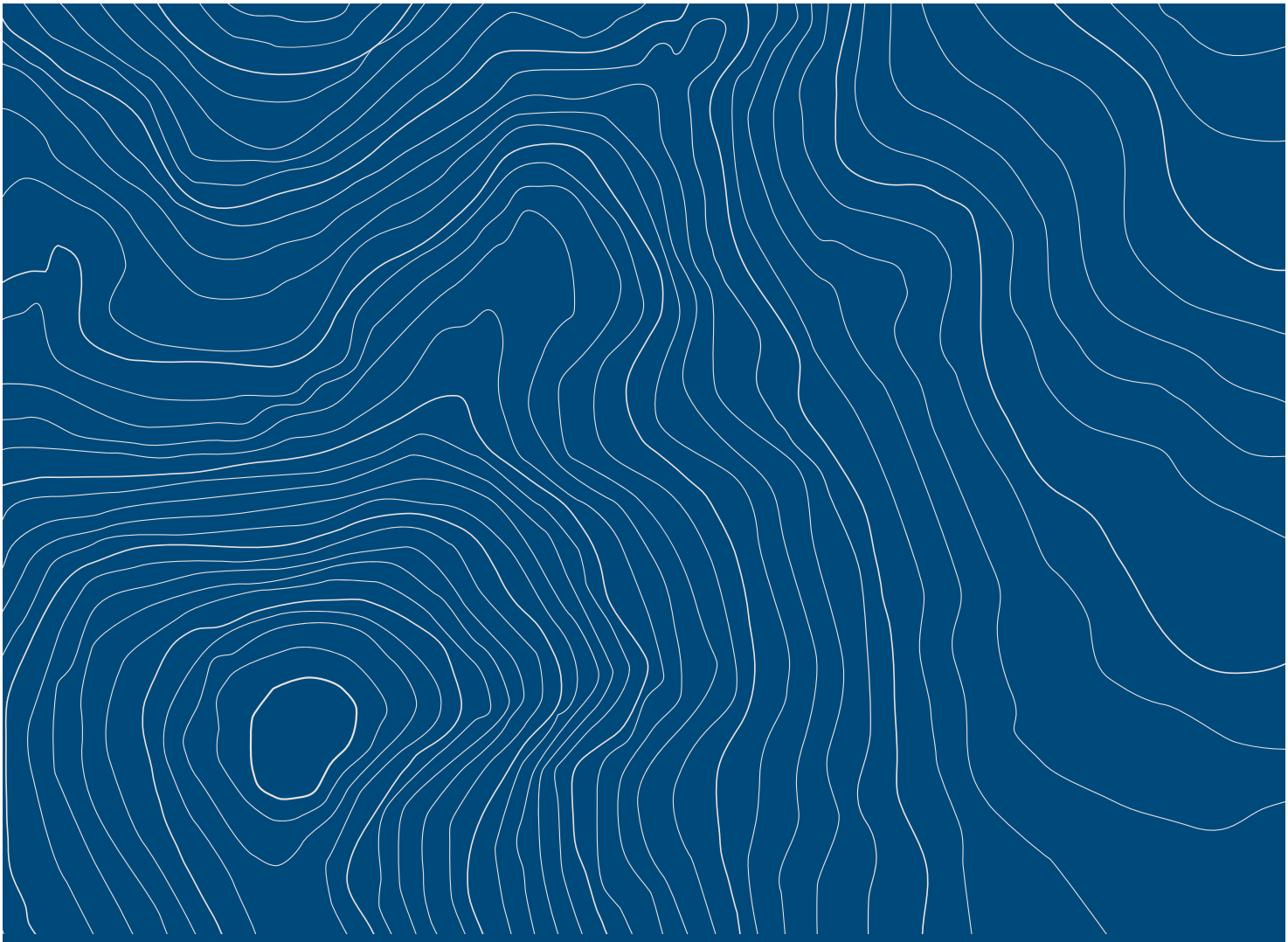

DublinArray
Generation for generations

EIAR Volume 5: Onshore Infrastructure Assessment Chapters Chapter 4: Water (Hydrology, Hydrogeology and Flood Risk)

Kish Offshore Wind Ltd

RWE SLR GoBe APEM Group

www.dublinarray-marineplanning.ie

Dublin Array Offshore Wind Farm

Environmental Impact Assessment Report

Volume 5, Chapter 4: Water (Hydrology, Hydrogeology and Flood Risk)

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Glossary

Term	Definition
Abstraction	The process of extracting water from natural sources, such as rivers, lakes, or aquifers. This can include water for drinking, irrigation, industrial processes, and other purposes.
Aquifer	A geological formation that can store and yield groundwater to wells and springs. Aquifers are typically composed of permeable materials such as sand, gravel, or fractured rock, which allow water to move through them.
Bedrock	The solid rock layer beneath soil and loose material, forming the Earth's crust foundation
Catchment Flood Risk Assessment and Management (CFRAM)	A study to assess flood risk and develop strategies to manage and reduce it.
Culvert	A structure that allows water to flow under a road, railway, trail, or similar obstruction.
Construction Environmental Management Plan (CEMP)	A plan outlining measures to manage and mitigate environmental impacts during construction.
County Geological Site (CGS)	A County Geological Site is a location recognised for its significant geological features, requiring protection and promotion
Dewatering	The process of removing water from an excavation or construction site.
Flood Risk Assessment (FRA)	An evaluation of the potential flood risks associated with a project and measures to mitigate them.
Fluvial	Refers to rivers and streams and the processes associated with them.
Horizontal Directional Drilling (HDD)	A trenchless method of installing underground pipes, conduits, and cables.
Hydrogeology	Concerns the distribution and movement of groundwater in soil and rocks. It involves the study of the properties of aquifers and the flow of water through them, as well as the interaction between groundwater and surface water.
Hydromorphology	The study of the shape and form of water bodies and their physical characteristics.
Subsoil	Subsoil is the layer of soil beneath the topsoil, consisting of minerals and organic matter.
Surface Water	Water that collects on the surface of the ground, including rivers, lakes, and streams.
Sustainable Drainage Systems (SuDS)	Systems designed to manage surface water runoff sustainably, reducing flood risk and improving water quality.
Tufa springs	Springs that deposit calcium carbonate, forming tufa, a type of limestone.
Water Framework Directive (WFD)	European Union legislation aimed at protecting and improving the quality of water resources.

Acronyms

Term	Definition
AAR	Average Annual Rainfall
ABP	An Bord Pleanála
AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
AMAX	Annual Maximum
AOD	Above Ordnance Datum (Ordnance Datum for Ireland is Malin)
BOD	Biochemical Oxygen Demand
CDP	County Development Plan
CEMP	Construction Environmental Management Plan
CFRAM	Catchment Flood Risk Assessment and Management
CMS	Construction Method Statement
DART	Dublin Area Rapid Transit
DCC	Dublin City Council (Local Authority)
DPM	Direct Pipe Method
DLRCC	Dún Laoghaire-Rathdown County Council (Local Authority)
EC	European Community
ECR	Export Cable Route
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ELV	Emission Limit Value
EMS	Environmental Management System
EPA	Environmental Protection Agency
EQS	Environmental Quality Standard
EU	European Union
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FSU	Flood Studies Update
GIS	Geographical Information Systems
GSI	Geological Survey of Ireland
GWB	Ground Water Body
HDD	Horizontal Directional Drill

Term	Definition
HWM	High Water Mark (tidal)
IEMA	Institute of Environmental Management and Assessment
IFI	Inland Fisheries Ireland
IFS	Irish Forestry Soils
ISIS	Irish Soil Information System
LI	Locally Important Aquifer
LTA	Long-Term Averages
MMF	Mean Monthly Flows
m AOD	Meters Above Ordnance Datum (Malin OD)
NHA	Natural Heritage Areas
NIFM	National Indicative Fluvial Maps
NIS	Natura Impact Statement
NRA	National Roads Authority
O&M	Operations and Maintenance
OES	Onshore Electrical Infrastructure
OPW	Office of Public Works
OSi	Ordnance Survey of Ireland
OSS	Onshore Substation
PI	Poor Aquifer
RBD	River Basin District (under WFD)
RBMP	River Basin Management Plan
S.I.	Statutory Instrument
SAC	Special Area of Conservation
SDZ	Strategic Development Zone
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection (for flood defences)
SPA	Special Protection Area
SuDS	Sustainable Drainage Systems
TCC	Temporary Construction Compound
UK	United Kingdom
WFD	Water Framework Directive

4 Hydrology, Hydrogeology and Flood Risk

4.1 Introduction

4.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) assesses the likely significant effects of the onshore infrastructure of the proposed Dublin Array Offshore Wind Farm (Dublin Array) upon the water environment within the study area. The onshore infrastructure includes the proposed Operations and Maintenance Base (O&M Base) at Dún Laoghaire Harbour and the Onshore Electrical System (OES) comprising the Landfall Site, Onshore Export Cable Route (ECR) and Onshore Substation (OSS) and grid connection. Both are described in full in Volume 2, Chapter 2.6: Project Description (hereafter referred to as the Project Description Chapter).

4.1.2 The potential impacts which may occur as a result of the construction, operation and decommissioning of the Dublin Array onshore infrastructure and the determination of sensitivity of the receiving environment, the magnitude of the effect, and the overall significance of each effect will be presented herein. Specifically, this chapter considers impacts on receptors above the High Water Mark (HWM). For clarity, 'the Site', as referred to in this chapter, is the boundary of the onshore infrastructure (i.e. Landfall, Onshore ECR, OSS and O&M Base) as defined in the planning application.

4.1.3 This chapter uses baseline information presented in Volume 6, Chapter 6.5.4-1: Water (Hydrology, Hydrogeology and Flood Risk) Technical Baseline Report and associated appendices and drawings, hereafter referred to as the Onshore Water Environment Technical Baseline Report.

4.1.4 There are also two separate Flood Risk Assessments (FRAs) that support this chapter, as follows:

- Flood Risk Assessment for the Dublin Array OES (December 2024) which is provided in Technical Appendix 6.5.4-2 (hereafter referred to as the OES FRA); and
- Flood Risk Assessment for the Dublin Array Operations and Maintenance Base (October 2023) which is provided in Technical Appendix 6.5.4-3 (hereafter referred to as the O&M Base FRA).

4.1.5 There is a further appendix comprising the Dublin Array onshore infrastructure Water Framework Directive Assessment. This comprises a full assessment of the onshore infrastructure on the chemical and ecological status of relevant Water Framework Directive (WFD) water bodies and is provided in Volume 6, Appendix 6.5.4-4: Onshore Water Framework Directive Compliance Report (hereafter referred to as the Onshore WFD Report). The information from this chapter has been used to inform the conclusions of the WFD Assessment.

4.1.6 In addition, the chapter should be read in conjunction with Volume 3, Chapter 2: Marine Water and Sediment Quality, which deals with marine water quality, due to the interactions between the technical aspects and with Volume 5, Chapter 3: Land, Soils and Geology (hereafter referred to as the Land, Soils and Geology Chapter) and its supporting Technical Appendix 6.5.3-1 Technical Baseline Report (hereafter referred to as the LSG Technical Baseline Report).

4.2 Regulatory background

4.2.1 In addition to the general legislation, policy and guidance relevant to offshore renewables captured within Volume 2, Chapter 2: Consents, Legislation, Policy and Guidance (hereafter referred to as the Consents, Legislation, Policy and Guidance Chapter), this section outlines the legislation, policy and guidance that is specific to hydrology, hydrogeology and flood risk, including best practice guidelines.

4.2.2 The assessment of potential impacts from hydrology, hydrogeology and flood risk has been made with specific reference to the relevant regulations, guidelines and guidance within the Consents, Policy and Legislation Chapter. It has also been made with reference to relevant legislation, guidance and best practice as listed below.

Legislation

- Water Framework Directive 2000/60/EC;
- Groundwater Directive (2006/118/EC);
- Flood Directive 2007/60/EC;
- Urban Wastewater Treatment Directive 1991/271/EEC;
- Drinking Water Directive 2020/2184/EU;
- European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended ('the Groundwater Regulations');
- European Communities Environmental Objectives (Surface Waters) Regulations 2009 as amended ('the Surface Waters Regulations');
- European Communities (Drinking Water) (No. 2) Regulations 2007 (SI no. 278/2007); and
- European Communities (Assessment and Management of Flood Risks) Regulations 2010 as amended ('the Flood Risk Regulations').

4.2.3 The Nitrates Directive (1991/676/EEC) requires EU Member States to monitor the quality of waters and to identify areas that drain into polluted waters or at risk of pollution. These concern waters that due to agricultural activities are eutrophic or could contain a concentration of more than 50 mg/l of nitrates. There are no Nitrates used as part of the proposed development and therefore this Directive is not considered relevant to the proposed project.

4.2.4 The Bathing Water Directive 2006/7/EC and Shellfish Waters Directive 2006/113/EC are considered in the Marine Water and Sediment Quality Chapter. Inter-related effects with this EIAR Chapter are set out in Section 4.16.

Policy and guidance

- Dún-Laoghaire Rathdown (DLR) County Development Plan 2022-2028, in particular the following policies:
  - Policy Objective CA11: Onshore and Offshore Wind Energy and Wave Energy;
  - Policy Objective GIB24: Rivers and Waterways;
  - Policy Objective EI1: Sustainable Management of Water;
  - Policy Objective EI6: Sustainable Drainage Systems (SuDs);
  - Policy Objective EI8: Groundwater Protection and Appropriate Assessment;
  - Policy Objective EI16: Water Pollution; and
  - Appendix 16 Strategic Flood Risk Assessment.
- Groundwater Protection Schemes, (Geological Survey of Ireland (GSI), the Environmental Protection Agency (EPA), and the Department of Environment, Heritage and Local Government, 1999);
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements" (IGI, 2013);
- Guidelines on Protection of Fisheries During Construction Works in an Adjacent to Waters, (Inland Fisheries Ireland, 2016);
- Office of Public Works and the Department of the Environment, Heritage and Local Government) 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (2009), hereafter referred to as the 'Flood Guidelines';
- 3rd Cycle of River Basin Management Plan (RBMP) for the period of 2022-2027;
- Environmental Good Practice on Site Guide (C741), (CIRIA, 2015);
- Control of water pollution from linear construction projects (C648), (CIRIA, 2001);

- Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes'" (National Roads Authority, 2009); and
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports" (EPA, 2022).

4.2.5 The legislation above is detailed in Annex 1, along with key guidelines and technical standards which apply to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein.

4.3 Consultation

4.3.1 As part of the EIA for Dublin Array, consultation has been undertaken with various statutory and non-statutory authorities. The Dublin Array EIA Scoping Report (RWE, 2020) was made publicly available and issued to statutory consultees on 9th October 2020.

4.3.2 A record of key areas of consultation undertaken during the pre-application phases is summarised in Table 1.

Table 1 Summary of consultation relating to hydrology, hydrogeology and flood risk

Date	Consultation type	Consultation and key issues raised	Section where provision is addressed
13/11/20	Scoping	The Geological Survey of Ireland (GSI) expressed concern that there is a risk to the County Geological Site (CGS) within the vicinity of the proposed potential export cable Landfall Site. The CGS in question is Killiney Bay. GSI claim that there may be a potential impact to the integrity of the CGS in question. They state that in an ideal situation the site's integrity will not be damaged, they accept that mitigation methods will be applied to minimise the potential impacts of the development. Where integrity cannot be preserved, GSI request that careful consideration be given in design to accommodating preservation of exposures and access to the site during construction to record the exposures to strengthen our knowledge and datasets. We would also ask that the design considers the use of information panels as appropriate to highlight the significance of the impacted CGS.	The design of the Landfall Site and associated construction activities has been developed to minimise disturbance to the CGS. The project description is set out in the Project Description Chapter. Impacts on this area are assessed in the Land, Soils and Geology Chapter.
		GSI expressed concern that there is a risk to groundwater flow, quality and distribution. They advised to use their GW Flood tool to ensure that all appropriate information is used for the EIAR report.	This data source used in the study of the baseline environment as described in Sections 3.11 to 3.14 of the Onshore Water Environment Technical Baseline Report
		GSI confirmed that they maintain a large dataset of bedrock and subsoil geological mapping information which they would encourage is used for future assessments.	This has been used in the review of the baseline environment as described in the LSG Technical Baseline Report.
		GSI recommend that geohazards, particularly flooding, be taken into consideration for the project and they encouraged the use of their data when doing so.	The study area (described in the Land, Soils and Geology Chapter) has been reviewed for the presence of geohazards.

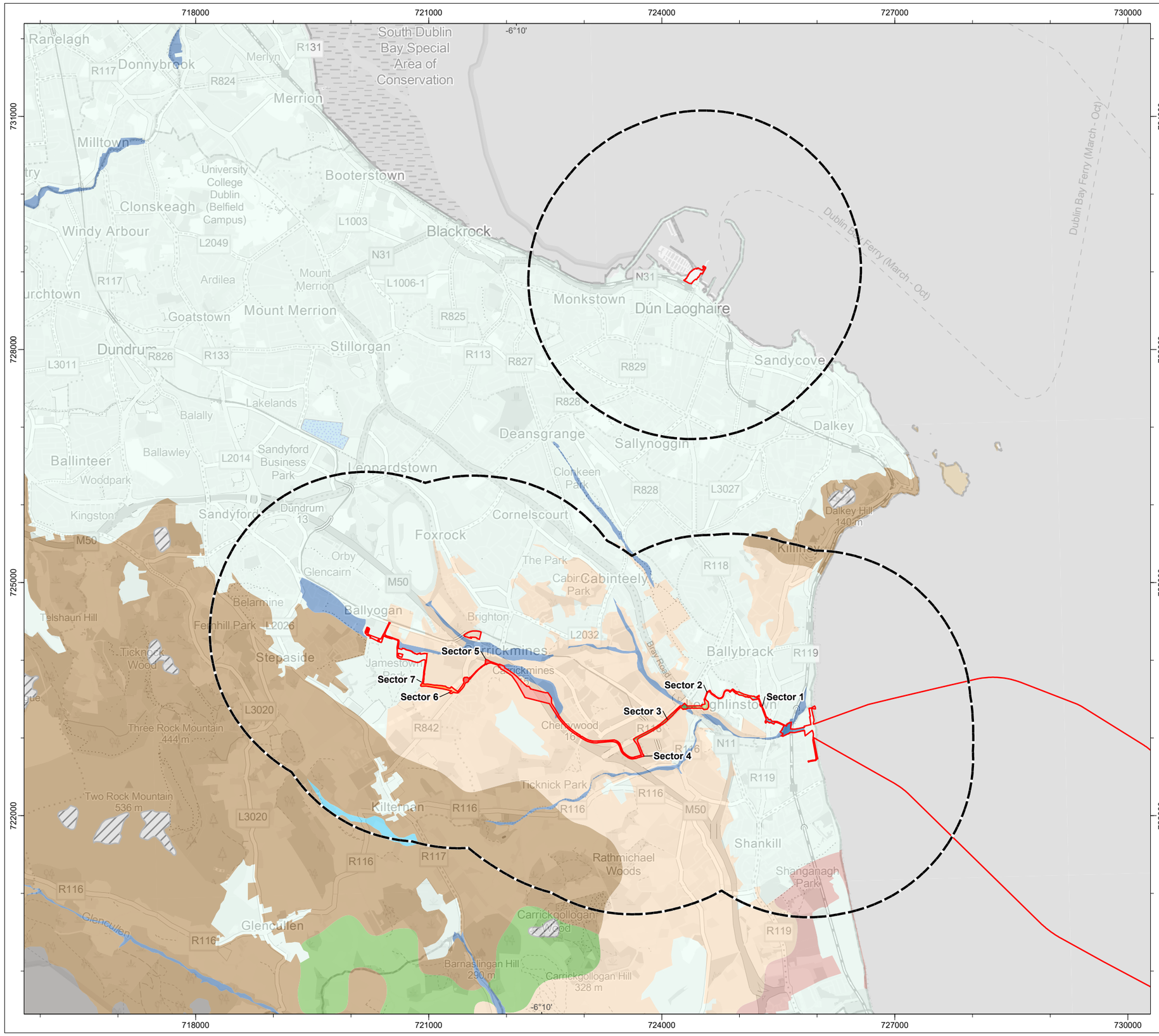
Date	Consultation type	Consultation and key issues raised	Section where provision is addressed
		GSI recommend that their geotechnical database is consulted as a part of any baseline geological assessment of the proposed development as can provide valuable baseline data.	This data source has been used in the review of the baseline environment as described in the LSG Technical Baseline Report.
		GSI recommend that their Aggregate Potential maps are utilised for this project, enabling the identification of high to very high source aggregate potential within the area. They also recommend that their minerals mapping database be used to ensure that natural resources used in the project are sustainable sourced from recognised and licensed facilities.	This data source has been used in the review of the baseline environment as described in the LSG Technical Baseline Report.
		GSI recommend that their Marine and Coastal Unit datasets and maps are utilised for this project, including INFOMAR which contains products such as Shipping and Navigation, Fisheries Management, Aquaculture, Marine Leisure & Tourism and Coastal Behaviour alongside seafloor mapping products.	This data source has been used in the review of the baseline environment for the marine environment and is included in Volume 3 Offshore Infrastructure Assessment Chapters and Volume 4 Offshore Infrastructure Technical Appendices.
		GSI indicated about the use of their new coastal vulnerability mapping initiative, application of the indices to provide detailed maps. This was only available for the east coast with extension nationally.	The data source has been used in the review of the baseline environment as described in the LSG Technical Baseline Report.
		GSI requested a copy of reports detailing any site investigations carried out. They also requested that will any significant bedrock cuttings be created they will remain visible as rock exposure rather than covered and vegetated. Alternatively, they request that a digital photographic record of significant new excavations is provided.	Copies of the reports are included in the LSG Technical Baseline Report.

4.4 Methodology

Study area

4.4.1 Two study areas have been defined for this assessment as shown on Figure 1:

- Onshore Electrical System (OES) study area – The OES study area has been set at 2 km from the planning application boundary for the OES. This area encompasses the area within which the proposed onshore works relating to the OES will be located, including the Landfall, Onshore Export Cable Route (ECR), Onshore Substation (OSS) and the proposed grid connection to the existing Carrickmines substation. The assessment considered a 2 km buffer, in line with the IGI guidelines (2013); and
- Operations and Maintenance (O&M) Base study area – The O&M Base study area has been set at 2 km from the planning application boundary for the O&M Base. This area encompasses the area within which the proposed onshore infrastructure relating to the O&M Base will be located. The assessment considered a 2 km buffer to, in line with the IGI guidelines (2013).



Application Site Boundary

Onshore Electrical System (OES) and Operations and Maintenance Base (O&M) 2 km Study Area

Export Cable Route (ECR) Sector

- Sector 1
- Sector 2
- Sector 3
- Sector 4
- Sector 5
- Sector 6
- Sector 7

Soil Association

- Carrigavanagh Assoc. – Lithosol (0410a)
- Lake Alluvium (05LAK)
- River Alluvium (05RIV)
- Knockboy Assoc. – Brown Podzolic (0960e)
- Crosstown Assoc. – Luvisol (1030a)
- Clonroche Assoc. – Brown Earth (1100a)
- 1xx
- Island
- Rock
- Urban
- Water body

DRAWING STATUS

PUBLIC

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MAP NOTES / DATA SOURCES:

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PROJECT TITLE

Dublin Array

DRAWING TITLE

Water: Study Area

DRAWING NUMBER: **1**

PAGE NUMBER: **1 of 1**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2024-12-09	DRAFT	JK	SW	AE

0 0.3 0.5 0.8 1 Kilometres

0 0.3 0.5 0.8 1 Miles

N GRID NORTH

SCALE 1:50,000 PLOT SIZE A3

DATUM IRENET95 VERTICAL REF ODN/LAT/MLLW

PRJ IRENET95 Irish Transverse Mercator

SLR

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Baseline data

4.4.2 Baseline information on the receiving environment has been obtained from:

- Ordnance Survey of Ireland (OSi) mapping to establish former channel courses and any diversion/culvert works in streams and rivers;
- Teagasc/Environmental Protection Agency (EPA)/Geological Survey Ireland (GSI) Soil and subsoils mapping for Ireland[1];
- Office of Public Works (OPW) stream flow, fluvial and tidal flood risk data and flood modelling information including proposals under the OPW Catchment Flood Risk Assessment and Management (CFRAM) for a flood relief scheme along the Shanganagh River at Loughlinstown;
- DLR County Development Plan (2022-2028) Appendix 15 Strategic Flood Risk Assessment (SFRA);
- Office of Public Works/Dún Laoghaire-Rathdown Flood Relief Scheme for Deansgrange (Kill-O-The-Grange) Stream[2];
- GSI groundwater and hydrogeology information (published available information at www.gsi.ie);
- EPA consented abstractions, discharges and licences (www.epa.ie);
- EPA water quality results and WFD surface water and groundwater status (www.epa.ie);
- River Basin Management Plan (RBMP);
- Inland Fisheries Ireland (IFI) survey and water quality information; and
- Local authority monitoring results (surface water and groundwater) for the former local authority landfill at Ballyogan, EPA Waste Licence for the facility (W00015-01).

4.4.3 These data sources are presented by receptor group in Table 2.

Table 2 Data sources consulted for the baseline

Environmental data	Data source
Soils	▪ Teagasc (Irish Soils Information System).
Subsoil Geology	▪ Teagasc/GSI/EPA (Subsoil Mapping).
Bedrock Geology	▪ GSI (Bedrock Geology).

[1] Irish Soil Information System

[2] https://www.dlrcoco.ie/water-drainage/flood-risk-schemes

Environmental data	Data source
Surface Water	▪ OSi (Discovery Series mapping); ▪ Environmental Protection Agency (Water Framework Directive data and catchment flow); ▪ OPW (CFRAM); ▪ DLRC Development Plan (2022-2028) SFRA.
Groundwater	▪ GSI (bedrock and gravel aquifer); ▪ GSI (Groundwater body description documents); and ▪ Environmental Protection Agency (Water Framework Directive data).
Climate	▪ Met Eireann (Rainfall data).
Protected Areas, Environmental Pressures	▪ Environmental Protection Agency (Water Framework Directive data); and ▪ National Parks and Wildlife Service (Designated Areas).

Site-specific surveys

4.4.4 The study areas were visited in July and August 2020 and September 2024 by way of a walkover survey to identify water features and potential sensitive hydro receptors.

4.4.5 The purpose of the walkover surveys was to confirm the key features identified from the desktop study. The walkover also focused on the proposed alignment river/stream crossing points and potential flood risk areas along the proposed Onshore ECR.

Assessment methodology

4.4.6 The methodology for undertaking this impact assessment has comprised a combination of a detailed desktop review to establish the baseline information available on the onshore water environment within the two defined study areas.

4.4.7 This desktop review was then combined with a site walkover within these study areas. The site walkover provided a further understanding of the study area in relation to the water environment to inform the baseline description of the project's receiving environment.

4.4.8 The assessment has been undertaken with due regard to the appropriate published standards and guidelines (see Section 4.2 and Annex 1) and consideration has been given to feedback received during the consultation phase (see Section 4.3).

4.4.9 The baseline study referred to for this impact assessment, the Onshore Water Environment Technical Baseline Report, describes the receiving environment at and in the immediate vicinity of the onshore infrastructure using the available baseline information gathered, specifically:

- Context of the receiving environment - location/magnitude/spatial extent and trends of the environmental factors;
- Character of the receiving environment - distinguishing aspects of the environment being considered here;

- Significance of the receiving environment – the quality, value or designation is assigned to the existing environment; and
- Sensitivity of the receiving environment - how sensitive is the aspect of the environment to change.

4.4.10 The baseline study is a qualitative assessment of the available information based on professional experience and interpretation of the available data.

4.5 Assessment criteria

4.5.1 This evaluation of impacts in this chapter is based on methodologies set out in the:

- 'Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes' published by the National Roads Authority (2009);
- 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' published by the IGI (2013); and
- 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' by the EPA (2022).

Sensitivity of receptor criteria

4.5.2 The sensitivity of the receiving environment can be considered through a combination of professional judgement and a set of pre-defined definitions as set out in Table 3 and Table 4, in line with IGI and National Roads Authority (NRA) Guidance.

4.5.3 The definitions consider the following (as per the above guidelines):

- Context – the degree to which the receptor will conform or contrast with the established (baseline) conditions. To define the context the following sub factors will be considered:
  - Adaptability – the degree to which a receptor can avoid or adapt to an impact;
  - Tolerance – the ability of a receptor to accommodate temporary or permanent change without a significant adverse impact; and
  - Recoverability – the temporal scale over and extent to which a receptor will recover following an impact.
- Value – a measure of the receptor's importance, rarity and worth.

4.5.4 Table 3 sets out the sensitivity for hydrological attributes.

Table 3 Sensitivity/importance of the hydrology attributes (Box 4.2, NRA 2008)

Receptor sensitivity	Criteria	Definition
Extremely High	Attribute has a high quality or value on an 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 ▪ Locally important amenity site for wide range of leisure activities.
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). ▪ Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on 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.

4.5.5 Table 4 sets out the sensitivity criteria for hydrogeological attributes.

Table 4 Sensitivity/importance of the hydrogeological attributes (Box 4.3, NRA 2008)

Receptor sensitivity	Criteria	Definition
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 (Special Area of Conservation) or SPA (Special Protection Area) status.
Very High	Attribute has a high quality or value on a regional or national scale.	▪ Regionally Important Aquifer with multiple wellheads; ▪ Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - e.g. NHA status; ▪ Regionally important potable water source supplying >2,500 homes; and ▪ 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 base flow to local rivers; ▪ Locally important potable water source supplying >1,000 homes; ▪ Outer source protection area for regionally important water source; and ▪ 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; and ▪ Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on local scale.	▪ Poor Bedrock Aquifer; and ▪ Potable water source supplying <50 homes.

Magnitude of impact criteria

4.5.6 The overall magnitude of impact has been defined in Table 5, and follows the EPA guidelines using the following definitions:

- Extent – the area, the number of sites and/or the proportion of a population affected over which an impact occurs, the nature, transboundary nature, intensity/complexity and probability;
- Duration – the expected onset and time for which the impact occurs;
- Frequency – how often the impact occurs;

- Probability – how likely the impact is to occur; and
- Consequences – the degree of change relative to the baseline level, whether it is reversible and the change in character.

Table 5 Magnitude of impact

Magnitude	Definition
High	**Extent:** Impact resulting in a loss of attribute and/or quality and integrity of attribute including: ▪ Loss or extensive change to water body or water dependent habitat; ▪ Increase in predicted peak flood level >100 mm; ▪ Extensive loss of fishery; ▪ Removal of large proportion of aquifer; and ▪ Changes to aquifer and unsaturated zones resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. **Duration:** The impact is expected to be permanent (over 60 years). **Frequency**: The impact will occur constantly throughout the relevant project phase. **Probability:** The impact can reasonably be expected to occur and/or the risk of a serious pollution incident of >2% annually. **Consequences:** Permanent changes across the environment to key characteristics or features of the particular environmental aspect's character or distinctiveness. The reversibility of these changes is likely. Extensive reduction in amenity value.
Medium	**Extent:** Impact across a significant portion of the receptor area including: ▪ Increase in predicted peak flood level >50 mm; ▪ Partial loss of fishery; ▪ Removal of moderate proportion of aquifer; and ▪ Changes to aquifer and unsaturated zones resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. **Duration:** Anticipated to start during the construction phase and likely to persist over the medium to long-term of between seven to 60 years **Frequency:** Regular occurrences expected during the relevant project phase and/or the risk of a serious pollution incident of >1% annually. **Probability:** Likely occurrence of the impact. **Consequences:** Permanent or enduring changes across a substantial part of the receptor area, affecting key characteristics or features of the environment. The reversibility of these changes is possible. Partial reduction in amenity value.
Low	**Extent:** Impact across a limited portion of the receptor area within or adjacent to the project site, including: ▪ Increase in predicted peak flood level >10 mm; ▪ Minor loss of fishery; ▪ Removal of small proportion of aquifer; and

Magnitude	Definition
	▪ Change to aquifer and unsaturated zones resulting in minor change to existing water supply springs and wells, river baseflow or ecosystems. **Duration:** Temporary changes expected throughout the project duration. **Frequency:** Intermittent occurrences during specific project activities and/or the risk of a serious pollution incident of >0.5% annually. **Probability:** Likely, but infrequent, occurrence of the impact. **Consequences:** Temporary alterations within a restricted area, limited impact on the environment's key characteristics or features. The changes are reversible. Slight reduction in amenity value.
Negligible	**Extent:** Impact confined to a very small area directly within the project site, including: ▪ Negligible change in predicted peak flood level; and ▪ Negligible change to aquifer and unsaturated zones resulting in Negligible change to existing water supply springs and wells, river baseflow or ecosystems. **Duration:** Momentary or temporary changes observed sporadically or occasionally. **Frequency:** Rare occurrences within specific project phases and/or risk of serious pollution incident of <0.5% annually. **Probability:** Unlikely but sporadic occurrence of the impact. **Consequences:** Barely discernible changes over a small, localized area, negligible impact on key environmental characteristics or features. Reversibility of these changes is immediate.

Defining the significance of effect

4.5.7 The sensitivity of a receptor and the magnitude of impact have been considered collectively to determine the potential effect and its significance. The collective assessment represents a 'considered assessment' by the assessor, based on the likely sensitivity of the receptor to the change (e.g. is a receptor present which would be affected by the change), and then the magnitude of that change.

4.5.8 Assessment of the significance of potential effect is described in Table 6, which is based on the EPA EIAR Guidelines.

Table 6 Significance of potential effects

Description of impact - Magnitude			Existing environment - Sensitivity				
			Extremely High	**Very High**	**High**	**Medium**	**Low**
	Adverse impact	**High**	Profound or Very Significant (significant)	Profound or Very Significant (significant)	Significant	Moderate*	Imperceptible
		Medium	Profound or Very Significant (significant)	Significant	Moderate*	Slight	Imperceptible
		Low	Significant	Moderate*	Slight	Slight	Imperceptible
	Neutral impact	**Negligible**	Not Significant	Not significant	Not significant	Not significant	Imperceptible
	Positive impact	**Low**	Significant	Moderate*	Slight	Slight	Imperceptible
		Medium	Profound or Very Significant	Significant	Moderate*	Slight	Imperceptible
		High	Profound or Very Significant	Profound or Very Significant (significant)	Significant	Moderate*	Imperceptible

*Moderate levels of effect have the potential, subject to the assessor's professional judgement, to be significant. Moderate will be considered as significant or not significant in EIA terms, depending on the sensitivity and magnitude of change factors evaluated. These evaluations are explained as part of the assessment, where they occur.

4.6 Receiving environment

4.6.1 This section describes the baseline conditions/receiving environment in terms of surface water and groundwater attributes within a defined onshore study area using existing available desktop information which is in the public domain, site walkover surveys and the professional expertise and knowledge of the authors.

4.6.2 This report is principally concerned with identifying significant effects and, as such, importance is placed on aspects of the environment that are likely to be (or may be) significantly affected by the development.

4.6.3 The Onshore Water Environment Technical Baseline Report can be referred to for a presentation of wider baseline data. This section is a summary of the key findings of the technical baseline report (and points of relevance to the assessment). This section is not intended to repeat or to carry out any additional assessment of impacts within the technical report.

OES study area

4.6.4 There are two main river channels which run through the eastern part of the OES study area nearest to the landfall location, namely the Loughlinstown/Shanganagh River (referred to here as the Shanganagh River) and the Kill-o-the-Grange/Deansgrange Stream (referred to here as the Kill-o-the-Grange Stream). In the western part of the OES is the Carrickmines Stream. The Carrickmines Stream is a sub-catchment of the Shanganagh River.

4.6.1 The stream and river names used in this chapter are the ones used by the EPA under the WFD. For clarity the EPA WFD naming structure has been used for the watercourses. The water courses are also known locally as:

- Kill-o-the-Grange Stream is often referred to as the Deansgrange Stream;
- Shanganagh River is often referred to as the Loughlinstown River; and
- Carrickmines Stream (which is a tributary of the Shanganagh River) is often referred to as the Ballyogan Stream or Barnacullia Stream further upstream.

4.6.2 The EPA WFD naming structure considers the following smaller streams, located within the study area, to comprise the Carrickmines Stream:

- Laughlanstown Stream (south of Cherrywood in Sector 4);
- Cabinteely Stream (running north from the Carrickmines Stream at Cherrywood in Sector 5);
- Jamestown 10 and Glenamuck North streams, which are located south of Carrickmines Retail Park in Sector 7).

4.6.3 Land use in this area is predominantly urban with areas of parkland and open space particularly along the river valleys. Other land uses include amenity and transport comprising road and rail.

4.6.4 The surface watercourses within this area have been significantly modified in the past; channels have been canalised and straightened with a loss of the natural floodplain. Significant sections of the watercourses have also been culverted, particularly along the Kill-o-the-Grange Stream at Loughlinstown Linear Park in Sector 2. The watercourse channels are considered to be of low sensitivity due to their hydromorphology.

4.6.5 The Shanganagh River is designated for drinking water abstraction although it is understood that there is no abstraction from the river for drinking water at present.

4.6.6 The Shanganagh River and Carrickmines Stream are classified as having Good water quality and not at risk under the WFD 2016 - 2021[3] , whilst the Kill-o-the-Grange Stream is reported to have Poor water quality and is at risk under WFD 2016 - 2021.

[3] https://www.catchments.ie/),

4.6.7 The EPA catchment assessment report highlights two significant pressures on the Kill-o-the-Grange stream: Hydromorphology, primarily due to the presence of culverts, and the Urban Wastewater agglomeration network. For both the Carrickmines and Kill-o-the-Grange streams, diffuse urban pressures have also been identified. These pressures are caused by misconnections, leaking sewers and runoff from paved and unpaved areas, impacting the quality of these waterbodies.

4.6.8 Flooding can be caused by a range of factors from different sources including coastal, tidal, river, groundwater and storm rainfall. The permanent infrastructure within the Landfall site is not considered vulnerable to flooding as infrastructure buried underground is designed to withstand water exposure. Nonetheless, flood risk at the Landfall is considered within the EIAR.

4.6.9 Flooding has the potential to occur at any time of year and can be caused by a range of factors. While watercourse flows are generally higher during the autumn and winter, flooding can also occur during summer months due to intense storm events. The OPW has modelled flood events along the Kill-o-the-Grange Stream, the Shanganagh River and the Carrickmines Stream. A Flood Risk Assessment (FRA) has been carried out for the proposed OSS site at Ballyogan, see OES FRA, and flooding along the OES is considered in the EIAR.

4.6.10 A review of the OPW CFRAM flood maps indicate that there is a risk of river (fluvial) flooding from all the modelled flood events associated with flooding of the Shanganagh River, however, no development is proposed within the river floodplains and therefore it is considered that there is no identified risk to the Dublin Array onshore infrastructure from fluvial flooding.

4.6.11 The OPW CFRAM Coastal flood maps show some limited flooding along the Shanganagh River, at the low-lying park area immediately upstream of Shanganagh Beach and the old railway line path. No development is proposed within the area identified as being liable to coastal flooding and therefore it is considered that there is no identified risk to the Dublin Array onshore infrastructure from coastal flooding.

4.6.12 The study area is within the Wicklow Groundwater Body (GWB) as designated under the WFD. The geology, both bedrock and subsoils, has implications for groundwater and the aquifer types which will vary depending on the geological characteristics.

4.6.13 Within the study area the bedrock aquifer is classified as a locally important aquifer (Ll) along the coastal area around Shanganagh and is classified as a Poor Aquifer (Pl) across the remainder of the study area inland.

4.6.14 Poor aquifers and Locally Important aquifers are generally not suitable to provide a sustainable groundwater supply.

4.6.15 The groundwater is assessed as being of Good Status by the EPA across the study area but is at risk under the WFD 2016 – 2021.

4.6.16 The proposed OSS is located in the Ballyogan Landfill and Recycling Facility, adjacent to the former landfill. Groundwater monitoring is undertaken by DLRCC at the former Ballyogan Landfill Facility, which is adjacent to the OSS site and the Carrickmines GCP substation. The monitoring is undertaken in compliance with the requirements of the EPA Waste Licence for the former active Ballyogan Landfill and active Recycling Facility (W00015-01), and groundwater quality and level monitoring is undertaken at the site on a biannual basis. The 2019 Q3-Q4 groundwater monitoring report indicated that groundwater conditions downgradient of the landfill had not been altered in any significant manner as a result of the landfilling activities.

4.6.17 A number of Tufa springs have been identified in the vicinity of Cherrywood approximately 400 m to the north of the ECR along the steep valley sides of the Carrickmines Stream. The Tufa springs are fed by localised permeable limestone deposits within the glacial till subsoils.

4.6.18 Localised areas of Tufa spring formation appear to be supported by relatively shallow groundwater flow systems within permeable zones of the subsoil with the limestone parent material within the subsoil acting as the source of the calcium carbonate. The Tufa spring formation is limited to where the limestone parent material is present in the subsoils and where there is a groundwater flow and discharge such as at localised slope banks.

O&M Base study area

4.6.19 The O&M Base is proposed to be located at St. Michael's Pier in Dún Laoghaire Harbour. The study area is located within the Dublin Bay coastal waterbody. The EPA latest water quality monitoring indicates that the Dublin Bay coastal waterbody has a 'Good' water quality status and is not at risk under the WFD 2016 – 2021.

4.6.20 There are no rivers, streams or lakes identified on the EPA Water Maps within the O&M Base study area.

4.6.21 The available EPA online maps do not indicate the presence of any surface water abstractions at or downstream of the study area, either for drinking water purposes or any other uses.

4.6.22 There are no surface waters in the vicinity of the proposed O&M Base designated as drinking water protected features.

4.6.23 OPW flood maps indicate that the O&M Base study area is not at risk of coastal flooding. The SFRA mapping for the area around the proposed O&M Base and in Dún Laoghaire Harbour is not in the modelled Flood Zone A[4] or Flood Zone B[5], however, the SFRA mapping does show that the hardstanding car/truck parking area immediately to the west of the site as being liable to being flooded from wave overtopping along the quay wall. A site-specific assessment of flood risk at the O&M Base has been carried out and reported in the O&M Base FRA.

[4]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).

[5] Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1,000 year 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).

4.6.24 The study area is in the northern part of the Kilcullen GWB as designated under the WFD. The geology, both bedrock and subsoils, has implications for groundwater and the aquifer types which will vary depending on the geological characteristics.

4.6.25 The study area is underlain by igneous granite rocks which are classified as a 'Poor' aquifer. Poor aquifers are generally not suitable to provide a sustainable groundwater supply.

4.6.26 The groundwater is assessed as being of 'Good' status by the EPA across the study area but is at risk under the WFD 2016 – 2021. The GWB is also a designated drinking water protected feature. All groundwater in Ireland is automatically designated as drinking water protected, irrespective of the aquifer type or the presence of any abstraction for drinking water.

4.6.27 Brewery Stream is a highly modified urban watercourse that is heavily culverted. The stream discharges into Dublin Bay approximately 1 km to the west of the O&M Base, however, given the stream is heavily culverted with intervening dense residential and commercial land use between it and the O&M base, it is not considered further in this assessment.

4.7 Defining the sensitivity of the baseline

4.7.1 The sensitivity for the receptors for each potential effects, using the criteria outlined in Section 4.5.

4.7.2 From the baseline review, the following sensitive hydrological and hydrogeological receptors have been identified:

OES study area

- Rivers and streams including the Shanganagh River, Carrickmines Stream and the Kill-o-the-Grange Stream;
- Underlying Locally Important and Poorly Productive aquifers;
- Areas of flood risk associated with Shanganagh River including coastal flood risk.
- Areas of flood risk around proposed river crossings; and
- Tufa deposits identified in Carrickmines River area.

O&M Base study area

- Underlying Poor aquifer; and
- Coastal flood risk.

Table 7 Sensitivity of baseline receptors

Baseline receptor	Sensitivity assigned	Criteria for sensitivity
Shanganagh River	High	Attribute has a high quality, significance or value on regional scale. Shanganagh River has been designed for drinking water abstraction and has 'Good' water quality status under WFD.
Kill-o-the Grange Stream	Medium	Attribute has a medium quality or value on a local scale. Kill-o-the-Grange Stream has 'Poor' water quality status under WFD.
Carrickmines Stream (and its tributaries)	High	Attribute has a high quality, significance or value on local scale. Carrickmines Stream has 'Good' water quality status under WFD.
Areas at risk from coastal flooding	High	Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Groundwater aquifers	Low to Medium	Groundwater is classified as locally important and/or poor aquifer.
Areas of flood risk around proposed river crossings	High	Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Tufa deposits identified in Carrickmines Stream area	Very High	Tufa deposits are designated as priority habitat on Annex 1 of the Habitats Directive.

4.8 Uncertainties and technical difficulties encountered

4.8.1 This chapter has been prepared based on existing available desktop information which is in the public domain, site walkover surveys and the professional expertise and knowledge of the authors.

4.8.2 Available flood risk information from published reports has been used here to indicate where flooding may occur. The flood extents information referenced is based on the data and assumptions used to inform the relevant flood studies.

4.8.3 The Do-Nothing scenario relevant to the water environment is one where Dublin Array does not go ahead and the study areas will continue as they are currently.

4.9 Scope of the assessment

Scoped in

4.9.1 The following impacts will be assessed:

- Construction phase:
  - **Impact 1: Pollution of surface waters and groundwater:** Impacts on surface water quality due to accidental spillage of chemicals/fuels or other hazard substances;
  - **Impact 2: Sedimentation to surface waters:** Discharge of sediment-laden runoff to drainage systems and watercourses;
  - **Impact 3: Fluvial and coastal flood risk:** increased flood risk to areas downstream through increased surface runoff; and
  - **Impact 4: Changes in groundwater levels and flow:** changes in groundwater levels from dewatering excavations.
- Operation and maintenance phase:
  - **Impact 5: Pollution risk:** accidental spillage impact on surface water quality; and;
  - **Impact 6: Fluvial flood risk:** increased flood risk to areas downstream through increased surface runoff.

4.9.2 There are no predicted impacts associated with the decommissioning of the proposed development which are scoped in here.

Scoped out from further evaluation in this EIAR

4.9.3 The following impacts have been scoped out of the assessment:

- **Sedimentation of surface waters during construction of the O&M Base.** There are no surface water receptors identified within the O&M Base study area, this impact has been scoped out of the assessment.
- **Potential flooding risk on groundwater receptors.** The magnitude of the increase in impermeable area is not considered sufficient to have a measurable effect on groundwater levels, as the extent of the impermeable area is insignificant compared to the extent of the underlying geology and groundwater body;

- **Potential erosion and sedimentation effect on groundwater receptors**. The unsaturated zone is unlikely to entrain any sediment and the majority of works relating to the onshore infrastructure will be relatively shallow above the groundwater table. It is therefore considered that an increase in sedimentation on groundwater receptors will be insignificant;
- **Increased flood risk caused by blockages to flow in watercourses during operation and maintenance of the Onshore ECR**. Any required permanent watercourse crossings will be subject to maintenance requirements and these will be determined at the detailed design stage;
- Available OPW CFRAM flood maps indicate that the onshore infrastructure will not intersect any areas denoted at risk of coastal flooding for present day and future modelled scenarios. Therefore, p**otential effects associated with coastal flooding on the onshore infrastructure** have been scoped out;
- The available OPW CFRAM flood maps indicate that the proposed O&M Base in Dún Laoghaire Harbour is not in modelled coastal Flood Zone A or Flood Zone B and any wave off topping will not extend to the O&M Base itself. Therefore, **potential effects associated with coastal flooding at the O&M Base** have been scoped out;
- **Adverse effect on surface water flow paths, watercourse discharge rates and alteration of watercourse hydromorphology**. There will be no uncontrolled discharge or modification to watercourses and therefore this potential impact has been scoped out;
- **An adverse effect on designated water sensitive habitats** as a result of the proposed development have been scoped out as no such dependant habitats have been identified; and
- **Adverse effects during the operational lifetime of the project from sediment to surface water and an impact on the groundwater regime** are considered unlikely Therefore, these potential impacts during the operation phase have been scoped out.

4.9.4 The Onshore Water Environment Technical Baseline Report confirms that Tufa springs have been identified in the vicinity of Cherrywood along the steep valley sides of the Carrickmines Stream. These deposits are designated as Priority Habitat on Annex 1 of the Habitats Directive. These receptors were identified during the route optioneering stage for the proposed Onshore ECR. The Onshore ECR will be at least 500 metres from the tufa springs. At the closest point the Onshore ECR will follow the route of the existing R118 road carriageway between the N11 and the M50 and will be located above the water table and therefore will not alter any groundwater flows that sustains the deposits. There will therefore be no adverse changes to the surface water and groundwater flow paths and contribution areas to the Tufa deposits and effects have been scoped out from further assessment.

4.10 Key design parameters for assessment

4.10.1 For each of the impacts 'Scoped-in' to the assessment and as described in the preceding (Section 4.9), the relevant design parameter used in assessing the impact are set out in Table 8. For the purpose of environmental assessment, the design parameters that could give rise to the maximum potential adverse impacts, in respect of receptors, have been chosen as the design parameter to assess impact against.

Table 8 Key project design parameters

Potential impact	Key project design parameters	Justification
Construction phase		
Impact 1: Pollution of surface waters and groundwater due to accidental spillage of chemicals/fuels or other hazard substances	Refuelling will only take place at the main TCC locations (Landfall Site, Clifton Park, Leopardstown) the site of the proposed OSS and the proposed O&M Base and will be undertaken in strict accordance with the Construction Environmental Management Plan (CEMP). For trenchless crossings along the Onshore ECR, including the works proposed at the Landfall Site, drilling fluids will be required. Drilling fluids have the potential to lead to contamination of soils and subsoils. Drilling fluids will be handled in strict accordance with the protocol set out in Section 4.11. When working near water courses, trenchless drilling techniques (HDD or similar) will be adopted at the majority of watercourse crossings along the Onshore ECR: ▪ Sector 1(TX-02): Shanganagh River; ▪ Sector 2: (TX-04 and TX-05)Two crossings of Kill-O-the-Grange stream; ▪ Sector 3: (TX-06) Carrickmines Stream; and ▪ Sector 4: (TX-07) Laughanstown Stream. In Sector 7, there will be two open cut trench crossings under the Glenamuck North and Jamestown 10 streams. For these crossings, a dam will be installed in the watercourse by installing sheet piling or an aqua dam at either side of the crossing location. The watercourse will be over pumped from one side of the dam to the other to maintain the flow of the watercourse. The cable ducting will then be installed in the dammed section via open cutting as per EirGrid specification drawing number OFD-SSS-529 (Standard - Riverbed Crossing). Once the ducts are installed the watercourse bed will be reinstated and the dam removed. The onshore export cables will then be pulled though the ducts at the nearest joint bays i.e. the watercourse will not be excavated again during the construction phase.	Construction activities can degrade water quality through accidental spills of fuel, oil, and chemicals, which can contaminate surface and groundwater. The assessment has been based on the maximum footprint and areas of temporary and permanent infrastructure which will be required. Full details are provided in the Project Description Chapter.

Potential impact	Key project design parameters	Justification
	The grid connection between the proposed OSS and the existing Carrickmines substation in Jamestown will cross the Carrickmines Stream within existing infill ground sitting above an existing culvert of the stream and this will use an open cut trench method.	
Impact 2: Sedimentation of surface waters	Potential for sedimentation of surface waters may occur in the following locations:	Construction earthworks will be required for separate elements of OES development. Sediment in runoff from earthworks during construction has the potential to degrade water quality. The assessment has been based on the maximum footprint and areas of temporary and permanent infrastructure which will be required. Full details are provided in the Project Description Chapter.
	OSS Subsoil will be removed as part of the construction of the OSS. This will be stored in an appropriate area on the site of the OSS and reused in landscaping works.	
	Onshore ECR In sections of soft ground, topsoil will be removed to facilitate the construction of the onshore ECR. This will be stored in an appropriate area for reuse at the reinstatement stage. In all sections excavation will commence downwards in layers, until the size and desired depth has been achieved. The excavated material will be stored a safe distance away from the excavation and will be reinstated upon completion of the works. When working near water courses, trenchless techniques (HDD or similar) will be adopted at the majority of crossings: ▪ Sector 1(TX-02): Shanganagh River; ▪ Sector 2: (TX-04 and TX-05)Two crossings of Kill-O-The-Grange; ▪ Sector 3: (TX-06) Carrickmines Stream; and ▪ Sector 4: (TX-07) Laughanstown Stream. In Sector 7, there will be two open cut trench crossings under the Glenamuck North and Jamestown 10 streams. For these crossings, a dam shall be installed in the watercourse by installing sheet piling or an aqua dam at either side of the crossing location. The watercourse shall be over pumped from one side of the dam to the other to maintain the flow of the watercourse. The ducting will then be installed in the dammed section via open cutting as per EirGrid specification OFD-SSS-529. Once the ducts are installed the watercourse bed will be reinstated and the dam removed.	

Potential impact	Key project design parameters	Justification
	The grid connection between the proposed OSS and the existing Carrickmines substation in Sector 7 will cross the Carrickmines Stream within existing infill ground sitting above an existing culvert of the stream and this will use an open cut trench method. The three TCC sites (Landfall Site, Clifton Park and Leopardstown) will be prepared by removing topsoil, which will be set aside for reuse. A geotextile or similar separation membrane will then be placed over the subsoil, followed by layers of granular stone. Alternatively, protective matting, temporary metal road surfaces (such as trackway system), or a tarmac surface may be used. After construction, foundations for the site cabins will be installed. Excavated topsoil and subsoils from the green space and agricultural fields will be temporarily stored for final surface reinstatement. Any waste material from trench excavation which is not suitable for re-use will be removed and disposed of at a licensed disposal facility in compliance with waste management regulatory requirements.	
	O&M Base Fill material and construction and demolition waste will be removed as part of the construction of the O&M Base.	
Impact 3: Fluvial flood risk	At the OSS and O&M Base sites, construction surface water drainage, attenuation and treatment measures will be established at the site before any construction works including earthworks commence.	Construction activities can increase surface runoff by disturbing natural drainage patterns and reducing the land's ability to absorb water. This can increase the risk of fluvial flooding downstream, as

Potential impact	Key project design parameters	Justification
		more water flows rapidly into rivers and streams.
Impact 4: Changes in groundwater levels and flows	Potential adverse effect on groundwater levels, flow and sensitive habitats as a result of construction activities such as excavating and dewatering.	Construction activities, particularly excavation and dewatering, can alter groundwater levels and disrupt natural flow patterns. This can negatively affect groundwater-dependent ecosystems and sensitive habitats by reducing water availability or changing water quality.
Operation and maintenance phase		
Impact 5: Pollution risk	Accidental pollution event arising from hydrocarbons or chemical spillage during the operational phase. These may occur at the following locations. **OES** ▪ Onshore ECR – spills from fuel/chemicals occurring during infrequent (typically annual) preventative inspection visits to the onshore ECR or during corrective visits to correct faults. Preventative visits will be infrequent and restricted to inspections of joint bays along the Onshore ECR. Corrective visits may involve excavation to correct faults. ▪ OSS – regular (typically weekly) inspection or corrective visits to the Onshore ECR. **O&M Base** ▪ Spills occurring from fuel/chemical use during operational phase activities at the O&M Base.	During the operational phase, maintenance activities involving site traffic and equipment can pose a pollution risk to surface and groundwater. Spills or leaks of fuel or oil, can contaminate water resources, potentially harming ecosystems and water quality.

Potential impact	Key project design parameters	Justification
Impact 6: Fluvial flood risk	Increased flood risk through increased surface water runoff from new permanent impermeable areas and retained watercourse crossings as a result of the proposed development.	The creation of permanent impermeable surfaces, such as those around the OSS and cable infrastructure, can increase surface water runoff, raising the risk of fluvial flooding. Retained watercourse crossings may also impede natural water flow, further exacerbating flood risks downstream.

4.11 Project design features, avoidance and preventative measures

4.11.1 As outlined within Volume 2, Chapter 3: EIA Methodology and in accordance with the EPA Guidelines (2022), this EIAR describes the following:

- Project design features: These are measures that were identified throughout design iteration and incorporated into the design to avoid and prevent likely significant effects in relation to the onshore water environment. These are presented within Table 9; and
- Other avoidance and preventative measures: These are measures that were identified throughout the early development phase of the Dublin Array project, also to avoid and prevent likely significant effects, which go beyond design features. These measures were incorporated in as constituent elements of the project, they are referenced in the Project Description Chapter of this EIAR and they form part of the project for which development consent is being sought. These measures are distinct from design features and are found within our suite of management plans. These are also presented within Table 9.

4.11.2 Additional mitigation measures were identified after the assessment of likely significant effects within each chapter of the EIAR, which are specifically introduced to mitigate against the any identified significant adverse effects on the environment. Where appropriate, monitoring arrangements will be proposed for this additional mitigation. The assessment of impacts is presented in Sections 4.12 to 4.15 of this EIAR chapter.

4.11.3 All project mitigation measures are secured within Volume 8, Chapter 4: Schedule of Measures of this EIAR.

4.11.4 Environmental aspects and other options relating to the Dublin Array onshore infrastructure have been considered within the Volume 2, Chapter 5: Consideration of Alternatives. A CEMP has been produced for the onshore infrastructure which includes measures for the environmental management of onshore construction activities. The mitigation measures in this EIAR will be secured via the project CEMP. A separate offshore Project Environmental Management Plan (PEMP) has been prepared with similar information.

Table 9 Project design features and other avoidance and preventative measures relating to hydrology, hydrogeology and flood risk

Project design feature/other avoidance or preventative measure	Where secured
Project design features	
Fluvial and coastal flood risk – design features to manage flood risk during construction, operational or decommissioning phases	
Landfall Site The Landfall has been sited outside of either Flood Zone A or B to avoid areas at risk of flooding. The installation of the offshore export cable ducts under Shanganagh Cliffs and the beach will be carried out using trenchless techniques. This approach will avoid any excavation of the cliff face thereby protecting the physical integrity of the cliff face to install the offshore export cable ducts. This will avoid any exacerbation of coastal erosion or cliff stability that could be caused by standard open-cut trenching construction methods. Horizontal Directional Drill (HDD) or Direct Pipe Method (DPM) have been identified as the preferred trenchless techniques.	Project Description Chapter.
Onshore ECR Trenchless crossing (HDD or similar) will be used for cable installation for the majority of the watercourses along the onshore ECR to avoid adverse impacts on river channels or exacerbation of flood risk. Trenchless technology will be adopted at the following watercourse crossings: ▪ Sector 1: Trenchless crossing of the Shanganagh River (TX-02); ▪ Sector 2: Two trenchless crossings of Kill o' the Grange Stream (TX-04/TX-05) at Achill Road; ▪ Sector 3: Trenchless crossing of Carrickmines Stream (and N11) at Loughlinstown (TX-06); and	Project Description Chapter

Project design feature/other avoidance or preventative measure	Where secured
▪ Sector 7: Trenchless crossing of the Laughanstown Stream, which includes the M50 (TX-07). Two crossings in Sector 7 will include open trench techniques, these are: ▪ Two open cut trench crossings proposed for the streams south of the Carrickmines Retail Park (Glenamuck North and Jamestown 10 streams). The water flows will be managed through use of a temporary dam to hold back waters with over pumping of the water downstream to enable the construction of the trenchless crossings ▪ The grid connection between the proposed OSS and the existing Carrickmines substation will cross the Carrickmines Stream within existing infill ground sitting above an existing culvert of the stream. An open cut trench method will be used for the installation of the cable in this location. The water flows will be managed through use of a temporary dam to hold back waters with over pumping of the water downstream to enable the construction of the trenchless crossings. Construction works will be set back from the river and stream channels, except for the two open-cut trenched crossings at Sector 7, and where it is not possible to maintain an adequate set back to prevent runoff going to the watercourse. Additional control measures such as silt fences will be deployed.	
OSS During Operation of the OSS, the surface runoff will be controlled to match existing greenfield runoff rates using a flow control device and an attenuation basin will store and attenuate runoff. An attenuation tank will be located below ground and have sufficient capacity to prevent flooding during the critical 1:100-year storm event (1% AEP) including + 20% allowance for climate change. The attenuated runoff will be discharged into the nearby Carrickmines Stream. The GIS building at the OSS will feature a green roof.	Project Description Chapter
O&M Base	Project Description Chapter

Project design feature/other avoidance or preventative measure	Where secured
The O&M Base has been sited outside of either Flood Zone A or B to avoid areas at risk of flooding. Finished levels on-site for the O&M Base have been designed such that in the event of the surface water system surcharging, surface water can still escape from the site and away from building structures, into the Irish Sea, by overland flood routing without damaging properties. A green roof is proposed as part of the design of the O&M Building to improve stormwater management and water quality.	
Pollution and sedimentation – design features to manage risk or sedimentation of surface waters or pollution of surface or ground waters	
Onshore ECR The onshore ECR has been routed to minimise the number of water course crossings which are necessary. Trenchless crossing (HDD or similar) will be used for cable installation for the majority of the watercourses along the onshore ECR to avoid adverse impacts on river channels or exacerbation of flood risk. Trenchless technology will be adopted at the following watercourse crossings: ▪ TX-02; ▪ TX-04; ▪ TX-05; ▪ TX-06; and ▪ TX-07. **Trenchless crossings**	Project Description Chapter

Project design feature/other avoidance or preventative measure	Where secured
For trenchless crossings (TX-02/TX-04/TX-05/TX-06/TX-07), temporary drilling compounds will be established on either side of the watercourse to facilitate the set-up of the necessary plant and equipment. Limited surface excavation works will be required to create the launch and exit pit in the temporary drilling compounds. The excavated drill pit will collect drill mud returns, the pumps will move the fluid from the pit into the recycling plant/tanks. **Open cut crossings in Sector 7** The open cut crossings in Sector 7 will involve the installation of a temporary dam at either side of the cable crossing location to create a dry section of the steam to facilitate a dry working area for installation of the cable ducts. Temporary dam methods such as sandbagging, sheet pilling or an aqua dam will be used to construct the temporary dam. To maintain the flow of the stream it is proposed to over-pump from upstream of the dam to downstream of the works area. The trench will then be excavated in the dry area to the required depth. The ducts will be placed, and a concrete surround poured around the ducts with a steel reinforcement mesh set in the concrete above the ducts. Cement bound granular mixture (CBGM) will then be backfilled on top of the concrete surround to the required depth and the riverbed reinstated above the CBGM. The dam will then be removed and the stream returned to its natural state. **TCCs – Landfall, Clifton Park TCC and Leopardstown TCC** Appropriate temporary drainage measures will be implemented as part of the TCC enabling works to manage surface water run-off and prevent water polluted with sediment and/or other contaminants leaving the site. This will include the implementation of measures such as filter drains, silt fencing, soakaways, infiltration	

Project design feature/other avoidance or preventative measure	Where secured
trenches and settlement ponds/tanks. Where required the surface water will be stored and removed off-site by a licensed service provider for treatment at a licensed wastewater facility. **OSS** Appropriate temporary drainage measures will be implemented as part of the OSS TCC enabling works to manage surface water run-off and prevent water polluted with sediment and/or other contaminants leaving the site. This will include the implementation of measures such as filter drains, silt fencing, soakaways, infiltration trenches and settlement ponds/tanks. Where required the surface water will be stored and removed off-site by a licensed service provider for treatment at a licensed wastewater facility. Within the operational drainage design for the OSS, the storm water components been designed in accordance with and comply with the requirements of the Greater Dublin Regional Code of Practice for Drainage Works. The applicant will apply to the local authority for a Section 4 license to discharge treated storm water runoff from the OSS site. Within the operational drainage design for the OSS, the discharge from the attenuation tank will go through a flow control chamber including hydrobrake or similar which will limit storm water discharge from the site to the greenfield equivalent rate of 3.3 l/s. The discharge line will also include a bypass oil/fuel separator to remove any hydrocarbons in the discharge waters. **O&M Base** The existing surface water drainage network at the O&M Base will be upgraded in the vicinity of St. Michaels Pier and the proposed hardstanding area. The new operational	

Project design feature/other avoidance or preventative measure	Where secured
drainage network will tie into the existing oil interceptor in the harbour which will clean surface water run off of all sediment and of any potentially hazardous material prior to discharging the surface water into tidal waters within the harbour. Details of the proposed drainage system are presented in the Project Description Chapter.	
Other Avoidance and Preventative Measures	
A planning stage CEMP has been included with the application for development consent and is included in Volume 7, Appendix 8. The purpose of the planning stage CEMP is to set out the measures which will be taken to manage the potential environmental impacts of the onshore construction of Dublin Array and limit the disturbance from onshore construction activities such as site preparation, material delivery and removal, works activities and site reinstatement as far as is reasonably practicable. The CEMP is a planning stage document that, by reference to the assessments reported in the Environmental Impact Assessment Report (EIAR), sets out the key construction stage environmental commitments. The Final Construction Stage CEMP will be sent by the Applicant to the Planning Authority for approval, as a condition of the development consent. The CEMP included at Volume 7, Appendix 8 includes the following measures which are relevant to hydrology, hydrogeology and flood risk, notably the impacts relating to Construction Phase Pollution Risk (Impact 1) and sedimentation of surface waters (Impact 2). The construction phase surface water management measures will apply the relevant CIRIA guidelines (CIRIA C648 Control of Water Pollution from Linear Construction Projects) and will include the construction activities and water pollution issues: ▪ Chemicals, fuel storage and refuelling; ▪ Site compounds; ▪ Dewatering;	Volume 7, Chapter 8: Onshore CEMP

Project design feature/other avoidance or preventative measure	Where secured
▪ Horizontal directional drilling (HDD); ▪ Runoff and sediment control; ▪ Earthworks; ▪ Floodplain works on/in; ▪ Topsoil stripping and reinstatement; ▪ Watercourse crossing works on/near; ▪ Water discharge; and ▪ Water treatment. Each of the above construction activities and water pollution issues, with relevant guidance on the management and control of water measures for the project, are set out in Annex 3. The surface water control measures which will be implemented during the construction phase will be subject to routine visual inspection with appropriate maintenance undertaken as identified and required to ensure that the management measures are effective. In addition to the CEMP, construction management measures will include the provision of an Emergency Incident Response procedure which will be prepared and deployed in the event of an emergency event. The measures outlined here will be secured within the CEMP and the Emergency Incident Response procedure.	

4.12 Environmental assessment: Construction phase

Impact 1: Pollution of surface water and groundwater

4.12.1 Oil and fuel spills from plant and machinery during the construction phase can pose significant environmental risks. These spills could occur due to leaks, overfilling, or accidents involving plant and machinery. When oil or fuel spills onto the ground, it can seep into the soil, contaminating it and potentially reaching groundwater sources or surface water receptors.

4.12.2 As set out in Section 4.11, a number of project design measures will help to reduce the risk of pollution events happening. These are summarised as follows:

OES

- Trenchless Crossings: For most watercourse crossings, trenchless techniques will be used. Temporary drilling compounds will be set up on either side of the watercourse, with limited surface excavation for launch and exit pits.
- Open Cut Crossings in Sector 7: These involve installing temporary dams on either side of the crossing to create a dry section for cable duct installation. Methods like sandbagging, sheet piling or aqua dams will be used. The stream flow will be maintained by over-pumping from upstream to downstream. The trench will be excavated, ducts placed, and a concrete surround with steel reinforcement will be poured. The area will be backfilled and the streambed reinstated before removing the dams.
- Temporary Construction Compounds (TCCs): At the Landfall Site, Clifton Park TCC, and Leopardstown TCC, temporary drainage measures will be implemented to manage runoff and prevent pollution. This includes filter drains, silt fencing, soakaways, infiltration trenches, and settlement ponds/tanks. Contaminated water will be tanked off-site for treatment by a licensed provider.
- OSS: Temporary drainage measures, including filter drains, silt fencing, soakaways, infiltration trenches, and settlement ponds/tanks, will manage runoff and prevent pollution. The attenuation tank with a bypass oil/fuel separator will remove hydrocarbons. Contaminated water will be tanked off-site for treatment.

O&M Base

- O&M Base: The existing surface water drainage network at the harbour will be upgraded. The new drainage network will tie into the existing oil interceptor in the harbour which will clean surface water run off of all sediment and of any potentially hazardous material prior to discharging the surface water into tidal waters within the harbour.

4.12.3 The CEMP contains measures to mitigate against pollution events happening and propose measures for dealing with such incidents. To prevent pollution during construction, the CEMP includes measures following CIRIA guidelines (CIRIA C648) for various activities including:

- Chemicals, fuel storage, and refuelling;
- Dewatering;
- Runoff and sediment control;
- Earthworks;
- Topsoil stripping and reinstatement;
- Watercourse crossing works; and
- Water discharge and treatment.

4.12.4 The surface water control measures which will be implemented during the construction phase will be subject to routine visual inspection with appropriate maintenance undertaken as identified and required to ensure that the management measures are effective. Specific measures will be applied to different construction elements like the onshore ECR, OSS site, TCCs, trenchless crossings pits, watercourse crossings, and the site of the proposed O&M Base.

Table 10 Determination of magnitude for pollution risk during construction for surface waters and groundwater

Definition	Justification
Extent – Low	Accidental pollution events have the potential to affect surface water or ground water quality within the study area. The greatest risk will be around water course crossing TX-04 where construction works will be undertaken directly adjacent to river channels. Design measures developed as part of the design process and summarised in Section 4.11 will significantly reduce the extent of any accidental spillage. Avoidance and preventative measures set out in Section 4.11 will ensure that spillages are addressed limiting the extent of any pollution.
Duration - Low	The duration of effect will be temporary. The avoidance and preventative measures set out in Section 4.11 will ensure that the duration of any spillage is restricted.
Frequency – Low	The avoidance and preventative measures set out in Section 4.11 will ensure that a pollution event will be a very rare occurrence.
Probability – Low	Avoidance and preventative measures set out in Section 4.11 will reduce the risk of spillages occurring by ensuring that good working practices are adopted and procedures are in place if accidental spillages do occur. The measures outlined will be secured in the CEMP and the Emergency Incident Response procedure.

Definition	Justification
	Design measures set out in Section 4.11 will reduce the risk of spillages impacting surface water features. On the basis of these measures it is considered that the probability of an event happening is very Low.
Consequence – Low	Reduction in surface water quality in local watercourses or groundwater quality. Temporary alterations within a restricted area, limited impact on the environment's key characteristics or features. The changes are reversible.
Overall magnitude	The potential magnitude on surface waters and groundwater is rated as **Low** based on the extent, duration, frequency, probability, and consequence set out above.

4.12.5 As set out in Section 4.6 the surface water network in the study area is classified under the WFD (2016 to 2021) with Poor to Good water quality. Surface water is deemed an important receptor due to its local significance and WFD classification. It has been attributed a sensitivity rating of **High** for the assessment.

4.12.6 Within the study area the bedrock aquifer is classified as a locally important aquifer (Ll) along the coastal area around Shanganagh and is classified as a Poor Aquifer (Pl) across the remainder of the study area inland. It has been attributed a sensitivity rating of **Medium** for the assessment.

4.12.7 The magnitude of the impact on **surface water receptors** has been assessed above as **Low**, with the maximum sensitivity of the receptors being **High**. Therefore, the significance of effect from pollution risk is **Slight Adverse**, which is not significant in EIA terms.

4.12.8 The magnitude of the impact on **groundwater receptors** has been assessed above as **Low**, with the maximum sensitivity of the receptors being **Medium**. Therefore, the significance of effect from pollution risk is **Slight Adverse**, which is not significant in EIA terms.

Residual effect assessment

4.12.9 **No significant adverse residual effects** have been predicted in respect of pollution of surface and groundwater during construction.

Impact 2: Sedimentation of surface waters

4.12.10 Various onshore infrastructure construction activities will require earthworks resulting in the removal of vegetation cover and excavation of mineral subsoil. Exposed and disturbed ground may increase the risk of erosion and subsequent sediment laden surface water runoff. The release of suspended solids is primarily a consequence of the physical disturbance of the ground during the construction phase and/or from the temporary stockpiling of material.

OES

4.12.11 The OES construction phase will involve various earthworks activities that have potential impacts on surface water conditions:

- Construction of temporary and permanent infrastructure on site, including hardstands, site access tracks, substation, cable trenches, construction compounds;
- Laying of underground electrical cabling, as part of the Onshore ECR; and
- Watercourse crossings along the Onshore ECR using open-cut trench techniques or trenchless technology at various locations along the Onshore ECR and at the Landfall Site – see Section 4.10 for details.
- Stockpiling of excavated material at the following sites:
  - Landfall TCCs;
  - Clifton Park TCC;
  - Leopardstown TCC;
  - The site of the proposed OSS and
  - Within the Onshore ECR including trenchless crossing compounds.

4.12.12 Where the trenchless technology approach for water course crossings is adopted. The trenchless crossing compounds will be located away from the watercourse the risk to surface water from sediment in the runoff is negligible. However, at Achill Road the drill entry and exit pits will be located in close proximity to the Kill o' the Grange Stream due to spatial constraints at this location (TX-04 and TX-05 in Sector 2). Avoidant and preventative mitigation measures will be included to prevent sediment in runoff from the drill compound entering the watercourse.

4.12.13 Potential sources of sediment laden water include:

- Soil stripping, if necessary, to construct the cable trenches, hardstands, and substation;
- Run-off and erosion from soil stockpiles at the TCC's and excavation areas at the landfall Site, the OSS and the trenchless crossing compounds;
- Construction of the onshore ECR cable trench resulting in entrainment of sediment from the excavations during construction, particularly where the trenchless drill pad sites have to be located close to a watercourse (TX-02, TX-04, TX-05, TX-06, TX-07) due to physical operational constraints. In such instances silt traps or silt fencing will be used to prevent any material entering into the nearby watercourse. This is not expected to occur at sections of the Onshore ECR running along public roads; and
- Erosion of sediment at two water crossings where open cut trench will be used, in Sector 7.

4.12.14 Where the drill pad sites are located close to a watercourse, and at the two trenched crossings in Sector 7, activities at these locations have potential to release suspended solids to surface watercourses. This may result in the increased turbidity of receiving waters affect the water quality of downstream water bodies. Avoidance and preventative mitigation measures set out in Section 4.11 will ensure that these effects are unlikely to occur (see Table 11 below)

4.12.15 The surface water network within the study area has been classified under WFD (2016 to 2021) with Poor to Good water quality.

4.12.16 The extent of the Onshore ECR within surface water catchment is small in scale compared to the overall catchment area. Given the transient nature of surface waters, they are expected to recover relatively quickly from sedimentation impacts in the unlikely event of this impact occurring.

4.12.17 Surface water sedimentation impacts arising from the O&M Base construction have been scoped out as there are no surface water terrestrial receptors within the study area.

Table 11 Determination of magnitude for sedimentation of surface waters during construction

Definition	Justification
Extent	Potential to affect surface water quality in the local surface water network close to major excavations and TCCs along the Onshore ECR. These are at the OSS, Landfall Site, TCCs and open cut crossings of watercourses in Sector 7 and at the trenchless crossing compounds.
Duration	The duration of impacts, if any, will vary according to the activities, but will be temporary lasting less than one year during construction.
Frequency	This impact is not considered to be a frequent occurrence and will only occur in the event of an accidental spillage occurring.
Probability	Unlikely as any release will be accidental only and is considered unlikely given the project design features outlined above in Section 4.11, these include: ▪ A buffer between watercourses and any proposed construction activities or infrastructure, except at proposed watercourse crossing locations; ▪ At the Ballyogan Landfill and Recycling Facility any existing site drains will be diverted in advance of construction (under license) and containment measures will be adopted to control site run off during construction; ▪ The construction phase management measures will follow the relevant CIRIA guidelines (CIRIA C648 Control of Water Pollution from Linear Construction Projects; and ▪ The measures outlined here will be secured within the CEMP and the Emergency Incident Response procedure.
Consequence	Reduction in surface water quality in local surface water network.
Overall magnitude	The potential magnitude on surface water is rated as **Low** based on the extent, duration, frequency, probability and consequence set out above.

4.12.18 The magnitude of the impact associated with works at the OSS, Landfall, TCCs and open cut crossings of watercourses and at the drill pad sites has been assessed as **Low**, with the maximum sensitivity of the receptors being **High**. Therefore, the significance of effect from erosion and sedimentation is **Slight Adverse**, which is not considered significant in EIA terms.

Residual effect assessment

4.12.19 **No significant adverse residual effects** have been predicted in respect of sedimentation of surface waters during construction.

Impact 3: Fluvial and coastal flood risk

4.12.20 As set out in Section 4.1 Introduction and described in the description of the receiving environment Section 4.6, there are two Flood Risk Assessments (FRAs) that support this assessment, as follows:

- Flood Risk Assessment for the Dublin Array OES (December 2024) which is provided in the OSS FRA; and
- Flood Risk Assessment for the Dublin Array Operations and Maintenance Base (October 2023) which is provided in the O&M Base FRA.

4.12.21 This assessment is informed by the findings of these FRAs.

4.12.22 Run-off from the larger construction site areas such as the OSS, Clifton Park TCC, Leopardstown TCC and the Landfall Site TCC and open cut crossings of watercourses (within Sector 7) has the potential to result in soil erosion and consequently sediment release into nearby watercourses.

4.12.23 The risk of an increase in downstream flooding from the larger construction site areas is considered to be low due to the small scale of these areas relative to overall catchment areas.

4.12.24 Sediment erosion on site has the potential to cause blockages in on-site drainage infrastructure if not maintained, and which have the potential to cause some minor increase in surface water flooding across the infrastructure areas from site runoff.

4.12.25 Flooding receptors in the study area, as identified by the OPW NIFM (National Indicative Fluvial Maps) indicate that the onshore infrastructure elements cross several areas at flood risk.

OES

Landfall Site

4.12.26 Based on the OPW NIFM (National Indicative Fluvial Maps), the Landfall site is located within Flood Zone C[6], an area at low risk of flooding. In terms of flood risk the Landfall is considered to be 'water compatible' development and therefore is appropriate development within this zone. Water compatible development in the Planning Guidelines is generally described as development which by its very nature must be located in flood zones A and/or B and is resilient to flooding.

4.12.27 Where the development is water compatible then the Justification Test[7] under the Flood Guidelines is not required with no flood mitigation measures required. The infrastructure will be installed underground and the surface will be reinstated to original form and levels, and as such flooding will not impact the development and the development will have no impact to flooding or surface water runoff. If flooding was to occur at the site, it is considered that these infrastructure elements will not be damaged, and operation will not be impacted.

Remainder of the OES

4.12.28 The OES is mostly within Flood Zone C however, sections of the ECR are situated within Flood Zones A and B. Given that the onshore export cables will be installed underground in its permanent state it is not anticipated to alter the flood mechanism or cause any changes to existing flood risk. It is considered that the development is 'water compatible' under the Flood Guidelines and is therefore considered to be appropriate development within any flood zones and the Justification Test is not required. Water compatible development in the Planning Guidelines is generally described as development which by its very nature must be located in flood zones A and/or B and is resilient to flooding.

4.12.29 The proposed OSS will be located within Flood Zone C. The OSS site is relatively small compared to the catchment size and the runoff will be managed during construction. Therefore, storm runoff from the OSS construction site will not increase the flood risk downstream of the site.

[6] 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.
[7] The 'Planning System and Flood Risk Management Guidelines for Planning Authorities' Guidelines (2009) outline a 'Justification Test' to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk.

O&M Base

4.12.30 The proposed O&M Base will be situated within Flood Zone C (low risk of flooding) with the exception of a relatively small area of the site, at the north-western boundary which falls within Flood Zone A (high risk of flooding). However, there is no development proposed within this north-western area of the O&M Base site. As the O&M Base falls within the 'water-compatible development' category according to the Flood Guidelines and is considered an appropriate development that does not require a Justification Test under the Flood Guidelines, or further mitigation. Water-compatible development is described in the guidelines as including '*Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location*', it is considered that the O&M Base activities fall under this description.

4.12.31 The potential for increase in flooding is considered to be negligible relative to the overall catchment areas. It is considered that the limited increase in runoff from surfaced and hard-standing areas will not increase the risk of flooding. Recoverability is high, as flooding events are transient and, given the minor scale of potential flooding, recovery is expected to be quick.

Table 12 Determination of magnitude for fluvial flood risk during construction of the OSS and O&M Base

Definition	Justification
Extent	Potential to increase flood risk in the local area.
Duration	Duration of effect will be short-term.
Frequency	This is contingent on storm rainfall event and intensity.
Probability	Unlikely due to the project design features outlined above in Section 4.11, these include: ▪ Construction of site drainage, attenuation and treatment prior to the commencement of earthworks and construction activities.
Consequence	Adverse effects on local area as a result of increase surface water runoff.
Overall magnitude	The potential magnitude is rated as **Low** based on the extent, duration, frequency, probability and consequence set out above.

4.12.32 The magnitude of the impact on flooding receptors has been assessed as **Low**, with the maximum sensitivity of the receptors being **High**. Therefore, the significance of effect from pollution risk is **Slight Adverse**, which is considered not significant in EIA terms.

Residual effect assessment

4.12.33 **No significant adverse residual effects** have been predicted in respect to flooding during construction.

Impact 4: Groundwater levels and flow

4.12.34 Dewatering may be necessary during the construction phase at locations where excavations are necessary. This is most likely to occur at locations where deeper excavations are necessary to facilitate the construction of foundations or below surface level infrastructure. This is most likely to occur at the Landfall Site where the Transition Joint Bays (TJBs) will be constructed below the surface and at the OSS site where foundations will be necessary to support the construction of the OSS. A detailed description of the construction works at these locations is set out in the Project Description Chapter.

4.12.35 At these locations there is the potential for local groundwater levels in the immediate vicinity of the deeper foundation excavations to be lowered slightly. However, any potential impacts on groundwater levels are not anticipated to be significant due to the limited extent/depth of the excavations required for foundations. In addition, the foundation excavations will not be particularly deep so will not alter the local groundwater flow regime.

4.12.36 Groundwater inflows may need to be pumped from any deeper excavations, i.e., for dewatering, resulting in short-term localised drawdown of the water table and discharges to surface water channels. This could impact on local groundwater levels immediately around the excavations.

4.12.37 Location specific good practice measures around dewatering will be included in the CEMP and the measures will minimise generation of suspended solids and the treatment of any water to remove suspended solids if present, see Annex 3 for construction mitigation measures in relation to water.

4.12.38 Groundwater bodies in the study area are classified as Locally Important or Poor Aquifers and the geology at site has a low bulk hydraulic conductivity. The tolerance of these receptors is relatively high, as the scale of the construction works, including any temporary dewatering, is small compared to the overall catchment and the potential magnitude of temporary groundwater ingress will be small. Groundwater bodies, however, are expected to have a slower recoverability due to their less dynamic nature compared to surface waters. These groundwater bodies are considered Low to Medium value receptors, given their local significance. As a result, the overall sensitivity of hydrogeological receptors to construction activities is rated as **Low** to **Medium**.

Table 13 Determination of magnitude for hydrogeological receptors during construction

Definition	Justification
Extent	Size and scale of effect will be localised.
Duration	Duration of effect will be short-term.
Frequency	The effect is anticipated to only occur when temporary dewatering is required.
Probability	Considered unlikely as any dewatering is likely to be of limited volume and restricted to deeper excavations such as the TJB at the Landfall Site and the OSS. Excavations here will be relatively shallow; therefore, the dewatering volumes will be small and the period for

Definition	Justification
	dewatering will be temporary while the foundations are excavated and built.
Consequence	Reduction in groundwater level and flow in subsoils and /or underlying bedrock aquifer, where encountered.
Overall magnitude	The potential magnitude on groundwater is rated as **Low** to **Negligible** based on the extent, duration, frequency, probability and consequence set out above.

4.12.39 The magnitude of the impact on groundwater receptors has been assessed as **Low to Negligible**, with the maximum sensitivity of the receptors being **Medium**. Therefore, the significance of effect from pollution risk is **Slight Adverse** to **Negligible**, which is not significant in EIA terms.

Residual effect assessment

4.12.40 **No significant adverse residual effects** have been predicted in respect to impacts on groundwater levels and flow during construction.

4.13 Environmental assessment: Operational phase

Introduction

OES

4.13.1 As set out in the Project Description Chapter, following an initial proving period, the OES will be transferred to EirGrid. All assets which are included in the OES, from the Landfall to the final grid connection point at Carrickmines will be transferred to EirGrid.

4.13.2 From the start of the Operational Phase until transfer to EirGrid (up to 18 months) Dublin Array will have responsibility for the operation and maintenance of the OES. On handover, EirGrid will take responsibility for the operation and maintenance of the OES, including the TJBs, onshore ECR, the OSS and the grid connection to the final connection point at Carrickmines.

4.13.3 As set out in the Project Description Chapter, onshore operations and maintenance activities will be categorised as either preventative or corrective activities. Preventative maintenance concerns scheduled services, whereas corrective maintenance concerns unexpected repairs, component replacements, retrofit campaigns and breakdowns.

4.13.4 OES operation and maintenance requirements will be largely preventative, accompanied by infrequent on‐site inspections of the OES. Preventative servicing is likely to comprise:

- Co-located link boxes and communication chambers will need to be serviced approximately once a year to ensure correct operation. Note, the TJB is not expected to be visited during the operational phase; and
- The OSS will be visited approximately once per week.

4.13.5 Corrective activities may be required to the onshore ECR in the event of a fault and for repair purposes. Typically, this will involve excavating the two adjacent joint bays, pulling the cable back through the ducting and pulling a new cable through. Alternatively, the area of the fault may be excavated (with up to an additional 40 m in both directions) and two new joints installed within this area. Methods for excavation and reburial will be similar to the original construction period, as described in Impacts 1 to 4.

O&M Base

4.13.6 As set out in the Project Description Chapter the O&M Base will be operated by Dublin Array. Daily operations at the base will include the delivery of spare parts, materials and supplies to the O&M warehouse. No heavy engineering or manufacturing processes will take place at the site. Approximately 80 persons will work at the O&M Base, including approximately 25 offshore technicians.

4.13.7 Deliveries to site will generally consist of small loads delivered by light goods vehicles (on average 2 deliveries per day) with an occasional HGV expected on rare occasions. Traffic will access the internal O&M Base via the main harbour gates off Harbour Road. Deliveries will be moved to/from the warehouse area using a forklift truck

Impact 5: Pollution risk

4.13.8 The greatest risk of a pollution event occurring will be at the site of the OSS, where inspections are most frequent and spillage of oils, fuel or chemicals may occur.

4.13.9 Storm water attenuation and treatment for OSS in line with SuDS best practice; and

4.13.10 The discharge line will also include a bypass oil/fuel separator to remove any hydrocarbons in the discharge waters from the OSS and the O&M Base.

4.13.11 The potential for a pollution event to occur during these operation and maintenance activities is unlikely There will be a limited number of vehicles required onsite for routine maintenance and operational activities.

4.13.12 The surface water network has been classified Poor to Good water quality. Groundwater bodies within the study areas are classified as Locally Important or Poor Aquifers. The extent of the construction works within the surface water catchment and groundwater bodies is small in comparison to the overall catchment areas. Surface water is considered a Medium to High value receptor due to its local importance and WFD status, whereas groundwater bodies are classified as Low to Medium value receptors. Consequently, the overall sensitivity of surface water to pollution risk during operation is rated as Medium to High, while groundwater sensitivity is rated as Low to Medium.

Table 14 Determination of magnitude for pollution risk during operation

Definition	Justification
Extent	Potential to affect surface water and groundwater quality in the local network
Duration	The duration of effect will be short-term.
Frequency	This impact is not considered to be a frequent occurrence and will only occur in the event of an accidental spillage occurring.
Probability	Unlikely due to the project design features for the OSS and the O&M Base outlined above in Section 4.11. These comprise: ▪ Storm water attenuation and treatment for OSS and O&M Base sites in line with SuDS best practice; and ▪ The discharge line will also include a bypass oil/fuel separator to remove any hydrocarbons in the discharge waters from the OSS and the O&M Base.
Consequence	Reduction in surface water quality in local surface water network.
Overall magnitude	The overall magnitude for potential pollution risk during the operational phase is rated as **Low** based on the extent, duration, frequency, probability and consequence set out above.

4.13.13 The magnitude of the impact on surface water receptors has been assessed as **Low**, with the maximum sensitivity of the receptors being **High**. Therefore, the significance of effect from pollution risk is **Slight Adverse**, which is not significant in EIA terms.

4.13.14 The magnitude of the impact on groundwater receptors has been assessed as **Low**, with the maximum sensitivity of the receptors being **Medium**. Therefore, the significance of effect from pollution risk is **Slight Adverse**, which is not significant in EIA terms.

Residual effect assessment

4.13.15 **No significant adverse residual effects** have been predicted in respect to pollution risk impacts during the operational phase.

Impact 6: Fluvial flood risk

4.13.16 Operation of the onshore infrastructure requires limited activities. The presence of hardstanding will prevent infiltration and increase surface water runoff, particularly at the OSS site.

4.13.17 The sensitivity assessment for flooding receptors during operation indicates that the OES is at low risk of flooding. Any increase in flooding is considered to be negligible due to the relatively small rise in runoff from surfaced and hardstanding areas associated with the development, compared to the overall catchment areas and the volume of flood flows in the watercourses.

Table 15 Determination of magnitude for fluvial flood risk during operation

Definition	Justification
Extent	Potential to increase flood risk in the local area.
Duration	Duration of effect will be short-term.
Frequency	The worst impacts will likely occur following high rainfall and storms.
Probability	Unlikely due to the project design features for the OSS site outlined above in Section 4.11, these include: ▪ Storm water attenuation and treatment for OSS site in line with SuDS best practice limiting the runoff from the OSS site to the site greenfield equivalent rate of 3.3 l/s.
Consequence	Adverse effects on local area as a result of increase surface water runoff.
Overall magnitude	The potential magnitude on groundwater is rated as **Low** based on the extent, duration, frequency, probability and consequence set out above.

4.13.18 The magnitude of the impact on flooding receptors has been assessed as **Low**, with the maximum sensitivity of the receptors being **High**. Therefore, the significance of effect from pollution risk is **Slight Adverse**, which is not significant in EIA terms.

Residual effect assessment

4.13.19 **No significant adverse residual effects** have been predicted in respect to flooding during construction.

4.14 Environmental assessment: Decommissioning phase

The OES

4.14.1 The construction, operation and maintenance works associated with the OES will be managed by the Applicant until the end of the proving period and handover of ownership to EirGrid. As the enduring asset owner, EirGrid will become responsible for decommissioning of the transferring assets at the end of their deemed lifetime.

4.14.2 Accordingly, this planning application does not seek permission for decommissioning of the OES. However, for the purpose of enabling a comprehensive environmental impact assessment, we have set out below our recommended approach to decommissioning, should EirGrid choose to decommission any aspect of the OES. This approach is informed by the Applicant's experience of decommissioning onshore substations and onshore export cables on other projects and knowledge of how EirGrid typically do this.

4.14.3 In addition, we have set out below the factors which should inform any decision by EirGrid to decommissioning:

- The baseline environment at the time decommissioning works are carried out;
- Technological developments relating to decommissioning of onshore transmission infrastructure;
- Changes in what is accepted as best practice relating to decommissioning of onshore transmission infrastructure;
- Submissions or recommendations made by interested parties, organisations and other bodies concerned with decommissioning of onshore transmission infrastructure; and
- Any new relevant regulatory requirements.

4.14.4 Further, any decommissioning works must:

- Comply with any decommissioning specific conditions in the Development Consent;
- Ensure that the environmental impacts are consistent or less in scale and magnitude to those predicted in the EIAR, Natura Impact Statement and Water Framework Directive Assessment associated with the Development Consent or any amendment of the Development Consent or any subsequent consent EirGrid might be granted in respect of decommissioning; and
- Comply with the relevant health and safety regulations.

4.14.5 A decommissioning plan, along with an environmental management plan, should be prepared before any decommissioning works begin. If necessary, an application for consent should be made by EirGrid, and submitted to the relevant competent authority, in respect of any decommissioning works which require consent. We will expect any such application to involve further environmental assessment and public participation, and for any decision made by the competent authority to be judicially reviewable.

O&M Base

4.14.6 A decommissioning and restoration plan has been included in Volume 7 Appendix 7.2: Decommissioning and Restoration Plan of the Environmental Impact Assessment Report (hereafter referred to as the Decommissioning and Restoration Plan). As outlined in the Decommissioning and Restoration Plan, the O&M building will be either re-purposed for an alternative use or demolished following the decommissioning of the offshore infrastructure.

4.14.7 Following the decommissioning of the offshore infrastructure the fencing and pontoon will be removed, and the hardstanding area will be taken over by DLRCC for general harbour operations.

4.14.8 Decommissioning activities for the OES and the O&M Base are not anticipated to exceed the construction phase design parameters which have been assessed in Section 4.12. Accordingly, it is anticipated that there will be the same level of impact and resulting level of effect and significance (or less) in comparison to the assessment of construction effects set out in Section 4.12 of this chapter. There will be **no Significant adverse effects** arising during the decommissioning phase.

4.15 Environmental assessment: Cumulative effects

4.15.1 A list of cumulative projects is provided in Volume 2, Chapter 4: Cumulative Effects Assessment Methodology and the locations of these developments are shown in that chapter.

4.15.2 A cumulative effect is considered to occur when there is a combination of a moderate or above significance of effect on a receptor, or group of receptors, as a result of the construction, operation and maintenance and decommissioning phases associated with the onshore infrastructure of the proposed Dublin Array Offshore Wind Farm (Dublin Array), and an effect on the same receptor, or group of receptors, as a result of another project or projects.

4.15.3 Cumulative effects relating to Hydrology, Hydrogeology and Flood Risk can be direct or indirect. A cumulative direct effect will relate to direct impacts to a receptor from the onshore infrastructure of Dublin Array and from other project(s) also. A cumulative indirect effect will be the result of impacts upon the setting of a receptor(s) from the onshore infrastructure of Dublin Array and from another project(s).

4.15.4 This assessment has considered each cumulative project listed in the longlist in relation to its location in either the Landfall Site and OES or O&M Base study areas. This is shown below with regards to those cumulative projects scoped out or scoped into this assessment.

Onshore projects for cumulative assessment

OES

4.15.5 This assessment has determined that local developments have the potential for cumulative effects through surface water runoff and flooding impacts.

4.15.6 The full list of sites considered in the cumulative assessment for hydrology, hydrogeology and flood risk is as follows:

- Glenamuck district road scheme, ABP Reference 303945 (now in construction) – new road overlaps with the OES at Ballyogan Road;
- Beckett Road Re-alignment and Ancillary Amendments, ABP Reference 308753 (consented, pre construction) – the proposed new road overlaps with the OES in Cherrywood; and
- Dublin Replacement Underground Cable Programme CP1146 Carrickmines to Poolbeg Cable Replacement (pre-submission stage, optioneering details in the public domain) – the proposed cable route overlaps with the OES in Carrickmines.

- The East Coast Railway Infrastructure Protection Project (ECRIPP). The Dalkey Tunnel to Shanganagh Wastewater Treatment Plant section of this coastal stability project overlaps with the OES at the Landfall;
- The Deansgrange Flood Relief Scheme at Glenavon Park will overlap with the onshore ECR in Sector 2;
- Mixed use development on a 6.9 hectares (17 acre) site at The Park, Brookfield, Glenamuck Road, Carrickmines Great & Jamestown, Dublin 18, DLRCC Reference D07A/0936;
- 30 No. houses and 173 No. apartments with all associated site works at Glenamuck Road South, Kilternan, Dublin 18, ABP Reference 303978;
- 927 no. residential units (355 no. houses and 572 no. apartments) at Clay Farm, Ballyogan Road, Dublin 18; ABP reference 301522;
- 443 No. residential units at Priorsland, within the townlands of Carrickmines Great and Brennanstown, Dublin 18; ABP Reference 313322;
- 482 no. apartments, creche and associated site works at Golf Lane, Carrickmines, Dublin 18; ABP Reference 309026; and
- Retail/Commercial Development comprising a neighbourhood centre, retail warehouses, cinema and other leisure space, residential units, creche, office space, car showroom, medical centre, linear park and associated works at Glenamuck Road and Ballyogan Road, Carrickmines Great and Jamestown, Dublin 18.

4.15.7 In all cases, where it is necessary the developments will be designed to SuDS drainage principles and are located outside of identified flood zones.

4.15.8 Therefore, the OES of the proposed Dublin Array was assessed to have a **Negligible** impact upon flooding and flood risk as runoff from the OSS will be managed and runoff from the OES during construction will be negligible. Therefore, the effect on surface water volumes and flooding is considered to be **Not Significant**.

O&M Base

4.15.9 It is not considered that there are any cumulative impacts on hydrology, hydrogeology or flood risk associated with the proposed O&M Base development.

4.16 Interactions of the environmental factors

4.16.1 A matrix illustrating the likely interactions arising from the proposed development on Hydrology, Hydrogeology and Flood Risk receptors is provided in Volume 8, Chapter 1: Interactions of the Environmental Factors (hereafter referred to as the Interactions of the Environmental Factors Chapter).

4.16.2 Interactions of the foregoing are considered to be the effects and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- **Project lifetime effects**: Assessment of the scope for effects that occur throughout more than one phase of the project (construction, operation, and decommissioning) to interact and potentially create a more significant effect on a receptor than if just assessed in isolation in these three project phases; and
- **Receptor-led effects**: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. For example, all effects on water quality such as contamination and alterations to groundwater levels may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short-term, temporary, or transient effects, or incorporate longer-term effects.

4.16.3 As indicated in the interactions matrix (Interactions of the Environmental Factors Chapter), there are linkages between the topic-specific chapters presented within this EIAR, whereby the effects assessed in one chapter have the potential to result in secondary effects on another receptor.

4.16.4 The different Hydrology, Hydrogeology and Flood Risk effects are already inter-related. Therefore, these linked processes have been considered within the assessment. The potential effects on Hydrology, Hydrogeology and Flood Risk during construction, operational and decommissioning phases of the Project have been assessed in Sections 4.12 to 4.15. In turn, this assessment of changes to Hydrology, Hydrogeology and Flood Risk has been used to inform other EIA aspects.

4.16.5 Effects on Hydrology, Hydrogeology, and Flood Risk (e.g. from changes in groundwater levels or accidental release of contaminants) also have the potential to have secondary effects on other receptors which have been fully assessed in the topic-specific chapters. These chapters are:

- Marine Water and Sediment Quality – Volume 3, Chapter 2;
- Biodiversity – Volume 5, Chapter 2; and
- Land, Soils and Geology – Volume 5, Chapter 3.

4.16.6 The following potential effects have been considered within the interactions assessment:

- Potential pollution of ground water and surface water caused by accidental releases or spills of materials or chemicals during construction/decommissioning works or during the operation and maintenance phase.

Project lifetime effects

4.16.7 Project lifetime effects consider impacts from the construction, operation, or decommissioning of the proposed development on the same receptor (or group). The potential inter-related effects that could arise in relation to Hydrology, Hydrogeology, and Flood Risk receptors are presented in Table 16.

Table 16 Project lifetime effects assessment for potential inter-related effects on Hydrology, Hydrogeology and Flood Risk

Impact type	Effects (assessment alone)			Interaction assessment
	Construction	O&M	Decommissioning	Project lifetime effects
Potential pollution of ground water and surface water caused by accidental releases or spills of materials or chemicals during construction/decommissioning works or during the operation and maintenance phase.	Slight adverse	Slight adverse	Slight adverse	Site activities during the construction, operation or decommissioning phases could affect biodiversity, land and soil and potentially marine waters if carried downstream into Dublin Bay. The effect where there is potential for this to occur is if there was to be an accidental release of pollution caused during the construction phase (Impact 1) or operational phase (Impact 5). The potential for this effect to result in consequential effects on other receptors (e.g. marine waters or terrestrial biodiversity) will be controlled by the avoidance and preventative measures set out in this chapter in Section 4.11. As set out in this section, these measures will be secured through use of a CEMP as presented in Volume 7 of the EIAR. Accordingly, the effect is predicted to be at worst **slight adverse** which is **not significant** in EIA terms. No significant in-combination effects are anticipated to occur.

Receptor-led effects

4.16.8 Potential exists for spatial and temporal interactions between degradation or loss of groundwater quality, release of contaminants (through handling of contaminated materials), and accidental release or spills of contaminants during the lifetime of the proposed development. Based on current understanding, the greatest scope for potential interactions between impacts is predicted to arise through the interaction of potential impacts arising from the release of contaminants during the construction phase caused by accidental spills (Impact 1) and groundwater levels and flow (Impact 4).

4.16.9 These individual impacts were assigned a significance of slight adverse as standalone impacts. While potential combined impacts may arise, it is unlikely they will occur at the same time or in the same location i.e. an accidental pollution incident occurring at the same time and location as groundwater levels being adversely affected. In combination and taking account of the preventative and avoidance measures set out in Section 4.11, the effects are not expected to be greater than currently predicted. No significant effects are predicted to arise.

4.17 Transboundary effects

4.17.1 There are no national transboundary implications with regards to hydrology, hydrogeology and flood risk as the onshore infrastructure will not be sited in proximity to any international boundaries.

4.18 Summary of residual effects

4.18.1 This section provides a summary of the residual effects from the identified impacts with the project design features and other avoidance and preventative measures in place.

Table 17 Summary of residual effects with project design features, avoidance and preventative measures

Number	Description of effect	Project design features and other avoidance and preventative measure	Residual effect
Construction			
Impact 1	Pollution of surface waters and groundwaters	Good practice measures of preventing pollution as outlined in the CEMP.	No significant adverse residual effects.
Impact 2	Sediment to surface waters	Good practice measures of preventing increased erosion and sedimentation as outlined in the CEMP.	No significant adverse residual effects.
Impact 3	Fluvial and coastal flood risk	Appropriate drainage design that incorporates measures to attenuate and treat runoff from construction areas, which will be included in the final CEMP.	No significant adverse residual effects.

Number	Description of effect	Project design features and other avoidance and preventative measure	Residual effect
Impact 4	Groundwater levels and flows	Good practice measures will form part of the final CEMP and will be used to minimise the potential for drainage and dewatering effects.	No significant adverse residual effects.
Operation and Maintenance			
Impact 5	Pollution Risk	Appropriate storage and handling of potential pollutants. Adopted through a long-term operational drainage and monitoring programme for OSS discharge waters by way of a Section 4 Discharge Licence from the Local Authority.	No significant adverse residual effects.
Impact 6	Fluvial flood risk	Adoption of a long-term operational drainage and monitoring programme for discharge from OSS.	No significant adverse residual effects.
Decommissioning			
Same as construction effects outlined above.	Same as construction effects outlined above.	Same as construction effects outlined above.	No significant adverse residual effects.
Cumulative effects			
Cumulative effects	Cumulative effects through surface water runoff and flooding impacts	None Assumed that SuDS drainage principles are applied to cumulative sites and that they are located outside of identified flood zones.	No significant adverse residual effects.
Transboundary			
There are no transboundary effects associated with hydrology, hydrogeology and flood risk in relation to onshore infrastructure.			

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Annex 1 Legislation and policy guidance

Policy/Legislation	Key provisions	Section where provision is addressed
Statutory		
Legislation		
Water Framework Directive, 2000	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishes a framework for Community action in the field of water policy. The key provisions of the Water Framework Directive (WFD) relevant to the onshore infrastructure focus on minimising impacts on water bodies and ensuring sustainable water management. Developers must assess potential effects on groundwater and surface waters, ensuring that infrastructure does not cause pollution or deterioration of water quality. Projects are required to integrate water protection measures, including runoff management and habitat conservation, into their design. In addition, planning must consider local hydrology, particularly in sensitive areas like wetlands, and follow best practices to avoid disrupting natural watercourses, ensuring compliance with river basin management plans and environmental objectives set by the WFD.	Provisions are addressed in Sections 4.12 to 4.15 of the EIAR, detailing the assessment of potential impacts on water quality and the integration of water protection measures into project design. A full assessment of the Dublin Array onshore infrastructure on the chemical and ecological status of relevant WFD water bodies is provided in the onshore WFD Report. The information from this chapter has been used to inform the conclusions of the onshore WFD Report for which the objectives of the River Basin Management Plan (2022 -2027) have been considered
Groundwater Directive, 2006	The Groundwater Directive (2006/118/EC) imposes requirements for onshore infrastructure development, such as underground cables and substations, to prevent groundwater pollution and deterioration. Developers must assess potential risks to groundwater during construction and operation, particularly regarding potential pollutant leakage or contamination from hazardous substances.	Addressed in Section 4.12 to 4.15 of the EIAR, where groundwater protection measures are outlined. This includes risk assessments for potential pollution sources and the design of infrastructure to prevent contamination of groundwater resources.

Policy/Legislation	Key provisions	Section where provision is addressed
	Projects must incorporate design measures to protect groundwater, such as sealing and monitoring systems to prevent infiltration of contaminants. Additionally, developments in sensitive areas, like groundwater protection zones, must ensure compliance with local threshold values for pollutants and adopt best practices to minimise impacts, ensuring long-term groundwater quality.	
Flood Directive, 2007	Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks. In relation to onshore infrastructure, such as underground cables and substations, the Floods Directive (2007/60/EC) requires developers to assess flood risks that could affect the infrastructure's construction and operation. Flood hazard and risk maps will be consulted to identify areas prone to flooding, and appropriate flood prevention and mitigation measures must be integrated into the design and location of infrastructure projects. Flood Risk Management Plans (FRMPs) should guide development to minimise potential impacts, ensuring that critical infrastructure is resilient to flood risks, protecting both the infrastructure and surrounding environments from flood-related damage.	Discussed in Section 4.12 to 4.15. the OES FRA and the O&M Base FRA, which outline the flood risk assessment process, identification of flood hazard areas, and incorporation of flood prevention measures into project planning. This section ensures that infrastructure is resilient to flood risks.
Urban Wastewater Treatment Directive, 1991	Directive 1991/271/EEC concerns Urban Wastewater Treatment. The Directive concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of wastewater from certain industrial sectors. The objective of the Directive is to protect the environment from the adverse effects of wastewater discharges.	The protection of water quality is covered in sections 4.12 to 4.15 of the EIAR. There is no proposed discharge of wastewater to surface water as part of the proposed development. The Shanganagh UWWTP falls under the Directive however the discharge of treated water from the plant is directly to the Irish Sea.
Drinking Water Directive 2020	Directive 2020/2184/EU on the quality of water intended for human consumption aims to protect human health by	The protection of water quality is covered in sections 4.12 to 4.15 of the EIAR. No drinking water abstractions were

Policy/Legislation	Key provisions	Section where provision is addressed
	ensuring the quality of water intended for human consumption ensure that drinking water quality is controlled through standards based on the latest scientific evidence and to improve access to water intended for human consumption.	identified in the study area of the proposed development. There is no proposed discharge of process water as part of the proposed development.
European Communities Environmental Objectives (Groundwater) Regulations 2010 and amendments	The European Communities Environmental Objectives (Groundwater) Regulations 2010 and its amendments require developers to ensure that their projects do not negatively impact groundwater quality. Infrastructure must be designed and constructed to prevent the infiltration of hazardous substances, including oil, chemicals, or other contaminants, into groundwater. Risk assessments must consider the potential for groundwater pollution, and mitigation measures, such as protective barriers or containment systems, should be implemented. Compliance with local groundwater quality standards is essential, and developments must ensure they do not contribute to the deterioration of groundwater status or exceed established threshold values.	Covered in Sections 4.12 to 4.15 of the EIAR, focusing on the assessment of potential impacts on groundwater quality and the implementation of measures to avoid pollution during construction and operation.
European Communities Environmental Objectives (Surface Waters) Regulations 2009 and amendments	The European Communities Environmental Objectives (Surface Waters) Regulations 2009 and its amendments require that projects avoid negatively impacting surface water bodies. Developers must assess the potential effects of construction and operation on rivers, lakes, and coastal waters, ensuring that infrastructure does not lead to pollution, changes in water flow, or the degradation of water quality. Compliance with surface water quality standards and the objectives of the Water Framework Directive is essential, and projects should incorporate measures to manage runoff, prevent pollution, and	Addressed in Sections 4.12 to 4.15 of the EIAR, where the impacts on surface water bodies are assessed, including mitigation strategies to prevent deterioration in water quality and ensure compliance with surface water standards.

Policy/Legislation	Key provisions	Section where provision is addressed
	maintain the ecological health of nearby water bodies, ensuring no deterioration in the status of surface waters.	
European Communities (Drinking Water) (No. 2) Regulations 2007 (SI no. 278/2007)	These Regulations prescribe quality standards to be applied, and related supervision and enforcement procedures in relation to supplies of drinking water, including requirements as to sampling frequency, methods of analysis, the provision of information to consumers and related matters.	The protection of groundwater quality is covered in sections 4.12 to 4.15 of the EIAR. No groundwater drinking water abstractions were identified in the study area of the proposed development.
European Communities (Assessment and Management of Flood Risks) Regulations, 2010	The European Communities (Assessment and Management of Flood Risks) Regulations 2010 require developers to assess and manage flood risks associated with their projects. This involves identifying flood-prone areas and integrating flood risk management measures into the design and planning stages. Developers must consult flood hazard and risk maps to ensure that infrastructure is resilient to potential flooding, minimising impacts on both the infrastructure itself and surrounding communities. Compliance with flood risk management strategies is essential to protect public safety and the environment from flood-related challenges.	Discussed in Sections 4.12 to 4.15. The OES FRA and the O&M Base FRA, detailing flood risk management strategies, assessment of flood-prone areas, and measures to enhance the resilience of infrastructure against flooding.
Planning Policy and Development Control		
DLRC County Development Plan, 2022 - 2028	Planning Control: ▪ **Policy Objective CA11: Onshore and Offshore Wind Energy and Wave Energy** ▪ This objective promotes the development of renewable energy sources, specifically focusing on the potential for onshore and offshore wind and wave energy projects, while	The relevant provisions from the Dún Laoghaire-Rathdown County Development Plan 2022-2028 are addressed throughout the EIAR as follows: ▪ **Policy Objective CA11** is covered in Sections 4.12 to 4.17, which evaluates the potential impacts of renewable energy projects on the environment and local communities ▪ **Policy Objective GIB24** is discussed in Sections 4.12 to 4.17, focusing on the assessment of impacts on

Policy/Legislation	Key provisions	Section where provision is addressed
	ensuring environmental sustainability and community engagement. ▪ **Policy Objective GIB24: Rivers and Waterways** ▪ This policy emphasises the protection and enhancement of rivers and waterways, promoting biodiversity, water quality, and recreational use, while integrating flood risk management into planning decisions. ▪ **Policy Objective EI1: Sustainable Management of Water** ▪ This objective supports the sustainable management of water resources, aiming to ensure water availability, quality, and efficiency in use, aligned with broader environmental and community needs. ▪ **Policy Objective EI6: Sustainable Drainage Systems** ▪ This policy encourages the implementation of sustainable drainage systems (SuDS) to manage surface water runoff effectively, reduce flooding, and enhance water quality in new developments. ▪ **Policy Objective EI8: Groundwater Protection and Appropriate Assessment**	rivers and waterways, including biodiversity and water quality considerations. ▪ **Policy Objective EI1** is addressed in Sections 4.12 to 4.15 and the Project Description Chapter where sustainable management strategies for water resources within the project area are considered. ▪ **Policy Objective EI6** is included in Sections 4.12 to 4.15 and the Project Description Chapter where the design and implementation of sustainable drainage systems (SuDS) are outlined to manage surface water effectively. ▪ **Policy Objective EI8** is covered in Sections 4.12 to 4.15 emphasizing groundwater protection measures and the need for appropriate assessments to mitigate impacts on groundwater quality. ▪ **Policy Objective EI16** is discussed in Sections 4.12 to 4.15, which assesses potential sources of water pollution and outlines strategies to prevent and control pollution in compliance with local and EU standards.

Policy/Legislation	Key provisions	Section where provision is addressed
	▪ This objective focuses on protecting groundwater resources through appropriate assessments to mitigate potential impacts from development and maintain groundwater quality. ▪ **Policy Objective EI16: Water Pollution** ▪ This policy aims to prevent and control water pollution from various sources, promoting measures to protect water bodies and ensure compliance with water quality standards.	
Non-Statutory		
Guidelines and technical standards		
Groundwater Protection Schemes, 1999	The Groundwater Protection Schemes document, prepared jointly by the Geological Survey of Ireland (GSI), the Environmental Protection Agency (EPA), and the Department of Environment, Heritage and Local Government, provides a framework for protecting groundwater resources in Ireland. It outlines methods for assessing and managing groundwater quality and quantity, aiming to safeguard these vital resources from pollution and over-extraction.	The provisions of the Groundwater Protection Schemes are addressed in the EIAR as follows: Groundwater risk assessments and management strategies are detailed in Sections 4.12 to 4.15 and 4.11 (regarding management strategies), which identifies potential threats to groundwater quality and quantity from the proposed project. Protection measures, including land use planning and mitigation strategies, are outlined in Section 4.11 ensuring that development complies with groundwater protection guidelines. Monitoring protocols for groundwater quality and quantity are discussed in Section 4.11 highlighting how the project will align with the recommendations for ongoing assessment and compliance.

Policy/Legislation	Key provisions	Section where provision is addressed
Guidelines for Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, 2013	The Guidelines for Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements provide essential recommendations for assessing and managing soil, geological, and hydrogeological impacts in Environmental Impact Statements (EIS) for onshore infrastructure projects.	The provisions of the Guidelines for Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements are addressed in the EIAR as follows: ▪ Baseline results are presented in Section 4.6; ▪ Potential impacts are evaluated in Sections 4.12 to 4.15; ▪ Relevant project design features, avoidance and preventative measures are set out in Section 4.11.
Guidelines on Protection of Fisheries During Construction Works in an Adjacent to Waters, 2016	The Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters provide essential recommendations for safeguarding fish populations and aquatic habitats during construction activities.	Design measures to protect watercourses during construction works in line with the guidance are set out in the Project Description Chapter. Relevant project design features, avoidance and preventative measures are set out in Section 4.11.
The Planning System and Flood Risk Management-Guidelines for Planning Authorities, 2009	The Planning System and Flood Risk Management – Guidelines for Planning Authorities provide crucial recommendations for integrating flood risk management into the planning process.	The provisions of The Planning System and Flood Risk Management – Guidelines for Planning Authorities are addressed in the EIAR as follows: ▪ Flood risk assessments are presented in the OES FRA and the O&M Base FRA respectively. ▪ Flood zone mapping and categorisation are detailed in the OES FRA and the O&M Base FRA respectively. ▪ Mitigation measures are outlined in the OES FRA and the O&M Base FRA respectively. ▪ Sustainable drainage is presented in the OES FRA and the O&M Base FRA respectively.
2nd Cycle of the of the WFD 2016-2021 includes the River Basin Management Plan (RBMP) 2018-2021. Department of Housing, Planning and Local Government. (2018).	The River Basin Management Plan 2018-2021 outlines strategies for protecting and improving water quality in Ireland, focusing on sustainable water management and community engagement. The Plan includes the following key provisions: improved wastewater treatment; conservation and leakage reduction; detailed assessments	The provisions of the River Basin Management Plan for the Period of 2018-2021 are addressed in the EIAR as follows: ▪ Water quality objectives are outlined in Section 4.6 and the Onshore Water Environment Technical Baseline Report; and Relevant project design features, avoidance and preventative measures are set out in Section 4.11.

Policy/Legislation	Key provisions	Section where provision is addressed
	of water bodies to guide national policies and local measures; and new governance structures. These provisions are part of a coordinated effort to achieve 'good' ecological status in water bodies by 2027.	
3rd Cycle of the WFD 2022-2027 includes the River Basin Management Plan (RBMP) for the period of 2022-2027.	The 3rd Cycle of the WFD includes the River Basin Management Plan (RBMP) for the Period of 2022-2027 which outlines strategies for protecting and improving water quality in river basins. Key provisions in the plan include water quality objectives, pollution reduction measures, monitoring and assessment, public participation and integrated management.	The provisions of the 3rd Cycle of River Basin Management Plan (RBMP) for the Period of 2022-2027 are addressed in the EIAR as follows: ▪ Water quality objectives are outlined in Section 4.6 and the Onshore Water Environment Technical Baseline Report; and ▪ Relevant project design features, avoidance and preventative measures are set out in Section 4.11.
Environmental Good Practice on Site Guide (C741), CIRIA, 2015	The Environmental Good Practice on Site Guide (C741) provides essential recommendations for implementing environmentally responsible practices during construction activities.	▪ Relevant project design features, avoidance and preventative measures are set out in Section 4.11.
Control of water pollution from linear construction projects (C648), CIRIA, 2001	Control of Water Pollution from Linear Construction Projects (C648) provides critical guidelines for preventing water pollution during the construction of linear infrastructure projects, such as roads and pipelines.	The provisions of the Control of Water Pollution from Linear Construction Projects (C648) are addressed in the EIAR as follows: ▪ Relevant project design features, avoidance and preventative measures are set out in Section 4.11; ▪ Training and awareness initiatives for construction personnel are presented in Volume 7 Construction Environmental Management Plan.

Policy/Legislation	Key provisions	Section where provision is addressed
Guidelines for Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA, 2009	The Guidelines for Assessment of Geology, Hydrology, and Hydrogeology for National Road Schemes provide recommendations for evaluating geological and hydrological factors in the planning and construction of national road projects. The Guidelines are applicable to the assessment of underground cable routes and substations as they provide a framework for evaluating potential geological and hydrological impacts, ensuring effective mitigation and monitoring strategies to protect the environment during construction activities.	The provisions of the Guidelines for Assessment of Geology, Hydrology, and Hydrogeology for National Road Schemes are addressed in the EIAR as follows: ▪ Baseline data collection is detailed in Section 4.4 and the Onshore Water Environment Technical Baseline Report; ▪ Impact assessments are presented in Sections 4.12 to 4.15; ▪ Relevant project design features, avoidance and preventative measures are set out in Section 4.11; ▪ Stakeholder and public consultation efforts are discussed in Section 4.3

Annex 2 Schedule of watercourse crossings

Sector	Type of Crossing	Crossing Reference	River Name	What is Proposed
Sector 1	Trenchless	TX-02	Shanganagh River	Onshore ECR will cross the river using trenchless drilling technology. The drilling compounds will be located either side of the river crossing point, located southwest of the Shanganagh WWTP in Clifton Park and Bayview.-
Sector 2	Trenchless	TX-04 TX-05	Kill-o-the-Grange stream. Sector 2 of the Onshore ECR will cross the stream twice	Onshore ECR will cross the river using trenchless technology. The drill compounds will be located either side of the river crossing point. Sector 2 of the Onshore ECR crosses over the Kill-o-the-Grange Stream at Achill Road and running parallel to the stream on its northern side for approximately 200 m before crossing over the stream again and travelling along the South-western edge of Glenavon park.
Sector 3	Trenchless	TX-06	Carrickmines Stream	Onshore ECR will cross the river (and adjacent N11 road) using trenchless technology. The entry pit will be located to the eastern side of the river crossing point. The Carrickmines Stream is located to the west of the N11 road.
Sector 4	Trenchless	TX-07	Laughanstown Stream	Onshore ECR will cross the stream/ditch (and adjacent M50 motorway) using trenchless technology. The drill entry pit will be located to the western side of the river crossing point. The Laughanstown Stream is located to the west of the M50 road.
Sector 5	No Watercourse Crossings			
Sector 6	No Watercourse Crossings			
Sector 7	Two crossing points. Open-cut trench		50 stream (western side of sector 7)	The crossing below the riverbed is used at both crossing points to facilitate the installation of the onshore ECR.
OSS	Crossing of the Carrickmines Stream will be within existing infill ground sitting above the existing culvert of this stream. No trenchless crossing of the stream will be necessary.			

Annex 3 Construction activities and water pollution issues with measures for the management and control of water (From CIRIA C648, Control of Water Pollution from Linear Construction Projects)

Construction activities and water pollution issues	Measures for the management and control of water.
Chemicals, Fuel Storage and Refuelling	**Chemicals and Fuel:** ▪ delivery arrangements for bulk materials, fuel, oils; and ▪ chemicals etc will be discussed with the key suppliers and, where appropriate, with subcontractors and agree emergency procedures. **Fuel Storage:** Wherever possible, fuel storage areas will be located: ▪ well away from sensitive receptors (watercourses, aquifers, drains etc) - at least 50 m from a spring or borehole and 10 m from a watercourse or drain; ▪ on level ground; ▪ on an impermeable base – concrete slab or other areas of hardstanding; ▪ under cover to prevent damage from the elements ▪ in secure areas; ▪ well away from moving plant, machinery and vehicles; and ▪ Containers used to store materials such as fuel, hydraulic oils, chemicals, solvents etc must be fit for purpose and of sufficient strength and structural integrity to ensure that they will not fail or leak. All containers will be stored upright and clearly labelled with capacity and contents (in accordance with COSHH) and appropriate hazard warning signs displayed. Consideration will also be given to additional protection arrangements such as bunded storage areas or the use of drip trays. As part of the emergency plan, establish and maintain an up-to-date inventory of the type of product stored/used and the quantity available on site, including details of: ▪ product type; ▪ trade name; ▪ UN number; ▪ maximum quantity stored; ▪ location of material on site; and ▪ material safety data sheet (MSDS) or COSHH assessment. Any potentially hazardous wastes, such as waste oil, chemicals and preservatives, must be stored in sealed containers. The materials will be stored in designated areas that are isolated from surface water drains

Construction activities and water pollution issues	Measures for the management and control of water.
	or open waters. Skips need to be closed or covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. Any waste material will be collected by a registered waste carrier. **Refuelling:** Integrally bunded fuel tanks will be used at the site compounds during construction to store fuel. Bunded mobile bowsers fitted with fuel-dispensing equipment will be used for the refuelling of plant along the route. The mobile browsers will be refuelled at the main site construction compounds. Fuel stores and refuelling equipment, including tanks and mobile bowsers, will be visually inspected regularly for signs of spillages, leaks and damage during use. A record will be kept of these inspections and any improvements needed, which will be carried out immediately. Only designated trained and competent operatives will be authorised to refuel plant on site. The emergency plan will include details cleaning up small spillages as well as dealing with an emergency incident. Emergency spill kits including absorbent materials such as sand, spill granules, absorbent pads and booms will be kept at each work site, on plant working near water and particularly at refuelling areas and where fuel or oil is stored. A spill response procedure will be set up and staff trained to deal with spillages including the use of spill kits.
Site Compounds (for TCCs and trenchless crossings)	The following measures will be followed when siting compounds: ▪ locate the compound away from watercourses (including ditches) and aquifers; ▪ avoid locations that are designated conservation areas; and ▪ Site compounds will be secured against unauthorised access and all fuel storage will be secured to ensure that no vandalism results in the uncontrolled release of any fuels.
Dewatering	Dewatering is the process by which water is removed either from the ground or from within an excavation. Dewatering covers a range of situations and processes, but is typically applied when: ▪ the water table is lowered to allow a wide or deep excavation to take place in “dry” conditions; ▪ an excavation extends below the water table and groundwater seeps in, requiring removal; ▪ rainfall or surface water runoff has to be removed from open excavations; and ▪ works need to take place in water and the area is sealed off and pumped out. Pumped water will need to be disposed of to a grassed area for infiltration, a watercourse, a surface water drain or to a foul sewer without causing pollution. Submersible pumps can generate more sediment through water turbulence. Silt generation can be reduced by:

Construction activities and water pollution issues	Measures for the management and control of water.
	▪ using a corner of the excavation will be used as a sump and care taken to avoid disturbing that corner; ▪ Simple additional measures can be taken to reduce unnecessary sediment generation such as placing the pump in a perforated oil drum, a short length of wide-bore perforated pipe or concrete manhole rings containing granular fill; and ▪ Alternative methods include the holding the pump off the base of an excavation
Trenchless Drilling Techniques	Trenchless techniques such as horizontal directional drilling or similar techniques are used to avoid direct works in or adjacent to watercourses. The benefits of trenchless techniques are: ▪ minimal impacts on the watercourse; ▪ reduced levels of reinstatement; ▪ faster installation; ▪ production of significantly less waste spoil; and ▪ fewer seasonal restrictions. All fluids or grouts used in the drilling must be managed, recycled where possible, and ensure no material goes to any watercourse. Care must be taken to locate the entry pit and exit pit for drilling as far away as possible from watercourses.
Runoff and Sediment Control	Sediment, including all soils, mud, clay, silt, sand etc, is the single main pollutant generated at construction sites and largely arises from the erosion of exposed soils by surface water runoff. The adoption of appropriate erosion and sediment controls during construction is essential to prevent sediment pollution. Managing the reducing the quantity of runoff and sediment on site can be achieved through: ▪ sediment and erosion control measures; ▪ estimating runoff; ▪ planning for flood conditions; ▪ estimating sediment generation; and ▪ erosion and sediment control measures. Control and treat surface water runoff before leaving the site. Ensure on-site operations such as constructing earth bunds, pumping or drainage works do not cause or worsen flooding on neighbouring land. Erosion control is intended to prevent runoff flowing across exposed ground and becoming polluted with sediments, while sediment control is designed to slow runoff to allow any suspended solids to settle out in situ. **Measures:** ▪ Meshes, netting, mats and sheeting made of natural or synthetic material can be used to stabilise soil temporarily or permanently. Typically, they are suited to post-construction site stabilisation, but they may be used for temporary stabilisation of easily eroded soils in sensitive areas, including channels and streams where flow velocity may cause erosion;

Construction activities and water pollution issues	Measures for the management and control of water.
	▪ Matting may be applied to disturbed soils and places where existing vegetation has been removed. Organic matting materials, such as jute or straw, provide temporary protection until permanent vegetation is established and will not need to be removed, as they will rot down. They may also be appropriate when seasonal circumstances dictate the need for temporary stabilisation until weather or construction delays are resolved; ▪ A silt fence comprises a geotextile filter fabric, straw bales or a combination of the two installed in the path of sheet flow runoff to filter out heavy sediments. At best, a silt fence will remove heavy settleable solids, but it is not effective at reducing turbidity (fine solids in suspension). The silt fence detains sediment-laden water, promoting sedimentation behind the fence. Posts support the filter fabric, the base of which will be well buried in the ground; and ▪ Straw bales can also be used to filter out heavy sediments. During wet weather bales deteriorate rapidly and require frequent replacement, but they are a cost-effective temporary measure. Stockpiles can be a significant source of erosion and sediment. To minimise the loss of sediment from stockpiles they should be: ▪ located away from drains and watercourses; ▪ seeded or provided with other stabilisation measures appropriate to the length of time stored; ▪ provided with earth bunds or another form of diversion to keep runoff away from stockpiles; and ▪ provided with silt fences or straw/rock barriers at the toe of the stockpile to mitigate runoff during rain events. Stormwater runoff is of particular concern along sections of the onshore ECR passing through urban or built-up areas, or following existing infrastructure. Temporary measures can be put in place at the outfall (or intersection with other drainage) to remove sediments and oil, such as a catch pit, sump or a geotextile screen, or the pipe/culvert can be temporarily blocked or diverted.
Earthworks	Where possible major earthworks to be programmed for the summer periods when rainfalls are lower, and evaporation is at its seasonal high. The measures outlined above for runoff and sediment control will be implemented during earthworks campaigns. Install drainage and runoff controls before starting site clearance and earthworks.
Floodplain works on/in	Works in the floodplain will be completed in the short possible timeframeas far as reasonably possible, including temporary works, be designed for flood conditions. The emergency and contingency plans will include: ▪ Identify areas liable to river flooding; ▪ schedule the construction to avoid works in flood-prone areas during the winter; and

Construction activities and water pollution issues	Measures for the management and control of water.
	▪ Monitor Met Éireann weather warnings for rainfall. The design and operation of the works in the floodplain is not likely to increase the potential for flooding or create a risk of flood damage.
Topsoil stripping and reinstatement	When stripping topsoil a grass buffer strip next to watercourses to filter runoff will be left. Where possible leave a 5 m grassed strip next to river banks when stripping topsoil or place grassed soil bunds along river banks etc to prevent site runoff gaining direct access to watercourses. Only strip topsoil when required for construction activities in order to prevent bare areas of soil and stockpiled soils for extended periods of time
Watercourse crossing works on/near	Examples of working in or near water include open-cut crossings and trenchless crossings An emergency plan for the whole site will be prepared, containing particular contingencies for a pollution incident in or adjacent to water. Emergency equipment such as absorbent mats, booms, straw bales, geotextile matting and rags will be kept adjacent to the watercourse. Undertake visual monitoring of water course on a regular basis and keep record of inspections and measures or actions taken. When excavations in water are required such as at crossings where trenching is required, the area is generally cut off from the water by one of the following options: ▪ clay bund; ▪ sand bags; ▪ stop planks; ▪ cofferdams (using sheet piles, diaphragm walls etc.); ▪ caissons; and ▪ specialist dams (fabric, inflatable etc). Short-term works (i.e. lasting no more than one day) across the whole width of a watercourse, particularly in still or slow-flowing water, can be undertaken by simply damming off the works area. When works are likely to take longer, and/or the flow is high, over pumping will be required to maintain the “flow” of water from upstream to downstream of the works without flooding the site. Although some works require “hard” bank protection, “soft” techniques, which allow vegetation to establish at the water’s edge, will be employed wherever possible. Leaving the ground surface broken up to revegetate naturally is a simple, cost-effective method, as used in the reinstated river crossing. Rapid stabilisation for areas prone to erosion can be achieved by placing biodegradable matting (hessian, coir etc) and seeding it with fast-growing grasses. Other “soft” techniques available include reed-planted coir fibre rolls and brushwood rolls. Timber washboards (Figure 20.16), gabions and stone-filled mattresses, pitch and dry-stone walls are also appropriate. **Works near watercourses:** Surface runoff is the most significant risk because of the short distance from the works to the watercourse. The following points are specifically relevant to work adjacent to watercourses. Before existing vegetation is

Construction activities and water pollution issues	Measures for the management and control of water.
	removed, a buffer strip will be left along the edge of the watercourse and/or around the works to help filter any silty runoff. Earth bunds, cut-off ditches or silt fences will be constructed around site compounds and other works to isolate them from the water body. If necessary, runoff can be channelled to a settlement area before it is released to the watercourse (with permission). Where volumes are small, runoff will be directed over grassland where possible.
Water discharge	Water discharge (runoff) will be managed and treated as per the measures outlined above for Runoff and Sediment Control.
Water treatment	Runoff will be managed and treated as per the measures outlined above for Runoff and Sediment Control.

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