Chapter 22:
Hydrology and Flood Risk

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report
Chapter 22: Hydrology and Flood Risk

MDR1520B
EIAR – Chapter 22
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22 HYDROLOGY AND FLOOD RISK

22.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) provides an assessment of the potential impacts of the Oriel Wind Farm Project (hereafter referred to as "the Project") on hydrology and flood risk. Specifically, this chapter considers the potential impact of the onshore infrastructure the Project above the High-Water Mark (HWM) during the construction, operational and maintenance, and decommissioning phases. This includes the onshore cable (including transition joint bay, joint bays, passing bays) and the onshore substation.

The assessment presented is informed by the following technical chapters and appendices:

- Chapter 7: Marine Processes (volume 2B);
- Appendix 7-2: Water Framework Directive Assessment Report (volume 2B);
- Chapter 19: Onshore Biodiversity;
- Chapter 21: Soil, geology and hydrogeology; and
- Appendix 22-1: Flood Risk Assessment Report.

In terms of EIA, water relates to the potential for impact on the chemical, physical and biological water characteristics of the natural water environment through hydromorphological changes, water quantity and water quality (Environmental Protection Agency (EPA, 2022a). The potential risk and impact of flooding is also addressed in this chapter.

The assessment of impacts to water must cover the range of potential receptors including surface water, estuarine waters, marine waters and groundwater. This chapter specifically relates to the potential for onshore impacts to the freshwater environment, (i.e. the rivers and streams) potentially impacted by the onshore infrastructure of the Project above the HWM. Potential effects within the marine environment are addressed in volume 2B, chapter 7: Marine Processes, and potential effects on groundwater are addressed in chapter 21: Soil, Geology and Hydrogeology.

The details and competencies of the specialist who prepared this chapter can be found in volume 2A, chapter 1: Introduction.

22.2 Purpose of this chapter

The primary purpose of the EIAR chapter is to provide an assessment of the likely direct and indirect significant effects of the Project on the freshwater environment and the potential for flood risk associated with the Project. In particular, this EIAR chapter:

- Presents the existing environmental baseline established from desk top studies, site-specific surveys and consultations (section 22.7);
- Identifies any assumptions made and limitations encountered in compiling the environmental information (section 22.7.12);
- Presents an assessment of the potential likely significant effects on hydrology and flood risk arising from the Project, based on the information gathered and the analysis and assessments undertaken (section 22.10). An assessment of potential cumulative impacts is provided in section 22.11 and an assessment of transboundary effects is outlined in section 22.12; and

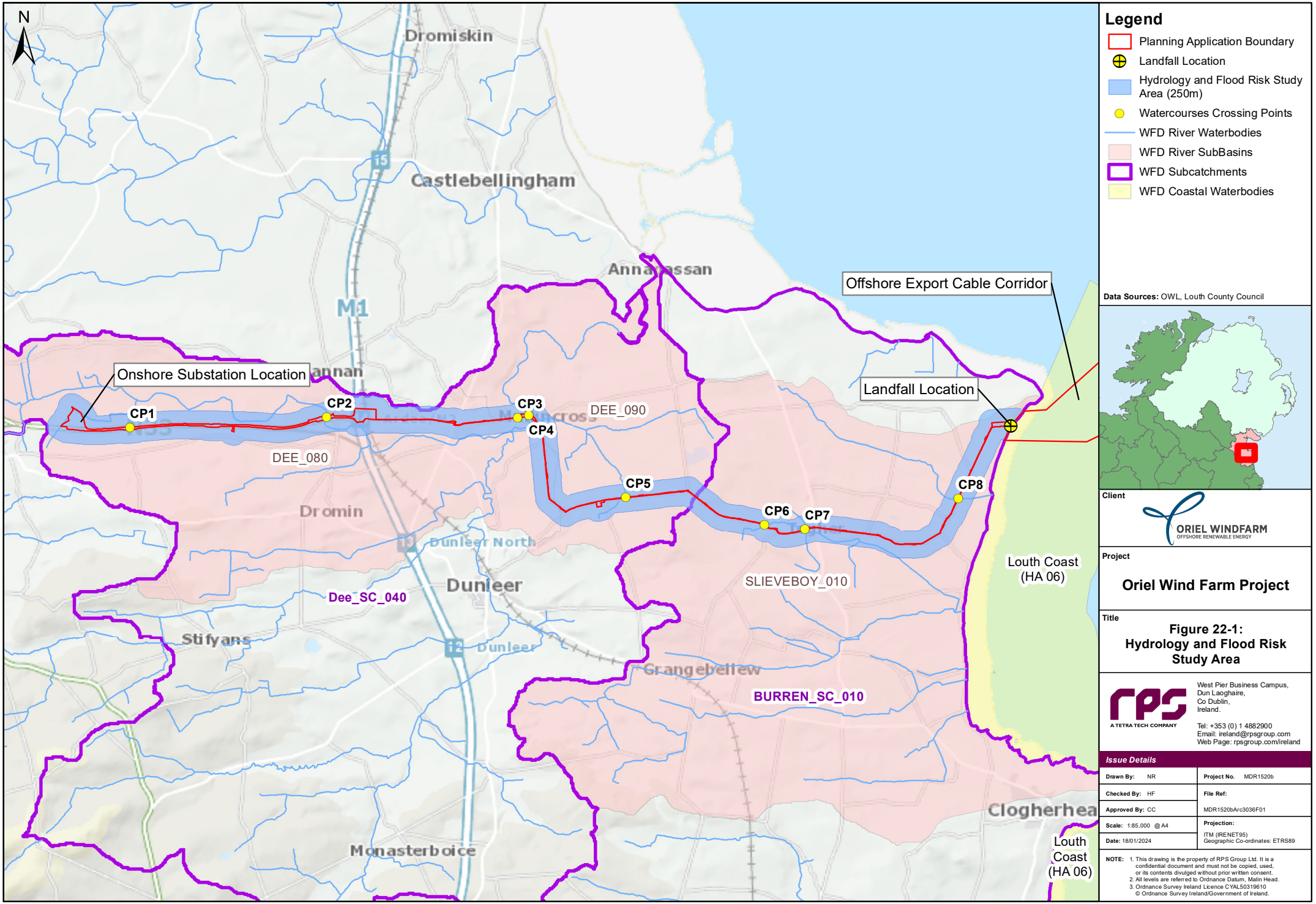
- Highlights any necessary monitoring (section 22.10.7) and/or measures (section 22.10.6) which could prevent, minimise, reduce or offset the possible environmental effects identified in the in the impact assessment section of this chapter.

22.3 Study area

The National Roads Authority (NRA) 'Guidelines on procedures for assessment and treatment of geology, hydrology and hydrogeology for national roads schemes' (2009) recommend that "*the study area for detailed Environmental Impact Assessment purposes should generally extend 250 m beyond the landtake boundary*." Hence the Hydrology and Flood Risk Study Area is defined by the 250 m extension beyond the application site boundary for the onshore infrastructure above the HWM.

The Hydrology and Flood Risk Study Area also considers the Zone of Influence (ZoI) of the Project. In terms of water quality and flood risk, the ZoI extends to the wider Water Framework Directive (WFD) sub-basins, and the nearest coastal waterbody. In this case, this includes the Slieveboy_010 sub-basin, which includes the landfall and eastern section of the onshore cable route, the Dee_080 and Dee_090 sub-basins, which includes the onshore substation site and the western section of the onshore cable route, and the Louth Coast (HA 06) coastal waterbody (CWB) to the east of the landfall location (see Figure 22-1). These sub-basins are located within the Burren_SC_010 sub-catchment and the Dee_SC_040 sub-catchment.

The Hydrology and Flood Risk Study Area for this assessment is illustrated in Figure 22-1. This study area also defined the search area for other projects that could result in potential for cumulative effects with the Project (see section 22.11).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Dromiskin
Castlebellingham
M1
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Offshore Export Cable Corridor
Onshore Substation Location
Landfall Location
CP1
CP2
CP3
CP4
CP5
CP6
CP7
CP8
DEE_090
DEE_080
Dromin
Dunleer North
Dunleer
Dee_SC_040
SLIEVEBOY_010
Louth Coast (HA 06)
Stifyans
Grangebellew
BURREN_SC_010
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Data Sources: OWL, Louth County Council
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Figure 22-1:
Hydrology and Flood Risk Study Area
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22.4 Policy context

Planning policy on renewable energy infrastructure is presented in volume 2A, chapter 2: Policy and Legislation. This section presents planning policy that specifically relates to hydrology and flood risk, which is summarised in Table 22-1.

Table 22-1: Summary of policy framework provisions relevant to water.

Summary of relevant policy framework	How and where considered in the EIAR
Louth County Development Plan 2021-2027 policies to promote and protect water quality and protect properties from flood risk whilst maintaining habitats.	Current water quality and flood risk is presented in section 22.7 and an assessment of potential impact to this baseline quality is presented in section 22.10.
The (EU) Water Framework Directive (WFD) - The sustainable use of water resources, defines a management and reporting system based on River Basin Districts (RBDs) and sets environmental objectives which take account of the full range of pressures on the aquatic environment (including pollution, abstraction, flow regulation, habitat impact etc).	As above, current WFD water quality status is presented in section 22.7 and an assessment of potential impact to this baseline quality is presented in section 22.10. A WFD assessment has also been undertaken and is provided in appendix 7-2: WFD Assessment Report (volume 2B).
Floods Directive, Catchment-based Flood Risk Assessment and Management Studies (CFRAMS) and the requirement for an appropriately detailed Flood Risk Assessment	Flood risk is presented in section 22.7. A flood risk assessment of the onshore substation is provided in appendix 22-1: Flood Risk Assessment Report.

The Louth County Development Plan (CDP) 2021-2027 (Louth County Council (LCC), 2021) is the over-arching Development Plan for the whole of Co. Louth and seeks to progress the sustainable development of the county. There are a number of relevant policies relating to water quality and flooding contained within the CDP, and are listed below:

- ENV 1: To implement European, national and regional policy in relation to the protection of the environment, climate action and the pursuance of sustainable development principles in respect of the council's policies and procedures;
- ENV 3: To seek to achieve European and national standards in relation to air, noise and water quality in the county and apply BAT standard (Best Available Techniques);
- ENV 15: To implement recommendations contained in the River Basin District Management Plans for Ireland 2018 - 2021 or any subsequent plan. Proposed plans, programmes and projects shall not have an unacceptable impact on the water environment, including surface waters, groundwater quality and quantity, river corridors and associated woodlands. Also, to have cognisance of, where relevant, the EU's Common Implementation Strategy Guidance Document No.20 and 36 which provide guidance on exemptions to the environmental objectives of the WFD;
- ENV 16: To increase awareness through educational and other means so as to inform the public of the need, and importance of maintaining the highest possible water quality standards;
- ENV 51: To recognise the concept of coastal evolution and fluvial flooding as part of our dynamic physical environment, and adopt an adaptive approach to working with these natural processes. The focus of a flood management strategy should not solely be driven by conservation of existing lands. It should recognise that marshes, mud flats and other associated eco-systems evolve and degenerate and appropriate consideration should be given to the realignment of defences and use of managed retreat and sacrificial flood protection lands to maintain such habitats as part of an overall strategy;
- ENV 59: To protect the excellent status classification of identified bathing water areas within Co. Louth; and

- ENV 67: To protect the quality of designated shellfish waters off the Louth coast.

The Water Framework Directive (2000/60/EC) is a European Union environmental legislation that provides a framework for the protection of all waters including rivers, lakes, estuaries and coastal water bodies, and their dependent wildlife/habitats under one piece of legislation. The objectives of this framework are to:

- Protect/enhance all waters (surface and coastal waterbodies);
- Achieve “good status” for all waters;
- Manage water bodies based on river basins or catchments; and
- Involve the public particularly with respect to management plans (i.e. River Basin Management Plans (RBMPs)) and Programmes of Measures (PoM’s).

A key development in meeting the requirements of the WFD has been the publication of RBMPs which have provided a coordinated approach to water management throughout Ireland and across Europe. The second cycle RBMP covers the period 2018-2021 and its PoM’s is being implemented by local authorities to allow for the protection of at least good status, or the restoration of good status, for all water bodies. The outcomes are then monitored in order to feed into further characterisation and setting of measures as the cycle moves forward. The third cycle RBMP is in draft (at the time of writing this EIAR) and will cover the period 2022-2027.

The European Communities Environmental Objectives (Surface Waters) Regulations 2009 (Department of the Environment, Heritage and Local Government (DEHLG), 2009a), as amended (S.I. No. 272/2009) (the Surface Water Regulations) are of particular relevance to this assessment. These regulations set the requirements for the physio-chemical and biological water quality for surface waters in Ireland in order to achieve ‘good’ or ‘high’ status.

Directive 2007/60/EC on the assessment and management of flood risks requires Member States to assess if all watercourses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas, and to take adequate and coordinated measures to reduce this flood risk. With this Directive also reinforces the rights of the public to access this information and to have a say in the planning process.

The Office of Public Works (OPW) is responsible for the implementation of the Floods Directive in Ireland and this is being carried out through the Catchment-based Flood Risk Assessment and Management Studies (CFRAMS). The OPW undertook Preliminary Flood Risk Assessments to identify areas of existing or potentially significant future flood risk and to prepare flood hazard and risk maps for these areas. Following this, 29 Flood Risk Management Plans were developed for these areas setting objectives for managing the flood risk and setting out a prioritised set of measures to achieve the objectives.

The Assessment and Management of Flood Risks Regulations (DEHLG, 2010) and the Planning System and Flood Risk Management Guidelines for Planning Authorities (DEHLG, 2009b) and Circular PL2/14 (DECLG) require planning applications to contain an appropriately detailed Flood Risk Assessment in the applications. Hence, this report contains the flood risk review for the landfall location and onshore cable route. A detailed Flood Risk Assessment (FRA) for the onshore substation site was completed by the Electricity Supply Board (ESB) (see appendix 22-1: Flood Risk Assessment Report).

22.5 Consultation

Table 22-2 summarises the issues raised relevant to hydrology and flood risk which have been identified during consultation activities undertaken to date, together with how these issues have been considered in the preparation of this EIAR chapter. Chapter 6: Consultation (volume 2A) provides details on the types of consultation activities undertaken for the Project between 2019 and 2024 and the consultees that were contacted.

Table 22-2: Summary of key consultation issues raised during consultation activities undertaken for the Project relevant to Hydrology and Flood Risk.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this Chapter
July 2019	Local Resident consultation during walkover survey	Recurring flooding on local access road along onshore cable route at Salterstown Stream crossing.	The flood risk associated with the onshore cable route is discussed in further detail in section 22.7.13.
September 2019	Louth County Council - EIA scoping response	Louth County Council advised of the relevant land use planning policy for flood risk and new development.	The flood risk associated with the onshore cable route is discussed in further detail in section 22.7.13.
November 2022	Irish Water – consultation on buried assets	Query regarding impact on two water abstraction points on the River Dee.	Water abstraction points within the ZoI of the Hydrology and Flood Risk Study Area are outlined in section 22.7.7.
Public consultation 2023	Members of the public during public consultation	Concern raised over the potential impacts on water quality from construction activities.	Water quality impacts are assessed in relation to sediment discharge and accidental spillages/discharge of chemicals/fuel in all project phases in section 22.10.

22.6 Methodology to inform the baseline

22.6.1 Desktop study

The key sources (i.e. data and reports) used to inform the baseline characterisation of the Hydrology and Flood Risk Study Area are summarised in Table 22-3 below. The data was collected in February 2019 and again in November 2023. These sources provide the most up to date data for this assessment.

Table 22-3: Summary of data sources.

Sources	Study	Data type	Format
Environmental Protection Agency (EPA) and WFD: https://gis.epa.ie/EPAMaps/, www.catchments.ie, http://www.wfdireland.ie/ https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/water-quality-in-ireland-20162021-summary-report.php	Surface waters	• Surface water courses in the area and their respective water quality status • Special Areas of Conservation & Special Protected Areas • WFD Cycle 3 Report – Newry, Fane Glyde and Dee Catchment (HA 06) • WFD Cycle 2 Report - Newry, Fane, Glyde and Dee Sub-catchment Report (Burren_SC_10) • WFD Cycle 2 Report - Newry, Fane, Glyde and Dee Sub-catchment Report (Dee_SC_40) • WFD data • EPA Water Quality in Ireland 2016 -2021 Report	Webmap PDF Document
OPW, Teagasc and ESB (2024): www.opw.ie, www.floodinfo.ie , http://www.floodmaps.ie/, https://www.floodinfo.ie/publications/ http://gis.teagasc.ie/soils/map.php http://map.geohive.ie/	Flooding	• Office of Public Works Flood Hazard Mapping Website • OPW Preliminary Flood Risk Assessment and Catchment Flood Risk Assessment Management Study & National Coastal Flood Hazard Mapping 2021 predicted flood maps • Irish Coastal Wave and Water Level Modelling Study • Teagasc Soils maps • Ordnance Survey Ireland (OSI) historical maps • Oriel 220 kV Onshore Substation Flood Risk Assessment	Webpage Webmap PDF Document

Sources	Study	Data type	Format
Teagasc: http://gis.teagasc.ie/soils/map.php	Soils	• Teagasc Soil Maps	Webmap
Ordnance Survey Ireland: https://www.osi.ie/	OSI Mapping	• Ordnance Survey Ireland aerial photographs and historical mapping	Webmap
Met Éireann: www.met.ie	Weather data	• Historic rainfall and evapotranspiration data	Webpage Data tables
National Parks and Wildlife Service: http://webgis.npws.ie/npwsviewer/	Protected sites	• National Parks and Wildlife Services and designated sites	Webmap Data tables
EPA: www.epa.ie/licensing	Licensed facilities	• Annual Environmental Reports	PDF Document
Louth County Council: www.louthcoco.ie	Surface waters and flooding	• Louth County Development Plan 2021-2027	PDF Document
Hydronet: http://opw.hydronet.com/	Catchment flooding	• Catchment characteristics – Flood Studies Update	PDF Document

22.6.2 Site-specific surveys

In order to inform the EIAR, site-specific surveys were undertaken. A summary of the surveys undertaken to inform the impact assessment is outlined in Table 22-4. The inspections were carried out to assess evidence of historical flooding (i.e. wrack levels on hydraulic structures, river sediment deposits on banks) and condition of the watercourses (i.e. low/ high flow, light/ heavily vegetated) in the vicinity of the Project. The watercourses, particularly the tributaries to the River Dee and local drains discharging directly to the Irish Sea, were observed to be heavily vegetated and in some cases to have little or no flow at the time of surveying.

Table 22-4: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Hydrology & Flood Risk	Onshore cable route above HWM and onshore substation	Walkover survey; Inspection of surface waters	RPS	29 July 2019; and 25 August 2022	See section 22.7.

22.7 Baseline environment

22.7.1 The landfall

The landfall location for the Project is located south of Dunany Point. The offshore cable comes ashore in an intertidal environment, consisting of exposed mixed substrata shoreline comprised of boulders, pebbles, cobbles, gravel, and sand. It then traverses cliffs before traversing low-lying agricultural lands, which are largely drained by field drains discharging directly into the Louth Coast (HA 06) CWB. There are no significant onshore hydrological features in the immediate vicinity (<1 km) of the landfall location.

22.7.2 Onshore cable route

The onshore cable route, which extends between the landfall and the onshore substation site, traverses the Burren_SC_010 and the Dee_SC_040 sub-catchments which drain into Dundalk Bay and the Irish Sea (i.e. Louth Coast CWB) south of Dunany Point, as indicated in Figure 22-2.

The onshore cable route intersects surface waterbodies at eight locations (Table 22-5) within the River Dee and local stream catchments, as shown in Figure 22-1 and Figure 22-2. Of these crossings, the River Dee is the most significant one. The River Dee is intersected by the onshore cable route at two locations (crossings points (CP) CP2 & CP4)). A number of other small streams are intersected by the onshore cable route including the Rock Stream (CP1), a drainage ditch (CP3), the Newhall Stream (CP5), the Port Stream and the Ardballan Stream together (CP7) and the Salterstown Stream (CP8). The drainage ditch (CP3) was identified during the walkover survey and the Ardballan Stream (CP7) is a tributary to the Port Stream. The Port Stream and the Salterstown Stream discharge directly to the Irish Sea, south of Dunany Point.

There were open channels identified along the public road verges on the onshore cable route during the walkover surveys. These open channels were dry and heavily vegetated. The open channels were inspected and no other watercourse crossings (i.e. culverts) were found that may transverse the onshore cable route underneath the public road. In the eventuality that the excavation works during construction uncovers an unidentified culvert that transverse the onshore cable route, the below approach will be adopted:

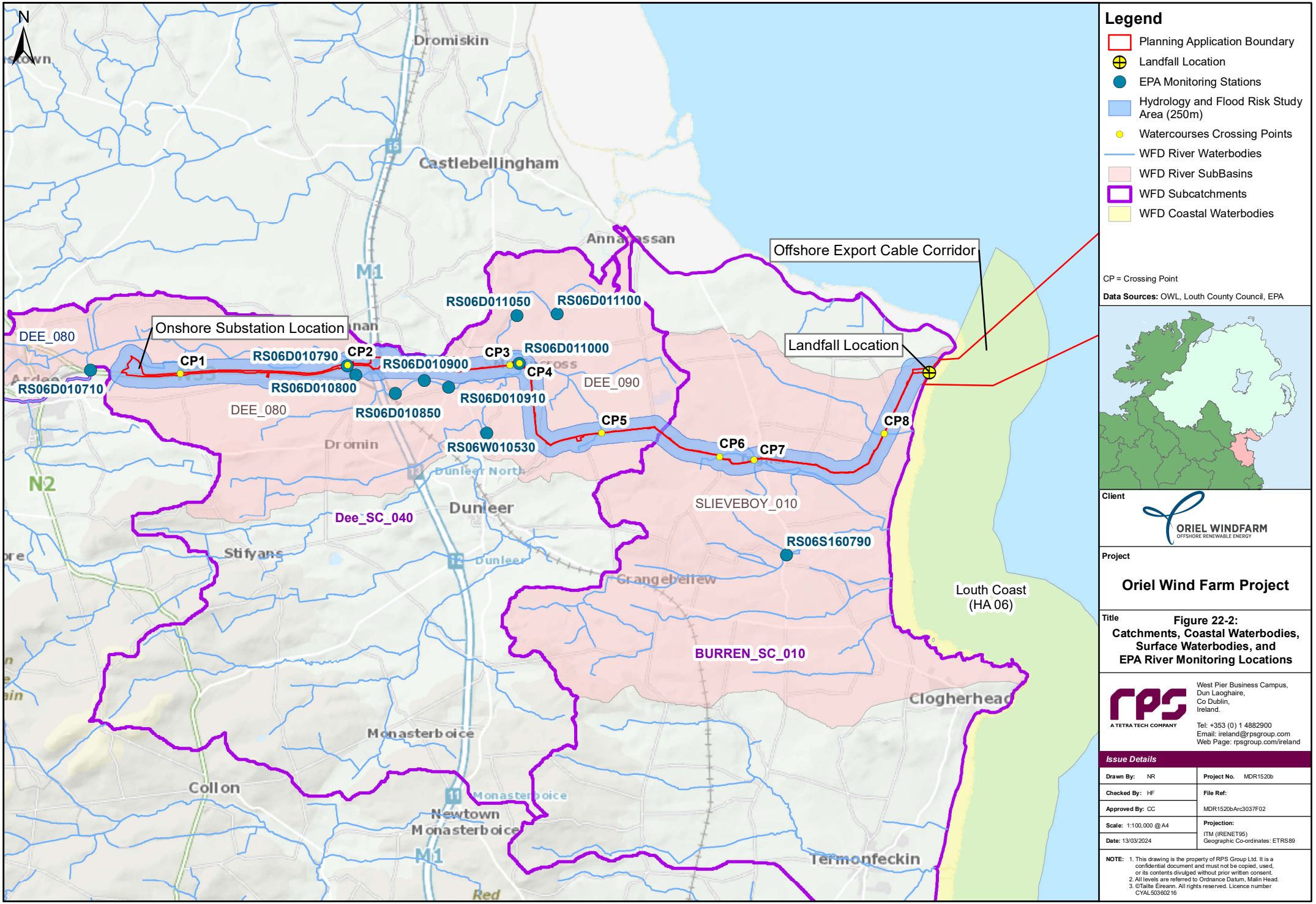
- Install the cable within the road between the top of the culvert and road surface; and
- If there is insufficient depth between the top of the culvert and road surface the cable will be installed within the open channel using the open trench method.

Table 22-5: Schedule of river crossing points.

Crossing Reference	Water feature	Location	Preferred Crossing Method
CP1	Rock Stream (tributary of River Dee)	0.8 km east of the onshore substation site	Install above existing culvert on hard shoulder of the N33 carriageway
CP2	River Dee	Richardstown, N33	Horizontal Directional Drill (HDD) Method (Field)
CP3	Drainage ditch	0.8 km west of Joint Bay 13	Open Trench Method
CP4	River Dee	Drumcar	HDD Method (Field)
CP5	Newhall Stream	Tullydonnel	Open Trench Method
CP6	Port Stream	Clonmore	Open Trench Method (Field)
CP7	Port Stream & Ardballan Stream	Togher	HDD Method (Field)
CP8	Salterstown Stream	Salterstown	HDD Method (Road)

22.7.3 Onshore substation site

The onshore substation site, shown in Figure 22-1 and its immediate surroundings within the Hydrology and Flood Risk Study Area consist of agricultural lands which are largely drained by the Rock Stream. The Rock Stream discharges to the River Dee approximately 1 km downstream of the onshore substation site (Figure 22-2).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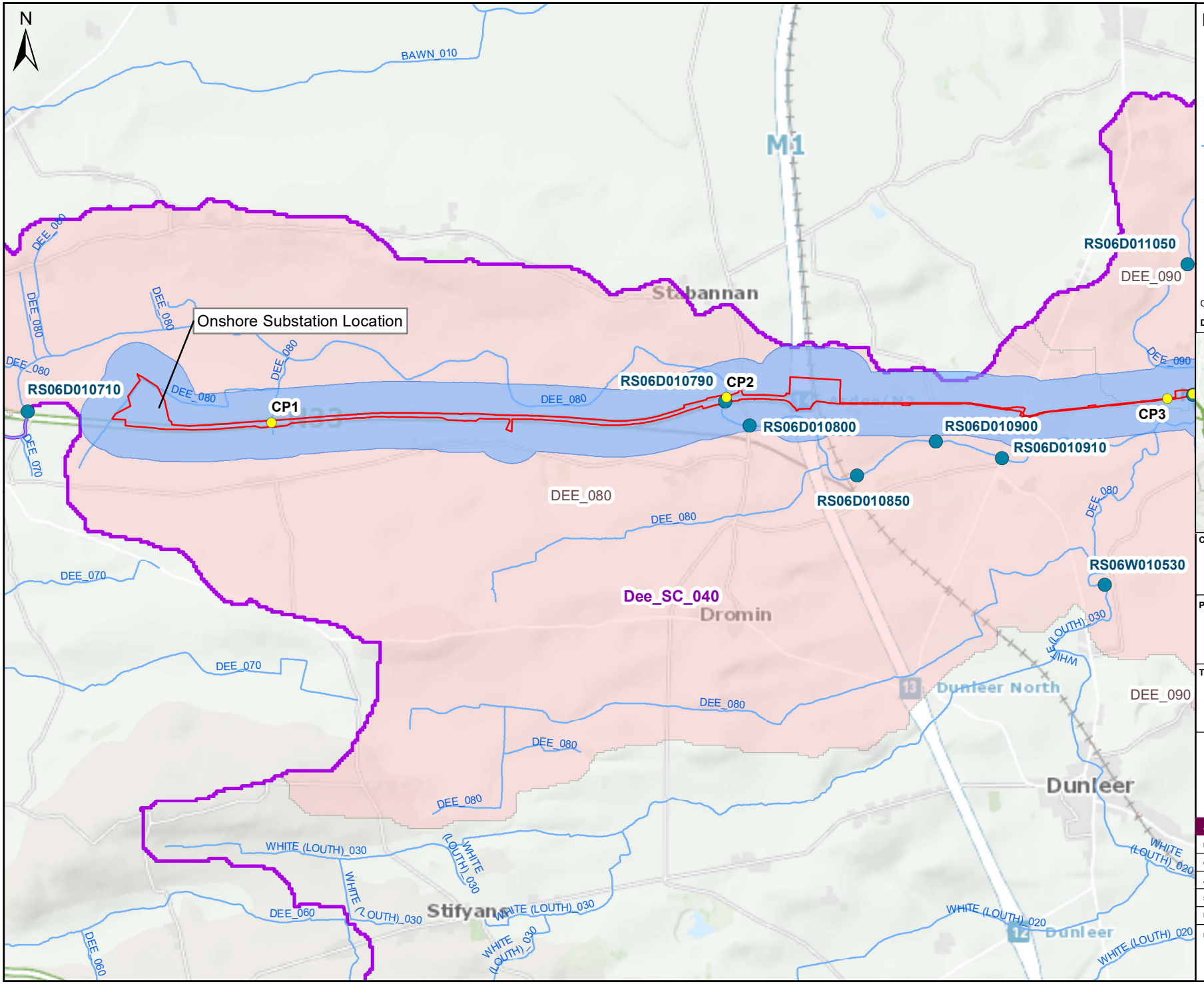

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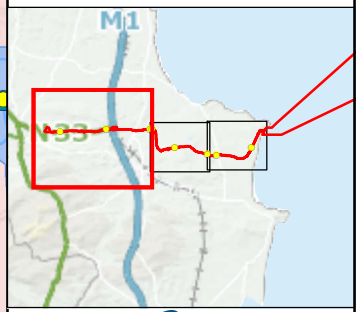

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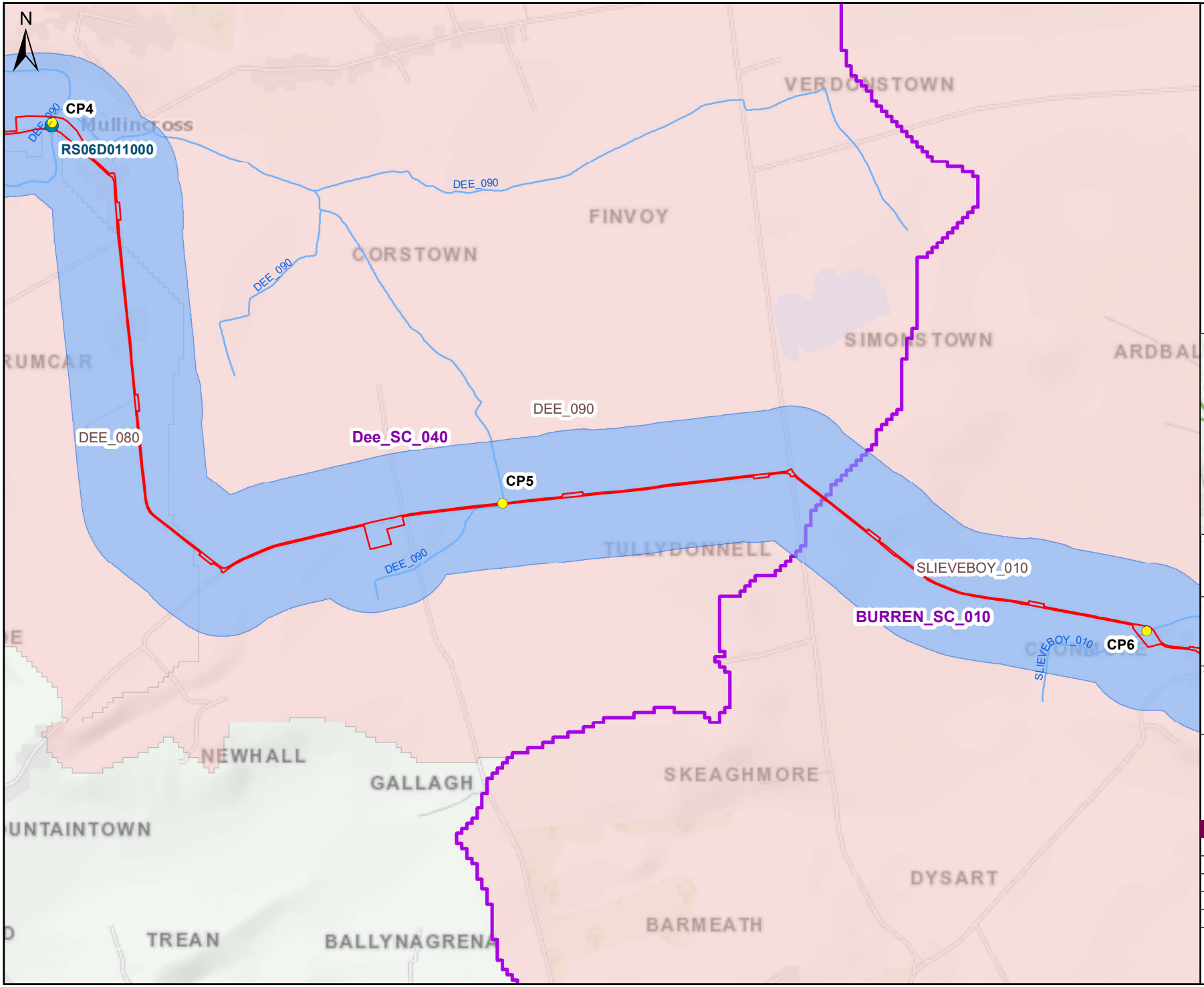

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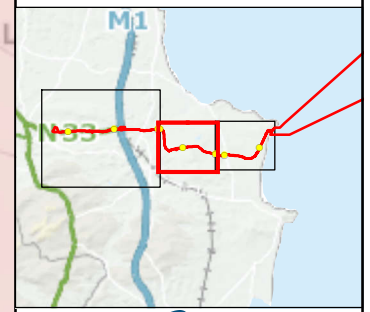

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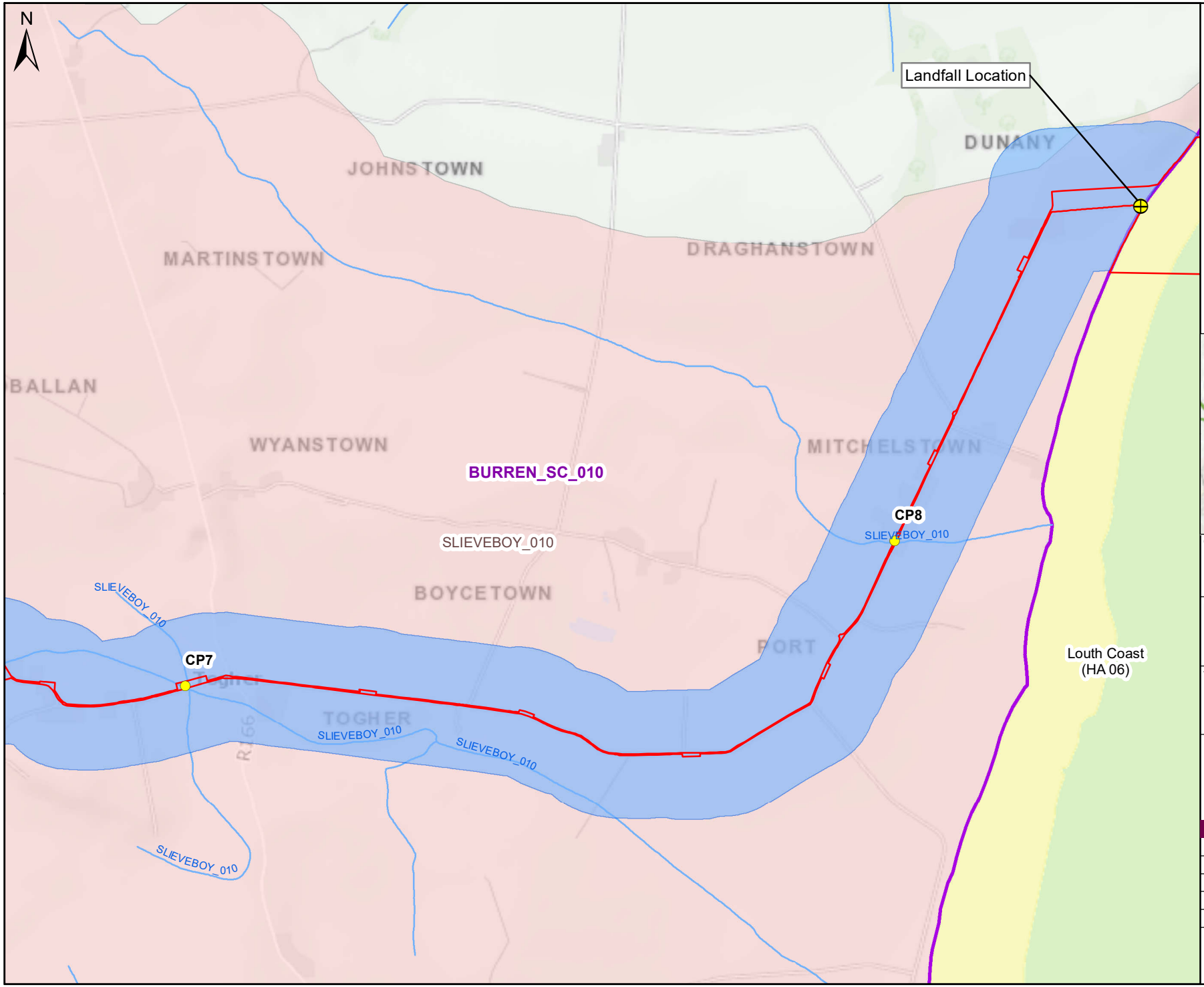

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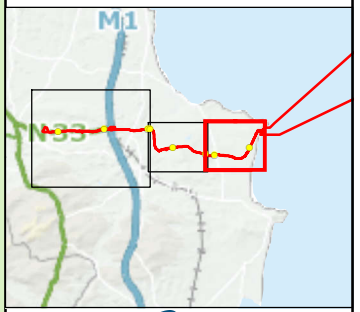

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Checked By: HF	**File Ref:** MDR1520bArc3037F02
Approved By: CC	
Scale: 1:20,000 @A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 13/03/2024	

22.7.4 River Catchments

The onshore cable route traverses a number of river sub-basins, as shown in Figure 22-2 and described below.

River Dee

The River Dee is fed by a series of local streams and flows eastwards draining into Dundalk Bay. The river intersects with the onshore cable route at CP2 and CP4. The Rock Stream, a tributary to the River Dee, crosses the onshore cable route at CP1 approximately 255 m upstream of the confluence. A drainage ditch, which runs perpendicular to River Dee (connecting the River Dee north and south of the woodland at Drumcar), crosses the onshore cable route at CP3 approximately 190 m upstream of the confluence (Figure 22-2).

The River Dee confluences with the River Glyde approximately 6 km downstream of CP4 and 0.8 km upstream of the Glyde Estuary (WFD Code: IE_NB_040_0500). The River Dee catchment area consists of 4 sub-basins (Dee_SC_010 to Dee_SC_040) and is made up largely of greenfield / agricultural lands with one-off residential developments. The River Dee catchment areas upstream of CP2 and CP4 is 306 km^2 and 376.1 km^2, respectively. The catchment descriptors for the River Dee at CP4 are listed in Table 22-6.

The River Dee is part of the OPW Glyde and Dee Arterial Drainage Scheme. Works have been carried out to the River Dee catchment to relieve flooding.

Table 22-6: Catchment descriptors for the River Dee upstream of CP4[1].

Descriptor	Units	Value
Area	km^2	376.1
Average Annual Rainfall (61-90)	mm/yr.	868
Stream Length	km	415.2
Drainage Density	Channel length (km)/sq. km	1.1
Slope	Percent slope	5.5

Newhall stream

The Newhall Stream is located within the River Dee catchment area. It flows from the south to northwest until it discharges to the River Dee. The watercourse intersects with the onshore cable route at CP5 (Figure 22-2). The watercourse at this crossing location was observed to be heavily vegetated and had no flow during walkover surveys on 29 July 2019 and 25 August 2022.

The catchment area for the Newhall Stream is 1.34 km^2 at CP5. The catchment area is relatively shallow sloped consisting largely of cultivated lands. The catchment descriptors for the Newhall Stream upstream of CP5 are listed in Table 22-7.

Table 22-7: Catchment descriptors for the Newhall Stream downstream of CP5[1].

Descriptor	Units	Value
Area	km^2	1.341
Average Annual Rainfall (61-90)	mm/yr.	827
Stream Length	km	0.71
Drainage Density	Channel length (km)/ sq. km	0.53
Slope	Percent slope	2.6

[1] Catchment Descriptor values extracted for each catchment from the Office of Public Works (OPW) Flood Studies Update (FSU) Web Portal at FSU Web Portal - Home (hydronet.com).

Port stream

The Port Stream is located within the Burren catchment area, flowing from west-northwest to east-southeast and discharges directly into the Irish Sea. It crosses the onshore cable route at crossings CP6 and CP7 (Figure 22-2). The Ardballan Stream confluences with the Port Stream at CP7. The catchment area consists largely of cultivated lands and the catchment descriptors are shown in Table 22-8. The watercourse at CP6 and CP7 was observed to be heavily vegetated and had standing water during walkover survey on 25 of August 2022.

Table 22-8: Catchment descriptors for the Port Stream in the vicinity of CP7[1].

Descriptor	Units	Value
Area	km^2	8.22
Average Annual Rainfall (61-90)	mm/yr.	814
Stream Length	km	3.23
Drainage Density	Channel length (km)/sq. km	0.39
Slope	Percent slope	3.5

Salterstown stream

The Salterstown Stream is located within the Burren catchment area. Salterstown stream is a local stream which discharges directly into the Irish Sea. It flows from northwest to southeast and intersects with the onshore cable route at CP8 approximately 600 m upstream of where it discharges to the Louth Coast (HA 06) (Figure 22-2). The watercourse at this crossing location had standing water during the walkover survey on 25 August 2022.

The catchment area upstream of CP8 is 5.7 km^2; and consists largely of cultivated lands with one-off residential properties. The catchment descriptors for the Salterstown Stream upstream of CP8 are listed in Table 22-9:.

Table 22-9: Catchment descriptors for the Salterstown Stream upstream of CP8[1].

Descriptor	Units	Value
Area	km^2	5.714
Average Annual Rainfall (61-90)	mm/yr.	806
Stream Length	km	4.51
Drainage Density	Channel length (km)/ sq. km	0.79
Slope	Percent slope	2.3

22.7.5 Coastal water bodies

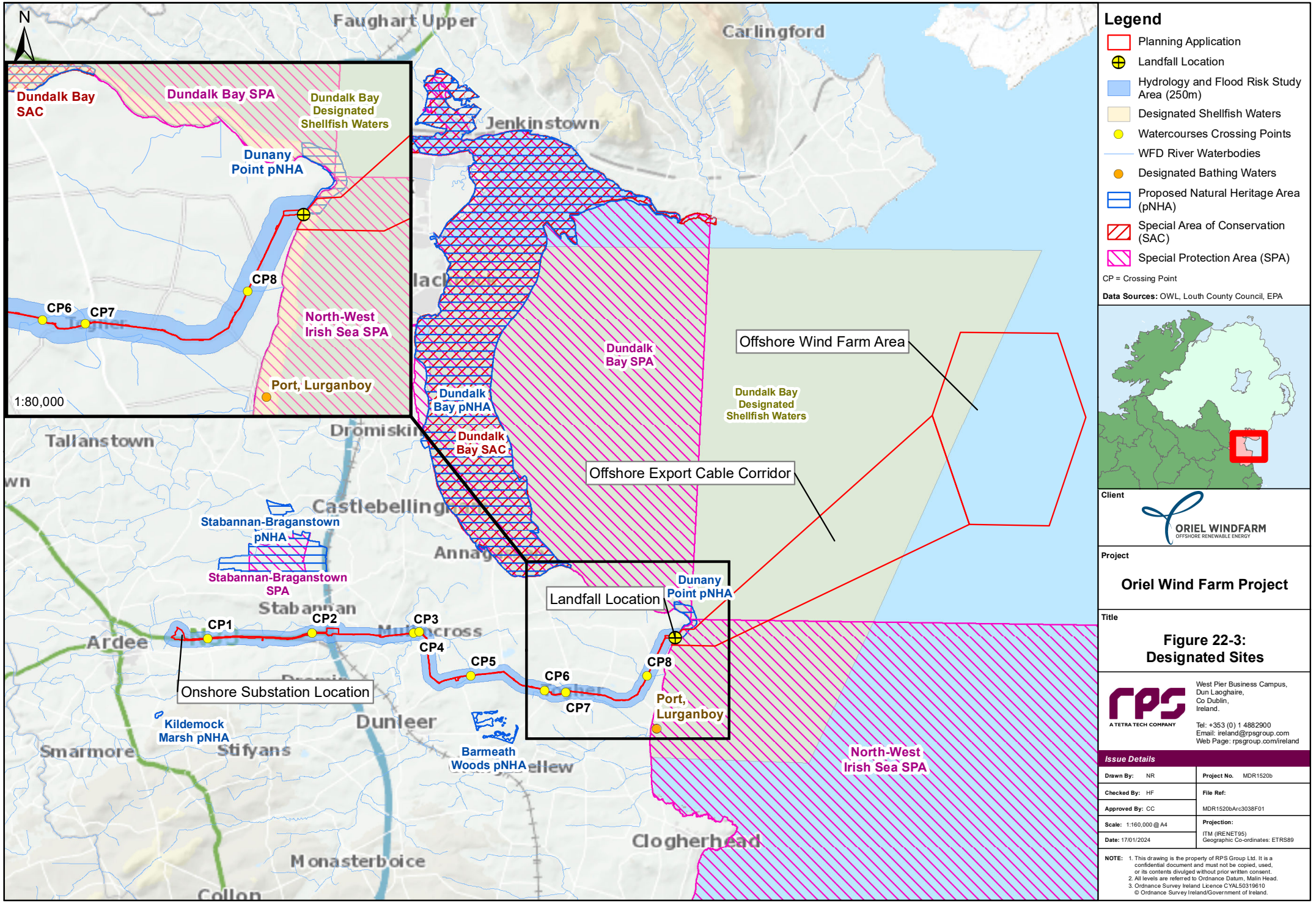
The landfall location for the offshore cable is adjacent to the Irish Sea (WFD Ref: Louth Coast CWB (HA06)), south of Dunany Point and Dundalk Bay (Figure 22-2). Dundalk Bay is a Special Area of Conservation (SAC) (Site code: 000455) and a Special Protection Area (SPA) (Site Code: 004026). It is also a designated Ramsar site (Site no: 834). The key habitats for Dundalk Bay SAC (which also provide supporting habitat to the species of Dundalk Bay SPA and the Dundalk Bay Ramsar site) are the intertidal sandflats and mudflats and extensive salt marshes. The offshore cable corridor intersects a section of the North-west Irish Sea cSPA (Site code: 004236). These designated sites and their habitats are located outside the Hydrology and Flood Risk Study Area as shown in Figure 22-3.

Dunany Point is a proposed Natural Heritage Area (pNHA) (Site Code: 001856) and is intersected by the offshore cable at the landfall as shown in Figure 22-3.

The Louth Coast CWB (HA06) is located adjacent to the landfall location and is a designated shellfish area under the European Communities (Quality of Shellfish Waters) (Amendment) Regulations, 2009 (S.I. No. 55

of 2009), and is part of Dundalk Bay Shellfish Area. Dundalk Bay Shellfish Area is 249.2 km^2 and extends out into the Irish Sea. The contributing catchment from land is 1,976 km^2 in area which is drained largely by watercourses discharging to Dundalk Bay (i.e. Fane, Castletown, Dee, Glyde, Ballymascanlan and Flurry Rivers). A section of the contributing catchment, particularly the south-eastern area, discharge directly to the Louth Coast CWB (HA06) through the smaller streams which includes the Port and Salterstown Streams. The southeastern area of the catchment is low-lying, consisting largely of agricultural land.

The Port, Lurganboy Beach (Bathing Waters ID: IENBBWC025_0000_0300) is a designated bathing area within the Irish Sea along Louth Coast (HA06). The Port Stream where it discharges to the Louth Coast (HA 06) CWB is located with this designated bathing area and is approximately 3.6 km downstream of CP7.



Legend

- Planning Application
- Landfall Location
- Hydrology and Flood Risk Study Area (250m)
- Designated Shellfish Waters
- Watercourses Crossing Points
- WFD River Waterbodies
- Designated Bathing Waters
- Proposed Natural Heritage Area (pNHA)
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

CP = Crossing Point

Data Sources: OWL, Louth County Council, EPA

Client
ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project
Oriel Wind Farm Project

Title
Figure 22-3: Designated Sites

RPS
A TETRA TECH COMPANY
West Pier Business Campus,
Dun Laoghaire,
Co Dublin,
Ireland.
Tel: +353 (0) 1 4882900
Email: ireland@rpsgroup.com
Web Page: rpsgroup.com/ireland

Issue Details			
Drawn By:	NR	Project No.	MDR1520b
Checked By:	HF	File Ref:	MDR1520bArc3038F01
Approved By:	CC		
Scale:	1:160,000 @ A4	Projection:	ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date:	17/01/2024		

22.7.6 Lakes

There are no lakes within the Hydrology and Flood Risk Study Area. The closest feature is a small pond approximately 500 m north of the onshore cable route, however it is located outside the Hydrology and Flood Risk Study Area. The pond does not appear on the OSI 6 inch and 25 inch maps which would indicate that it is possibly artificial with no direct hydrological connection to nearby surface water features and, as such, will not be affected by the Project.

22.7.7 Water supply sources

There are two drinking water abstraction points, identified from EPA Envision website (EPA, 2023a), on the River Dee in proximity to the Hydrology and Flood Risk Study Area. Further details on the two drinking water abstraction points are provided in Table 22-10.

Table 22-10: Drinking water abstraction - rivers.

WFD Subcatchment ID	Source	Surface Water Body	License Type	Abstraction Point
Dee_070	River Water	Neagh Bann RBD	Article 7 Abstraction for Drinking Water	Approximately 3.5 km upstream of the onshore substation site.
Dee_100	River Water	Neagh Bann RBD	Article 7 Abstraction for Drinking Water	Approximately 4.5 km and 7 km downstream of CP4 and CP5, respectively.

22.7.8 Wastewater discharges

The EPA website (EPA, 2023b) does not show any licensed wastewater discharge locations to the River Dee and its associated tributaries within the extent of the Hydrology and Flood Risk Study Area. The nearest licensed wastewater discharge location is the primary discharge point from Ardee Wastewater Treatment Plant (D0117-01) which discharges to the River Dee approximately 1.5 km upstream of the onshore substation site; and also the primary discharge point from Dunleer Wastewater Treatment Plant (D0111-01) which discharges to the White River 4.1 km upstream of CP4. The White River confluences with the River Dee approximately 3.6 km upstream of CP4. There are numerous of other EPA licensed wastewater discharge locations within the wider WFD sub-catchments.

There is one Section 4 discharge license (LA Ref.29) for a facility at Stabannon approximately 700 m north of the onshore cable route crossing (CP2) on the River Dee at Drumgoolestown Bridge.

22.7.9 Other projects and facilities

There are no licensed waste facilities within the Hydrology and Flood Risk Study Area. The nearest licensed waste facility is Whiteriver Landfill site (W0060-03) located approximately 10.5 km upstream of the River Dee CP2 at Drumcar Bridge. There are no Integrated Pollution Control (IPC) or Industrial Emissions (IE) licensed facilities within the Hydrology and Flood Risk Study Area. The nearest facility is Duleek Poultry Enterprises (P0935-01) which is approximately 4 km upstream of the onshore substation site.

22.7.10 Surface water quality

The EPA carries out water quality assessments (EPA, 2023c) of rivers and coastal areas as part of a nationwide monitoring programme. Data is collected from physio-chemical and biological surveys, sampling both surface water and the benthic substrate (sediment) in contact with the water. A WFD Assessment Report has also been completed and is provided in appendix 7-2 (volume 2B).

Surface water sampling

River waterbodies

The monitoring results for the water sampling carried out on the River Dee and the Louth Coast (HA 06) on a quarterly basis was provided by the EPA and included data to year end 2021. There are nine monitoring stations on the River Dee in the vicinity of the Hydrology and Flood Risk Study Area and these are listed in Table 22-11 below.

Table 22-11: EPA river monitoring stations.

Station ID	Location	Data Period	Comment
RS06D010710	On River Dee 2.5 km upstream of confluence with Rock Stream and 0.6 km west of the onshore substation site	2017 – 2021 (14 years)	Active Monitoring Station
RS06D010790	On River Dee at CP2	-	Pre WFD Monitoring Station and not active. No data available.
RS06D010800	On River Dee 0.4 km downstream of CP2	2007 – 2008 (2 years)	Pre WFD Monitoring Station and not active.
RS06D010850	On River Dee 1.5 km downstream of CP2	-	Pre WFD Monitoring Station and not active. No data available.
RS06D010900	On River Dee 2.2 km downstream of CP2	2007 – 2008 (2 years)	Pre WFD Monitoring Station and not active.
RS06D010910	On River Dee 2.8 km downstream of CP2 and 1.9 km upstream of CP4	-	Pre WFD Monitoring Station and not active. No data available.
RS06D011000	On River Dee at CP4	2017 – 2021 (14 years)	Active Monitoring Station
RS06D011050	On River Dee 1.7 km downstream of CP4	-	Pre WFD Monitoring Station and not active. No data available.
RS06D011100	On River Dee 3.4 km downstream of CP4	2017 – 2021 (14 years)	Active Monitoring Station

The nine monitoring stations consist of three active and six Pre-WFD monitoring stations which are not currently active. There are either no or limited sampling data from the Pre-WFD monitoring stations to inform comparison to statistical values as per the Surface Waters Regulations (S.I. No. 77/2019) and the Nitrates Directive (91/676/EEC).

The locations for the three active monitoring stations on the River Dee reviewed are shown in Figure 22-2. The relevant statistical values (mean, maximum and 95th percentile) for each parameter as per the Surface Waters Regulations calculated for each monitoring station for the two periods (2007 to 2021; and 2019 to 2021) are detailed in Table 22-12 below.

Table 22-12: River Dee EPA monitoring station statistical results.

Parameter	Units	Monitoring Data Period	2007 - 2021		2019 – 2021	
			Mean Value	95th Percentile Value	Mean Value	95th Percentile Value
Monitoring Station ID - RS06D010710						
Ammonia-Total (as N)	mg/l	2007 - 2021	0.267	0.870	0.062	0.112
Biochemical Oxygen Demand (BOD)	mg/l	2007 - 2021	1.714	2.900	1.507	2.190

Parameter	Units	Monitoring Data Period	2007 - 2021 Mean Value	2007 - 2021 95th Percentile Value	2019 – 2021 Mean Value	2019 – 2021 95th Percentile Value
Dissolved Oxygen	% Saturation	2007 - 2021	-	105.450	-	97.600
Nitrate (as N)	mg/l	2015 - 2021	2.682	4.29	3.120	4.4
Nitrite (as N)	mg/l	2008 - 2021	0.024	0.054	0.031	0.070
Orthophosphate (as P)	mg/l	2007 - 2021	0.085	0.410	0.049	0.085
Monitoring Station ID - RS06D011000						
Ammonia-Total (as N)	mg/l	2007 - 2021	0.078	0.242	0.061	0.137
BOD	mg/l	2007 - 2021	1.730	3.500	1.680	3.060
Dissolved Oxygen	% Saturation	2007 - 2021	-	106.000	-	99.300
Nitrate (as N)	mg/l	2015 - 2021	3.168	4.900	3.680	5.050
Nitrite (as N)	mg/l	2008 - 2021	0.031	0.060	0.035	0.066
Orthophosphate (as P)	mg/l	2007 - 2021	0.063	0.110	0.081	0.146
Monitoring Station ID - RS06D011100						
Ammonia-Total (as N)	mg/l	2007 - 2021	0.071	0.190	0.061	0.126
BOD	mg/l	2007 - 2021	1.662	2.960	1.547	2.900
Dissolved Oxygen	% Saturation	2007 - 2021	-	101.000	-	97.900
Nitrate (as N)	mg/l	2015 - 2021	3.245	4.800	3.867	4.950
Nitrite (as N)	mg/l	2008 - 2021	0.029	0.060	0.034	0.068
Orthophosphate (as P)	mg/l	2007 - 2021	0.067	0.130	0.077	0.149

The statistical analysis of the water sampling results for the physicochemical parameters from the three-monitoring stations on the River Dee shown in Table 22-12 indicate that the River Dee does not meet “good” WFD status.

Coastal waterbodies

There are four coastal monitoring stations in the vicinity of the landfall location listed in Table 22-13. Three of the coastal monitoring stations have no or limited sampling data to inform comparison to statistical values as per the Surface Waters Regulations. Therefore, the data from one coastal monitoring station (CW21006029CN1003) has been analysed and statistical values are compiled in Table 22-14 below.

Table 22-13: EPA coastal monitoring stations.

Station ID	Location	Data Period	Comment
CW21006029CN1003	Dundalk Bay – approximately 10 km north of the landfall location)	2013 – 2021 (8 years)	The 3rd closest monitoring station to the Hydrology and Flood Risk Study Area.
CW21006029CN1004	Dundalk Bay – approximately 8 km north of the landfall location)	-	No monitoring data available.
CW21006024BE2002	Louth Coast (HA 06) – approximately 8.6 km	-	No monitoring data available.

Station ID	Location	Data Period	Comment
	south of the landfall location)		
CW21006024BE2003	Louth Coast (HA 06) – approximately 3.5 km south of the landfall location)	2021 (1 year)	Closest monitoring station to the Hydrology and Flood Risk Study Area. Limited data available to inform comparison to statistical values as per the Surface Waters Regulations.

Table 22-14: Coastal EPA monitoring station statistical results.

Parameter	Units	Monitoring Data Period	2013 - 2021 Median Value	2013 - 2021 95th Percentile Value	2019 - 2021 Mean Value	2019 - 2021 95th Percentile Value
Monitoring Station ID - CW21006029CN1003						
Chlorophyll	ug/l	2013 - 2019	2.600	7.810	-	-
Dissolved Oxygen	% Saturation	2015 - 2021	-	110.650	-	106.600
Salinity	PSU	2013 - 2021	33.800	-	33.850	-
Dissolved Inorganic Nitrogen (as N)	mg/l	2013 - 2021	0.029	-	0.024	-

The statistical analysis of the water sampling results for the physicochemical parameters from the coastal monitoring station (CW21006029CN1003) shown in Table 22-14 indicate that Louth Coast (HA 06) in the vicinity of the landfall location, meets “high” WFD status.

Biological surveys

Biological surveys were carried out by the EPA between June and December between 1974 and 2020 (see Table 22-16). The biological surveys identified and measured the relative abundance and composition of the macro-invertebrate communities in watercourses. The macro-invertebrates surveyed include insects, shrimps, snails and bivalves, worms, and leeches. This data is used to measure the water quality based on the quantity and diversity of the macro-invertebrates identified and is measured to a numerical scale of Q-values or Biotic Index[2]. The indices are grouped into four classes and the classification for each is detailed in Table 22-15.

Table 22-15: Biotic index river water quality classification.

Biotic Index (Q value)	Quality Status	Quality Class	Condition
Q5, Q4-5, Q4	Unpolluted	Class A	Satisfactory
Q3-4	Slightly Polluted / Eutrophic	Class B	Transitional
Q3, Q2-3	Moderately Polluted	Class C	Unsatisfactory
Q2, Q1-2, Q1	Seriously Polluted	Class D	Unsatisfactory

[2] The Biotic Index of Water Quality (BIWQ), better known as the Q-value, was developed in Ireland by the EPA. Q-values and water quality classes are assigned using a combination of habitat characteristics and structure of the macroinvertebrate community within the water body. Individual macroinvertebrates are ranked for their sensitivity to organic pollution and the Q-value is assessed based, primarily, on their relative abundance within a biological sample. Individual macroinvertebrate taxa are ranked for their sensitivity to organic pollution and the Q-value is determined based on their relative abundance within the sample and reflects the average water quality at a location.

There are eight stations on the River Dee within the Hydrology and Flood Risk Study Area and the Q-value ratings provided for each year are listed in Table 22-16 for the period 1974 to 2020. The monitoring results indicate that the Q-Value Ratings for the River Dee within the extents of the Hydrology and Flood Risk Study Area to be between Q3 to Q4 for the 1994 to 2020 period. Hence, the biological water quality status for the River Dee varies between ‘slightly polluted to unpolluted’.

Table 22-16: Q-Value ratings for the River Dee.

River Dee Station Names	Station Nos.	1974	1977	1978	1980	1983	1986	1990	1994	1997	2000	2003	2006	2009	2011	2012	2015	2018	2020
DEE - 1.5 km d/s Ardee	06D010700	2	3-4	3-4	3	3-4	3	4	-	-	-	-	-	-	-	-	-	-	
150 m d/s old Rly Br (LHS)	06D010710	-	-	-	-	-	-	4	3-4	3-4	3-4	3	3	3	3	-	3-4	3-4	4
DEE - New Br u/s Drumgoolestown Br	06D010790	-	-	-	-	-	-	-	-	-	-	-	3-4	-	-	-	-	-	
DEE - Drumgoolestown Br	06D010800	4	3-4	3-4	4	4	3-4	4-5	3	3	3-4	3	-	-	-	-	-	-	
DEE - Charleville Weir	06D010900	-	-	-	-	-	3-4	-	-	-	-	-	-	-	-	-	-	-	
DEE - Cappoge Br	06D010910	-	-	-	4	4	3-4	4	-	-	-	-	-	-	-	-	-	-	
Br. At Drumcar	06D011000	4	3-4	3	3-4	3-4	3-4	3-4	3	3	3-4	3	3-4	3-4	3	-	3	3-4	4
At Williamstown House	06D011100	-	-	-	4	4	4	3-4	-	-	-	-	-	-	-	3	-	3	3

WFD water quality reports

The WFD Catchment Reports (EPA, 2023c), the EPA Water Quality in Ireland 2016 -2021 Report (EPA, 2023d), and the EPA Envision website (EPA, 2023a) outline the water quality status and significant pressures for each waterbody listed in Table 22-17. The WFD Catchment Reports reviewed are listed below:

- WFD Cycle 3 Report – Newry, Fane Glyde and Dee Catchment (HA 06) (EPA, 2021); and
- WFD Cycle 2 Report - Newry, Fane, Glyde and Dee Sub-catchment Report (Burren_SC_10, Code 06_14) (EPA, 2018).

The WFD Cycle 2 Report was reviewed for the Port Stream, Ardballan Stream, Salterstown Stream and the Louth Coast (HA 06) CWB in the absence of information not yet published as part of the WFD Cycle 3 catchment assessments. The assessment of water quality status and significant pressures were based on water quality information up to 2018 for Natura 2000 and Salmonid Waters; 2019 for Drinking Water; and 2020 for Nutrient Sensitive Areas and Bathing Waters.

Table 22-17: WFD water quality status for surface waterbodies within the Hydrology and Flood Risk Study Area.

Waterbody Name (EPA Name)	Locations	EPA Waterbody Code	2016 - 2021 WFD Status	WFD Risk	Significant Pressures
River Dee (Dee_080)	Onshore substation site & CP1 & CP2	IE_NB_06D011000	Moderate	At Risk	Agricultural & Hydromorphic
River Dee (Dee_090)	CP3 to CP5	IE_NB_06D011100	Poor	At Risk	Agricultural & Hydromorphic
Port Stream, Ardballan Stream & Salterstown Stream (Slieveboy_010)	CP6 to CP8	IE_NB_06S160790	Moderate	Under Review	Agricultural
Dundalk Bay (Louth Coast (HA 06))	Landfall location	IE_NB_025_0000	High	Under Review	Agricultural

All waterbodies listed above are subject to agricultural pressures. The draft WFD Cycle 3 Report (EPA, 2021) noted a significant proportion of the River Dee catchment area being underlain by poorly draining soils and subsoils. These areas have high pollution impact potential for phosphate, particularly from agriculture, to surface water.

The hydromorphic pressures are a result of the arterial drainage works carried out by the OPW within the River Dee catchment as part of the Glyde and Dee Arterial Drainage Scheme. The arterial drainage works lead to altered flow, high levels of siltation and habitat degradation.

Bathing water quality

The “Bathing Water Quality in Ireland” report published by the EPA for the year 2020 (EPA, 2022b) reported the water quality status for Port, Lurganboy Beach (Bathing Waters ID: IENBBWC025_0000_0300) to be “excellent” (the highest, cleanest class).

Designated shellfish area - water quality

Dundalk Bay Pollution Reduction Programme (DEHLG, 2022a) and Characterisation Report Number 30 (DEHLG, 2022b) accessed online from www.gov.ie dated November 2023 was reviewed to assess status for Dundalk Bay Designated Shellfish Area. The Pollution Reduction Programme (PRP) included an assessment

of water quality monitoring data to verify compliance with water quality standards outlined in Schedules 2 and 4 of the Quality of Shellfish Waters Regulations (DEHLG, 2006). The assessment is updated on an annual basis. The results of the monitoring reported water quality non-compliance. The key pressures identified were urban wastewater systems at Blackrock, Dundalk and Annagassan, and also higher than average density of on-site wastewater treatment systems and agriculture within the land based contributing catchment for Dundalk Bay Designated Shellfish Waters.

22.7.11 Future baseline scenario

The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (hereafter the EIA Regulations 2018) require that "*a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge*" is included within the EIAR.

In the event that the Project is not constructed, an assessment of the future baseline conditions has been carried out and is described below.

The River Dee catchment (Dee_080 & Dee_090) is subject to pressures from agricultural and hydromorphic sources and, is at "At Risk" of not achieving its WFD environmental objective of Good or High Ecological Status. Agricultural pressures identified for the Port Stream, Ardballan Stream and Salterstown Stream (Slieveboy_010) are also contributing to the WFD Risk Status which are at "Review" for these watercourses. The same applies to the Louth Coast (HA 06) coastal waterbody. The River Dee catchment is recommended for restoration action in the WFD "*3rd Cycle Draft Newry, Fane Glyde and Dee Catchment Report (HA 06)*" dated August 2021.

Further flood relief works are being considered for the River Dee to relieve flooding for the town of Ardee upstream of the Hydrology and Flood Risk Study Area as part of Dundalk and Ardee Flood Relief Scheme (FRS). The project is currently at "Stage 1 – Scheme Development and Design" stage and potential flood relief measures are currently being assessed. The potential flood relief measures can contribute to further hydromorphic pressures on the River Dee catchment within the Hydrology and Flood Risk Study Area if implemented.

If the Project does not proceed, the current hydrological regime within the Hydrology and Flood Risk Study Area may change as a result of flood relief measures on the River Dee for the town of Ardee upstream of the Project. Any flood relief measures proposed for the River Dee as part of the Dundalk and Ardee FRS will be required to be in compliance with the relevant environmental standards to obtain planning permission for the works. Restoration action is recommended for the River Dee catchment as part of WFD "*3rd Cycle Draft Newry, Fane Glyde and Dee Catchment Report (HA 06)*" hence it is not envisaged that there will be further agricultural pressures within the Hydrology and Flood Risk Study Area. In summary, it is not expected that there will be significant changes to the future baseline conditions.

22.7.12 Data validity and limitations

The baseline data used to inform the hydrology and flood risk assessment is obtained from online resources and desktop studies listed in section 22.6.1 of this chapter and is informed by the site specific surveys. This is in line with good practice and relevant guidelines as listed in section 22.4.

Surface water quality data was obtained from the EPA which carries out water quality assessments of rivers as part of a nationwide monitoring programme. This data was collected from physio-chemical and biological surveys, sampling both river water and the benthic substrate (sediment) in contact with the water. The data contains the latest available information, hence the data is valid for the purpose of this assessment.

The predicted flood risk mapping data was obtained from the Office of Public Works online resources. The predicted flood risk mapping data provided by the OPW is the best available information regarding to flood risk for the study area and is in line with the relevant guidelines as listed in section 22.4. Hence, the data is valid for the purpose of this assessment.

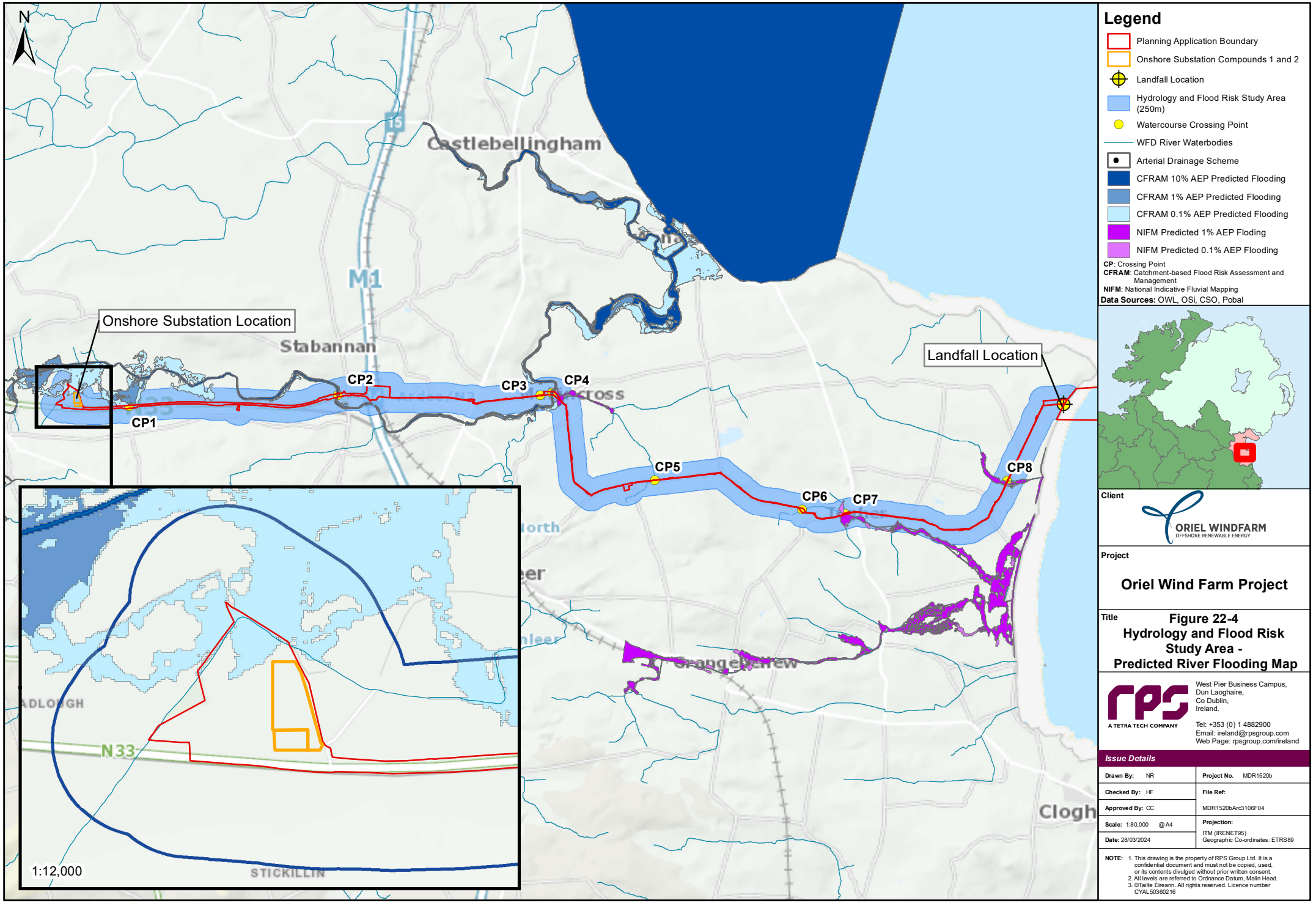
The EPA surface water quality data collected lacks information on oils and hydrocarbons which would have been used to establish a baseline scenario for parameters such as oils/ hydrocarbons and petrol. However, a

conservative approach was taken and the baseline was considered not to have been contaminated by these substances and appropriately control measures will be in place to contain leaks and accidental spills during construction. Therefore, this limitation is not deemed to affect the certainty or predictability of this assessment.

22.7.13 Flood risk identification

A flood risk identification was undertaken to inform the potential impacts based on available information listed in Table 22-3 in addition to a site walkover survey. A site-specific Flood Risk Assessment completed for the onshore substation (2024), included in appendix 22-1, was also used to inform the flood risk identification.

The OPW's indicative river and coastal flood maps and historical flood maps (OPW, 2021) were reviewed to identify whether there is a potential flood risk to any part of the onshore substation site, onshore cable route and the landfall location. The potential flood risk for the onshore infrastructure is indicated in Table 22-18 and detailed in Table 22-19. The extents of the predicted river flooding are shown in Figure 22-4, and the extents of the predicted coastal flooding area shown in Figure 22-5. The 0.1% Annual Exceedance Probability (AEP) predicted flood extents for the present day, Mid-Range Future Scenario (MRFS) - 20% uplift on river flows and High-End Future Scenario (HEFS) - 30% uplift on river flows, were compared to assess whether climate change impact has potential to increase flooding or cause new flooding within the Hydrology and Flood Risk Study Area. The 0.1% AEP predicted river flooding extents for the climate change scenarios are shown in Figure 22-6, and the 0.1% AEP predicted coastal flooding extents for the climate change scenarios are shown in Figure 22-7.



Legend

- Planning Application Boundary
- Onshore Substation Compounds 1 and 2
- Landfall Location
- Hydrology and Flood Risk Study Area (250m)
- Watercourse Crossing Point
- WFD River Waterbodies
- Arterial Drainage Scheme
- CFRAM 10% AEP Predicted Flooding
- CFRAM 1% AEP Predicted Flooding
- CFRAM 0.1% AEP Predicted Flooding
- NIFM Predicted 1% AEP Floding
- NIFM Predicted 0.1% AEP Flooding

CP: Crossing Point
CFRAM: Catchment-based Flood Risk Assessment and Management
NIFM: National Indicative Fluvial Mapping
Data Sources: OWL, OSi, CSO, Pobal

Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title: **Figure 22-4 Hydrology and Flood Risk Study Area - Predicted River Flooding Map**

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Issue Details

Drawn By: NR	Project No. MDR1520b
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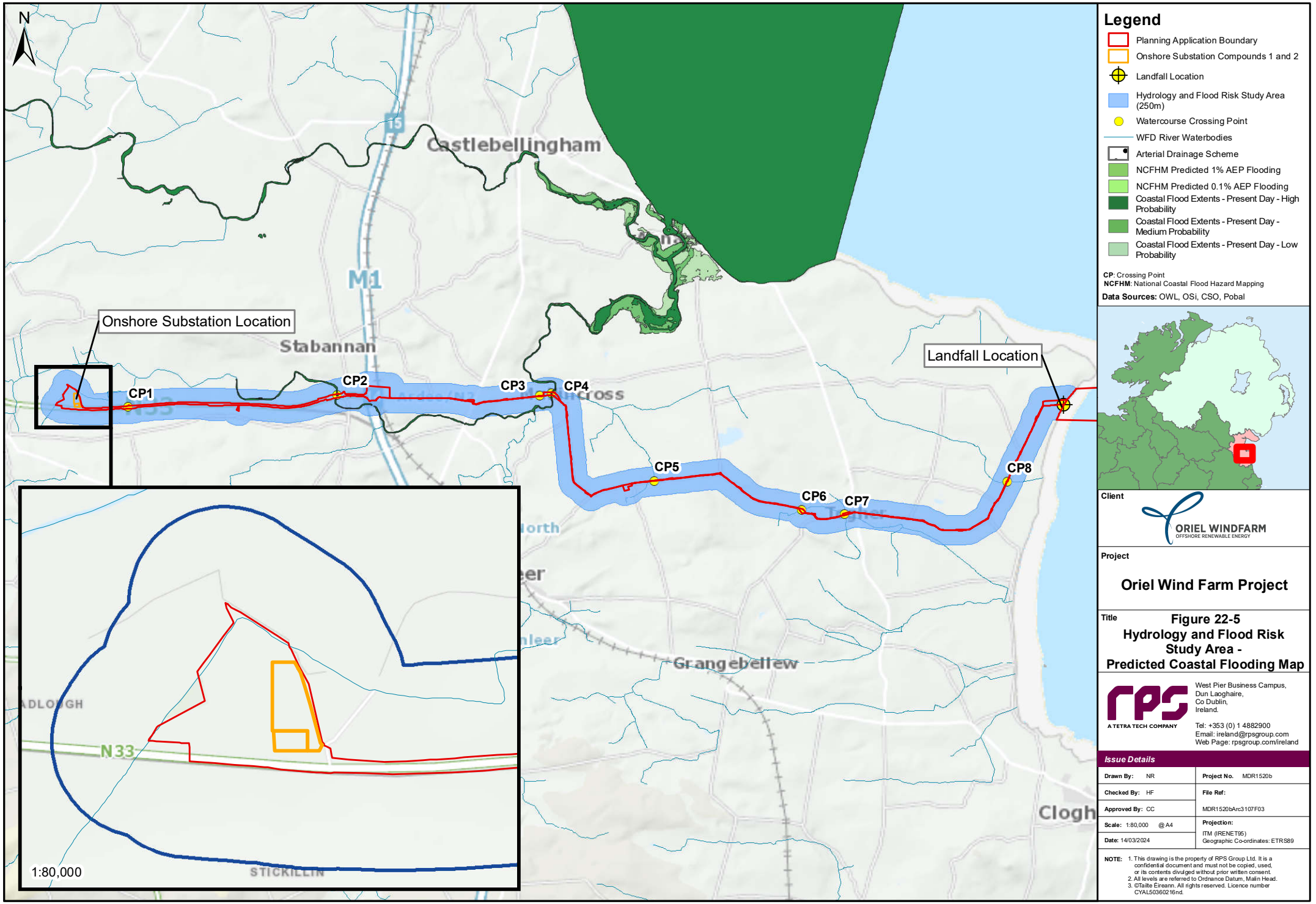
Scale: 1:80,000 @A4	Projection: ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 28/03/2024	



Legend

- Planning Application Boundary
- Onshore Substation Compounds 1 and 2
- Landfall Location
- Hydrology and Flood Risk Study Area (250m)
- Watercourse Crossing Point
- WFD River Waterbodies
- Arterial Drainage Scheme
- NCFHM Predicted 1% AEP Flooding
- NCFHM Predicted 0.1% AEP Flooding
- Coastal Flood Extents - Present Day - High Probability
- Coastal Flood Extents - Present Day - Medium Probability
- Coastal Flood Extents - Present Day - Low Probability

CP: Crossing Point
NCFHM: National Coastal Flood Hazard Mapping
Data Sources: OWL, OSi, CSO, Pobal

Client: ORIEL WINDFARM OFFSHORE RENEWABLE ENERGY

Project: **Oriel Wind Farm Project**

Title: **Figure 22-5 Hydrology and Flood Risk Study Area - Predicted Coastal Flooding Map**

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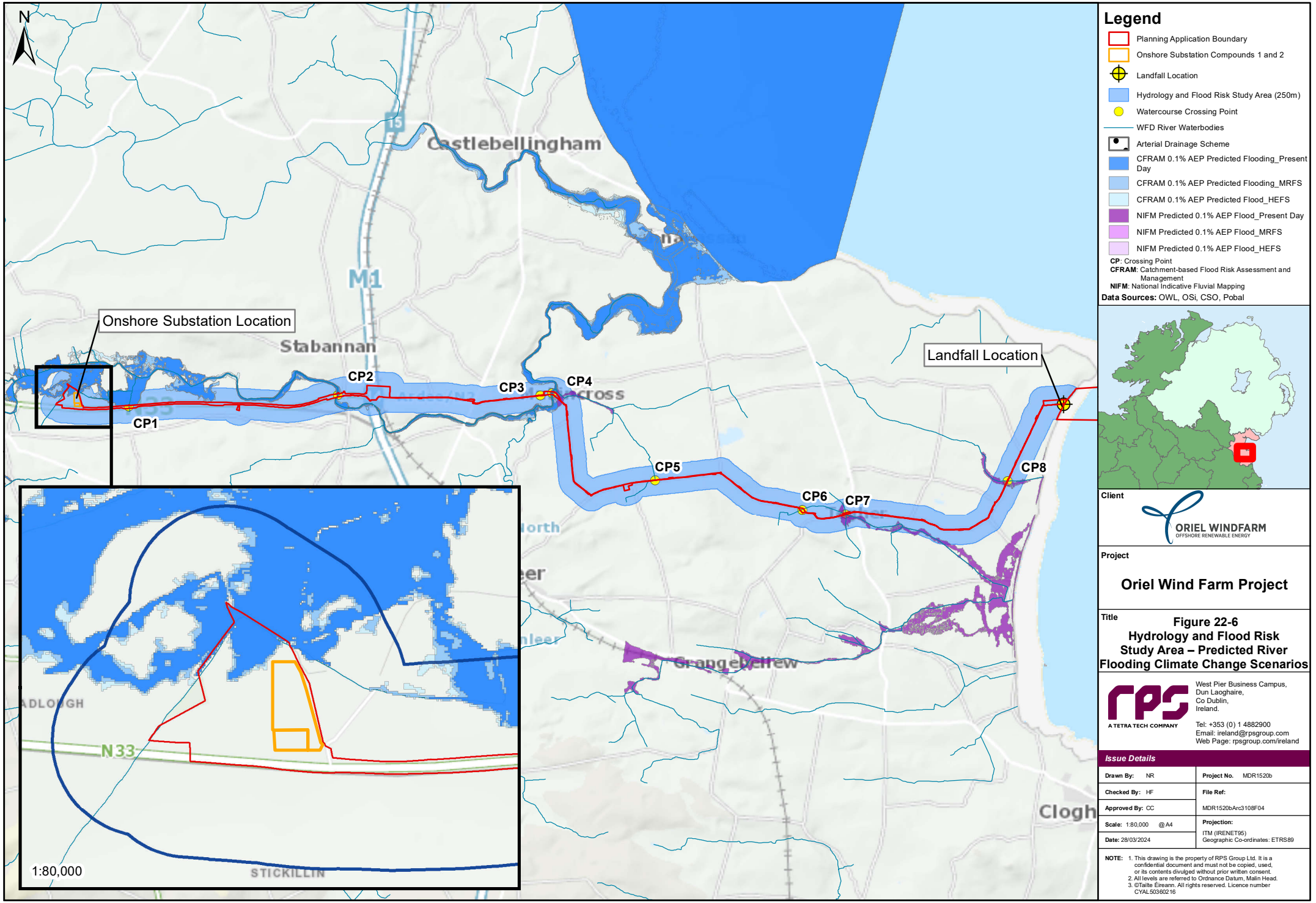
N
Castlebellingham
M1
Stabannan
Onshore Substation Location
Landfall Location
CP1
CP2
CP3
CP4
CP5
CP6
CP7
CP8
N33
1:80,000
Legend
Planning Application Boundary
Onshore Substation Compounds 1 and 2
Landfall Location
Hydrology and Flood Risk Study Area (250m)
Watercourse Crossing Point
WFD River Waterbodies
Arterial Drainage Scheme
CFRAM 0.1% AEP Predicted Flooding_Present Day
CFRAM 0.1% AEP Predicted Flooding_MRFS
CFRAM 0.1% AEP Predicted Flood_HEFS
NIFM Predicted 0.1% AEP Flood_Present Day
NIFM Predicted 0.1% AEP Flood_MRFS
NIFM Predicted 0.1% AEP Flood_HEFS
CP: Crossing Point
CFRAM: Catchment-based Flood Risk Assessment and Management
NIFM: National Indicative Fluvial Mapping
Data Sources: OWL, OSi, CSO, Pobal
Client
ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY
Project
Oriel Wind Farm Project
Title
Figure 22-6
Hydrology and Flood Risk Study Area – Predicted River Flooding Climate Change Scenarios
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File Ref: MDR1520bArc3108F04
Projection: ITM (IRENET95)
Geographic Co-ordinates: ETRS89
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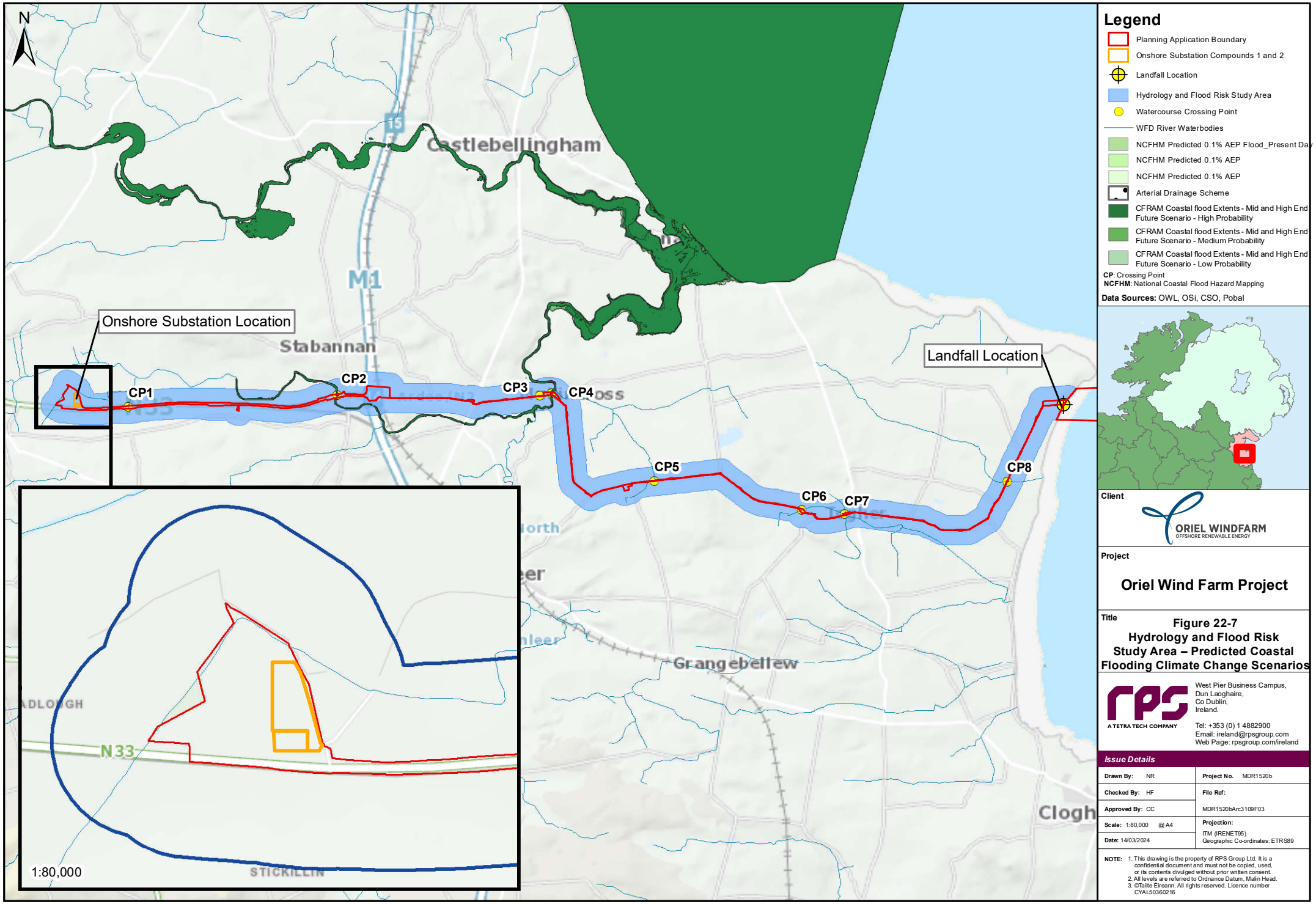

Legend

- Planning Application Boundary
- Onshore Substation Compounds 1 and 2
- Landfall Location
- Hydrology and Flood Risk Study Area
- Watercourse Crossing Point
- WFD River Waterbodies
- NCFHM Predicted 0.1% AEP Flood_Present Day
- NCFHM Predicted 0.1% AEP
- NCFHM Predicted 0.1% AEP
- Arterial Drainage Scheme
- CFRAM Coastal flood Extents - Mid and High End Future Scenario - High Probability
- CFRAM Coastal flood Extents - Mid and High End Future Scenario - Medium Probability
- CFRAM Coastal flood Extents - Mid and High End Future Scenario - Low Probability

CP: Crossing Point
NCFHM: National Coastal Flood Hazard Mapping

Data Sources: OWL, OSi, CSO, Pobal

Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 22-7
Hydrology and Flood Risk Study Area – Predicted Coastal Flooding Climate Change Scenarios

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Date: 14/03/2024	

Table 22-18: Indication of flood risk within the Hydrology and Flood Risk Study Area.

Location	FHMW	CFRAMS	NIFM	ICWW & NCFHM	Soils Map	OSI	AI	Potential Flood Risk
Substation site	Y	Y	N	N/A	Y	N	N	Y
Onshore cable corridor	N	N	Y	N/A	Y	N	Y	Y
Landfall	N	N	N	Y	N	N	N	Y

FHMW: Full Width at Half Maximum; CFRAMS: Catchment-based Flood Risk Assessment and Management Studies; NIFM: National Indicative Fluvial Mapping; ICWW: Irish Coastal Wave and Water; NCFHM: National Coastal Flood Hazard Mapping; OSI: Ordnance Survey Ireland; AI: Anecdotal Information.

Note: Y= yes; N= No.

The level of flood risk for the onshore substation site, onshore cable route and the landfall location are detailed in Table 22-19.

Table 22-19: Flood risk rating for the Project onshore infrastructure.

Location	Comments on Flood Risk Areas	Overall Flood Risk
Onshore substation site	The Flood Risk Assessment Report (appendix 22-1) for the onshore substation site indicated that it is not prone to flooding and will not, in itself, increase the risk of flooding elsewhere. The CFRAM predicted flood map indicates a potential 0.1% AEP flooding from the River Dee within the Hydrology and Flood Risk Study Area to the northwest from the footprint of the onshore substation. The 0.1% AEP predicted flood extents for the present day, Mid-range Future Scenario (MRFS) and High-end Future Scenario (HEFS) scenarios showed minor increase in predicted flooding from River Dee within the Hydrology and Flood Risk Study Area as a result of climate change. The increase does not encroach on the permanent footprint of the onshore substation site and is considered to be negligible.	Low
Onshore cable route	The CFRAM predicted flood maps indicate a potential localised 1% AEP and 0.1% AEP flooding from the Rock Stream and the River Dee at CP1, CP2 and CP4, and encroaching the onshore cable route at the agricultural lands adjacent to the Ardee Link Road (N33). The National Indicative Flood Mapping (NIFM) predicted flood maps indicate potential localised 1% AEP and 0.1% AEP flooding within the onshore cable route including the public road at the following locations: • Approximately 110 m southeast of CP4 – predicted flooding from Newhall Stream; • Within public road and adjacent fields at CP7 - predicted flooding from Port Stream and Ardballan Stream; and • At CP8 - predicted flooding from Salterstown Stream The 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed minor increase in predicted flooding in vicinity of onshore cable route and no new flooding as a result of climate change. The increase is considered to be negligible. Past flood events reports indicated a flood event at Togher Cross approximately 200 m downstream of CP6. The report states: “*Drogheda*	Medium

Location	Comments on Flood Risk Areas	Overall Flood Risk
	side prone to flooding. Remedial works have been carried out. [Flood ID 3093]". Past flood events reports a flood event at Clonmore approximately 200 m south of CP5. The report states: "*Regular flooding of low-lying land. [Flood ID 3094]*".	
Landfall location	The National Coastal Flood Hazard Mapping (NCFHM) 2021 (OPW, 2021) predicted flood extents indicate the 0.5% AEP and 0.1% AEP predicted coastal extents encroaching the coastline in the vicinity of the landfall location. The highest 0.5% and 0.1% AEP predicted coastal flood levels in the vicinity of the landfall location is 3.58 m.AD and 3.75 m.AD respectively for North East Coast Point 6 from the Irish Coastal Wave and Water Level Modelling Study (ICWW) 2018 Phase 1 – Extreme Water Levels Report, Appendix L (RPS, 2020). The 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed negligible increases in predicted flooding within landfall location as a result of climate change. Hence the climate change impact is considered to be negligible.	Low

22.8 Key parameters for assessment

22.8.1 Project design parameters

The project description is provided in volume 2A, chapter 5: Project Description. Table 22-20 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on hydrology and flood risk.

The final location and layout of the Transition Joint Bay (TJB) will be confirmed post consent on examination of the electrical and thermal properties of the selected offshore export cable and the ground conditions at the landfall (design flexibility - see volume 2A, chapter 5: Project Description). For the purposes of the assessment presented in section 22.10, both options result in the same potential impacts on hydrology and flood risk.

Table 22-20: Project design parameters used for the assessment of potential impacts on Hydrology and Flood Risk.

Potential impact	Phase[1]			Project Design Parameters	Justification
	C	*O*	*D*		
Potential obstruction and contamination of floodwaters from excavation works during flood events.	✓	✗	✓	• All excavation works (within the application planning boundary) will occur along the onshore cable route from the landfall (HWM) to the onshore substation site during the construction and decommissioning phases. • The excavation works include for open trench method at CP3, CP5 and CP6.	Due to the proximity of the onshore substation site and the landfall location from surface waters during construction and decommissioning, there is potential for; • Obstruction to flooding from excavation works (i.e. temporary mounds) which can increase flood risk to the Hydrology and Flood Risk Study Area; and • Contamination of floodwaters within excavation works areas

Potential impact	Phase[1] C	O	D	Project Design Parameters	Justification
					contributing to a decrease in water quality within the Hydrology and Flood Risk Study Area. During the operational and maintenance phase, the operational footprint is outside predicted flood extents and no excavation works required.
Water quality impact to surface waters due to increased sediments discharge.	✓	✗	✓	• All excavation works (within the planning application boundary) will occur along the onshore cable route, at the onshore substation site and at the landfall location during the construction and decommissioning phases. • The excavation works will also include for open trench method at CP3, CP5 and CP6. • All temporary working areas including those to facilitate HDD crossings at the following locations: – CP2 (River Dee on the N33 at Richardstown); – CP4 (River Dee at Drumcar Bridge); – CP7 (Port Stream & Ardballan Stream at Togher); – CP8 (Salterstown stream), however given space available this will likely be between 20-200 m^2; and – M1 and Dublin-Belfast Rail Line at Charleville.	The run-off generated from within the excavation areas and exposed surfaces can cause increased sediment discharge to receiving surface waters, hence, contributing to reduced water quality. Dewatering activities during excavation generates run-off containing silt/sediments which may contribute to increased sediment discharge to receiving surface waters, if untreated. The operational footprint is outside predicted flood extents and no excavation works required for the operational and maintenance phase.
Water quality impact to surface waters due to accidental spillages of chemicals / fuel.	✓	✗	✓	• Excavation works (within the planning application boundary) will occur at the onshore cable route, onshore substation site and the landfall location during the construction and decommissioning phases. • The excavation works include for open trench method at CP3, CP5 and CP6. • Temporary working areas will facilitate HDD crossing points at the following locations: – CP2 (River Dee on the N33 at Richardstown); – CP4 (River Dee at Drumcar Bridge); – CP7 (Port Stream & Ardballan Stream at Togher); – CP8 (Salterstown stream), however given space available this will likely be between 20-200 m^2; and – M1 and Dublin-Belfast Rail Line at Charleville.	The run-off from the construction works area has the potential to wash off accidental spillages of chemicals/fuel and discharge to receiving surface waters hence reducing water quality.
Potential obstruction to flow at watercourse crossings using open trench method.	✓	✗	✓	Open trench crossing at three locations along the onshore cable route at CP3, CP5 and CP6.	The open trench method for the onshore cable installation includes for the temporary damming of water within watercourses, which has the potential to increase flood risk.

Potential impact	Phase[1] C	O	D	Project Design Parameters	Justification
					There are no excavation works required during the operational and maintenance phase.
Interference with sediment transport at watercourse crossings using open trench method.	✓	x	✓	Open trench crossing at three locations along the onshore cable route at CP3, CP5 and CP6.	The open trench method for the onshore cable installation includes for the temporary damming of river water, restricting flow. Excavation works within the watercourse therefore have the potential to increase sedimentation upstream and sediment load within the water column downstream of the river crossings. There are no excavation works required during the operational and maintenance phase.

[1]*C= Construction, O = Operation, D = Decommissioning*

22.8.2 Measures included in the Project

As part of the project design process, a number of measures have been proposed to reduce the potential for impacts on hydrology and flood risk. These measures include designed-in and management measures (controls). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment presented in section 22.10 (i.e. the determination of magnitude assumes implementation of these measures). These measures are considered standard industry practice for this type of development (see Table 22-21).

Table 22-21: Measures included in the Project.

Measures included in the Project	Justification
Surface water management measures: The contractor will be required to implement the following surface water management measures prior to commencing construction and decommissioning works on site, in accordance with Best Practice Guidance for the storage of oil BPGCS005 – Oil Storage Guidelines (Enterprise Ireland, nd), and CIRIA guidance (Report No.113 titled "Control of groundwater for temporary works" (CIRIA, 1986)). **Principal Avoidance Measures:** • Site clearance involving topsoil stripping will progress along with the earthworks and will not be carried out over large areas in advance of the works; • Working areas will be kept as small as possible; • Material deposition areas are to be designed to avoid sediment entering adjacent watercourses and minimize water quality impacts on waterbodies; • Excavation works at proximity (10 m buffer zone) to surface waters to be kept to a minimum where possible; and • Suspend work in advance of extreme weather forecasts. **Principal Control Measures:** • Site compounds/storage facilities will be located at least 10 m away from surface waters. In addition, measures will be implemented to ensure that silt laden or contaminated surface water runoff from compound(s) do not discharge directly to the surface waters. Compounds will not be constructed in lands at risk of flooding; • All soiled construction runoff water will be passed through settlement ponds/ silt traps and/ or bunds prior to outfall to the receiving surface water where appropriate;	This is required to ensure the general protection of watercourses.

Measures included in the Project	Justification
• Management of material deposition areas to prevent siltation of watercourse systems through runoff during rainstorms. It is recommended to construct collector ditches surrounding material stockpiles to contain runoff and direct it to the settlement ponds/ silt traps before discharge to an adjacent watercourse; • Wheel wash facilities to be appropriately located to ensure wash waters are intercepted, contained and directed to settlement ponds/ silt traps prior to discharge to surface waters; and • Ensure run-off generated from dewatering activities for discharge to surface waters is treated utilizing temporary settlement pond/tanks(s) in accordance with CIRIA Report No.113 titled "Control of groundwater for temporary works" (CIRIA, 1986).	
Accidental Spillages The contractor will implement the following management measures prior to commencing construction and decommissioning works/activities on site. The contractor will adopt best practice measures in accordance with best practice guidance. **Principal Avoidance Measures:** • The storage and handling of oils, fuel, chemicals and hydraulic fluids will be in secure areas within the site compounds and will not occur within a minimum of 10 m from watercourses; and • Storage of fuels, chemicals and lubricants at the contractor's compound must be fenced off and have a lockable gate to prevent unauthorized access or vandalism. **Principal Control Measures:** • Foul drainage from all site offices and construction facilities will be taken off-site and disposed of by a licensed contractor; • Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with NRA guidance "*Guidelines for the crossing of watercourses during the construction of National Road Schemes"* (NRA, 2008). All chemical and fuel filling locations will be protected from potential spillages through the provision of appropriate protection measures including bunded areas and double skinned bowser units with spill kits; • Storage tanks will have secondary containment provided by means of an above ground bund to capture any oil leakage. Storage tanks and associated provision, including bunds, will conform to the current best practice for oil storage and will be undertaken in accordance with Best Practice Guide BPGCS005 – Oil Storage Guidelines (Enterprise Ireland, nd); • Where required, the pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents will be completed in the dry and allowed cure for 48 hours in order to avoid pollution of watercourses; • The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage. Alternate construction methods are encouraged for example, use of pre-cast concrete or permanent formwork will reduce the amount of in-situ concreting required. Where on-site batching is proposed by the contractor, this activity will be carried away from watercourses (minimum 10 m). Washout from such mixing plant and from concrete delivery trucks will be carried out only in a designated contained impermeable area; • An Environmental incident and emergency response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes (e.g. concrete) to be in place prior by the contractor to commencement of the Project, Relevant staff, including cover staff, shall be trained in the implementation of the plan and the use of any spill kit/ control equipment as necessary. The contractor shall provide a list of all such staff to the Employer's Site Representative detailing the name, contact number, and training received, and the date of that training; and	This is required to ensure the general protection of watercourses, particularly at compound locations.

Measures included in the Project	Justification
• Plant and equipment shall be maintained in place and in working order for the duration of the works.	
Following the installation of the cable ducts within watercourse crossings, in the case of an open trench construction method, the stream bed will be reinstated with original or similar material under the supervision of an aquatic ecologist.	This is required to ensure that the watercourses associated with trenching works are restored to their original condition without short to long term implications on the local ecology.
Design for drainage infrastructure within the onshore substation site limits peak run-off discharge to adjacent surface waters to the greenfield run off rate.	This is to ensure no increased runoff discharging to watercourses thus increasing flows and flood risk downstream.
HDD crossing design at CP2, CP4, CP7 & CP8.	This ensures no hydraulic connection with watercourses associated with the trenchless works (i.e. horizontal directional drilling and tunnelling) and does not reduce the bridge or channel capacity. It also ensures minimal works in close proximity to the River Dee at CP2 and CP4, Port Stream and Ardballan Stream at CP7, and Salterstown Stream at CP8.
Cable installation at CP1 above the culvert within the N33 carriageway.	The cable is proposed to be installed underground above the existing culvert hence there is no potential interaction with watercourse at CP1.
Footprint for the onshore substation to be located outside the predicted 1% AEP and 0.1% AEP flood extents within the application site boundary.	This ensures no loss of flood storage and therefore no increase in flood risk elsewhere.

22.8.3 Impacts scoped out of the assessment

On the basis of the baseline environment and the project description outlined in volume 2A, chapter 5: Project Description, a number of impacts are proposed to be scoped out of the assessment for hydrology and flood risk. These impacts are outlined, together with a justification for the scoping out decision, in Table 22-22.

Table 22-22: Impacts scoped out of the assessment for hydrology and flood risk.

Potential impact	Justification
Localised increased flows and flooding in the receiving surface waters due to the increased impermeable area within the onshore substation site.	The proposed drainage system for the onshore substation site and its access road will be designed to limit the run-off discharge to receiving watercourse to greenfield run-off rate. Hence, there will be no increased rate in the run-off discharging directly to receiving watercourse.
Increased run-off discharging to adjacent surface and coastal waters from the landfall location, during all phases.	The landfall will have no above ground permanent structures, and no hardstanding areas are proposed. An access track will be required of TJB option 2, but overall there will be no change to surface run-off from the landfall location.
Water quality impact to surface waters due to accidental spillages/discharge of chemicals/fuel during operation and maintenance phases	The proposed drainage system for the onshore substation site and its access road is designed to include for a petrol interceptor to intercept and treat accidental spillages/ discharges of chemicals prior to discharge to surface waters. Hence, there will be no untreated accidental spillages/ discharges of chemicals/ fuels to surface waters from the onshore substation site.

Potential impact	Justification
Potential obstruction to river flow as a result of cable installation above existing culvert at watercourse crossings.	The excavation works for cable installation above existing culvert will be confined to the public road and hence, there will be no interaction with the water column or obstruction to river flow.
Potential obstruction to river flow as a result of cable installation by HDD method at major watercourse crossings.	The HDD will be a minimum of 4 m below the stream bed of watercourses and hence, there will be no interaction with the water column or obstruction to river flow.

22.9 Impact assessment methodology

22.9.1 Overview

The assessment on hydrology and flood risk has followed the methodology set out in volume 2A, chapter 3: Environmental Impact Assessment Methodology. Specific to the hydrology and flood risk assessment, the following guidance documents have also been considered:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EIAR), (EPA, 2022a);
- Draft Advice Notes for Preparing Environmental Impact Statements (EPA, 2015);
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2009);
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors (Construction Industry Research and Information Association (CIRIA), 2001); and
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (DEHLG, 2009b).

22.9.2 Impact assessment criteria

The criteria for determining the significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in volume 2A, chapter 3: EIA Methodology.

The importance of hydrology attributes (rating criteria) is defined in accordance with the NRA Guidelines (NRA, 2009). The NRA Guidance closely follows the principles established in the EPA Guideline Documents (2015 and 2022) for the preparation of and content of EIAR and provides specific guidance regarding impact categories, nature and type including examples on hydrological attributes. The criteria for rating the magnitude of impact are listed in Table 22-23 and the site importance-sensitivity of the receptors are listed in Table 22-24.

Table 22-23: Definition of terms relating to the magnitude of an impact.

Magnitude	Definition	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Loss or extensive change to a waterbody or water dependent habitat Increase in predicted peak flood level >100 mm Extensive loss of fishery Calculated risk of serious pollution incident >2% annually Extensive reduction in amenity value
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50 mm Partial loss of fishery

Magnitude	Definition	Typical Examples
		Calculated risk of serious pollution incident >1% annually Partial reduction in amenity value
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10 mm Minor loss of fishery Calculated risk of serious pollution incident >0.5% annually Slight reduction in amenity value
Negligible	Results in an impact on attribute but not of sufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality	Reduction in predicted peak flood level >10 mm Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality	Reduction in predicted peak flood level >50 mm Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100 mm

The criteria for defining receptor sensitivity in this chapter are outlined in Table 22-24 below.

Table 22-24: Definition of terms relating to the sensitivity/importance of the receptor.

Sensitivity	Definition	Typical Examples
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 scale.	River, wetland or surface water body ecosystem protected by national legislation – National Heritage Area (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, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1)

Sensitivity	Definition	Typical Examples
		Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

The significance of the effect upon hydrology and flood risk is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 22-25 Where a range of significance of effect is presented in Table 22-25, the final assessment for each effect is based on calculated assessment and professional judgement. No beneficial effects are assessed and have not been included in Table 22-25.

For the purposes of this assessment, any effects with a significance level of moderate or less have been concluded to be not significant in terms of the EIA Regulations.

Significance has been taken from the NRA (2009): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (Box 5.4: Rating of Significant Environmental Impacts at EIA Stage).

Table 22-25: Matrix used for the assessment of the significance of the effect (adverse effects only).

Importance of Attribute	Magnitude of Potential Impact			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely high	Imperceptible	Significant	Profound	Profound
Very high	Imperceptible	Significant/Moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

22.10 Assessment of significance

The potential impacts arising from the construction, and decommissioning phases of the Project are listed in Table 22-20, along with the project design parameters against which each impact has been assessed.

As outlined in volume 2A, chapter 5: Project Description, at the end of the operational lifetime of the Project, it is anticipated that all structures above ground level will be completely removed. Onshore cables would be removed by disconnecting each section at the joint bay and pulling them through the cable ducts, however no further excavation along the onshore cable route would be required unless there was a specific requirement to remove joint bays. Therefore, the same potential for impacts as outlined in Table 22-20 can occur during decommissioning but such impacts will be lesser in nature and of a smaller scale.

A description of the potential effects on hydrology and flood risk receptors caused by each identified impact during the construction is given below. A description of potential effects on hydrology and flood risk during the decommissioning phase are not outlined but as discussed above, potential effects will be less than those outlined for construction phase.

22.10.1 Potential obstruction and contamination of floodwaters from excavation works during flood events

Obstruction to flooding from excavation works has the potential to alter out-of-bank flooding flow path and therefore increase flood risk on site and elsewhere. The flooding of excavation areas also has the potential to contribute to reduced water quality of the floodwaters due to increased sediment discharge from loose

material. The potential flooding locations from watercourses within the Hydrology and Flood Risk Study Area were identified at the following areas;

- Onshore substation site from the River Dee;
- Onshore cable route CP2 from the Rock Stream and the River Dee;
- Onshore cable route approximately 110 m southeast of CP4 from Newhall Stream;
- Onshore cable route at CP7 from the Port Stream and the Ardballan Stream;
- Onshore cable route at CP8 from the Salterstown Stream; and
- The landfall location from the Louth Coast (HA 06) CWB.

Construction phase

Magnitude of impact

The predicted 1% and 0.1% AEP flooding from the River Dee are located outside the footprint of the onshore substation site, however the predicted 0.1% AEP flooding intersects the application site boundary at the northwest corner (approx. 0.013 km^2). The extent of the predicted 0.1% AEP flooding within the application site boundary represents less than 2% of the extensive predicted floodplain from the River Dee. The impact is predicted to be of local spatial extent, temporary duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be small adverse.

The predicted 0.1% AEP flooding from the River Dee encroaches the northern boundary of the onshore cable route at CP2. The impact is predicted to be of minimal spatial extent, temporary duration, intermittent and high reversibility. The magnitude is therefore considered to be negligible.

The predicted 1% and 0.1% AEP flooding from the Newhall Stream intersects a section of the onshore cable route approximately 110 m southeast of CP4. The extent of the predicted flooding is localised for a length of 150 m within a low point on the public road. The impact is predicted to be of local spatial extent, temporary duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be small adverse.

The predicted 1% and 0.1% AEP flooding from the Port Stream and Ardballan Stream intersects the onshore cable route at CP7. The extent of the predicted flooding cuts the onshore cable route for a length of 140 m. The impact is predicted to be of local spatial extent, temporary duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be small adverse.

The predicted 0.1% AEP flooding from the Salterstown Stream intersects the onshore cable route at CP8. The extent of the predicted flooding is localised within a low point on the public road for a length of 40 m. The impact is predicted to be of local spatial extent, temporary duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be small adverse.

The previous flooding reported at the southern side of Toghers Cross occurred from the Port Stream approximately 250 m east of CP7. Remedial works were noted to be carried out. The flooding location is downstream and outside of the onshore cable route, hence the potential impact is considered to be negligible.

The previous flooding reported at Clonmore approximately 200 m south of CP6 at the Port Stream is located within the River Dee catchment area and is outside of the onshore cable route, hence the potential impact is considered to be negligible.

The predicted 0.5% and 0.1% AEP flooding from the Louth Coast CWB encroaches the eastern boundary of the landfall location. The impact is predicted to be of minimal spatial extent, temporary duration, intermittent and high reversibility. Hence, the potential magnitude of the impact is negligible.

Sensitivity of the receptor

The River Dee has a Biotic Index ranging from Q3, to Q3-4 (moderately polluted to unpolluted). The Newhall Stream, a tributary to the River Dee, does not have an assigned Biotic Index. The predicted flooding from Newhall Stream affects between 1 to 5 residential or commercial properties approximately 110 m south east of CP4. The River Dee including the Newhall Stream is not located within any designated sites (i.e. SPA, SAC or NHA). The wastewater discharges to watercourses identified in section 22.7.8, one water abstraction point, and other project and facilities identified in section 22.7.9 are in the River Dee catchment but upstream of the proposed substation, onshore route corridor and landfall sites. One other water abstraction point is downstream of CP4 and CP5. Hence, the sensitivity of the receptor is therefore considered to be high.

The Port Stream and Ardballan Stream do not have an assigned Biotic Index and the predicted flooding affects between 1 to 5 residential or commercial properties. The Port Stream discharges to the Irish Sea within a designated bathing area approximately 3.6 km downstream of CP7. Hence, the sensitivity of the receptor is therefore considered to be medium.

The Salterstown Stream at CP8 does not have an assigned Biotic Index and the predicted flooding affects between 1 to 5 residential or commercial properties. Hence, the sensitivity of the receptor is therefore considered to be medium.

The Louth Coast (HA 06) CWB is within Dundalk Bay Designated Shellfish Waters, the North-west Irish Sea SPA and a section of the landfall location is within Dunany Point proposed Natural Heritage Area (pNHA). Hence, the sensitivity of the receptor is therefore, considered to be very high.

Significance of the effect

Overall, the magnitude of the impact for the River Dee catchment ranges from negligible to small adverse and the sensitivity of the receptor is high. The effect will, therefore, be of **imperceptible** to **moderate/slight significance,** which is not significant in EIA terms.

Overall, the magnitude of the impact for the Port Stream, Ardballan Stream and Salterstown Stream is considered to be small adverse and the sensitivity of the receptor is medium. The effect will, therefore, be of **slight significance**, which is not significant in EIA terms.

Overall for the Louth Coast (HA 06) CWB, the magnitude of the impact is deemed to be negligible and the sensitivity is considered to be very high. The effect will, therefore, be of **imperceptible significance**, which is not significant in EIA terms.

22.10.2 Water quality impact to surface waters due to increased sediment discharge

Excavation works, including dewatering activities (i.e. during any excavation works) and stockpiling of excavated materials, within close proximity to surface waters have the potential to contribute to increased sediment discharge to watercourses and coastal waters. Additionally, the open trench method to install cables underneath the riverbed at watercourse crossings has the potential to contribute to increased sediment discharge to watercourses. Receptors potentially at risk of sediment discharge include the River Dee, the Rock Stream, the drainage ditch, the Newhall Stream, the Port Stream and Ardballan Stream and the Salterstown Stream, as well as the downstream water abstraction location, the wastewater discharge location other project and facilities identified.

Construction phase

Magnitude of impact

The construction of the onshore cable route and the landfall will include excavation works within close proximity to surface waters including within riverbeds (in-stream) using the open trench method at

watercourse crossings. The potential for uncontrolled increased sediment discharge from excavation works adjacent to and within watercourses can contribute to partial effects on fisheries and a partial reduction in amenity value. Therefore, the impact is predicted to be of local spatial extent, short term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be small adverse.

Sensitivity of the receptor

The River Dee has a Biotic Index ranging from Q3 to Q3-4 (moderately polluted to unpolluted). The catchment is not located within any designated sites (i.e. SPA, SAC or NHA). This receptor also includes the Rock Stream, the drainage ditch and the Newhall Stream as these watercourses are part of the River Dee catchment.

The wastewater discharges to watercourses identified in section 22.7.8, one water abstraction point, and other project and facilities identified in section 22.7.9 are in the River Dee catchment but upstream of the proposed substation, onshore route corridor and landfall sites. One other water abstraction point is downstream of CP4 and CP5. Hence the sensitivity of this receptor (i.e. the River Dee catchment) is therefore, considered to be high.

The Port Stream and Ardballen Stream do not have an assigned Biotic Index and the predicted flooding affects between 1 to 5 residential or commercial properties. The Port Stream discharges to the Irish Sea within a designated bathing area approximately 3.6 km downstream of CP7 and CP8. Hence the sensitivity of the receptor is therefore, considered to be medium.

The Salterstown Stream at CP8 does not have an assigned Biotic Index and the predicted flooding affects between 1 to 5 residential or commercial properties. Hence, the sensitivity of the receptor is therefore considered to be medium.

The Louth Coast (HA 06) CWB is within Dundalk Bay Designated Shellfish Waters, the North-west Irish Sea SPA and a section of the landfall location is within Dunany Point pNHA. Hence, the sensitivity of the receptor is therefore considered to be very high.

Significance of the effect

Overall for the River Dee, the magnitude of the impact is deemed to be negligible and the sensitivity is considered to be high. The effect will, therefore, be of **imperceptible significance**, which is not significant in EIA terms.

Overall for the Port Stream, Ardballen Stream and Salterstown Stream, the magnitude of the impact is deemed to be negligible and the sensitivity is considered to be medium. The effect will, therefore, be of **imperceptible significance**, which is not significant in EIA terms.

Overall for the Louth Coast (HA 06) CWB, the magnitude of the impact is deemed to be negligible and the sensitivity is considered to be very high. The effect will, therefore, be of **imperceptible significance**, which is significant in EIA terms.

22.10.3 Water quality impact to surface waters due to accidental spillages/discharge of chemicals/fuel

The operation of plant and machinery on site has the potential to contribute to accidental discharge to nearby surface waters from spillages, leaks or refuelling on site during the construction phase. The washing of equipment/machinery and/or construction vehicles may pose a pollution risk if done within close proximity to surface waters. Chemicals being stored within the onshore substation site also the potential to contribute to accidental discharge to adjacent surface waters. Receptors potentially at risk of accidental spillage include the River Dee, the Rock Stream, the drainage ditch, the Newhall Stream, the Port Stream and Ardballen Stream and the Salterstown Stream, as well as the downstream water abstraction location, the wastewater discharge location other project and facilities identified.

Construction phase

Magnitude of impact

The magnitude of impact from hydrocarbons and other hazardous chemicals discharging to surface waters within the Hydrology and Flood Risk Study Area is directly attributed to the number of heavy machinery and chemical storage quantities, including the proximity to surface waters. The operation of heavy machinery particularly at watercourse crossing points along the onshore cable route and at the landfall location has the potential to contribute to minor effects on fisheries and a slight reduction in amenity valve. Hence, the impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. The magnitude is therefore considered to be small adverse.

Sensitivity of the receptor

The River Dee has a Biotic Index ranging from Q3 to Q3-4 (moderately polluted to unpolluted). The catchment is not located within any designated sites (i.e. SPA, SAC or NHA). This receptor includes the Rock Stream, drainage ditch and the Newhall Stream as these watercourses are part of the River Dee catchment.

The wastewater discharges to watercourses identified in section 22.7.8, one water abstraction point, and other project and facilities identified in section 22.7.9 are in the River Dee catchment but upstream of the proposed substation, onshore route corridor and landfall sites. One other water abstraction point is downstream of CP4 and CP5. Hence, the sensitivity of the receptor is therefore, considered to be high.

The Port Stream and Ardballen Stream do not have an assigned Biotic Index and the predicted flooding affects between 1 to 5 residential or commercial properties. The Port Stream discharges to the Irish Sea within a designated bathing area approximately 3.6 km downstream of CP7. Hence, the sensitivity of the receptor is therefore considered to be medium.

The Salterstown Stream at CP8 does not have an assigned Biotic Index and the predicted flooding affects between 1 to 5 residential or commercial properties. Hence, the sensitivity of the receptor is therefore considered to be medium.

The Louth Coast (HA 06) CWB is within Dundalk Bay Designated Shellfish Waters, the North-west Irish Sea SPA and a section of the landfall location is within Dunany Point pNHA. Hence, the sensitivity of the receptor is therefore considered to be very high.

Significance of the effect

Overall for the River Dee, the magnitude of the impact is deemed to be negligible and the sensitivity is considered to be high. The effect will, therefore, be of **imperceptible significance**, which is not significant in EIA terms.

Overall for the Port Stream, Ardballen Stream and Salterstown Stream, the magnitude of the impact is deemed to be negligible and the sensitivity is considered to be medium. The effect will, therefore, be of **imperceptible significance**, which is not significant in EIA terms.

Overall for Louth Coast (HA 06) CWB, the magnitude of the impact is deemed to be negligible and the sensitivity is considered to be very high. The effect will, therefore, be of **imperceptible significance**, which is significant in EIA terms.

22.10.4 Potential obstruction to flow at watercourse crossings using open trench method

The open trench method for the onshore cable route installation underneath the riverbed at watercourse crossings, includes for temporary damming of flow. The temporary damming within watercourses restricting flow, has the potential to allow the water levels within the open channel upstream of the trench crossing to rise and overspill the banks potentially causing nearby residential properties and public roads to flood.

Construction phase

Magnitude of impact

The temporary damming within watercourses restricting flow has the potential to increase flood risk in the immediate vicinity of the works. The methods include for either “fluming” or “pumping” to transfer flows from upstream of the temporary dam to downstream of the trench crossing. The magnitude of the impact is contingent on the flume and/or pump having sufficient capacity to convey the flows. Otherwise, if the capacity of the flume and/or pump is being exceeded by the flow upstream it will contribute to a build-up in river water level within the channel upstream and subsequently cause flooding of the immediate surrounding areas. This method is applied only to the smaller watercourses with lower flows within the Hydrology and Flood Risk Study Area namely, the unnamed stream at CP3, Newhall Stream at CP5 and the Port Stream at CP6. Therefore, the impact is predicted to be of local spatial extent, temporary duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be small adverse.

Sensitivity of the receptor

The unnamed stream at CP3, Newhall Stream at CP5 and the Port Stream at CP6 have one to five residential properties at each crossing. Hence, the sensitivity of these receptors are therefore, considered to be medium.

Significance of the effect

Overall for the unnamed stream at CP3, Newhall Stream at CP5 and the Port Stream at CP6, the magnitude of the impact is deemed to be small adverse and the sensitivity is considered to be medium. The effect will, therefore, be of **slight significance**, which is not significant in EIA terms.

22.10.5 Interference with sediment transport at watercourse crossings using open trench method

The open trench method for onshore cable route installation underneath the riverbed at watercourse crossings, includes for temporary damming of the flow and excavation works within the watercourses.

Construction phase

Magnitude of impact

The temporary damming within watercourses restricting flow interferes with sediment transport and increases the risk of sedimentation upstream. The “fluming” and/or “pumping” also has the potential to increase turbulence downstream of the trench crossing which subsequently can generate increased sediment concentration with flow. The magnitude of the impact is contingent on the capacity of the flume and/or pump discharge pipework to convey flows without increasing flow velocity and also limiting the restriction of flow upstream of the temporary dam. This method is applied only to the smaller watercourses with lesser flows within the Hydrology and Flood Risk Study Area namely the unnamed stream at CP3, Newhall Stream at CP5 and Port Stream at CP6. Therefore, the impact is predicted to be of local spatial extent, temporary duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be small adverse.

Sensitivity of the receptor

The unnamed stream at CP3, Newhall Stream at CP5 and the Port Stream at CP6 does not have an assigned Biotic Index. The Port Stream discharges to the Irish Sea within a designated bathing area approximately 4.5 km downstream of CP6. Hence the sensitivity of the receptor is therefore considered to be low.

Significance of the effect

Overall for the unnamed stream at CP3, Newhall Stream at CP5 and the Port Stream at CP6, the magnitude of the impact is deemed to be small adverse and the sensitivity is considered to be low. The effect will, therefore, be of **imperceptible significance**, which is not significant in EIA terms.

22.10.6 Mitigation and residual effects

The assessment of impacts has concluded that there are no significant effects and therefore it is considered that no measures over those included in the Project (as outlined in section 22.8.2) are required.

Residual effects

With the implementation of the measures included in the Project (see section 22.8.2), the residual effects are as outlined in the assessment provided in section 22.10.6.

22.10.7 Future monitoring

Table 22-26 below outlines the proposed monitoring commitments for hydrology and flood risk during the construction and decommissioning phases. No monitoring will be required during the operational and maintenance phase as there are no potential significant residual impacts predicted on hydrology and flood risk.

Table 22-26: Monitoring commitments.

Environmental effect	Monitoring commitment
Excavation works at close proximity to the watercourses particularly at watercourse crossings has the potential to reduce water quality due to increased sediments discharge and accidental spillage.	Water quality sampling will be undertaken prior to construction and decommissioning in order to update the baseline, and on bimonthly basis at the onshore substation and cable crossing locations when rainfall results in any discharge from the site or from a control structure. If oils and grease are visually evident, a sample will be forwarded to an accredited laboratory for analysis. Monthly sampling will be adequate during times when there is no rainfall/site discharge. Water Quality Sampling to be undertaken using hand-held water probes to measure the following: pH, turbidity, dissolved oxygen, Total Dissolved Solids (TDS), and temperature. Biological water quality sampling will also be paired with daily visual/sensory observations for water quality characteristics including: algae growth, presence of foam, turbidity, colour, presence of oil, and odour.

22.11 Cumulative Impact Assessment (CIA)

The Cumulative Impact Assessment (CIA) takes into account the impact associated with the Project together with other projects within the Zone of Influence (ZoI) of the Project (see section 22.3). The list of projects examined to determine if there is potential for cumulative impacts with this Project are listed in appendix 3-1: CIA Screening Annex (see volume 2A). Each project has been considered on a case-by-case basis and either screened in or out for cumulative assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

No projects were screened in for cumulative impact assessment in this assessment as there was no potential for spatial or temporal for hydrology and flood risk.

22.12 Transboundary effects

The potential effects of the Project on hydrology and flood risk are considered to be of local extent. Therefore, there is no potential for significant transboundary effects on hydrology and flood risk from the Project upon the interests of the UK or other European Economic Area (EEA) States.

22.13 Interactions

A description of the likely interactions arising from the Project on hydrology and flood risk is provided in chapter 32: Interactions.

22.14 Summary of impacts, mitigation measures and residual effects

Information on hydrology within the Hydrology and Flood Risk Study Area was established from a combination of desk studies and site-specific surveys.

Table 22-27 presents a summary of the potential impacts, mitigation measures and residual effects in respect to hydrology and flood risk. The impacts assessed include:

- Potential obstruction and contamination of floodwaters from excavation works during flood events;
- Water quality impact to surface waters due to increased sediment discharge;
- Water quality impact to surface waters due to accidental spillages/discharge of chemicals/fuel;
- Potential obstruction to flow at watercourse crossings using open trench method; and
- Interference with sediment transport at watercourse crossings using open trench method.

Overall, it is concluded that there will be no significant effects arising from the Project during the construction phase.

No potential cumulative or transboundary impacts have been identified for the Project.

Table 22-27: Summary of potential environment effects, mitigation and monitoring during the construction phase.

Description of impact	Measures included in the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Potential obstruction and contamination of floodwaters from excavation works during flood events	Onshore substation to be located outside the 1% AEP and 0.1% AEP predicted flood extents. HDD crossing design at CP2 & CP4. Cable installation at CP1 above the culvert within the N33 carriageway. HDD crossing design at CP7 & CP8.	Negligible, small adverse	Medium to Very High	Imperceptible, moderate/slight	None	Imperceptible moderate/slight	None
Water quality impact to surface waters due to increased sediments discharge	The contractor will adhere to the recommended measures prior to commencing construction works on site to mitigate increased sediment discharge to adjacent watercourses during excavation works.	Small adverse	Medium to Very High	Imperceptible	None	Imperceptible	Water Quality monitoring twice monthly at the onshore substation and cable crossing locations during the construction phase when rainfall results in any discharge from the site or when discharging from a silt control structure. Monthly sampling will be adequate during times when there is no rainfall/site discharge.
Water quality impact to surface waters due to accidental spillages of chemicals/ fuel	The contractor will adhere to the recommended measures prior to commencing construction works on site to mitigate against accidental chemical/ fuel discharge to adjacent watercourses.	Small adverse	Medium to Very High	Imperceptible	None	Imperceptible	Water Quality Sampling on a bimonthly basis at the onshore substation and cable crossing locations when rainfall results in any discharge from the site or from a control structure. If oils and grease are visually evident, a sample will be forwarded to an accredited laboratory for analysis. Monthly sampling will be adequate during times when there is no rainfall/site discharge.
Potential obstruction to flow at watercourse crossings using open trench method	The stream bed to reinstated with original or similar material under the supervision of an aquatic ecologist.	Small Adverse	Medium	Slight	None	Slight	None
Interference with sediment transport at watercourse crossings using open trench method		Small Adverse	Low	Imperceptible	None	Slight	None

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