
Eirgrid Ballyragget Substation
Cloghnagh
N

EIAR Chapter 8: Water

Figure 8.4 - OPW Past Flood Zone Event Map

Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)
- EPA waterbodies
- Single Flood Event
- Recurring Flood Event

Source: Office of Public Works - Floodinfo.ie

DURROW

BALLYRAGGET

CASTLECOMER

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12

HR9 HR10 HR11 HR12 HR13

Met Mast

Internal Cable Link

Ballynalacken Grid Connection

Tinnalintan Substation

Eirgrid Ballyragget Substation

N

EIAR Chapter 8: Water

Figure 8.5 - Groundwater Bodies

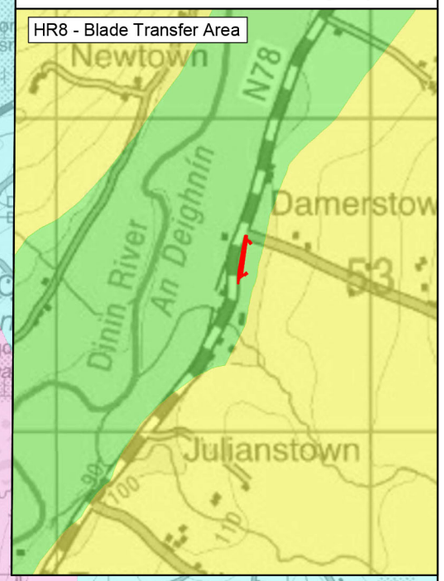
Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)

Ground Waterbody WFD:

- Ballingarry GWB
- Durrow GWB
- Castlecomer GWB
- Kilkenny-Ballynakill Gravels GWB
- Lisdowney GWB
- Newtown GWB

Source: Environmental Protection Agency



Met Mast
T12
T11
T10
T9
T8
T6
T7
T5
T4
T3
T2
T1
HR12
HR13
HR11
HR11
HR11
HR10
HR9
HR8
Internal Cable Link
Ballynalacken Grid Connection
Tinnalintan Substation
Eirgrid Ballyragget Substation
Ballingarry GWB
Durrow GWB
Castlecomer GWB
Kilkenny-Ballynakill Gravels GWB
BALLYRAGGET
CASTLECOMER
Loughill
Rathgarry
Skehana
Moyhora
Maigh Shamhraidh
Ballyoskill
Firoda Upper
Ballylinnen
Baile Uí Lonáin
Ballynalacken
Kiltown
Glenmagoor
Byrnesgrove
Garrannaguilly
Rathduff
Finnan
Seven Cross Rds
Rathkyle
Clashduff Upper
Ballyhimmin
Clashduff
Clashduff Lower
Toor More
Moyne
Tinalintan
Toor Beg
Coolnambrisklaun or Coolnacoppoge
Sleveen
Ballycomy
Knockanaddoge
Dysart Glebe
Tomakeany
Maudlin
Newtown
Donaghmore
Tinnalintan
Parksgrove
Moatpark
Grange
Oldtown
Nicholastown
Russellstown
Gorteenara
Glebe
Grenan
Attanagh
Áth Tanaí
Earlsgarden
Ballynafunshin
Raheenduff
Clorhaun
Fermoyle Cross Rds
Fortified House
Rosconnell
Castlemarket
Owenbeg River
An Abhainn Bheag
An Fheoir
Nore
Glashagar River
Ballymartin Cross Rds
Ballymartin Commons
Donaguile
Fulacht Fia
Sraleagh
Hillfort
Tobar Muire
Kilmacar Br
Dysart Br
Dinin River
An Deighnín
Coolraheen
N

EIAR Chapter 8: Water

Figure 8.6 - Aquifers

Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)

Groundwater Resources (Aquifers):

- Locally Important Aquifer - Bedrock which is Moderately Productive
- Poor Aquifer - Bedrock which is Generally Unproductive
- Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Regionally important gravel aquifer
- Regionally Important Aquifer - Karstified (diffuse)
- Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Source: Geological Survey Ireland Spatial Resources

HR8 - Blade Transfer Area

Met Mast
T12
T11
T10
T9
T8
T6
T7
T5
T4
T3
T2
T1
HR12
HR13
Internal Cable Link
HR11
HR11
HR11
HR10
HR9
HR8
Ballynalacken Grid Connection
Tinnalintan Substation
Eirgrid Ballyragget Substation
BALLYRAGGET
CASTLECOMER
N

EIAR Chapter 8: Water

Figure 8.7 - Public Water Supply - Abstractions

Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)
- Uisce Eireann Abstraction Point
- Spring
- Uisce Eireann Troyswood Kilkenny City Public Water Supply
- Uisce Eireann Radestown Reservoir
- Pipeline connecting the Radestown Reservoir to Troyswood (Currently under construction)
- Nore_160 DWPA
- Nore_120 DWPA
- Dinin (Main Channel)_020 DWPA
- EPA Waterbodies

Castlecomer Stream

Spring

Loughill

Nore_120 DWPA

Uisce Eireann Abstraction Point - Ballyragget

River Nore

HR11

HR11

Uisce Eireann Abstraction Point - Castlecomer

Glenmagoo or Firoda Lower

HR11

HR10

HR9

HR8

Dinin (Main Channel)_020 DWPA

Nore_160 DWPA

Kilkenny City Public Water Supply at Troyswood

Radestown Reservoir

N

EIAR Chapter 8: Water

Figure 8.8 - Local Private Water Supplies

Legend:

- Ballynalacken Windfarm Project
- Borrow Pit
- 500m of Ballynalacken Turbines or Borrow Pits
- Local Wells within 500m of Ballynalacken Turbines or Borrow Pits
- Ballynalacken Windfarm Construction Works Area (Areas subject to Excavations/Groundworks)
- 500m Study Area from the Ballynalacken Windfarm Construction Works Area
- Local Wells within 500m of the Ballynalacken Windfarm Construction Works Area

Groundwater Vulnerability:

- Vulnerability - Rock at or near Surface or Karst
- Vulnerability - Extreme
- Vulnerability - High
- Vulnerability - Moderate
- Vulnerability - Low

Source: Geological Survey Ireland Spatial Resources

LOUGHILL
BALLYOSKILL
BALLYMARTIN
TINNALINTAN
SRALEIGH
RATHDUFF
MOATPARK
BYRNESGROVE
Met Mast
Borrow Pit No.1
Borrow Pit No.2
GW_01
GW_02
GW_03
GW_04
GW_05
GW_06
GW_07
GW_08
GW_09
GW_10
GW_11
GW_12
GW_13
GW_14
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
HR12
HR13
L58442
R432
N

EIAR Chapter 8: Water

Figure 8.9 - Designated Sites

Legend:

- Ballynalacken Windfarm Project
- Haul Route Works remote from the windfarm site
- Special Area of Conservation (SAC)
- Special Protection Areas (SPA)
- Proposed Natural Heritage Areas (pNHA)
- EPA Waterbodies

WFD SubCatchments:

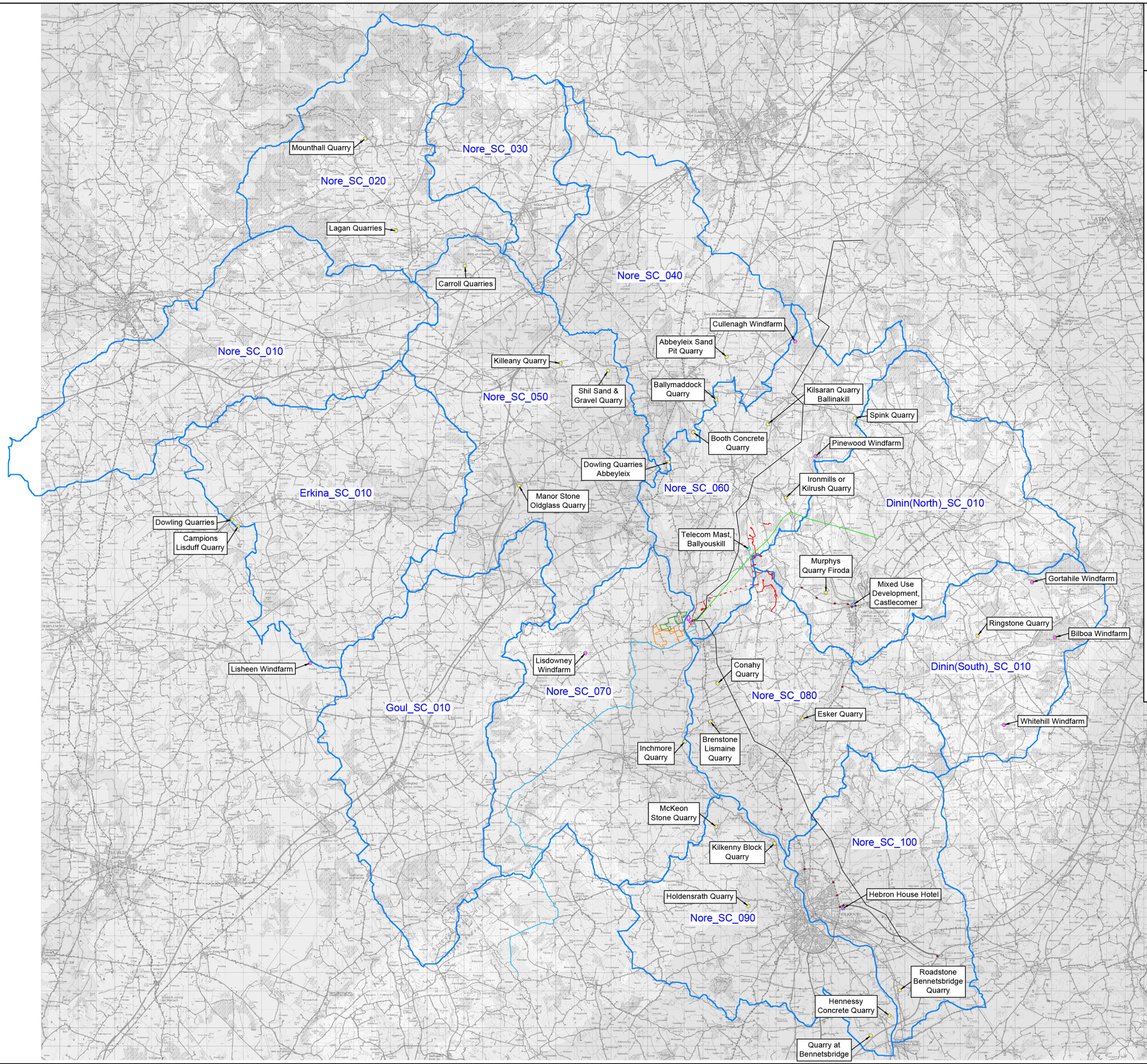
- Nore_SC_080
- Dinin(North)_SC_010
- Nore_SC_060
- Nore_SC_100

Source:
-National Parks & Wildlife Service
-Environmental Protection Agency

BALLINAKILL
DURROW
BALLYRAGGET
CASTLECOMER
JOHNSTOWN
Lisbginey Bog SAC (000869)
Owveg River
Kilcronan
Castlecomer Stream
Dinin River
Rathduff 15
Cloghnagh
Ballynalacken Windfarm Project
River Barrow And River Nore SAC (002162)
River Nore Abbeyleix Woods Complex pNHA (002076)
Galmoy Fen SAC (001858)
Cullahill Mountain SAC (000831)
River Nore SPA (004233)
River Nore
Spahill and Clomantagh Hill SAC (000849)
Inchbeg pNHA (000836)
The Loughans SAC (000407)
Ardaloo Fen pNHA (000821)
Dunmore Complex pNHA (001859)
N

EIAR Chapter 8: Water

Figure 8.10 - Projects within Surface Water Cumulative Study Areas



Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)
- Regional Cumulative Study Area - Subcatchments

Other Projects:

- Laois-Kilkenny Grid Reinforcement Project
- Moatpark - Loan 38kV Overhead Line
- Telecoms Masts, Ballyouskill
- Farranrory Wind Farm Grid Connection
- Ballyragget & Parksgrove Solar Farm and Grid Connection
- Battery Energy Storage developments (2) beside Moatpark
- Mixed Use Development, Castlecomer
- Hebron House Hotel
- Other Windfarms
- Tirlán processing plant, waste water treatment plant, anaerobic digester development, solar farm
- Quarries

EIAR Chapter 8: Water

Figure 8.11 - Other Projects within Groundwater Cumulative Study Areas

Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)

Other Projects:

- Laois-Kilkenny Grid Reinforcement Project
- Moatpark - Loan 38kV Overhead Line
- Telecoms Masts, Ballyouskill
- Farranrory Wind Farm Grid Connection
- Ballyragget & Parksgrove Solar Farm and Grid Connection
- Battery Energy Storage developments (2) beside Moatpark
- Mixed Use Development, Castlecomer
- Hebron House Hotel
- Tirlán Processing plant, waste water treatment plant, anaerobic digester development, solar farm

Laois-Kilkenny Grid Reinforcement Project

Telecoms Mast, Ballyouskill

Moatpark - Loan 38kV Overhead Line

Battery Energy Storage developments (2) beside Moatpark

Tirlán Processing plant, waste water treatment plant, anaerobic digester development, solar farm

Ballyragget & Parksgrove Solar Farms Grid Connection

Laois-Kilkenny Grid Reinforcement Project

Farranrory Wind Farm Grid Connection

Mixed Use Development, Castlecomer

Hebron House (Hotel) Development

N

Appendix 8.1 Surface Water Monitoring Results

Appendix to Chapter 8: Water

Appendix 8.1: Surface Water Quality Monitoring Results

Round 1 Sampling

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1697S003

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62378
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	01/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	01/09/2021
Sample Description:	SITE A3	**Date Certificate Issued:**	08/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	7	mg/l
Biochemical Oxygen Demand	SOP 2006	1	mg/l
Total Nitrogen	SOP 2075	2.4	mg/l
Nitrate	SOP 2060	11.44	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.06	mg/l P
Ammonia Nitrogen	SOP 2057	0.05	mg/l NH_3-N
Orthophosphate	SOP 2061	0.07	mg/l PO_4
Turbidity	SOP 2022	0.96	NTU

Signed: WD McCall Date: 08/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1761S006

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62379
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	02/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	02/09/2021
Sample Description:	SITE B2	**Date Certificate Issued:**	10/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	43	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	3.1	mg/l
Nitrate	SOP 2060	2.68	mg/l NO_3
Nitrite	SOP 2059	0.23	mg/l NO_2
Total Phosphorus	SOP 2125	0.51	mg/l P
Ammonia Nitrogen	SOP 2057	2.14	mg/l NH_3-N
Orthophosphate	SOP 2061	0.87	mg/l PO_4
Turbidity	SOP 2022	31.84	NTU

Signed: WD McCall Date: 10/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1761S005

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62379
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	02/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	02/09/2021
Sample Description:	SITE B3	**Date Certificate Issued:**	10/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	129	mg/l
Biochemical Oxygen Demand	SOP 2006	4	mg/l
Total Nitrogen	SOP 2075	<0.5	mg/l
Nitrate	SOP 2060	2.77	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.12	mg/l P
Ammonia Nitrogen	SOP 2057	0.06	mg/l NH_3-N
Orthophosphate	SOP 2061	0.06	mg/l PO_4
Turbidity	SOP 2022	62.72	NTU

Signed: WD McCall Date: 10/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1761S004

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62379
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	02/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	02/09/2021
Sample Description:	SITE B4	**Date Certificate Issued:**	10/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	432	mg/l
Biochemical Oxygen Demand	SOP 2006	6	mg/l
Total Nitrogen	SOP 2075	0.9	mg/l
Nitrate	SOP 2060	3.92	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus*	SOP 2125	3.09	mg/l P
Ammonia Nitrogen	SOP 2057	0.05	mg/l NH_3-N
Orthophosphate	SOP 2061	0.53	mg/l PO_4
Turbidity	SOP 2022	172.0	NTU

Signed: WD McCall Date: 10/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 2616S001

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES CARROLL	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	300921.E
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	30/09/2021
Sample Reference:	SURFACE WATERS	**Date Analysis Commenced:**	30/09/2021
Sample Description:	SITE B5	**Date Certificate Issued:**	14/10/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	41	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	<0.5	mg/l
Nitrate	SOP 2060	3.92	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus*	SOP 2125	9.77	mg/l P
Ammonia Nitrogen	SOP 2057	0.04	mg/l NH_3-N
Orthophosphate	SOP 2061	0.14	mg/l PO_4
Turbidity	SOP 2022	12.96	NTU
Chloride	SOP 2065	17.72	mg/l

Signed: WD McCall Date: 14/10/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1761S008

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62379
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	02/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	02/09/2021
Sample Description:	SITE B6	**Date Certificate Issued:**	10/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids*	SOP 2016	1757	mg/l
Biochemical Oxygen Demand	SOP 2006	<1	mg/l
Total Nitrogen	SOP 2075	0.8	mg/l
Nitrate	SOP 2060	4.00	mg/l NO_3
Nitrite	SOP 2059	0.10	mg/l NO_2
Ammonia Nitrogen	SOP 2057	2.06	mg/l NH_3-N
Orthophosphate	SOP 2061	0.23	mg/l PO_4
Turbidity	SOP 2022	641.0	NTU
Total Phosphorous*		1.68	mg/l

Signed: WD McCall Date: 10/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 2616S002

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES CARROLL	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	300921.E
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	30/09/2021
Sample Reference:	SURFACE WATERS	**Date Analysis Commenced:**	30/09/2021
Sample Description:	SITE B7	**Date Certificate Issued:**	14/10/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	16	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	1.6	mg/l
Nitrate	SOP 2060	4.62	mg/l NO_3
Nitrite	SOP 2059	0.10	mg/l NO_2
Total Phosphorus	SOP 2125	0.30	mg/l P
Ammonia Nitrogen	SOP 2057	0.14	mg/l NH_3-N
Orthophosphate	SOP 2061	0.48	mg/l PO_4
Turbidity	SOP 2022	4.73	NTU
Chloride	SOP 2065	17.72	mg/l

Signed: WD McCall Date: 14/10/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1761S003

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62379
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	02/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	02/09/2021
Sample Description:	SITE C1	**Date Certificate Issued:**	10/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids*	SOP 2016	4437	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	1.3	mg/l
Nitrate	SOP 2060	6.47	mg/l NO_3
Nitrite	SOP 2059	0.23	mg/l NO_2
Total Phosphorus*	SOP 2125	19.9	mg/l P
Ammonia Nitrogen	SOP 2057	1.76	mg/l NH_3-N
Orthophosphate	SOP 2061	2.11	mg/l PO_4
Turbidity	SOP 2022	462.5	NTU

Signed: WD McCall Date: 10/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1761S002

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62379
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	02/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	02/09/2021
Sample Description:	SITE C2	**Date Certificate Issued:**	10/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	7	mg/l
Biochemical Oxygen Demand	SOP 2006	<1	mg/l
Total Nitrogen	SOP 2075	2.1	mg/l
Nitrate	SOP 2060	9.86	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.05	mg/l P
Ammonia Nitrogen	SOP 2057	0.03	mg/l NH_3-N
Orthophosphate	SOP 2061	0.11	mg/l PO_4
Turbidity	SOP 2022	1.99	NTU

Signed:  Date: 10/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1697S002

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62378
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	01/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	01/09/2021
Sample Description:	SITE C3	**Date Certificate Issued:**	08/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	6	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	3.6	mg/l
Nitrate	SOP 2060	10.91	mg/l NO_3
Nitrite	SOP 2059	0.20	mg/l NO_2
Total Phosphorus	SOP 2125	0.05	mg/l P
Ammonia Nitrogen	SOP 2057	0.22	mg/l NH_3-N
Orthophosphate	SOP 2061	0.02	mg/l PO_4
Turbidity	SOP 2022	43.04	NTU

Signed: WD McCall Date: 08/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1761S001

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62379
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	02/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	02/09/2021
Sample Description:	SITE C4	**Date Certificate Issued:**	10/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	17	mg/l
Biochemical Oxygen Demand	SOP 2006	<1	mg/l
Total Nitrogen	SOP 2075	0.9	mg/l
Nitrate	SOP 2060	4.49	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2125	0.10	mg/l P
Ammonia Nitrogen	SOP 2057	0.09	mg/l NH_3-N
Orthophosphate	SOP 2061	0.20	mg/l PO_4
Turbidity	SOP 2022	7.29	NTU

Signed: WD McCall Date: 10/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 1697S001

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	62378
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	01/09/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	01/09/2021
Sample Description:	SITE C5	**Date Certificate Issued:**	08/09/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	51	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	2.3	mg/l
Nitrate	SOP 2060	7.96	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2125	0.21	mg/l P
Ammonia Nitrogen	SOP 2057	0.04	mg/l NH_3-N
Orthophosphate	SOP 2061	0.28	mg/l PO_4
Turbidity	SOP 2022	53.91	NTU

Signed: WD McCall Date: 08/09/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

Round 2 Sampling

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S003

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE A1	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	69	mg/l
Biochemical Oxygen Demand	SOP 2006	10	mg/l
Total Nitrogen	SOP 2075	0.8	mg/l
Nitrate	SOP 2060	3.34	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.10	mg/l P
Ammonia Nitrogen	SOP 2057	0.05	mg/l NH_3-N
Orthophosphate	SOP 2061	0.14	mg/l PO_4
Turbidity	SOP 2022	34.09	NTU
Chloride	SOP 2065	9.62	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 4095S002

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	COURIER
Company Name:	ECO POWER	**Sample Card Number:**	221121.A
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	22/11/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	22/11/2021
Sample Description:	SITE A2	**Date Certificate Issued:**	02/12/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	7	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	2.4	mg/l
Nitrate	SOP 2060	9.33	mg/l NO_3
Nitrite	SOP 2059	<0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.02	mg/l P
Ammonia Nitrogen	SOP 2057	0.02	mg/l NH_3-N
Orthophosphate	SOP 2061	<0.01	mg/l PO_4
Turbidity	SOP 2022	1.39	NTU
Chloride	SOP 2065	14.74	mg/l

Signed: WD McCall Date: 02/12/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S004

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE A3	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	4	mg/l
Biochemical Oxygen Demand	SOP 2006	5	mg/l
Total Nitrogen	SOP 2075	1.5	mg/l
Nitrate	SOP 2060	7.44	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.06	mg/l P
Ammonia Nitrogen	SOP 2057	0.04	mg/l NH_3-N
Orthophosphate	SOP 2061	0.10	mg/l PO_4
Turbidity	SOP 2022	2.41	NTU
Chloride	SOP 2065	16.40	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S002

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE B2	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	7	mg/l
Biochemical Oxygen Demand	SOP 2006	9	mg/l
Total Nitrogen	SOP 2075	2.9	mg/l
Nitrate	SOP 2060	13.51	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2125	0.09	mg/l P
Ammonia Nitrogen	SOP 2057	0.05	mg/l NH_3-N
Orthophosphate	SOP 2061	0.18	mg/l PO_4
Turbidity	SOP 2022	2.29	NTU
Chloride	SOP 2065	19.86	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S001

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE B3	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	89	mg/l
Biochemical Oxygen Demand	SOP 2006	23	mg/l
Total Nitrogen	SOP 2075	0.7	mg/l
Nitrate	SOP 2060	2.33	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.09	mg/l P
Ammonia Nitrogen	SOP 2057	0.05	mg/l NH_3-N
Orthophosphate	SOP 2061	0.13	mg/l PO_4
Turbidity	SOP 2022	39.74	NTU
Chloride	SOP 2065	15.40	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S006

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE B4	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	10	mg/l
Biochemical Oxygen Demand	SOP 2006	8	mg/l
Total Nitrogen	SOP 2075	0.9	mg/l
Nitrate	SOP 2060	4.84	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2125	0.10	mg/l P
Ammonia Nitrogen	SOP 2057	0.10	mg/l NH_3-N
Orthophosphate	SOP 2061	0.20	mg/l PO_4
Turbidity	SOP 2022	8.69	NTU
Chloride	SOP 2065	15.44	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S005

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE B5	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	9	mg/l
Biochemical Oxygen Demand	SOP 2006	5	mg/l
Total Nitrogen	SOP 2075	1.0	mg/l
Nitrate	SOP 2060	5.54	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.06	mg/l P
Ammonia Nitrogen	SOP 2057	0.05	mg/l NH_3-N
Orthophosphate	SOP 2061	0.10	mg/l PO_4
Turbidity	SOP 2022	1.87	NTU
Chloride	SOP 2065	17.01	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S007

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE B6	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	11	mg/l
Biochemical Oxygen Demand	SOP 2006	4	mg/l
Total Nitrogen	SOP 2075	<0.5	mg/l
Nitrate	SOP 2060	<2.2	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.05	mg/l P
Ammonia Nitrogen	SOP 2057	0.04	mg/l NH_3-N
Orthophosphate	SOP 2061	0.07	mg/l PO_4
Turbidity	SOP 2022	1.69	NTU
Chloride	SOP 2065	15.73	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 3950S008

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	171121.D
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	17/11/2021
Sample Reference:	SURFACE WATER SAMPLES	**Date Analysis Commenced:**	17/11/2021
Sample Description:	SITE B7	**Date Certificate Issued:**	30/11/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	2	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	1.2	mg/l
Nitrate	SOP 2060	8.40	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.07	mg/l P
Ammonia Nitrogen	SOP 2057	0.19	mg/l NH_3-N
Orthophosphate	SOP 2061	0.19	mg/l PO_4
Turbidity	SOP 2022	1.17	NTU
Chloride	SOP 2065	18.38	mg/l

Signed: WD McCall Date: 30/11/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 4095S004

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	COURIER
Company Name:	ECO POWER	**Sample Card Number:**	221121.A
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	22/11/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	22/11/2021
Sample Description:	SITE C1	**Date Certificate Issued:**	02/12/2021

Parameter	Method	Result	Unit
Total Suspended Solids*	SOP 2016	9790	mg/l
Biochemical Oxygen Demand	SOP 2006	424	mg/l
Total Nitrogen	SOP 2075	4.8	mg/l
Nitrate	SOP 2060	<2.2	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus*	SOP 2125	11.9	mg/l P
Ammonia Nitrogen	SOP 2057	4.22	mg/l NH_3-N
Orthophosphate	SOP 2061	1.72	mg/l PO_4
Turbidity	SOP 2022	398.7	NTU
Chloride	SOP 2065	20.13	mg/l

Signed: WD McCall Date: 02/12/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 4095S005

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	COURIER
Company Name:	ECO POWER	**Sample Card Number:**	221121.A
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	22/11/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	22/11/2021
Sample Description:	SITE C2	**Date Certificate Issued:**	02/12/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	138	mg/l
Biochemical Oxygen Demand	SOP 2006	8	mg/l
Total Nitrogen	SOP 2075	3.6	mg/l
Nitrate	SOP 2060	16.24	mg/l NO_3
Nitrite	SOP 2059	<0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.27	mg/l P
Ammonia Nitrogen	SOP 2057	0.02	mg/l NH_3-N
Orthophosphate	SOP 2061	0.01	mg/l PO_4
Turbidity	SOP 2022	57.26	NTU
Chloride	SOP 2065	19.54	mg/l

Signed: WD McCall Date: 02/12/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 4095S003

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	COURIER
Company Name:	ECO POWER	**Sample Card Number:**	221121.A
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	22/11/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	22/11/2021
Sample Description:	SITE C3	**Date Certificate Issued:**	02/12/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	36	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	3.0	mg/l
Nitrate	SOP 2060	12.45	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.04	mg/l P
Ammonia Nitrogen	SOP 2057	0.01	mg/l NH_3-N
Orthophosphate	SOP 2061	<0.01	mg/l PO_4
Turbidity	SOP 2022	2.56	NTU
Chloride	SOP 2065	19.31	mg/l

Signed: WD McCall Date: 02/12/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 4095S006

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	COURIER
Company Name:	ECO POWER	**Sample Card Number:**	221121.A
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	22/11/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	22/11/2021
Sample Description:	SITE C4	**Date Certificate Issued:**	02/12/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	37	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	2.2	mg/l
Nitrate	SOP 2060	6.86	mg/l NO_3
Nitrite	SOP 2059	<0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.19	mg/l P
Ammonia Nitrogen	SOP 2057	0.02	mg/l NH_3-N
Orthophosphate	SOP 2061	<0.01	mg/l PO_4
Turbidity	SOP 2022	23.07	NTU
Chloride	SOP 2065	16.83	mg/l

Signed: WD McCall Date: 02/12/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 4095S007

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	COURIER
Company Name:	ECO POWER	**Sample Card Number:**	221121.A
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	22/11/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	22/11/2021
Sample Description:	SITE C5	**Date Certificate Issued:**	02/12/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	28	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	2.6	mg/l
Nitrate	SOP 2060	9.55	mg/l NO_3
Nitrite	SOP 2059	<0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.11	mg/l P
Ammonia Nitrogen	SOP 2057	0.03	mg/l NH_3-N
Orthophosphate	SOP 2061	0.02	mg/l PO_4
Turbidity	SOP 2022	18.45	NTU
Chloride	SOP 2065	18.36	mg/l

Signed: WD McCall Date: 02/12/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 4095S008

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	COURIER
Company Name:	ECO POWER	**Sample Card Number:**	221121.A
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	22/11/2021
Sample Reference:	SURFACE WATER	**Date Analysis Commenced:**	22/11/2021
Sample Description:	SITE C6	**Date Certificate Issued:**	02/12/2021

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	21	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	3.1	mg/l
Nitrate	SOP 2060	12.45	mg/l NO_3
Nitrite	SOP 2059	<0.03	mg/l NO_2
Total Phosphorus	SOP 2125	0.07	mg/l P
Ammonia Nitrogen	SOP 2057	0.03	mg/l NH_3-N
Orthophosphate	SOP 2061	<0.01	mg/l PO_4
Turbidity	SOP 2022	15.26	NTU
Chloride	SOP 2065	18.12	mg/l

Signed: WD McCall Date: 02/12/2021

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

Round 3 Sampling

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S006

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE A1	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	4	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	1.0	mg/l
Nitrate	SOP 2060	4.88	mg/l NO_3
Nitrite	SOP 2059	<0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.04	mg/l P
Ammonia Nitrogen	SOP 2057	0.01	mg/l NH_3-N
Orthophosphate	SOP 2061	0.03	mg/l PO_4
Turbidity	SOP 2022	4.05	NTU
Chloride	SOP 2065	8.09	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S008

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE A2	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	9	mg/l
Biochemical Oxygen Demand	SOP 2006	1	mg/l
Total Nitrogen	SOP 2075	4.8	mg/l
Nitrate	SOP 2060	20.90	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.03	mg/l P
Ammonia Nitrogen	SOP 2057	0.03	mg/l NH_3-N
Orthophosphate	SOP 2061	0.04	mg/l PO_4
Turbidity	SOP 2022	3.47	NTU
Chloride	SOP 2065	17.19	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S007

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE A3	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	21	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	2.8	mg/l
Nitrate	SOP 2060	11.62	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2126	0.07	mg/l P
Ammonia Nitrogen	SOP 2057	0.07	mg/l NH_3-N
Orthophosphate	SOP 2061	0.10	mg/l PO_4
Turbidity	SOP 2022	4.06	NTU
Chloride	SOP 2065	17.18	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S005

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE B2	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	7	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	4.3	mg/l
Nitrate	SOP 2060	16.59	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2126	0.11	mg/l P
Ammonia Nitrogen	SOP 2057	0.13	mg/l NH_3-N
Orthophosphate	SOP 2061	0.18	mg/l PO_4
Turbidity	SOP 2022	1.91	NTU
Chloride	SOP 2065	16.31	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S004

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE B3	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	8	mg/l
Biochemical Oxygen Demand	SOP 2006	6	mg/l
Total Nitrogen	SOP 2075	0.9	mg/l
Nitrate	SOP 2060	4.14	mg/l NO_3
Nitrite	SOP 2059	<0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.03	mg/l P
Ammonia Nitrogen	SOP 2057	0.02	mg/l NH_3-N
Orthophosphate	SOP 2061	0.02	mg/l PO_4
Turbidity	SOP 2022	9.38	NTU
Chloride	SOP 2065	17.67	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S009

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE B4	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	1	mg/l
Biochemical Oxygen Demand	SOP 2006	4	mg/l
Total Nitrogen	SOP 2075	1.6	mg/l
Nitrate	SOP 2060	6.20	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.07	mg/l P
Ammonia Nitrogen	SOP 2057	0.09	mg/l NH_3-N
Orthophosphate	SOP 2061	0.11	mg/l PO_4
Turbidity	SOP 2022	3.67	NTU
Chloride	SOP 2065	15.76	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S001

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE B5	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	19	mg/l
Biochemical Oxygen Demand	SOP 2006	4	mg/l
Total Nitrogen	SOP 2075	1.9	mg/l
Nitrate	SOP 2060	8.05	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.08	mg/l P
Ammonia Nitrogen	SOP 2057	0.03	mg/l NH_3-N
Orthophosphate	SOP 2061	0.09	mg/l PO_4
Turbidity	SOP 2022	3.32	NTU
Chloride	SOP 2065	17.38	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S002

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE B6	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	5	mg/l
Biochemical Oxygen Demand	SOP 2006	4	mg/l
Total Nitrogen	SOP 2075	2.0	mg/l
Nitrate	SOP 2060	4.84	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.06	mg/l P
Ammonia Nitrogen	SOP 2057	0.04	mg/l NH_3-N
Orthophosphate	SOP 2061	0.09	mg/l PO_4
Turbidity	SOP 2022	3.96	NTU
Chloride	SOP 2065	17.05	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6785S003

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	150222.C
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	15/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	15/02/2022
Sample Description:	SITE B7	**Date Certificate Issued:**	02/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	8	mg/l
Biochemical Oxygen Demand	SOP 2006	3	mg/l
Total Nitrogen	SOP 2075	2.5	mg/l
Nitrate	SOP 2060	11.57	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2126	0.06	mg/l P
Ammonia Nitrogen	SOP 2057	0.02	mg/l NH_3-N
Orthophosphate	SOP 2061	0.11	mg/l PO_4
Turbidity	SOP 2022	3.96	NTU
Chloride	SOP 2065	18.24	mg/l

Signed: WD McCall Date: 02/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6549S004

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	080222.G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	08/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	08/02/2022
Sample Description:	SITE C1	**Date Certificate Issued:**	01/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	100	mg/l
Biochemical Oxygen Demand	SOP 2006	4	mg/l
Total Nitrogen	SOP 2075	2.1	mg/l
Nitrate	SOP 2060	14.34	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2126	0.37	mg/l P
Ammonia Nitrogen	SOP 2057	0.12	mg/l NH_3-N
Orthophosphate	SOP 2061	0.76	mg/l PO_4
Turbidity	SOP 2022	31.09	NTU
Chloride	SOP 2065	23.24	mg/l

Signed: WD McCall Date: 01/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6549S005

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	080222.G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	08/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	08/02/2022
Sample Description:	SITE C2	**Date Certificate Issued:**	01/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	34	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	2.6	mg/l
Nitrate	SOP 2060	15.22	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.02	mg/l P
Ammonia Nitrogen	SOP 2057	0.07	mg/l NH_3-N
Orthophosphate	SOP 2061	0.02	mg/l PO_4
Turbidity	SOP 2022	5.60	NTU
Chloride	SOP 2065	19.13	mg/l

Signed: WD McCall Date: 01/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6549S003

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	080222.G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	08/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	08/02/2022
Sample Description:	SITE C3	**Date Certificate Issued:**	01/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	4	mg/l
Biochemical Oxygen Demand	SOP 2006	1	mg/l
Total Nitrogen	SOP 2075	3.6	mg/l
Nitrate	SOP 2060	23.67	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2126	0.03	mg/l P
Ammonia Nitrogen	SOP 2057	0.10	mg/l NH_3-N
Orthophosphate	SOP 2061	0.04	mg/l PO_4
Turbidity	SOP 2022	1.11	NTU
Chloride	SOP 2065	24.76	mg/l

Signed: WD McCall Date: 01/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6549S006

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	080222.G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	08/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	08/02/2022
Sample Description:	SITE C4	**Date Certificate Issued:**	01/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	19	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	2.1	mg/l
Nitrate	SOP 2060	14.08	mg/l NO_3
Nitrite	SOP 2059	0.10	mg/l NO_2
Total Phosphorus	SOP 2126	0.08	mg/l P
Ammonia Nitrogen	SOP 2057	0.08	mg/l NH_3-N
Orthophosphate	SOP 2061	0.14	mg/l PO_4
Turbidity	SOP 2022	11.03	NTU
Chloride	SOP 2065	18.45	mg/l

Signed: WD McCall Date: 01/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6549S002

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	080222.G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	08/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	08/02/2022
Sample Description:	SITE C5	**Date Certificate Issued:**	01/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	8	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	3.6	mg/l
Nitrate	SOP 2060	23.72	mg/l NO_3
Nitrite	SOP 2059	0.17	mg/l NO_2
Total Phosphorus	SOP 2126	0.06	mg/l P
Ammonia Nitrogen	SOP 2057	0.12	mg/l NH_3-N
Orthophosphate	SOP 2061	0.13	mg/l PO_4
Turbidity	SOP 2022	2.75	NTU
Chloride	SOP 2065	21.07	mg/l

Signed: WD McCall Date: 01/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6369S011

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	030222.E
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	03/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	03/02/2022
Sample Description:	SITE C6	**Date Certificate Issued:**	22/02/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	2	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	3.0	mg/l
Nitrate	SOP 2060	19.89	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.03	mg/l P
Ammonia Nitrogen	SOP 2057	0.04	mg/l NH_3-N
Orthophosphate	SOP 2061	0.07	mg/l PO_4
Turbidity	SOP 2022	0.04	NTU
Chloride	SOP 2065	19.39	mg/l

Signed: _____ Date: 22/02/2022

-

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 6549S001

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	JAMES	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	080222.G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	08/02/2022
Sample Reference:	BALLYNALACKEN	**Date Analysis Commenced:**	08/02/2022
Sample Description:	SITE C7	**Date Certificate Issued:**	01/03/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	<1	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	3.9	mg/l
Nitrate	SOP 2060	21.43	mg/l NO_3
Nitrite	SOP 2059	0.07	mg/l NO_2
Total Phosphorus	SOP 2126	0.04	mg/l P
Ammonia Nitrogen	SOP 2057	0.12	mg/l NH_3-N
Orthophosphate	SOP 2061	0.07	mg/l PO_4
Turbidity	SOP 2022	<0.02	NTU
Chloride	SOP 2065	19.06	mg/l

Signed: WD McCall Date: 01/03/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

Round 4 (Additional Round) Sampling

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 8572S001

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	PETER BRETT	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	200422G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	20/04/2022
Sample Reference:	BALLYNALACKEN SAMPLES	**Date Analysis Commenced:**	20/04/2022
Sample Description:	SITE A1	**Date Certificate Issued:**	29/04/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	9	mg/l
Biochemical Oxygen Demand	SOP 2006	2	mg/l
Total Nitrogen	SOP 2075	<0.5	mg/l
Nitrate	SOP 2060	<2.2	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.02	mg/l P
Ammonia Nitrogen	SOP 2057	0.22	mg/l NH_3-N
Orthophosphate	SOP 2061	0.03	mg/l PO_4
Turbidity	SOP 2022	3.01	NTU
Chloride	SOP 2065	8.58	mg/l
Total Oxidised Nitrogen	SOP 2058	<0.50	mg/l N

Signed: WD McCall Date: 29/04/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 8572S004

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	PETER BRETT	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	200422G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	20/04/2022
Sample Reference:	BALLYNALACKEN SAMPLES	**Date Analysis Commenced:**	20/04/2022
Sample Description:	SITE A2	**Date Certificate Issued:**	29/04/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	3	mg/l
Biochemical Oxygen Demand	SOP 2006	1	mg/l
Total Nitrogen	SOP 2075	<0.5	mg/l
Nitrate	SOP 2060	3.04	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.09	mg/l P
Ammonia Nitrogen	SOP 2057	0.04	mg/l NH_3-N
Orthophosphate	SOP 2061	0.23	mg/l PO_4
Turbidity	SOP 2022	1.69	NTU
Chloride	SOP 2065	42.73	mg/l
Total Oxidised Nitrogen	SOP 2058	0.70	mg/l N

Signed: WD McCall Date: 29/04/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS LABORATORIES

Independent Analytical Supplies

Test Report

Lab Report Number: 8572S005

Customer ID:	ECO.P1	**Analysis Type:**	ECO POWER 2 (ECO POW 2)
Contact Name:	PETER BRETT	**Delivery By:**	CUSTOMER
Company Name:	ECO POWER	**Sample Card Number:**	200422G
Address:	ZETEC HOUSE PURCELLSINCH IDA BUS PK DUBLIN ROAD KILKENNY	**Condition on Receipt:**	Acceptable
Sample Type:	SURFACE WATER	**Date Sample Received:**	20/04/2022
Sample Reference:	BALLYNALACKEN SAMPLES	**Date Analysis Commenced:**	20/04/2022
Sample Description:	SITE C6	**Date Certificate Issued:**	29/04/2022

Parameter	Method	Result	Unit
Total Suspended Solids	SOP 2016	17	mg/l
Biochemical Oxygen Demand	SOP 2006	1	mg/l
Total Nitrogen	SOP 2075	4.3	mg/l
Nitrate	SOP 2060	17.03	mg/l NO_3
Nitrite	SOP 2059	0.03	mg/l NO_2
Total Phosphorus	SOP 2126	0.03	mg/l P
Ammonia Nitrogen	SOP 2057	0.32	mg/l NH_3-N
Orthophosphate	SOP 2061	0.07	mg/l PO_4
Turbidity	SOP 2022	5.92	NTU
Chloride	SOP 2065	17.40	mg/l
Total Oxidised Nitrogen	SOP 2058	3.88	mg/l N

Signed: WD McCall Date: 29/04/2022

Wendy McCall - Laboratory Manager

*** = not INAB Accredited ^ = Subcontracted**

This report must not be reproduced, except in full, without the prior written approval of IAS Laboratories. This report relates only to the sample submitted and tested.
Opinions and interpretations expressed herein are outside the scope of INAB accreditation.
Uncertainty of Measurement is not taken into account for any test results reported.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.275T

IAS Laboratories, Unit 4 Bagenalstown Bus. Park, Bagenalstown, Co Carlow, R21 YX99

Phone: 059 9721022 Email: reception@iaslabs.ie Web: www.iaslabs.ie

Appendix 8.2 Inventory Watercourses and Wet Drainage Channels

Appendix to Chapter 8: Water

Appendix 8.2: Inventory of Watercourses and Wet Drainage Channels

Water Crossing: W1

Type:	EPA Watercourse
Coordinates (ITM)	648525, 674106
Watercourse details	**Channel Width**: 1m
Construction requirements	Bottomless precast concrete culvert to be installed in watercourse - Windfarm road and cables installed over culvert
Instream Works	No



Water Crossing: W2

Type:	EPA Watercourse
Coordinates (ITM)	645934, 673603
Watercourse details	**Channel Width**: 1m
Construction requirements	Cables to be installed in the public road above the existing culvert. No instream works.
Instream Works	No







Water Crossing: W3

Type:	Bridge over EPA watercourse
Coordinates (ITM)	644510, 672747
Watercourse details	**Channel Width**: 2.3m **Structure condition:** Good **Note:** This watercourse is seasonally dry
Construction requirements	**Option 1**: Cables to be installed in the deck of the existing bridge structure, parapet walls height will need to be built upto 1.25m and road level to be raised to provide minimum cover of 450mm to top of duct. No instream works; **Option 2**: Cables to be installed by directional drilling under the bridge. No instream works.
Instream Works	No





Wet Drain: D1

Type:	Wet drainage channel
Coordinates (ITM)	648657, 674161
Watercourse details	**Channel Width**: 0.5m
Construction requirements	Bottomless precast concrete culvert to be installed in watercourse – Windfarm road and cables installed over culvert. Modification of 50m of existing channel alignment
Instream Works	Yes



Wet Drain: D2

Type:	Wet drainage channel
Coordinates (ITM)	648172, 673809
Watercourse details	**Channel Width**: 0.7m
Construction requirements	Plastic pipe culvert to be extended north by 8m to allow for widening existing forestry road for turbine component haulage
Instream Works	Yes



Wet Drain: D3

Type:	Wet drainage channel
Coordinates (ITM)	648230, 674137
Watercourse details	**Channel Width**: 0.5m
Construction requirements	Bottomless precast culvert to be installed in the wet drainage channel – Windfarm road and cables to be installed over culvert
Instream Works	No



Wet Drain: D4

Type:	Wet drainage channel
Coordinates (ITM)	647740, 676291
Watercourse details	**Channel Width**: 0.5m
Construction requirements	Bottomless precast culvert to be installed in the wet drainage channel – Windfarm road and cables to be installed over culvert
Instream Works	No



Appendix 8.3 Flood Risk Assessment Report

Appendix to Chapter 8: Water

Appendix 8.3: Flood Risk Assessment Report

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

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

PROPOSED BALLYNALACKEN WIND FARM PROJECT, CO. KILKENNY

FLOOD RISK ASSESSMENT

FINAL REPORT

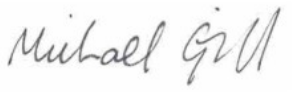
Prepared for:

ECOPOWER DEVELOPMENTS LIMITED

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**BALLYNALACKEN WIND FARM PROJECT, CO. KILKENNY FLOOD RISK ASSESMENT**
Issue Date:	**5th March 2025**
Project Number:	**P1562-0**
Project Reporting History:	**-**
Current Revision No:	**P1562-0_ FINAL F1**
Author(s):	**Michael Gill** **David Broderick** **Jenny Law**
Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

TABLE OF CONTENTS

1. INTRODUCTION 4
1.1 BACKGROUND 4
1.2 STATEMENT OF QUALIFICATIONS 4
1.3 REPORT LAYOUT 5
2. BACKGROUND INFORMATION 6
2.1 INTRODUCTION 6
2.2 SITE LOCATION AND TOPOGRAPHY 6
2.3 PROPOSED DEVELOPMENT DETAILS 6
3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS 9
3.1 INTRODUCTION 9
3.2 HYDROLOGY 9
3.2.1 Regional and Local Hydrology 9
3.2.2 Rainfall and Evaporation 10
3.3 GEOLOGY 11
3.4 DESIGNATED SITES & HABITATS 11
4. SITE SPECIFIC FLOOD RISK ASSESSMENT 12
4.1 INTRODUCTION 12
4.2 FLOOD RISK IDENTIFICATION 13
4.2.1 OPW Past Flood Event Mapping 13
4.2.2 Soils Maps - Fluvial Maps 14
4.2.3 Historical Mapping 14
4.2.4 CFRAM River Flood Extents Mapping 14
4.2.5 National Indicative Fluvial Mapping (NIFM) 15
4.2.6 GSI Winter (2015/2016) Surface Water Flood Mapping 16
4.2.7 Groundwater Flooding 16
4.2.8 Coastal Flooding 16
4.2.9 Climate Change 17
4.2.10 Summary – Flood Risk Identification 17
4.3 INITIAL FLOOD RISK ASSESSMENT 17
4.3.1 Hydrological Flood Conceptual Model 17
4.3.2 Summary – Initial Flood Risk Assessment 17
5. PLANNING POLICY AND JUSTIFICATION TEST 19
5.1 PLANNING POLICY AND COUNTY DEVELOPMENT PLAN 19
5.2 JUSTIFICATION TEST 20
5.3 PROPOSED ON-SITE RUNOFF ATTENUATION 20
6. REPORT CONCLUSIONS 22
7. REFERENCES 23

FIGURES IN TEXT

Figure A: Site Location Map 7
Figure B: Local Hydrology Map 10
Figure C: OPW Past Flood Event Map 13
Figure D: CFRAM and National Indicative Fluvial Mapping 16

TABLES IN TEXT

Table A. Project Site – Return Period Rainfall Depths (mm) 11
Table B. S-P-R Assessment of Flood Sources for the Proposed Project Site 18
Table C: Kilkenny County Council Planning Policy/Objective and Responses 19
Table D: Matrix of Vulnerability versus Flood Zone 20

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by Ecopower Developments Limited to undertake a Stage 2 Flood Risk Assessment (FRA) for the proposed Ballynalacken Windfarm Project located approximately 4.2km northwest of Castlecomer and approximately 4.3km northeast of Ballyragget, Co. Kilkenny. A site location map is shown as **Figure A** below.

In brief, the project site includes 12 no. turbines, an electrical control building, underground cabling, 110kV electrical substation, underground grid connection, ancillary and haul route works. Refer to Section 2.2 for more details on the project.

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

1.2 STATEMENT OF QUALIFICATIONS

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling, and prepare flood risk assessment reports.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm-related projects.

David Broderick P.Geo (BSc, H.Dip Env Eng, MSc) is a hydrogeologist with over 17 years' experience in both the public and private sectors. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into Environmental Impact Assessment Reports/Environmental Impact Statements (EIAR/EIS) for a range of commercial developments. For example, David has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Meenbog WF, Arderroo WF and Yellow River WF, and over 80 other wind farm related projects across the country.

Jenny Law (BSc, MSc) is an environmental geoscientist holding a first honour's degree in applied environmental geosciences from the University College Cork in 2022. Jenny has assisted in the preparation of the land, soils and geology and hydrology chapters for various environmental impact assessment reports, hydrological impact assessments, Water Framework Directive Assessment reports and Flood Risk Assessment reports for a variety of projects including wind farm developments and strategic housing developments.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the project site setting and details of the project;
- Section 3 outlines the hydrological and geological characteristics of the receiving environment;
- Section 4 presents a site-specific flood risk assessment (FRA) undertaken for the project site which was carried out in accordance with the above-mentioned guidelines;
- Section 5 reviews local authority planning policy with regard flooding; and,
- Section 6 presents the FRA report conclusions.

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

- OPW Flood Studies Update (FSU) Web Portal;
- Geological Survey of Ireland (GSI) maps on superficial deposits;
- EPA hydrology maps;
- OPW National Indicative Fluvial Mapping (NIFM);
- Kilkenny City and County Development Plan 2021 – 2027;
- Site walkovers and investigations conducted by HES on 22nd February, 24th May, 1st and 5th July, 22nd September 2022 and on 24th January, 8 & 25th March and 14th April 2023.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the project site along with a description of the proposed project.

2.2 PROJECT DETAILS

The Ballynalacken Windfarm Project will comprise the following elements:

EIAR Nomenclature	Overview Description
Ballynalacken Windfarm	12 No. Wind Turbines and associated works including foundations and hardstanding areas, windfarm roads, electrical control building and internal underground cabling connecting the wind turbines to the control building.
Internal Cable Link	Underground cabling which will connect the Windfarm Control Building to the Tinnalintan Substation.
Tinnalintan Substation	110kV Electrical Substation and associated access road.
Ballynalacken Grid Connection	Underground Grid Connection from the Tinnalintan Substation to the existing EirGrid Ballyragget Substation and facilitating works in the EirGrid Substation.
Ancillary & Haul Route Works	Site entrances, 1 no. met mast, 1 no. telecoms relay pole, site drainage network, temporary construction compounds, 2 no. temporary borrow pits (which will also be used as spoil deposition areas), temporary works in private lands and along the public road corridor, public road widening works along the L5840, L5845 and L5846 local roads, landscaping and reinstatement works. Works/Activities along the Public Road to facilitate turbine delivery and access to the turbine sites (Haul Route Works & Activities).

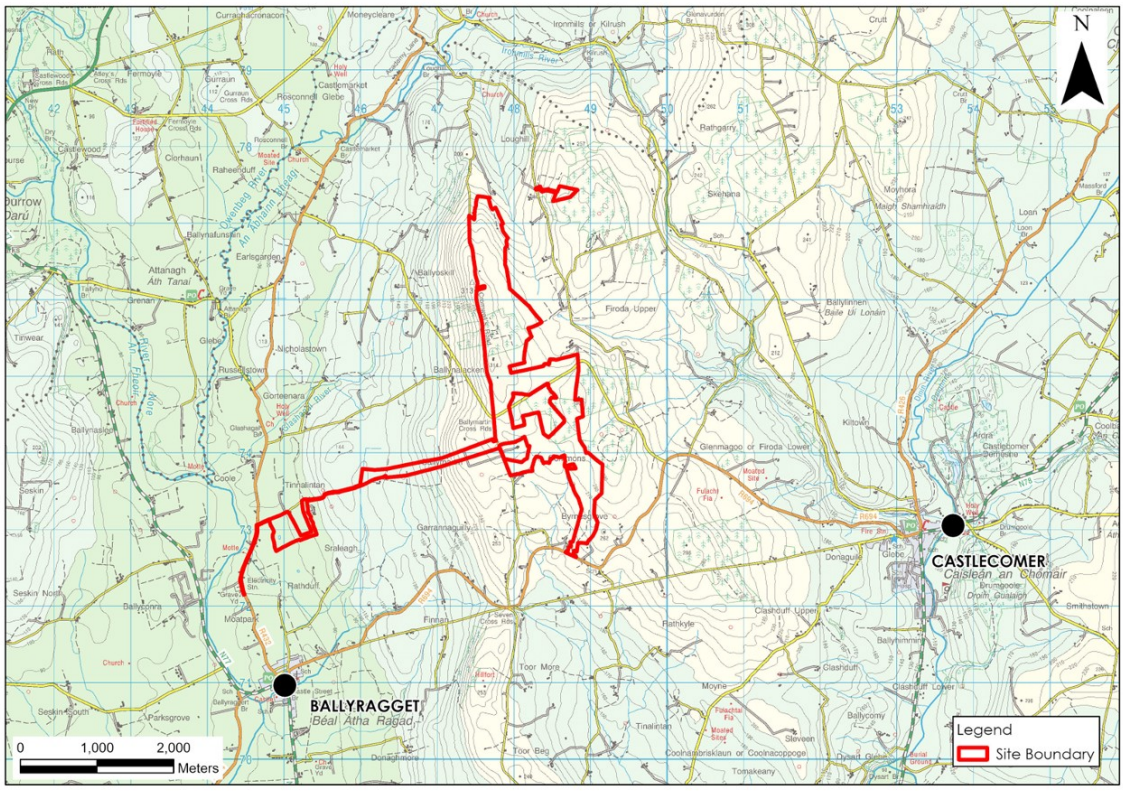


Figure A: Site Location Map

2.3 SITE LOCATION AND TOPOGRAPHY

The proposed Ballynalacken Wind Farm Project site ("project site") is located approximately 4.2km northwest of the town of Castlecomer and approximately 4.3km northeast of Ballyragget, entirely in County Kilkenny. The project site is located to the south of the Kilkenny-Laois County boundary.

The windfarm site generally consists of agricultural fields and coniferous forestry with the latter being more dominant on the southern section of the windfarm site. The proposed wind farm site is positioned in a linear arrangement along a narrow north-south trending topographic ridgeline where the ground slopes steadily to the east and west of the ridgeline. The steepest slopes are western facing. The elevation of the wind farm site ranges between approximately 250 to 315m OD with the highest point being centrally located.

The windfarm site can be accessed via several small local roads which branch northwards from the R694, which joins Castlecomer and Ballyragget to the south of the windfarm site. A public road runs along the top of the ridgeline immediately to the west of the windfarm site. This road crossroads near the mid-western boundary of the windfarm site. The public road running easterly from the crossroad junction divides the windfarm site into northern and southern portions. These public roads provide access to various areas of the project site (i.e. there are 11 no. site access points from local roads into the project site).

The northern portion of the wind farm site (which includes 6 no. of the proposed 12 no. turbines) is positioned largely along the eastern facing slope of the ridgeline, while the southern portion of the proposed windfarm site (which includes the remaining 6 no. turbines) is positioned on western/southwestern facing slopes.

The proposed substation at Tinnalintan is located approximately 3.2km (as the crow flies) to the southwest of the windfarm control building. The proposed underground internal cable link, which will connect the windfarm control building to the Tinnalintan Substation runs south-westerly from the proposed windfarm control building at the windfarm site to the proposed substation, is 4km in length and is overlain by grassland, with sections under private tracks and public roads.

The underground grid connection, which is 1.96km in length, and will connect the proposed Tinnalintan substation to the existing EirGrid 110kV substation north of Ballyragget town. The proposed substation is located in gently undulating grassland surrounded by hedgerows where the ground elevation is mapped at approximately 75m OD. The proposed underground grid route is overlain by a mixture of private track and public roads.

The haul route works typically include provision of small hard-core areas and street furniture removal, between Exit 8 on the M9 Motorway, via Castlecomer town and the R694 regional road to the windfarm site entrances. Some road widening will also be required along the local roads at the windfarm site.

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

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the region and the project site.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

Regionally the project site is located in the River Nore regional surface water catchment within Hydrometric Area 15 of the Southeastern River Basin District. The River Nore flows in a southerly direction approximately 4 - 5km to the west of the proposed windfarm site and approximately 0.5km west of the proposed substation, and 0.2km west of the grid connection route along the regional road. The majority of the windfarm site however drains to the River Nore via the Dinin River (8 turbines) and the Owveg (Owenbeg) River (4 turbines).

On a sub-catchment scale, the northern and western sections of the windfarm site including the grid connection and substation are located in the Nore_SC_060 sub-catchment, which includes the River Nore channel to the west and the furthest downstream reach of the Owveg River to the north.

The central section of the proposed development site mainly drains easterly into the Dinin (North)_SC_010 sub-catchment, while the southern section is located in the Nore_SC_080 sub-catchment. Both are mapped as sub-catchments of the Dinin River, which flows to the east and south of the windfarm site.

On a more local hydrological (sub-basin) scale the northern section of the wind site (which includes 4 no. turbines, T9 – T12) is located in the Owveg (Nore)_040 sub-basin within the Owveg River sub-catchment.

The central section of the windfarm site (which includes 2 no. turbines, T6 & T8) is located in the Castlecomer Stream_010 sub-basin, within the Dinin River sub-catchment. The southern section of the windfarm site (which includes 6 no. turbines, T1 – T5 & T7) is located in the Cloghnagh_010 sub-basin, and is also mapped within the Dinin River sub-catchment.

The internal cable link, substation and grid connection are located in the Nore_120 sub-basin, within which a small local river waterbody, Rathduff_15, drains directly into the nearby River Nore.

The downstream distance from the project site to the 4 no. river sub-basins associated with the River Nore are as follows- Cloghnagh_010 (~16.2km), Castlecomer Stream_010 (~23.4km), Owveg (Nore)_040 (~10.5km) and Nore_120 (0.2km).

Sub-basins in which the haul route work are located within include the Rathgarvan or Clifden_010 (HR1),Brownstown(Pocoke)_010 (HR2, HR3, HR4, HR5), Nore_170 (HR6), Nore_160 (HR7), Dinin (Main Channel)_010 (HR8), Dinin (north)_040 (HR9), Castlecomer Stream_010 (HR10, HR11), Nore_120 (HR12) and Cloghnagh_010 (HR13).

A local hydrology map is attached as **Figure** B.

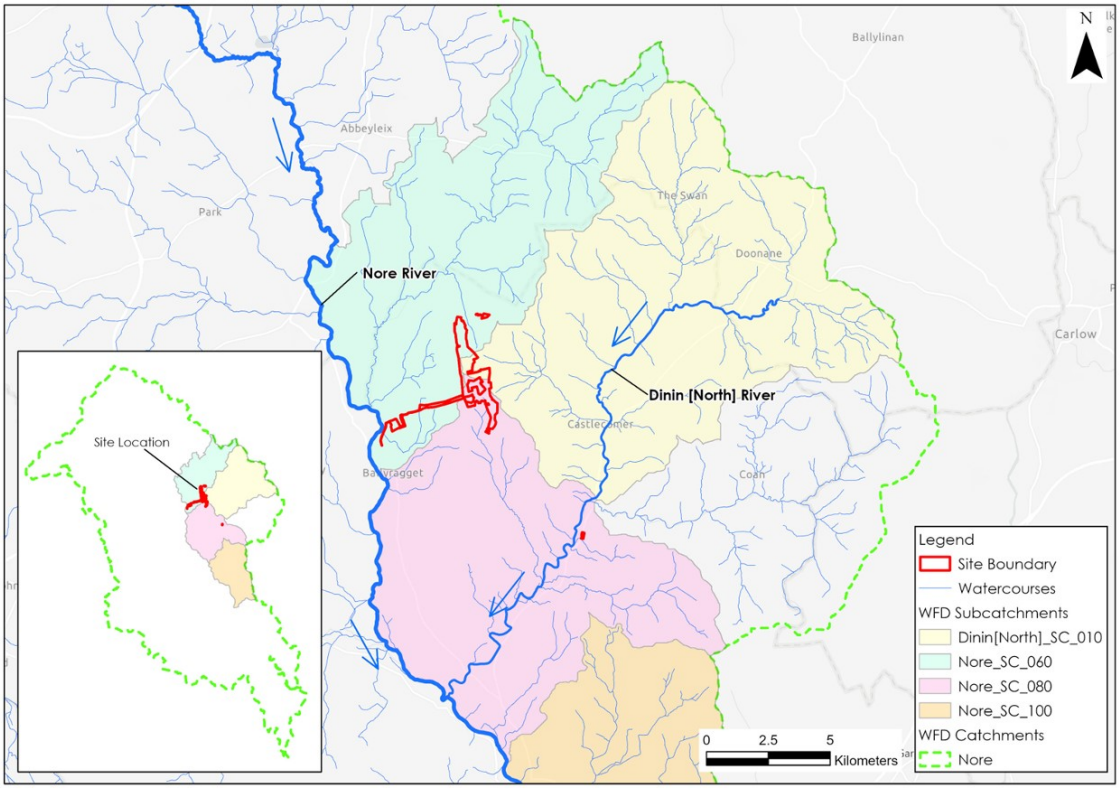


Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

Long term Average Annual Rainfall (AAR) and evaporation data was sourced from Met Éireann. The 30-year annual average rainfall (AAR) recorded at Coon, 11km southeast of the project site is 1,056mm/year.

The closest synoptic[1] station where the average potential evapotranspiration (PE) is recorded is at Kilkenny, approximately 17km south of the project site. The long-term average PE for this station is 459mm/year. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the project site is estimated as 436mm/year (which is 0.95 × PE).

The effective rainfall (ER)[2] represents the water available for runoff and groundwater recharge. The ER for the project site is calculated as follows:

Effective rainfall (ER) = AAR – AE

= 1,056 mm/year – 436mm/year

ER = 620mm/year

Based on the GSI mapping, a groundwater recharge cap of 100mm/year is applied to aquifers in the area of the wind farm site. Therefore, surface water runoff rates for the wind farm site are estimated to be 520mm/year.

[1] Meteorological station at which observations are made for synoptic meteorology and at the standard synoptic hours of 00:00, 06:00, 12:00, and 18:00.

[2] *ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.*

This suggests that surface water runoff rates at the windfarm site (~85%) are significantly higher than recharge rates (~15%).

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. **Table A** below presents return period rainfall depths for the area of the project site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

Table A. Project Site – Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.8	6.1	10.0	13.6
15 mins	6.2	10.0	16.4	22.3
30 mins	8.1	12.7	20.2	26.9
1 hours	10.6	16.2	24.8	32.4
6 hours	21.3	29.9	42.3	52.6
12 hours	27.8	37.9	52.0	63.3
24 hours	36.4	48.1	64.0	76.3
2 days	44.8	57.9	75.5	89.0

3.3 GEOLOGY

The GSI subsoil mapping show that subsoils are largely absent on the northern portion of the wind farm site (i.e. mapped as "bedrock outcrop or subcrop") with more localised areas mapped as sandstone and shale tills (i.e. glacial tills).

On the southern portion of the wind farm site sandstone and shale tills are more dominant, while bedrock outcrop or subcrop is less extensive. Blanket peat is mapped in a localised depression on the north of the south of the site where no infrastructure is proposed.

Subsoil depths are shallowest on the northern portion of the wind farm site where bedrock was generally encountered between 1 and 2 meters below ground level (mbgl) during trial pitting.

Subsoil depths are deeper on the southern portion of the wind farm site where most trial pits did not encountered bedrock at depths ranging from 2.3m to 4mbgl.

The findings of the trial pit investigations are generally consistent with the GSI subsoil mapping as described above.

3.4 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The project site is not located within any designated conservation site, however there are downstream hydrological connections with some of the Natura 2000 sites in the region as described below.

The River Barrow and River Nore SAC (Site Code: 002162), River Nore SPA (Site Code: 004233), and River Nore/Abbeyleix Woods Complex pNHA (Site Code: 002076) are located, at their closest points, 0.08km, 0.118km, and 0.08km respectively downstream of the Ballynalacken Windfarm Project and includes the Nore River itself as well as reaches of the Owveg River and Dinin River.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The basic objectives of these guidelines are to:

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

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

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

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

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

4.1 FLOOD ZONE MAPPING

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined according to OPW guidelines:

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

4.2 FLOOD RISK IDENTIFICATION

4.2.1 OPW Past Flood Event Mapping

To identify those areas as being at risk of flooding, OPW's Past Flood Event mapping (www.floodinfo.ie) were consulted.

No recurring or historic flood incidents are recorded within the proposed project site or immediately downstream.

The closest recurring flood event is recorded along the River Nore at Ballyragget, approximately 4.4km southwest of the wind farm site and 2km southwest of the existing Ballyragget substation [Flood ID: 2813]. Further downstream along the River Nore (~4.8km) another recurring flood event is recorded at Lismaine Bridge [Flood ID 2589].

A single flood event was recorded in November 2000, roughly 6.8km downstream of the wind farm site along the River Dinin, south of Castlecomer [Flood ID 4804].

No areas within the project site are mapped as an OPW Drainage District (i.e. an area where drainage schemes to improve land for agricultural purpose) or as Benefiting Lands (i.e. land identified by the OPW as potentially benefitting from the implementation of Arterial (Major) Drainage Schemes and an indicator of land subject to flooding and poor drainage).

Past flood events in the vicinity and downstream of the project site are shown on **Figure** C below.

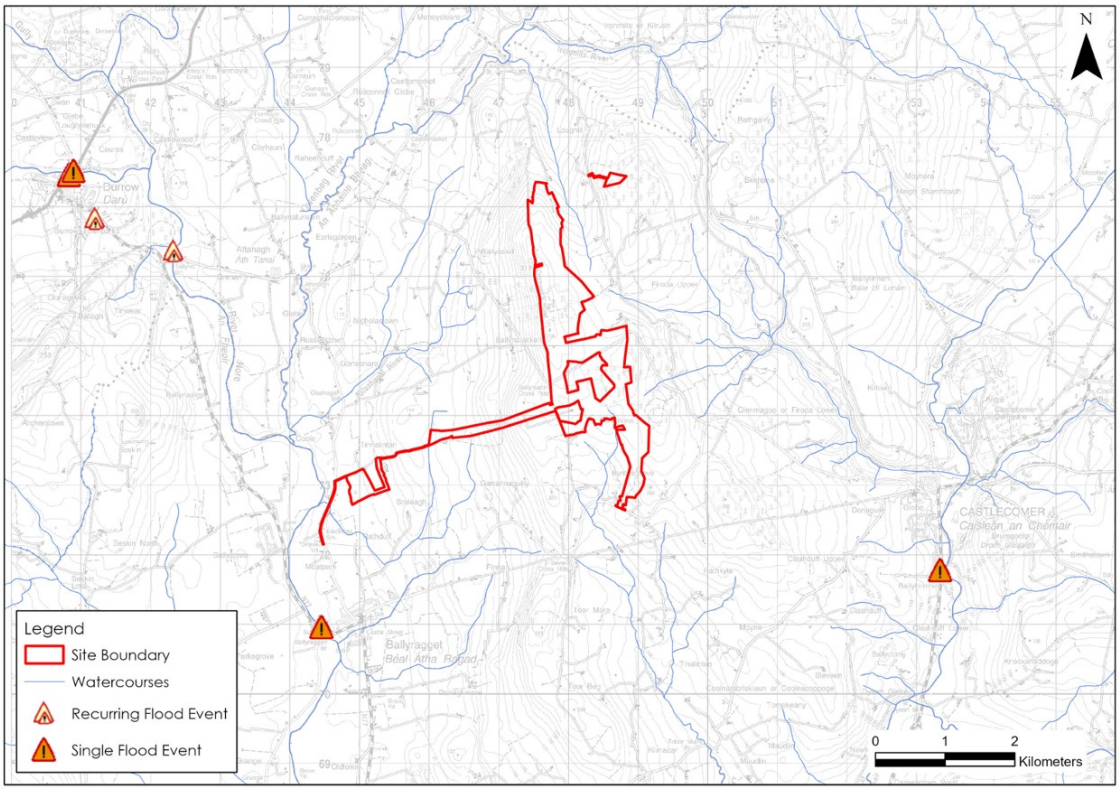


Figure C: OPW Past Flood Event Map

4.2.2 Soils Maps - Fluvial Maps

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

Based on the EPA/GSI soil map for the local area, very little fluvial or lacustrine deposits are mapped within the project site.

Furthermore, alluvium soils (AlluvMIN) are mapped downstream from the project site along the courses of the Owveg River, Castlecomer (Stream), the Cloghnagh, the Dinin River and the River Nore.

4.2.3 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. There was no identifiable map text on local available historical 6" or 25" mapping for the study area that would identify lands that are "liable to flood" within or in the vicinity of the project site.

Lands liable to flood were identified on historical mapping along the River Nore, west of the existing Ballyragget substation, and at the very lower reach of the Dinin River downstream of the wind farm site.

4.2.4 CFRAM River Flood Extents Mapping

Catchment Flood Risk Assessment and Management (CFRAM)[3] River Flood Extent Maps are now the primary reference for flood risk planning in Ireland and are more accurate than the National Indicative Fluvial Mapping (NIFM).

CFRAM mapping has been completed for the main channel of the River Nore within the area of the project site with low, medium and high probabilities, however no CFRAM fluvial mapping extents encroach upon the project site.

The closest CFRAM mapping extents downstream of the site in the 4 no. sub-basins is as follows - Owveg(Nore)_040 (~10.5km), Castlecomer Stream_010 (~23km), Cloghnagh_010 (~17km) and Nore_120 (0.5km).

Haul route works location HR3 is mapped inside a CFRAM 100-year flood zone. HR3 is located at an existing roundabout junction. Only temporary removal of road signs is proposed at HR3.

A map showing the CFRAM Mapping for the present-day scenario is included as **Figure D** below.

The potential effects of climate change on flooding have been separately modelled (see **Section 4.2.9** below.)

In addition, according to the CFRAM rainfall (pluvial) flood maps, no areas of the project site are affected by pluvial flooding.

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

4.2.5 National Indicative Fluvial Mapping (NIFM)

National Indicative Fluvial Mapping (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

The Present-Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.2.9** below.)

For the Present-Day Scenario, no medium (1 in 100) and low probability (1 in 1,000) fluvial flood zones are mapped within the project site. NIFM fluvial flood zones are mapped downstream of the project site within the Owveg (Nore)_040, Castlecomer Stream_010, and Cloghnagh_010 river sub basins.

The NIFM medium and low probability mapping extents within the Owveg (Nore)_040 river sub basin are mapped along the Owveg River, ~3.2km downstream of the site via the Kilcronan stream. Within the Castlecomer Stream_010 river sub basin, NIFM mapping begins ~2km downstream of the wind farm site via the Castlecomer Stream. NIFM flood extents are also mapped along the Cloghnagh stream, ~4.3km downstream from the wind farm site within the Cloghnagh_010 river sub basin. Based on the National Indicative Fluvial Mapping, the mapped flood zones for the Owveg River, Castlecomer Stream and the Cloghnagh stream do not encroach the proposed project site.

The Dinin River is mapped within NIFM flood extents with low and medium probabilities until it reaches its confluence with the River Nore, which is mapped within the CFRAM fluvial mapping extents as described above in **Section 4.2.4**.

As such, the entire project site, including all proposed infrastructure is located in Flood Zone C, where the probability of fluvial flooding is low (less than 0.1%).

A map showing the National Indicative Fluvial Mapping for the present-day scenario is included as **Figure D** below.

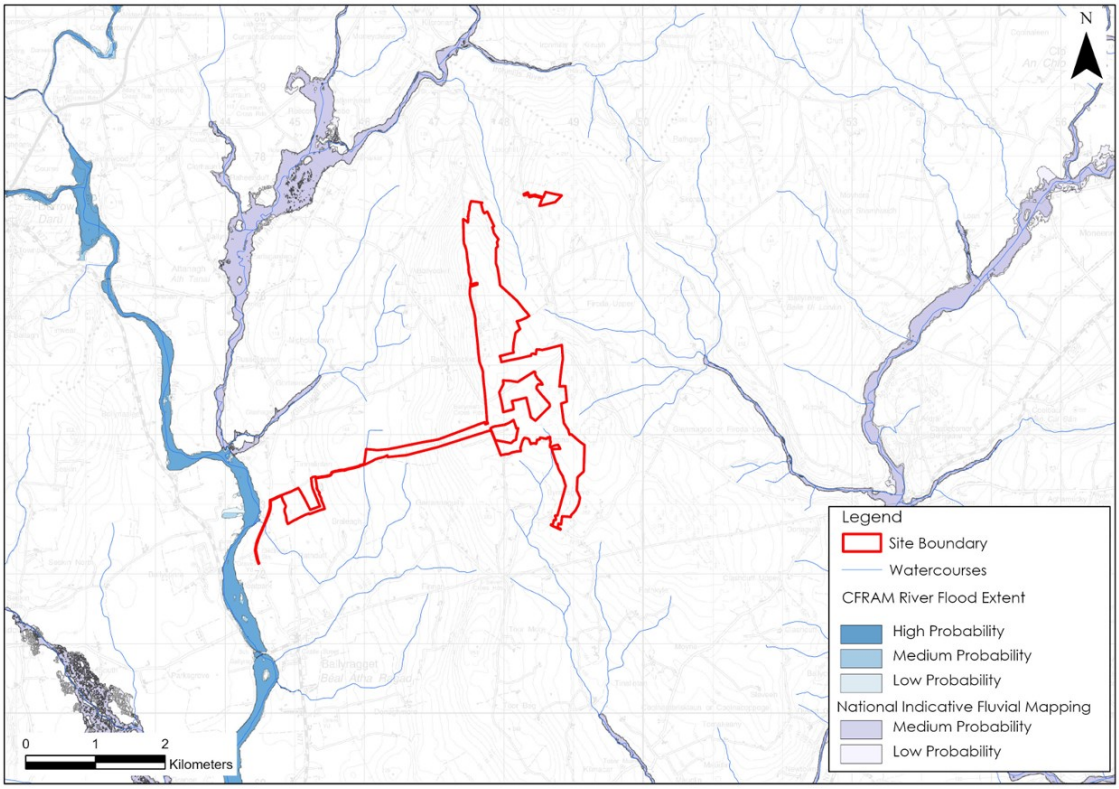


Figure D: CFRAM and National Indicative Fluvial Mapping

4.2.6 GSI Winter (2015/2016) Surface Water Flood Mapping

The GSI Winter (2015/2016) Surface Water Flooding Map[4] shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas.

GSI Winter (2015/2016) Surface Water Flooding Maps have not recorded the occurrence of any surface water flooding within the proposed project site.

4.2.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the proposed project site.

The closest historic groundwater flood recorded in the vicinity of the project site is a small area located ~1km to the west of the Ballyragget substation, on the far western bank of the River Nore.

4.2.8 Coastal Flooding

The project site is located approximately 70km inland from the sea. Therefore, the project site is not at risk of coastal (tidal) flooding.

[4] GSI *Historical flood mapping principally developed using Sentinel-1 Satellite Imagery from the European Space Agency Copernicus Programme as well as any available historic records (from winter 2015/2016 or otherwise)*

4.2.9 Climate Change

Fluvial flood modelling has also been completed to consider future climate scenarios where the potential effects of climate change can increase rainfall.

The CFRAM Flood Mapping Mid-Range Future Scenario models flood extents based on a 20% increase in rainfall. Similarly, the CFRAM Fluvial Flood Mapping High-End Future Scenario models flood extents based on a 30% increase in rainfall.

In addition to CFRAM climate scenarios, National Indicative Fluvial Mapping Mid-Range Future Scenario models flood extents are based on a 20% increase in rainfall. Similarly, the National Indicative Fluvial Mapping High-End Future Scenario models flood extents based on a 30% increase in rainfall.

Both the CFRAM and NIFM, Mid-Range and High-End Future Scenario modelled flood extents show similar flood zones to the Present-Day Scenarios discussed above in **Sections 4.2.4** & **4.2.5** respectively.

Therefore, flood zones near the proposed project site vicinity are unlikely to be significantly impacted by future climate change.

4.2.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process it is apparent that no part of the proposed project site is located in Fluvial Flood Zone A or B. The entire project site is located in Flood Zone C and is at low risk of flooding.

4.3 INITIAL FLOOD RISK ASSESSMENT

4.3.1 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the project site can be described using the Source – Pathway – Receptor Model (S-P-R).

Given the elevated and sloping nature of the project site, no area of the project site is likely to be directly flooded during an extremely severe rainfall event.

There are no high-risk sources of flooding at the project site, namely tidal and fluvial sources. Groundwater flooding is also not considered to be an issue at the project site given the overall elevated nature of the site along with dominantly poorly productive aquifers.

Haul route works location HR3 is mapped inside a CFRAM 100-year flood zone. This is however only temporary removal of road sign works at an existing roundabout junction.

4.3.2 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it is considered that flooding is unlikely to be high risk at the site or downstream of the site. The potential sources of flood risk for the proposed site are outlined and assessed in **Table B**.

Table B. S-P-R Assessment of Flood Sources for the Proposed Project Site.

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the rivers and streams that are close to some of the wind farm infrastructures.	Land & infrastructure	The proposed project site is located in Fluvial Flood Zone C where there is a low risk of fluvial flooding. Haul route works location HR3 is mapped inside a CFRAM 100-year flood zone. HR3 is located at an existing roundabout junction.
Pluvial	Ponding of rainwater on site	Land & infrastructure	There is very little risk of pluvial flooding within the proposed site as drainage moves relatively freely due to the sloping topography of the site. CFRAM have no pluvial flood areas mapped at the site.
Surface water	Surface ponding/ Overflow	Land & infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land & infrastructure	Based on local hydrogeological regime and GSI mapping, there is no risk of groundwater flooding at the proposed project site.
Coastal/tidal	Overbank flooding	Land, People, & property	The project site is ~70km inland from the sea so no coastal flooding will be possible.

5. PLANNING POLICY AND JUSTIFICATION TEST

5.1 PLANNING POLICY AND COUNTY DEVELOPMENT PLAN

The following policies (**Table C**) are defined in Kilkenny CDP 2021-2027 in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the proposed project design:

Table C: Kilkenny County Council Planning Policy/Objective and Responses

No.	Policy/Objective	Development Design Response
10.2.6.2	Where flood risk may be an issue for any proposed development, a detailed flood risk assessment should be carried out appropriate to the scale and nature of the development and the risks arising. In particular, any area within or adjoining flood zone A or B, or flood risk area, shall be the subject of a site-specific Flood Risk Assessment appropriate to the type and scale of the development being proposed. This shall be undertaken in accordance with the Planning System and Flood Risk Management – Guidelines and the Strategic Flood Risk Assessment accompanying this Plan.	This document provides a site-specific FRA for the proposed development. The site is located in Flood Zone C (Low Risk).
10.2.8	For developments adjacent to watercourses of a significant conveyance capacity any structures (including hard landscaping) must be set back a minimum of 5-10m from the edge of the watercourse to allow access for channel clearing/maintenance. Any required setback may be increased to provide for habitat protection. Development consisting of construction of embankments, wide bridge piers, or similar structures will not normally be permitted in or across flood plains or river channels.	No proposed structures are located within 5 – 10 metres of watercourses with a significant conveyance capacity.
10.2.6 to 10.2.8	The Council seeks to ensure the sustainable management of surface water discharges and to minimise the risk of flooding by requiring new development in the City through the incorporation of Sustainable Drainage Systems (SuDS) in new developments.	The proposed development will be consistent with best practice SUDs drainage design. The proposed project includes a surface water drainage plan.
10.2.6	Have regard to the EU Flood Risk Directive, the Flood Risk Regulations (S.I. No. 122/2010) and the Guidelines for Planning Authorities on the Planning System and Flood Risk Management and Circular PL2/2014, through the use of the sequential approach and application of the Justification Tests in Development Management.	The proposed project is in accordance with the sequential approach set out in the DoEHLG guidelines on Flood Risk and with the principles of development design outlined in Appendix B of these guidelines. The requirement for Justification Test is determined at **Section 5.2** below.
9.2.2	To ensure that appropriate mitigation and/or compensation measures to conserve biodiversity, landscape character and green infrastructure networks are required in developments	The proposed operational phase drainage system mimics the existing greenfield drainage regime at the proposed project site. The drainage system does not interact with

	where habitats are at risk or lost as part of a development.	any high-value habitats.

5.2 JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[5] is shown in **Table D**.

It may be considered that the proposed project is a 'Highly vulnerable development' as it is associated with essential infrastructure for electricity generation.

However, the entire proposed project site is located in Flood Zone C. Therefore, the proposed project is appropriate, from a flood risk perspective, and a Justification Test is not required, as shown **Table D** below.

Haul route works location HR3 is mapped inside Flood Zone A. This is however only temporary removal of road signs at an existing roundabout junction and therefore will have no potential to increase flood risk. The proposed temporary works can be considered water compatible and therefore appropriate.

Table D: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	**Appropriate**
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	**Appropriate**	Appropriate	Appropriate

Note: Taken from Table 3.2 (DoEHLG, 2009)
***Bold:** Applies to this project.*

Box 5.1 of "The Planning System and Flood Risk Management Guidelines" (PSFRM Guidelines) outlines the criteria required to complete the "Justification Test".

5.3 PROPOSED ON-SITE RUNOFF ATTENUATION

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

The volume of water requiring attenuation relates to direct precipitation on the roads and hard-standing footprint only. The aim of the storm water attenuation measures is to limit the

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

flow rate from the developed area to that which prevails on the undeveloped site. This is achieved by limiting the flow rate to the downstream receiving waters and temporarily storing the excess water that accumulates as a result. The developed surfaces have some permeability and this reduces the attenuation requirement. Conventional attenuation systems use proprietary flow control units but these can become blocked with debris and vegetation and require regular maintenance. They are therefore not appropriate for use within an upland agricultural/forestry environment or where routine maintenance would not be practical.

It is proposed to provide the temporary storage within the drainage channels by creating stone check dams within them at regular intervals. The spacing of the check dams is typically 20 - 30m but depends on the channel slope, with steeper channels requiring shorter intervals. The dams, which are constructed with small sized aggregate, also reduce the flow rate through the drainage system and are an effective means of providing flow control. Silt fence also provide storage and flow control.

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

All drainage elements at the project site (i.e. existing drains/watercourses as well as roadside/infrastructure drainage) will be inspected every 6 months.

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed Ballynalacken Windfarm Project, Co. Kilkenny. From this study:
    - No instances of historical flooding were identified in historic OS maps;
    - No instances of recurring or historic flooding were identified on OPW maps within the proposed project site;
    - The proposed project site is not identified within the OPW/CFRAM Flood Zones; and,
    - The proposed project site is not located within any National Indicative Fluvial Flood Zones.
- The proposed project can be categorised as "Highly Vulnerable Development", however, the proposed infrastructure is located outside of areas mapped as Flood Zones and therefore the proposed project is appropriate from a flood risk perspective;
- The overall risk of fluvial flooding at the project site is considered to be low. The entire area of the project site footprint is located in fluvial Flood Zone C;
- Haul route works location HR3 is mapped inside Flood Zone A. This is however only temporary removal of road signs at an existing roundabout junction and therefore will have no potential to increase flood risk;
- In addition, the risk of the project site contributing to downstream flooding is also very low, as there will be no alteration of the catchment size contributing to each of the main downstream watercourses. All development drainage water captured within individual site sub-catchments will be attenuated and released within the same sub-catchments that it was captured.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.

Appendix 8.4 Water Framework Directive Assessment Report

Appendix to Chapter 8: Water

Appendix 8.4: Water Framework Directive Assessment Report

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

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

WATER FRAMEWORK DIRECTIVE ASSESSMENT

PROPOSED BALLYNALACKEN WINDFARM PROJECT, CO. KILKENNY

FINAL REPORT

PREPARED FOR:

ECOPOWER DEVELOPMENTS LTD

PREPARED BY:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	Water Framework Directive Assessment proposed Ballynalacken Windfarm Project, Co. Kilkenny
Issue Date:	8th January 2025
Project Number:	P1562-0
Project Reporting History:	P1562-0
current revision no:	FINAL F0
Author:	Michael Gill David Broderick Jenny Law
Signed:	 _____ Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services

Disclaimer:

This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

TABLE OF CONTENTS

1. INTRODUCTION 5
1.1 BACKGROUND 5
1.2 STATEMENT OF AUTHORITY 5
1.3 WATER FRAMEWORK DIRECTIVE 6
2. WATERBODY IDENTIFICATION CLASSIFICATION 7
2.1 INTRODUCTION 7
2.2 SURFACE WATERBODY IDENTIFICATION 7
2.3 SURFACE WATER BODY CLASSIFICATION 12
2.4 GROUNDWATER BODY IDENTIFICATION 17
2.5 GROUNDWATER BODY CLASSIFICATION 17
2.6 PROTECTED AREA IDENTIFICATION 19
2.6.1 Nature Conservation Designations 19
2.6.2 Bathing Waters 19
2.6.3 Nutrient Sensitive Areas 19
2.6.4 Shellfish Areas 20
2.6.5 Drinking Water Protected Areas (DWPA) 20
3. WFD SCREENING 21
3.1 SURFACE WATER BODIES 21
3.2 GROUNDWATER BODIES 22
3.3 PROTECTED AREAS 22
3.4 WFD SCREENING SUMMARY 22
4. WFD COMPLIANCE ASSESSMENT 28
4.1 PROPOSALS 28
4.2 POTENTIAL EFFECTS 29
4.2.1 Construction Phase (Unmitigated) 29
4.2.2 Operational Phase (Unmitigated) 33
4.3 MITIGATION MEASURES 38
4.3.1 Construction Phase 38
4.3.2 Operational Phase 41
4.3.1 Decommissioning Phase 42
4.3.2 Potential Effects with the Implementation of Mitigation 43
5. SUMMARY AND CONCLUSION 46

FIGURES (IN TEXT)

Figure A: Local Hydrology Map 11

Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021) 18

TABLES IN TEXT

Table A: Surface Water Catchment Areas 8

Table B: Summary of Regional and Local WFD Mapped Hydrology and Proposed Infrastructure 9

Table C: Summary WFD Information for River Water Bodies 14

Table D: Summary WFD Information for Groundwater Bodies 17

Table E: Screening of WFD water bodies located within the study area 23

Table F: Surface Water Quality Impacts (WF Site) during Construction Phase (Unmitigated) 29

Table G: Surface Water Quality Impacts (Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection) during Construction Phase (Unmitigated) 30

Table H: Groundwater Quality Impacts during Construction Phase (Unmitigated) 31

Table I: Potential Impact on Surface Water Flows (Wind Farm) during Operational Phase (Unmitigated) 33

Table J: Surface Water Quality Impacts (WF Site) during Operational Phase (Unmitigated) 36

Table K: Groundwater Quality Impacts (WF Site) During Operational Phase (Unmitigated) 37

Table L: Summary of Drainage Mitigation & their Application 38

Table M: Summary of WFD Status for Unmitigated and Mitigated Scenarios 44

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by Ecopower Developments Ltd to complete a Water Framework Directive (WFD) Compliance Assessment for the proposed Ballynalacken Windfarm Project near Ballyragget, Co. Kilkenny.

In brief, the project includes 12 no. turbines, an electrical control building, underground cabling, 110kV electrical substation, underground grid connection, 2 no. borrow pits, ancillary and haul route works.

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

This WFD Assessment is intended to supplement the EIAR submitted as part of the Project planning application.

1.2 STATEMENT OF AUTHORITY

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

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

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael was involved in the EIS/EIAR for Oweninny WF, Cloncreen WF, Derrinlough WF, and over 100 no. other wind farm related projects.

David Broderick (BSc, H.Dip Env Eng, MSc) is a hydrogeologist with over 17 years' experience in both the public and private sectors. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into Environmental Impact Assessment Reports/Environmental Impact Statements (EIAR/EIS) for a range of commercial developments. For example, David has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Meenbog WF, Arderroo WF and Yellow River WF, and over 80 other wind farm related projects across the country.

Jenny Law (BSc, MSc) is an Environmental Geoscientist, holding an M.Sc. in Applied Environmental Geoscience (2022) from University College Cork. Jenny has also completed a B.Sc. in Earth and Ocean Science (2019) from National University of Ireland, Galway. Jenny has prepared the Land, Soils and Geology and Hydrology and Hydrogeology chapters for several wind farm and grid connection EIAR projects, and she also has experience in preparing flood risk assessments and WFD assessment reports.

1.3 WATER FRAMEWORK DIRECTIVE

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

The WFDs Water Action Plan 2024 requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

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

The River Basin Management Plan (2022 - 2027)/Water Action Plan 2024 objectives, which have been integrated into the design of the proposed wind farm development, include:

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

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

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

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

2.2 SURFACE WATERBODY IDENTIFICATION

Regionally the Project site is located in the River Nore regional surface water catchment within Hydrometric Area 15 of the Southeastern River Basin District. The River Nore flows in a southerly direction approximately 4 - 5km to the west of the proposed windfarm site and approximately 0.4km west of the proposed Tinnalintan Substation location. The majority of the windfarm site however drains to the River Nore via the Dinin River (8 turbines) and via the Owveg (Owenbeg) River (4 turbines).

On a sub-catchment scale, the northern and western sections of the wind site including the Internal Cable Link, Tinnalintan Substation and Ballynalacken Grid Connection are located in the Nore_SC_060 sub-catchment, which includes the River Nore channel to the west and the furthest downstream reach of the Owveg River to the north.

The central section of the proposed wind farm site mainly drains easterly into the Dinin (North)_SC_010 sub-catchment, while the southern half of the wind farm site is located in the Nore_SC_080 sub-catchment. Both are mapped as sub-catchments of the Dinin River, which flows to the east and south of the windfarm site.

The downstream distance from the wind farm site to the 4 no. river sub-basins associated with the River Nore are as follows- Cloghnagh_010 (~16.2km), Castlecomer Stream_010 (~23.4km), Owveg (Nore)_040 (~10.5km) and Nore_120 (0.2km).

Sub-basins in which the haul route work are located include the Rathgarvan or Clifden_010 (HR1), Brownstown(Pococke)_010 (HR2, HR3, HR4, HR5), Nore_170 (HR6), Nore_160 (HR7), Dinin (Main Channel)_010 (HR8), Dinin (north)_040 (HR9), Castlecomer Stream_010 (HR10, HR11), Nore_120 (HR12) and Cloghnagh_010 (HR13).

Table A presents the catchment area of each waterbody downstream of the proposed wind farm site as far as the Nore_SC_100 into which these waterbodies ultimately drain. The rivers within the immediate vicinity of the site have the smallest catchment areas (Castlecomer Stream_010 with 16.58km^2, Cloghnagh_010 with 16.85km^2 and Owveg(Nore)_040 with 57.22km^2).

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

Table A: Surface Water Catchment Areas

WFD River Sub-Basin	Total Upstream Catchment Area (km^2)
Nore sub-catchment (Nore_SC_060)	
Owveg(Nore)_040	57.22
Owveg(Nore)_050	83
Nore_120	~1056.8
Dinin sub-catchment (Dinin[North]_SC_010)	
Castlecomer Stream_010	16.58
Dinin (North)_040	149.22
Nore sub-catchment (Nore_SC_080)	
Cloghnagh_010	16.85
Dinin (Main channel)_010	245.92
Dinin (Main Channel)_020	299.23
Nore_160	~1500
Nore sub-catchment (Nore_SC_100)	
Nore_170	~1700
Nore_180	~1690
Nore_190	1745

Table B: Summary of Regional and Local WFD Mapped Hydrology and Proposed Infrastructure

Sub-catchment	Local River Water Body (Sub-basin)	Proposed Infrastructure	Works Area (ha) in the sub-basin	% of works area in the sub-basin
Nore_SC_080 (Dinin River)	CLOGHNAGH_010	6 no. turbines (T1, T2, T3, T4, T5, T7), 1 no. borrow pit, windfarm control building, windfarm site roads and drainage network, Internal Cable Link, construction compound no.1, road widening work, watercourse works W1, works at wet drainage channels (D1, D2, D3) and Haul route works (HR13)	24.5	47%
	DININ (MAIN CHANNEL)_010	Haul route works (HR8)	1.3	2%
	NORE_160	Haul route works (HR7)	0.04	>1%
Dinin[North]_SC_010	CASTLECOMER STREAM_010	3 no. turbines (T6, T8, T9)[Note 1], 1 no. borrow pit, windfarm site roads and drainage network, construction compound and Haul route works (HR10, HR1)	7.2	14%
	DININ(NORTH)_040	Haul route works (HR9)	0	-
Nore_SC_060	OWVEG (NORE)_040	3 no. turbines (T10, T11, T12)[Note 1], met mast, windfarm site roads and drainage network, works at wet drainage channel D4 and road widening works	7.6	15%
	NORE_120	Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection, construction compounds no. 2 and 3, Haul route works (HR12), telecom relay pole, windfarm site roads and drainage network, watercourse works W2 and W3 and road widening works.	11.3	22%
	RATHGARVAN OR CLIFDEN_010	Haul route works (HR1)	0	-

Sub-catchment	Local River Water Body (Sub-basin)	Proposed Infrastructure	Works Area (ha) in the sub-basin	% of works area in the sub-basin
Nore_SC_100	BROWNSTOWN(POCOCKE)_010	Haul route works (HR2, HR3, HR4, HR5)	0.09	>1%
	NORE_170	Haul Route Works HR6	0	-

[1] Turbine T9 is mapped in the Castlecomer Stream_010 by the WFD but actually drains into the Owveg (Nore)_040.

Figure A below is a local hydrology map of the influence zone.

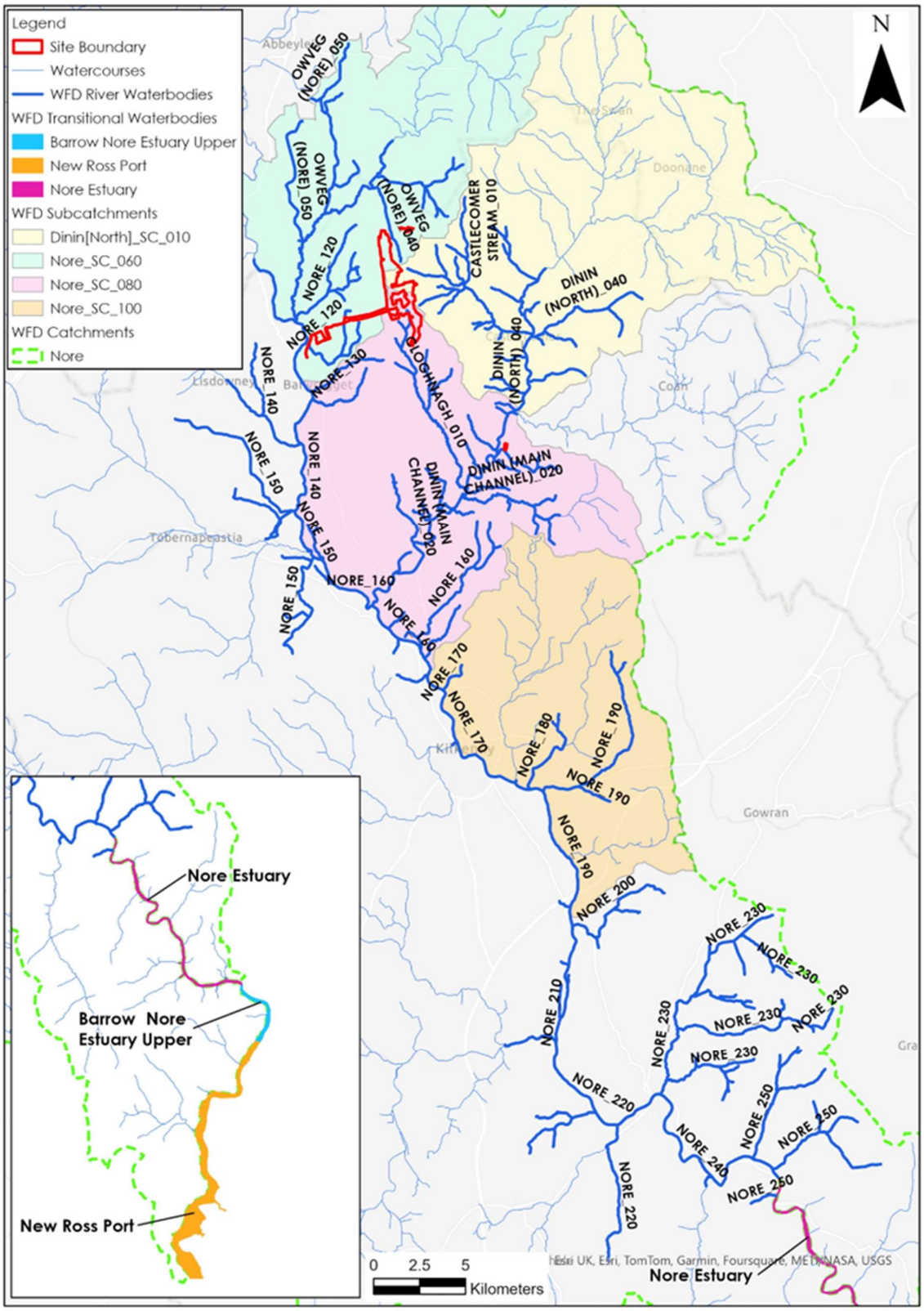


Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

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

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

As described in **Section 2.2** above, the northern section of the wind site is drained by the Owveg (Owenbeg) River. The latest 2016-2021 WFD cycle status of the Owveg River in the vicinity and downstream of the wind farm site is "Good" (Owveg(Nore)_040 and _050 river segments). Both segments of the Owveg River (Owveg(Nore)_040 and _050) have been deemed to be "Not at risk" of failing to meet their WFD objectives by 2027.

The Owveg River feeds into the River Nore (Nore_120). The Nore_120 river sub basin is also where the Internal Cable Link, Tinnalintan Substation and Ballynalacken Grid Connection are located. The Nore_120 achieved "Moderate" status in the latest WFD cycle is deemed to be "At risk". Industry has been identified as a significant pressure on the Nore_120 river waterbody as industrial discharges from the Tirlán processing plant (Ballyragget) has been causing nutrient and organic issues to arise. Further downstream the Nore_130, Nore_140 & Nore_150 river waterbodies all have a "Good" status and are all classified as being "Not at risk".

The central section of the Ballynalacken Windfarm site is mainly drained by the Castlecomer Stream_010 which achieved "Moderate" status in the latest WFD cycle and is thought to be "At risk" of failing to meet its WFD objectives. The significant pressures on the Castlecomer Stream_010 river waterbody include forestry and urban runoff. Forestry activities taking place include clearfelling and drainage, which have resulted in heavy siltation and excess nutrients in the water body. Diffuse urban runoff pressures are primarily caused by misconnections, leaking sewers and runoff from paved and unpaved areas.

Further downstream both the Dinin (North)_040 and Dinin (Main channel)_010 river waterbodies achieved "Moderate" status and have been deemed to be "At risk". Agriculture and domestic wastewater have been recognised as significant pressures impacting negatively on these river waterbodies. Urban runoff and urban wastewater are also additionally listed as significant pressures on the Dinin (North)_040, according to the 3rd Cycle Nore Catchment Report (HA 15), (EPA, 2021).

The southern section of the windfarm site is drained by the Cloghnagh_010 river waterbody which feeds into the Dinin (Main channel)_020 river waterbody. Both of these waterbodies achieved "Moderate" status in the latest WFD cycle. The risk status for the Cloghnagh_010 is currently under "Review", whilst the Dinin (Main channel)_020 is "At risk". A quarry has been identified as a potential significant pressure in Dinin (Main Channel)_020 river waterbody, however the impact type is unknown. Abstraction for public water supply was identified as a significant pressure in Dinin (Main Channel)_020 from Kilkenny City (Radestown) Public Water Supply (PWS). Agriculture is also seen as a significant pressure on this waterbody.

The WFD status of the Nore River downstream from the proposed project ranges from “Moderate” (Nore_190 & Nore_230) to “Good” (Nore_160 through to Nore_180, Nore_200 through to Nore_220, Nore_240 & Nore_250). The risk status of the Nore_190 through to the Nore_220 and the Nore_240 are all currently under “Review”. However, the Nore_230 is deemed to be “At risk” with urban runoff listed as a significant pressure impacting the river waterbody. The Nore_160, Nore_170, Nore_180 and Nore_250 waterbodies are all classified as “Not at risk”.

In terms of transitional waterbodies, the Nore Estuary, the Barrow Nore Estuary Upper and the New Ross Port downstream of the Nore River all have “Moderate” Status and are all deemed to be “At risk”. Agricultural activities are known to be a significant pressure on each of the transitional waterbodies mentioned, with urban runoff additionally listed as a significant pressure on the Barrow Nore Estuary Upper.

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

Table C: Summary WFD Information for River Water Bodies

SWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
Nore Catchment					
Owveg(Nore)_040	Good	Good	Good	Not at risk	-
Owveg(Nore)_050	Good	Good	Good	Not at risk	-
Nore_120	Unassigned	Good	Moderate	At risk	Industry
Nore_130	Good	Good	Good	Not at risk	-
Nore_140	Unassigned	Good	Good	Not at risk	-
Nore_150	Good	Good	Good	Not at risk	-
Castlecomer Stream_010	Good	Moderate	Moderate	At risk	Forestry & urban runoff
Dinin (North)_040	Good	Moderate	Moderate	At risk	Agriculture, domestic waste water, urban runoff & urban waste water
Dinin (Main channel)_010	Good	Moderate	Moderate	At risk	Agriculture & domestic waste water
Cloghnagh_010	Good	Good	Moderate	Under review	-
Dinin (Main Channel)_020	Moderate	Moderate	Moderate	At risk	Agriculture, mines & quarries & other
Nore_160	Unassigned	Good	Good	Not at risk	-

SWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
Nore_170	Good	Good	Good	Not at risk	-
Brownstown (Pococke)_010	Poor	Poor	Moderate	At Risk	Urban Runoff
Nore_180	Good	Good	Good	Not at risk	-
Kilderry_010	Unassigned	Good	Moderate	Under review	-
Nore_190	Unassigned	Moderate	Moderate	Under review	-
Rathgarvan or Clifden_010	Unassigned	Moderate	Poor	Under review	-
Nore_200	Unassigned	Moderate	Good	Under review	-
Nore_210	Moderate	Good	Good	Under review	-
Nore_220	Good	Moderate	Good	Under review	-
Nore_230	Good	Moderate	Moderate	At risk	Urban runoff
Nore_240	Good	Moderate	Good	Under review	-
Nore_250	Good	Good	Good	Not at risk	-
Nore Estuary	Moderate	Good	Moderate	At risk	Agriculture
Barrow Nore Estuary Upper	Good	Moderate	Moderate	At risk	Agriculture & urban runoff

SWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
New Ross Port	Moderate	Moderate	Moderate	At risk	Agriculture

2.4 GROUNDWATER BODY IDENTIFICATION

The Ballynalacken Windfarm site is located in the Ballingarry Groundwater Body (GWB) (Code: IE_SE_G_009) while the proposed Tinnalintan Substation is located in the Durrow GWB (Code: IE_SE_G_156). The proposed Ballynalacken Grid Connection is also located in the Durrow GWB with the exception of the final 1km at the EirGrid Substation at Moatpark which is located in the Kilkenny-Ballynakill Gravels GWB (Code: IE_SE_G_163).

The Ballingarry GWB is described as poorly productive and comprises Westphalian Sandstones, Westphalian Shales and Namurian Sandstones and Shales. Within the Ballingarry GWB groundwater will discharge locally to streams and rivers crossing the GWB and also to small springs and seeps.

The majority of the Durrow GWB comprises Dinantian Pure Bedded Limestones which are classified as a Regionally Important Aquifer - Karstified (diffuse). This GWB reportedly discharges via numerous large springs close to the main river channels or directly into the rivers within the overall GWB.

The Kilkenny-Ballynakill Gravels are a Regionally Important Gravel Aquifer. The sand and gravel deposits associated with the Nore are fluvio-glacial in origin, deposited by the large quantities of meltwater associated with ice-retreat. This means that coarse sands and gravels are likely to predominate.

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

2.5 GROUNDWATER BODY CLASSIFICATION

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

The Ballingarry GWB that underlies the windfarm site has been assigned 'Good' status in all 3 no. WFD cycles and have been deemed to be 'Not at Risk'.

The Durrow GWB is of 'Poor' status, and it has been deemed to be 'At Risk'. The GWB has deteriorated in status due to the increasing groundwater nitrate concentrations exceeding the drinking water standard. Agricultural activities are putting significant pressure on this GWB.

The Kilkenny-Ballynakill Gravels GWB has "Good" status and is "Not at risk" of failing to meet its WFD objectives in the future.

Table D: Summary WFD Information for Groundwater Bodies

GWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	Risk Status 3rd Cycle	Pressures
Ballingarry	Good	Good	Good	Not at risk	-
Durrow	Good	Poor	Poor	At risk	Agriculture
Kilkenny-Ballynakill Gravels	Good	Good	Good	Not at risk	-

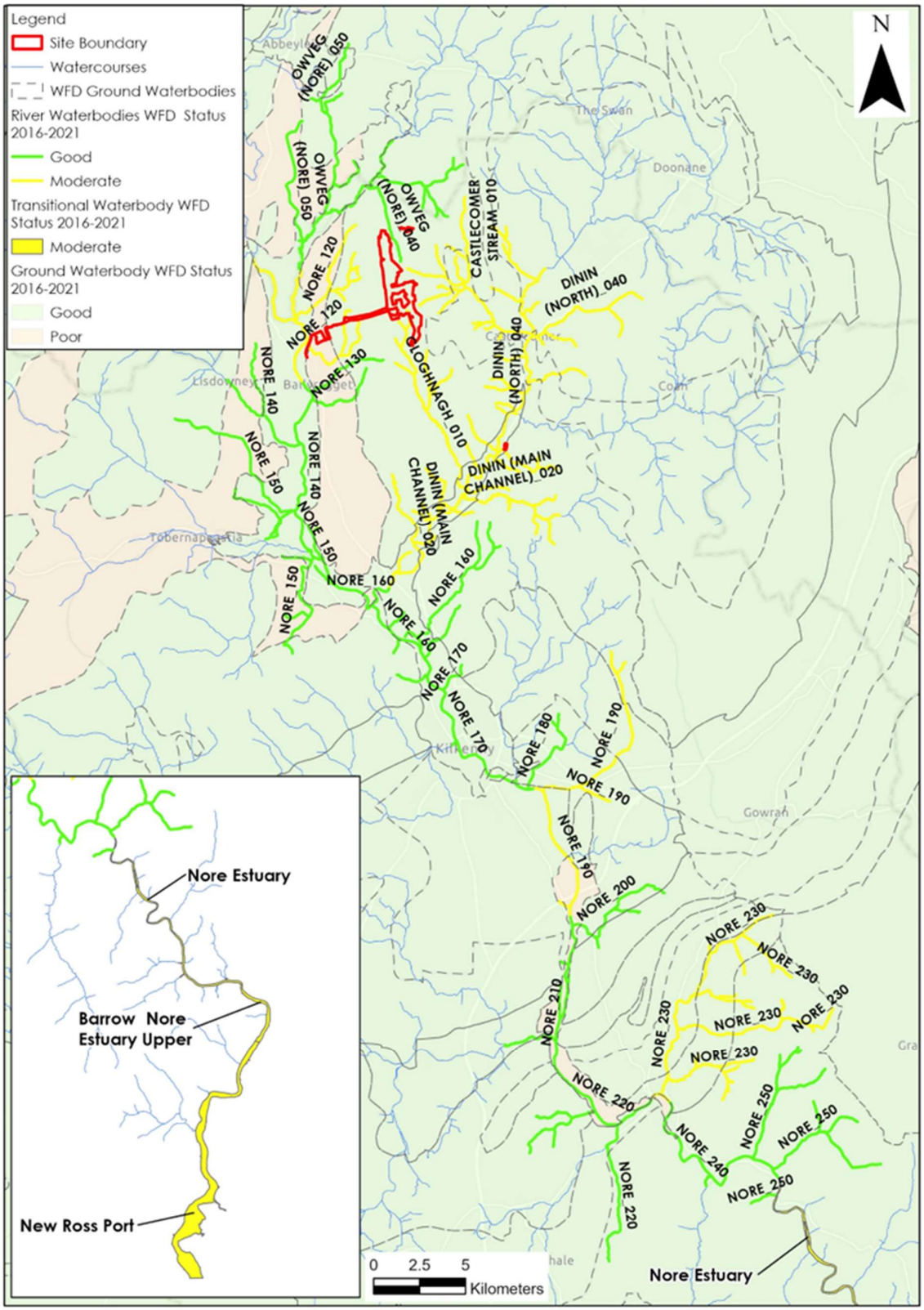


Figure B: WFD Groundwater and Surface Waterbody Status (2016-2021)

2.6 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below. Nature conservation designations, bathing waters, nutrient Sensitive areas (NSA), shellfish areas and drinking water protected area's (DWPA) are looked at as part of the assessment.

2.6.1 Nature Conservation Designations

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The River Barrow and River Nore SAC (Site Code: 002162) and River Nore SPA (Site Code: 004233) are located downstream of the Ballynalacken Windfarm Project and includes the Nore River itself as well as reaches of the Owveg River and Dinin River.

Other nearby designated sites scoped in for assessment include the River Nore/Abbeyleix Woods Complex pNHA (Site Code: 002076), Inchbeg pNHA and Ardaloo Fen pNHA also mapped along the Nore River.

2.6.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

There are no bathing waters in or directly adjacent to the catchment identified under the Bathing Water Regulations 2008.

According to EPA/WDF mapping (www.catchments.ie) all mapped bathing waters downstream of the Ballynalacken Windfarm Project are coastal and >60km from the proposed site.

2.6.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

The EPA carried out a review of Nutrient Sensitive Areas (NSAs) downstream of large urban waste water discharges in 2020. Once the regulations are in place, and nutrient sensitive areas have been identified, additional nutrient removal must be applied (if not already applied) to waste water treatment plants discharging to the sensitive area. If this treatment was in place the objective was deemed to have been met.

There are 4 no. NSAs downstream of the proposed project that are downstream of two urban wastewater agglomerations. The NSAs are located along the River Nore and include the following:

- Nore River(_180 - _250) associated with Kilkenny City.
- Nore Estuary associated with Kilkenny City.
- Barrow Nore Estuary associated with New Ross.
- New Ross Port associated with New Ross.

NSA objectives are being met in all of the NSAs in the catchment.

2.6.4 Shellfish Areas

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

There are no Shellfish areas located in the vicinity of the proposed project site. The project site is ~60km northwest of Waterford Harbour (Cheekpoint/Arthurstown/Creadan) (IEPA2_0056), the nearest shellfish area site (as the crow flies).

2.6.5 Drinking Water Protected Areas (DWPA)

There are 3 no. surface water DWPA's downstream of the proposed project protected under Article 7 Abstraction for Drinking Water:

- The Nore_120 DWPA (IEPA1_SE_15N011400)
- The Dinin (Main Channel)_020 DWPA (IEPA1_SE_15D020800)
- The Nore_160 DWPA (IEPA1_SE_15N011750)
- The Nore_220 DWPA (IEPA1_SE_15N012310)

The DWPA on the Nore_120 relates to the Ballyragget Public Water Supply, while the Dinin (Main Channel)_020 and Nore_160 relate to the Kilkenny City Public Water Supply.

The proposed project is not located within any groundwater Source Protection Area (SPA) but all GWBs underlying the project site are listed as DWPA under Article 7 Abstraction for Drinking Water:

- Ballingarry GWB (IE_SE_G_009)
- Durrrow GWB (IE_SE_G_156) groundwater body
- Kilkenny-Ballynakill Gravels GWB (IE_SE_G_163)

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 27 no. surface waterbodies which are located in the vicinity of the proposed Ballynalacken Windfarm Project site and downstream of the Project site. These comprise 24 no. river waterbodies and 3 no. transitional waterbodies downstream of the proposed Project site. In addition, 3 no. groundwater bodies underlie the proposed Project site. Furthermore, there are protected areas in the vicinity of the Project site, namely the River Barrow and River Nore SAC, River Nore SPA, River Nore/Abbeyleix Woods Complex pNHA and the Nore_120 DWPA.

3.1 SURFACE WATER BODIES

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

With consideration for the construction, operational and decommissioning phases of the proposed Project, it is considered that all sections of the Owveg River (Owveg (Nore)_040 & Owveg (Nore)_050) within the vicinity and downstream of the project are carried through into the WFD Impact Assessment. In addition, both the Castlecomer Stream_010 and the Cloghnagh_010 river waterbodies have been screened in due to the presence of proposed infrastructure within their respective catchments. The Dinin North_040 and Dinin (Main Channel)_010 river waterbodies, downstream of the Castlecomer Stream_010 SWB, and the Dinin (Main Channel)_020 river waterbody, downstream of the Cloghnagh_010, have also been screened in due to their proximal location downstream of the proposed development. These SWBs have been included for further assessment due to their proximal location to the proposed project works. The proposed project works within the wind farm site must not in any way result in a deterioration in the status of these SWBs and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

Segments of the River Nore have been included in the impact assessment also. These include the Nore_120 river waterbody, as the Internal Cable Link, Tinnalintan Substation and the Ballynalacken Grid Connection are located in the Nore_120 sub-basin. Further downstream the Nore_130 - Nore_190 river waterbodies have been included due to their proximal location downstream of the proposed Project.

The lower reaches of the Nore River (downstream of Nore_190 /Nore_SC_100) have been screened out due to their distal location from the proposed project site and due to its increased catchment area and flow volumes, which decreases the potential for the proposed project to impact a waterbody. The proposed Project has no potential to cause a deterioration in the status of these screened out SWBs and/or jeopardise their attainment of good surface water status.

Subbasins that only have proposed haul route works in them are also screened out due to the unlikely effects on WFD status from these minor works. These include Rathgarvan or Clifden_010 and Brownstown(Pococke)_010. There is no windfarm infrastructure upstream of these subbasins either.

All transitional waterbodies downstream of the proposed project, including the Nore Estuary, the Barrow Nore Estuary Upper and the New Ross Port have been screened out due to the large volumes of water within these SWBs and the saline nature of these waters. The proposed Project has no

potential to cause a deterioration in status of these SWBs and/or jeopardise the attainment of good surface water status in the future.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Ballingarry GWB, the Durrow GWB and the Kilkenny-Ballynakill Gravels GWB are carried through to the WFD Impact Assessment due to their location directly underlying the proposed project.

3.3 PROTECTED AREAS

The proposed Ballynalacken Windfarm Project has hydrological connections with downstream designated sites including the River Barrow and River Nore SAC and River Nore SPA being the most notable.

With consideration for the construction, operational and decommissioning phases of the proposed Project, it is considered that the River Barrow and River Nore SAC, River Nore SPA as well as the River Nore/Abbeyleix Woods Complex pNHA are carried through into the WFD Impact Assessment due to their proximal locations downstream of the proposed project.

All NSA's downstream of the proposed Project site, within the Nore River, (Nore River(_180 - _250) NSA, Nore Estuary NSA, Barrow Nore Estuary NSA and New Ross Port NSA) have all been screened out due to their distal location from the site and the large volumes of water within the river. The proposed Project has no potential to cause a deterioration in the status of these NSA's.

The Nore_120 DWPA, the Dinin (Main Channel)_020 DWPA and Nore_160 DWPA have been screened in due to their proximal location downstream of the proposed Project. Whereas the Nore_220 DWPA has been screened out due to its distant location from the proposed project site and the large volumes of water within the river waterbody. The proposed project has no potential to cause a deterioration in the status of this DWPA.

Due to the inland location of the proposed Project site no designated bathing waters or shellfish waters will be included in the assessment.

3.4 WFD SCREENING SUMMARY

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

Table E: Screening of WFD water bodies located within the study area

WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body River Nore Catchment			
River	Owveg(Nore)_040	Yes	The northern section of the wind farm site, including 4 no. turbines, is mapped within the Owveg(Nore)_040 river sub-basin. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Owveg(Nore)_050	Yes	The Owveg(Nore)_050 is located proximally to the wind farm site and directly downstream of the Owveg(Nore)_040 SWB. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Nore_120	Yes	Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection, construction compounds no. 2 and 3, Haul route works (HR12), and road widening works. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Nore_130	Yes	The Nore_130 SWB has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Nore_140	Yes	The Nore_140 SWB has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Nore_150	Yes	The Nore_150 SWB has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Castlecomer Stream_010	Yes	The central section of the windfarm site, including 2 no. turbines (T6 & T8), 1 no. borrow pit and Haul route works (HR10, HR11). An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Dinin (North)_040	Yes	The Dinin (North)_040, in which haul route works are proposed (HR09), is located proximally to the wind farm site and directly downstream of the Castlecomer Stream_010 SWB. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Dinin (Main channel)_010	Yes	The Dinin (Main channel)_010, in which haul route works are proposed (HR08), has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this SWB.

River	Cloghnagh_010	Yes	The southern section of the windfarm site including 6 no. turbines (T1, T2, T3, T4, T5, T7), borrow pit no. 1, windfarm control building, windfarm site roads and drainage network, Internal Cable Link, construction compound no.1, road widening works, Haul route works (HR13).
River	Dinin (Main Channel)_020	Yes	The Dinin (Main Channel)_020 is located proximally to the wind farm site and directly downstream of the Cloghnagh_010 SWB. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Nore_160	Yes	The Nore_160 SWB has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Nore_170	Yes	Nore_170 SWB, in which haul route works are proposed (HR06), has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Nore_190	Yes	The Nore_190 SWB has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this SWB.
River	Brownstown_Pocke_010	No	Catchment only contains haul route works which have no potential to alter WFD status.
River	Rathgarvan_Clifden_010	No	Catchment only contains haul route works which have no potential to alter WFD status.
River	Nore_180	No	The Nore_180 SWB has been screened in as there is proposed development upstream of this SWB.
River	Nore_200	No	The Nore_200 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Nore River.
River	Nore_210	No	The Nore_210 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Nore River.
River	Nore_220	No	The Nore_220 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Nore River.
River	Nore_230	No	The Nore_230 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Nore River.

River	Nore_240	No	The Nore_240 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Nore River.
River	Nore_250	No	The Nore_250 SWB has been screened out due to its distal location from the site and the increasing volumes of water within the Nore River.
Transitional	Nore Estuary	No	The Nore Estuary SWB has been screened out due to the saline nature of its waters and the large volumes of water within the transitional waterbody. The Proposed project has no potential to impact the status of this SWB.
Transitional	Barrow Nore Estuary Upper	No	The Barrow Nore Estuary Upper SWB has been screened out due to the saline nature of its waters and the large volumes of water within the Estuary. The Proposed project has no potential to impact the status of this SWB.
Transitional	New Ross Port	No	The New Ross Port SWB has been screened out due to the saline nature of its waters and the large volumes of water within the Bay. The Proposed project has no potential to impact the status of this SWB.
Groundwater Bodies			
Groundwater	Ballingarry	Yes	The wind farm site is mapped to overlie the Ballingarry GWB. An assessment is required to consider the potential impacts of the proposed project on this GWB.
Groundwater	Durrow	Yes	The proposed substation and majority of the grid connection route is mapped to overlie the Durrow GWB. An assessment is required to consider the potential impacts of the proposed project on this GWB.
Groundwater	Kilkenny-Ballynakill Gravels	Yes	The final 1km of the grid connection route at Ballyragget Substation is mapped to overlie the Kilkenny-Ballynakill Gravels GWB. An assessment is required to consider the potential impacts of the proposed project on this GWB.
Protected Areas			
Nature Conservation Designations	River Barrow and River Nore SAC	Yes	The wind farm site ultimately drains into the River Nore and flows through the River Barrow and River Nore SAC. An assessment is required to consider the potential impacts of the proposed development on this designated site.
	River Nore SPA	Yes	The wind farm site ultimately drains into the River Nore and flows through the River Nore SPA. An assessment is required to consider the potential impacts of the proposed development on this designated site.

	Nore/Abbeyleix Woods Complex pNHA	Yes	The wind farm site ultimately drains into the River Nore and flows through the River Nore/Abbeyleix Woods Complex pNHA. An assessment is required to consider the potential impacts of the proposed development on this designated site.
	Inchbeg pNHA	Yes	The wind farm site ultimately drains into the River Nore and flows adjacent to Inchbeg pNHA. An assessment is required to consider the potential impacts of the proposed development on this designated site.
	Ardaloo Fen pNHA	Yes	The wind farm site ultimately drains into the River Nore and flows adjacent to Ardaloo Fen pNHA. An assessment is required to consider the potential impacts of the proposed development on this designated site.
Nutrient Sensitive Areas	Nore River(_180 - _250) NSA	No	Nore River(_180 - _250) NSA has been screened out due to its distal location from the proposed development site and the large volume of water within the River. The proposed development has no potential to impact the status of this NSA.
	Nore Estuary NSA	No	Nore Estuary NSA has been screened out due to its distal location from the proposed development site and the large volume of water within the Estuary. The proposed development has no potential to impact the status of this NSA.
	Barrow Nore Estuary NSA	No	Barrow Nore Estuary NSA has been screened out due to its distal location from the proposed development site and the large volume of water within the Estuary. The proposed development has no potential to impact the status of this NSA.
	New Ross Port NSA	No	New Ross Port NSA has been screened out due to its distal location from the proposed development site and the large volume of water within the Estuary. The proposed development has no potential to impact the status of this NSA.
Shellfish Area	Waterford Harbour (Cheekpoint/Arthurstown/Creadan)	No	Waterford Harbour (Cheekpoint/Arthurstown/Creadan) Shellfish waters have been screened out due to its distal location from the proposed development site. The proposed development has no potential to impact this designated shellfish area.
Drinking Water	Nore_120	Yes	The internal cable link, substation and grid connection are located in the Nore_120 sub-basin. An assessment is required to consider the potential impacts of the proposed project on this DWPA.
	Dinin (Main Channel)_020	Yes	The Dinin (Main Channel)_020 is located proximally to the wind farm site and directly downstream of the Cloghnagh_010 SWB. An assessment is required to consider the potential impacts of the proposed project on this DWPA.

	Nore_160	Yes	The Nore_160 SWB has been screened in due to its proximal location in the vicinity and downstream of the proposed development. An assessment is required to consider the potential impacts of the proposed project on this DWPA.
	Nore_220	No	The Nore_220 DWPA has been screened out due to its distal location from the site and the increasing volumes of water within the Nore River.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

The Ballynalacken Windfarm Project will comprise the following elements:

EIAR Nomenclature	Overview Description
Ballynalacken Windfarm	12 No. Wind Turbines and associated works including foundations and hardstanding areas, windfarm roads, electrical control building and internal underground cabling connecting the wind turbines to the control building.
Internal Cable Link	Underground cabling which will connect the Windfarm Control Building to the Tinnalintan Substation.
Tinnalintan Substation	110kV Electrical Substation and associated access road.
Ballynalacken Grid Connection	Underground Grid Connection from the Tinnalintan Substation to the existing EirGrid Ballyragget Substation and facilitating works in the EirGrid Substation.
Ancillary & Haul Route Works	Site entrances, 1 no. met mast, 1 no. telecoms relay pole, site drainage network, temporary construction compounds, 2 no. temporary borrow pits (which will also be used as spoil deposition areas), temporary works in private lands and along the public road corridor to facilitate turbine delivery and access to the turbine sites, public road widening works along the L5840, L5845 and L5846 local roads, landscaping and reinstatement works.

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

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

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

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

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

Construction phase activities including site levelling/construction and building turbine foundation excavation and the borrow pits will require earthworks resulting in removal of vegetation cover and excavation of soil and subsoils. The main risk will be from surface water runoff from bare soil, spoil storage areas and borrow pit drainage/dewatering during construction works.

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

Release of effluent from wastewater treatment systems also has the potential to impact on surface waters.

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

As outlined in **Table A,** the rivers within the immediate vicinity of the site have the smallest catchment areas. The catchment area for the waterbodies increases progressively downstream. Therefore, those waterbodies which are located in close proximity to the site are more susceptible to water quality impacts as a result of activities associated with the proposed Project. The potential for the proposed Project to impact a waterbody decreases further downstream due to the increasing catchment area to the surface waterbody and resulting increase in flow volumes.

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

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Owveg(Nore)_040	IE_SE_15O010280	Good	Moderate
Owveg(Nore)_050	IE_SE_15O010400	Good	Moderate
Nore_120	IE_SE_15N011400	Moderate	Poor
Nore_130	IE_SE_15N011500	Good	Good

Nore_140	IE_SE_15N011600	Good	Good
Nore_150	IE_SE_15N011700	Good	Good
Castlecomer Stream_010	IE_SE_15C010100	Moderate	Poor
Dinin (North)_040	IE_SE_15D070400	Moderate	Poor
Dinin (Main channel)_010	IE_SE_15D020700	Moderate	Poor
Cloghnagh_010	IE_SE_15C040400	Moderate	Poor
Dinin (Main Channel)_020	IE_SE_15D020800	Moderate	Poor
Nore_160	IE_SE_15N011750	Good	Good
Nore_170	IE_SE_15N011950	Good	Good
Nore_180	IE_SE_15N012000	Good	Good
Nore_190	IE_SE_15N012090	Moderate	Moderate

4.2.1.2 Potential Surface Water Quality Effects along Grid Connection Route and Internal Cable Link Route

The proposed route of the Internal Cable Link, Tinnalintan Substation, and the route of the Ballynalacken Grid Connection are mapped within the Nore_120 WFD river sub-basin. There is 1 no. natural watercourse crossing along both the Internal Cable Link route (W2) and the Grid Connection (W3) within the Nore_120 sub-basin.

Construction activities along the cable routes have the potential to adversely impact the status of the Nore_120 SWBs.

Table G: Surface Water Quality Impacts (Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection) during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Nore_120	IE_SE_15N011400	Moderate	Poor

4.2.1.3 Potential Groundwater Quality Impacts

In terms of local GWBs, the Ballynalacken Windfarm site is located in the Ballingarry GWB while the proposed Tinnalintan Substation is located in the Durrow GWB. The Ballynalacken Grid Connection is also mainly located in the Durrow GWB with c.700m located in the Kilkenny-Ballynakill Gravels GWB.

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

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

Due to the lack of infrastructure proposed within the Kilkenny-Ballynakill Gravels GWB (limited to c.700m of the grid connection route) the potential for any significant changes to the groundwater body WFD status is significantly reduced even in an unmitigated scenario.

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

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

GWB	WFD Code	Current Status	Assessed Potential Status Change
Ballingarry	IE_SE_G_009	Good	Moderate
Durrow	IE_SE_G_156	Poor	Poor
Kilkenny-Ballynakill Gravels	IE_SE_G_163	Good	Good

4.2.1.4 Potential Impacts on Protected Areas

River Barrow and River Nore SAC, River Nore SPA & River Nore/Abbeyleix Woods pNHA

The main works at the Ballynalacken Windfarm Project relate to the construction of 12 turbines and access roads and ancillary works at the Ballynalacken Windfarm site, the construction of the Internal Cable Link, Tinnalintan Substation, and the construction of Ballynalacken Grid Connection to Moatpark. These works are upstream of, and hydrologically connected to the River Barrow and River Nore SAC, the River Nore SPA and the River Nore/Abbeyleix Woods Complex pNHA.

Project works in the Dinin River catchment and any haul route works in the Nore catchment downstream of Ballyragget are downstream of the River Nore/Abbeyleix Woods Complex pNHA, and therefore are not hydrologically connected to the pNHA, the potential for impacts can be excluded.

The Ballynalacken Windfarm site is proposed for a location upstream of the River Barrow and River Nore SAC, spread over a number of riverbody catchments – and is 2km from the SAC in the Owveg(Nore)_040 catchment, 5.3km from the SAC in the Castlecomer_Stream_010 catchment, 1.1km from the SAC in the Cloghnagh_010 catchment. The boundary of the SPA is generally further downstream from the Ballynalacken Windfarm – 4m, 22.5km, and 16km respectively. In relation to Tinnalintan Substation and the Ballynalacken Grid Connection which are located to the southwest of the windfarm, the SAC is c.600m from the Tinnalintan Substation site, and 90m downstream of the closest grid connection works. The River Nore/Abbeyleix Woods Complex pNHA overlaps the boundary of the SAC, with hydrological connectivity to the Project in the Nore_120 catchment.

Due to the close proximity of the SAC/SPA/pNHA to the main elements of the Ballynalacken Windfarm Project, the potential magnitude is Large Adverse.

The construction and installation of ancillary works such as the Haul Route Works remote from the site (including HR8) will have no effect on water quality in the SAC or SPA due to the very small extent and brief duration of works, and the location of these works either within or immediately adjacent to the public road network.

DWPA's

Construction phases activities as described above in **Section 4.2.1.1**, could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which could affect the water quality in the Nore_120, Dinin (Main Channel)_020 and the Nore_160 river waterbodies, therefore impacting on the Nore_120, Dinin (Main Channel)_020 and the Nore_160 DWPA's. However, as stated in the EIAR (Table 8-18), It is considered that due to the downstream separation distances and dilution ratios (in the River Nore) any impacts, even in worst-case unmitigated scenarios and effects on downstream DWPA's will be imperceptible.

4.2.2 Operational Phase (Unmitigated)

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

Little maintenance work will be required at the Tinnalintan Substation for the Internal Cable Link or Ballynalacken Grid Connection and therefore there is no potential to impact on the status of downstream SWBs or underlying GWBs.

4.2.2.1 Increased Wind Farm Site Runoff and Potential Hydromorphology Effects

Progressive replacement of vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the site and increase flood risk downstream of the proposed project.

The emplacement of the proposed permanent hardcore (~6.1ha at the windfarm site, 1.3ha at Tinnalintan Substation), as described in Chapter 5 of the EIAR, could (assuming emplacement of impermeable materials as a worst-case scenario) result in an average total site increase in surface water runoff of approximately 1,077m^3/month or 34.7m^3/day. This represents a potential increase of only approximately 0.43% in the average daily/monthly volume of runoff from the site area in comparison to the baseline pre-development site runoff conditions.

This is a very small increase in average runoff and results from a relatively small area of the overall study area being developed. Specifically, the proposed permanent development footprint represents only 2% of the total project landholding area of 300ha (development redline boundary).

The additional runoff volume is low due to the fact that the runoff potential from the project site is already relatively high (85% runoff coefficient) due to the prevailing baseline hydrogeological conditions at the site. Also, this calculation assumes that all hardstanding areas will be impermeable which is a conservative approach given that access tracks and crane hardstands will be constructed of aggregates which will facilitate the permeation/recharge of rainfall.

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

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Owveg(Nore)_040	IE_SE_15O010280	Good	Good
Owveg(Nore)_050	IE_SE_15O010400	Good	Good

Nore_120	IE_SE_15N011400	Moderate	Moderate
Nore_130	IE_SE_15N011500	Good	Good
Nore_140	IE_SE_15N011600	Good	Good
Nore_150	IE_SE_15N011700	Good	Good
Castlecomer Stream_010	IE_SE_15C010100	Moderate	Moderate
Dinin (North)_040	IE_SE_15D070400	Moderate	Moderate
Dinin (Main channel)_010	IE_SE_15D020700	Moderate	Moderate
Cloghnagh_010	IE_SE_15C040400	Moderate	Moderate
Dinin (Main Channel)_020	IE_SE_15D020800	Moderate	Moderate
Nore_160	IE_SE_15N011750	Good	Good
Nore_170	IE_SE_15N011950	Good	Good
Nore_180	IE_SE_15N012000	Good	Good
Nore_190	IE_SE_15N012090	Moderate	Moderate

4.2.2.2 Surface Water Quality Impacts from Operational Wind Farm Site Drainage

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads and hardstand areas, and the infrequent rewidening of site entrances to facilitate the replacement of a major turbine component. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added, or very small areas of topsoil are temporarily removed during maintenance works.

A summary of potential status change to SWBs arising from surface water quality impacts during the operation stage of the proposed project in the unmitigated scenario are outlined in

Table J.

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

SWB	WFD Code	Current Status	Assessed Potential Status Change
Owveg(Nore)_040	IE_SE_15O010280	Good	Good
Owveg(Nore)_050	IE_SE_15O010400	Good	Good
Nore_120	IE_SE_15N011400	Moderate	Moderate
Nore_130	IE_SE_15N011500	Good	Good
Nore_140	IE_SE_15N011600	Good	Good
Nore_150	IE_SE_15N011700	Good	Good
Castlecomer Stream_010	IE_SE_15C010100	Moderate	Moderate
Dinin (North)_040	IE_SE_15D070400	Moderate	Moderate
Dinin (Main channel)_010	IE_SE_15D020700	Moderate	Moderate
Cloghnagh_010	IE_SE_15C040400	Moderate	Moderate
Dinin (Main Channel)_020	IE_SE_15D020800	Moderate	Moderate
Nore_160	IE_SE_15N011750	Good	Good
Nore_170	IE_SE_15N011950	Good	Good
Nore_180	IE_SE_15N012000	Good	Good
Nore_190	IE_SE_15N012090	Moderate	Moderate

4.2.2.3 Groundwater Quality Impacts at the Wind Farm Site

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

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

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

GWB	WFD Code	Current Status	Assessed Potential Status Change
Ballingarry	IE_SE_G_009	Good	Good
Durrow	IE_SE_G_156	Poor	Poor
Kilkenny-Ballynakill Gravels	IE_SE_G_163	Good	Good

4.3 MITIGATION MEASURES

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

4.3.1 Construction Phase

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

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in Error! Reference source not found. below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls.

Table L: Summary of Drainage Mitigation & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	• Application of 50m buffer zones to natural watercourses where possible; • Using small working areas; • Working in appropriate weather and suspending certain work activities in advance of forecasted wet weather.	Construction work areas where sediment is being generated.
Source Controls:	Use of upstream interceptor drains and downstream collector drains, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment is being generated.
	• Using small working areas; • Covering stockpiles; • Weathering off / sealing stockpiles and promoting vegetation growth.	Stockpiles areas
In-Line Controls:	Interceptor drains, vee-drains, oversized swales/collector drains; • Erosion and velocity control measures such as: • sand bags; • oyster bags filled with gravel; • filter fabrics; • flow limiters; • weirs or baffles; • and/or other similar/equivalent or appropriate systems. • Silt fences, filter fabrics; • Collection sumps, temporary sumps, pumping systems; • Attenuation lagoons;	Interceptor and collection drainage systems

	• Sediment traps, stilling / settlement ponds.	
Water Treatment Controls:	• Temporary sumps; • Attenuation ponds; • Sediment traps, Stilling / Settlement ponds, silt bags; • Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.	Surface water treatment locations
Outfall Controls:	• Level spreaders; • Buffered outfalls; • Vegetation filters; • Silt bags; • Flow limiters and weirs.	Drainage run outfalls and overland discharge points

4.3.1.2 Mitigation Measures to Protect Groundwater Quality

The potential pollution of groundwater during the construction phase will be mitigated by the provision of appropriate controls and working methods. The relevant mitigation measures ID is provided where relevant. These measures include best practice methods for storage and handling of fuels and chemicals and include:

- MM24: All fuel and oil will be stored in an appropriately bunded area within the temporary construction compounds. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- MM24: All bunded areas will have 110% capacity of the volume to be stored;
- MM22: On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located.
- MM23: No refuelling will be permitted at works locations within the 100m hydrological buffer.
- MM22: The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- SM24: All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- MM22: Spill kits will be readily available to deal with and accidental spillage in;
- MM08: All waste tar material arising from road cuttings (from trenching or other works in public roads) will be removed off-site and taken to a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works;

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

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

Best practice methods for cement-based compounds will comprise:

- MM21: No batching of wet-cement products will occur on site. Ready-mixed concrete will be brought to site as required and, where possible, emplacement of pre-cast products, will take utilised;
- All watercourse crossings will utilise pre-cast products and the use of wet-cement products within the hydrological buffer will be avoided;
- MM21: Where concrete is delivered on site, only the chute will be cleaned, using a Roadside Concrete Washout, with waters being tankered and stored in the temporary construction compound, removed off site and disposed of at an approved licensed facility. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- MM11: Weather forecasting will be used to ensure that prolonged or intense rainfall is not predicted during concrete pouring activities; and,
- MM21: The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.3 Mitigation for Protected Areas

The potential for elevated levels of suspended solids and other pollutants such as hydrocarbons to enter the local surface water network is negligible as mitigation controls, described in **Sections 4.3** above, will be implemented during the construction phase. These mitigation measures include the use of interceptor drains, collector drains, silt fences, silt traps, check dams and settlement ponds. Mitigation measures will also be implemented to prevent the release of hydrocarbons.

With the implementation of these mitigation measures and with adherence to best practice methods during the construction of the proposed Ballynalacken Windfarm Project, the Project will not affect the WFD status of the River Barrow and River Nore SAC and the River Nore SPA Furthermore, the potential for the project to affect the Nore_120, the Dinin (Main Channel)_020 and the Nore_160 DWPA's with regard water quality is not significant and therefore the river waterbodies will not be prevented from achieving good status.

As described in Section EIAR 8.3.1.2.1 of the EIAR, the proposed Ballynalacken Windfarm Project includes additional treatment in the form of a water treatment train (such as Siltbuster) to be used in the Owveg River catchment (i.e. turbines T9 – T12). This is due to the short downstream distance to

the Owveg River (which is a designated SAC) and the higher potential for cumulative effects in the Owveg River catchment.

4.3.2 Operational Phase

4.3.2.1 Increased Site Runoff and Hydromorphology Effects

The operational phase drainage system of the Proposed project will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- SWMP: Interceptor drains will be installed up-gradient of all infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- SWMP: Swales/road side drains will be used to collect runoff from access tracks, turbine hardstanding areas and substation compound areas which may contain entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- SWMP: Transverse drains ('grips') will be constructed, where appropriate, in the surface layer of access tracks to divert any runoff into swales/track side drains;
- SWMP: Check dams will be used along sections of access tracks drains to intercept silts at source. Check dams will be constructed from a 40mm non-friable crushed rock or similar;
- SWMP: Settlement ponds, emplaced downstream of track swale sections, turbine locations and the selected substation option, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- SWMP: Settlement ponds will be designed in accordance the greenfield runoff rate requirements; and,
- MM13: Imported rock for construction purposes and road surfacing will be clean, high-grade bedrock, such as limestone, which will be resistant to erosion and have a low likelihood to generate fines in hardstand runoff.

The operation of the underground Internal Cable Link or Ballynalacken Grid Connection will not result in any likely hydrological or water quality effects and therefore do not require mitigation measures.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

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

Mitigation measures for oils and fuels during the operational phase of the proposed project are the same as those outlined in **Section 4.3.1.2** above.

4.3.2.3 Mitigation Measures to Protect Groundwater Quality

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

Mitigation measures for oils and fuels during the operational phase of the proposed project are the same as those outlined in **Section 4.3.1.2** above.

4.3.2.4 Mitigation for Protected Areas

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

Mitigation measures for oils and fuels during the operational phase of the proposed development are the same as those outlined in **Section 4.3.1.2** above.

It can be concluded that with best practice methods adhered to during the operation phase of the proposed wind farm development, the potential for the project to impact upon water quality (WFD qualitative status) of the local designated sites and DWPA's is not significant.

4.3.1 Decommissioning Phase

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

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

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

Other impacts such as possible contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site. Similar mitigation as outlined in **Section 4.3.1.2** for the construction stage will be implemented during the decommissioning phase to ensure no impacts of receiving waters. Refer also to Section EIAR 8.3.1.2.6 of the EIAR for decommissioning phase mitigation.

Some of the potential impacts to water bodies will be avoided by leaving elements of the proposed project in place where appropriate. The substation will be retained by EirGrid as a permanent part of the national grid. The turbine bases will be rehabilitated by covering with local topsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects. Mitigation measures to

avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

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

4.3.2 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3** are sufficient to meet the WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table M** below.

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

SWB	WFD Code	Current Status	Assessed Status - Unmitigated	Assessed Status with Mitigation Measures
Nore Catchment				
Owveg(Nore)_040	IE_SE_15O010280	Good	Moderate	Good
Owveg(Nore)_050	IE_SE_15O010400	Good	Moderate	Good
Nore_120	IE_SE_15N011400	Moderate	Poor	Moderate
Nore_130	IE_SE_15N011500	Good	Good	Good
Nore_140	IE_SE_15N011600	Good	Good	Good
Nore_150	IE_SE_15N011700	Good	Good	Good
Castlecomer Stream_010	IE_SE_15C010100	Moderate	Poor	Moderate
Dinin (North)_040	IE_SE_15D070400	Moderate	Poor	Moderate
Dinin (Main channel)_010	IE_SE_15D020700	Moderate	Poor	Moderate
Cloghnagh_010	IE_SE_15C040400	Moderate	Poor	Moderate

Dinin (Main Channel)_020	IE_SE_15D020800	Moderate	Poor	Moderate
Nore_160	IE_SE_15N011750	Good	Good	Good
Nore_170	IE_SE_15N011950	Good	Good	Good
Nore_180	IE_SE_15N012000	Good	Good	Good
Nore_190	IE_SE_15N012090	Moderate	Moderate	Moderate
Groundwater Bodies				
Ballingarry	IE_SE_G_009	Good	Moderate	Good
Durrow	IE_SE_G_156	Poor	Poor	Poor
Kilkenny-Ballynakill Gravels	IE_SE_G_163	Good	Good	Good

5. SUMMARY AND CONCLUSION

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

The proposed Ballynalacken Windfarm Project will not involve any abstraction of groundwater or alteration of drainage patterns. Therefore, the quantitative status (i.e., the available quantity (volume) of groundwater and surface water locally) to the receiving waters will remain unaltered during the construction, operational and decommissioning phases of the proposed project.

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

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

There is potential for the Ballynalacken Windfarm Project to impact upon nearby and downstream Protected Areas including designated sites and DWPA's, as explained individually in **Section 4.2.1.4**. Therefore, best practice methods will be adhered to throughout regarding the preservation of the protected areas.

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

As such, the proposed Ballynalacken Windfarm Project will not impact upon any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of good status.

As such, the Proposed Ballynalacken Windfarm Project:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive(2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in the EIAR Chapter 8 Water, Section EIAR 8.1.4).

* * * * * * * * * * * * * *

Appendix 8.5 Methodology for the evaluation of Water

Appendix to Chapter 8: Water

Appendix 8.5: Methodology for the evaluation of Water

A8.5 Methodology Applied

The criteria used for the scoping and subsequent impact evaluation in this report is based on the National Roads Authority's *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* (*2009)* which is also an approach that was referenced by the Institute of Geologists Ireland (IGI) *Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements* (2013).

A8.5.1 NRA Criteria for Estimating the Importance of Hydrology Attributes

Using the National Roads Authority (NRA) 2009 guidance, an estimation of the importance of the hydrological and hydrogeological environment within the study area is quantified, using the criteria set out in the Tables below.

Table 1: Estimation of Importance of Hydrology Attributes (NRA, 2009)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on international scale.	• River, wetland or surface water body ecosystem protected by EU legislation, e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale.	• River, wetland or surface water body ecosystem protected by national legislation – NHA status • Regionally important potable water source supplying >2500 homes • Quality Class A (Biotic Index Q4, Q5) • Flood plain protecting more than 50 residential or commercial properties from flooding • Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale.	• Salmon fishery Locally important potable water source supplying >1000 homes. • Quality Class B (Biotic Index Q3-4). • Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale	• Coarse fishery. • Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3). • Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale.	• Locally important amenity site for small range of leisure activities. • Local potable water source supplying <50 homes. • Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. • Amenity site used by small numbers of local people.

Table 2: **Estimation of Importance of Hydrogeology Attributes (NRA, 2009)**

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale.	• Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale.	• Regionally Important Aquifer with multiple wellfields. • Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status. • Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale.	• Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers. • Locally important potable water source supplying >1000 homes. • Outer source protection area for regionally important water source. • Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale.	• Locally Important Aquifer • Potable water source supplying >50 homes. • Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale.	• Poor Bedrock Aquifer Potable water source supplying <50 homes.

A8.5.2 NRA Criteria for Estimating the Magnitude of Impacts on Hydrology Attributes

The magnitude of the impact is evaluated using the NRA (2009) criteria outlined in Tables below.

Table 3: **Estimation of Magnitude of Impact on Hydrology Attributes (NRA, 2009)**

Magnitude	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	• Loss or extensive change to a waterbody or water dependent. • Habitat Increase in predicted peak flood level >100mm. • Extensive loss of fishery Calculated risk of serious pollution incident >2% annually. • Extensive reduction in amenity value
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Increase in predicted peak flood level >50mm. • Partial loss of fishery. • Calculated risk of serious pollution incident >1% annually. • Partial reduction in amenity value.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Increase in predicted peak flood level >10mm. • Minor loss of fishery. • Calculated risk of serious pollution incident >0.5% annually. • Slight reduction in amenity value.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Negligible change in predicted peak flood level. • Calculated risk of serious pollution incident <0.5% annually.

Table 4: **Estimation of Magnitude of Impact on Hydrogeology Attributes (NRA, 2009)**

Magnitude	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	• Removal of large proportion of aquifer. • Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. • Potential high risk of pollution to groundwater from routine run-off. • Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Removal of moderate proportion of aquifer Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. • Potential medium risk of pollution to groundwater from routine run-off. • Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Removal of small proportion of aquifer Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. • Potential low risk of pollution to groundwater from routine run-off. • Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Calculated risk of serious pollution incident <0.5% annually.

A8.5.3 NRA Criteria for Estimating the Significance of Impacts on Hydrology/Hydrogeology Attributes

The significance of an impact is evaluated using the NRA (2009) matrix in the table below.

Table 5: **Rating of the Significance of the Environmental Impact at EIAR Stage (NRA, 2009)**

	Magnitude of Impact			
Importance of Tribute	**Negligible**	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

A8.5.4 EPA Methodology applied to Impact Assessments

The criteria in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transboundary nature (if applicable). The descriptors used in this EIAR chapter for the scoping, baseline and evaluation sections are those set out in the EPA (2022).