Environmental Impact
Assessment Report

NISA

North Irish Sea Array

Volume 10: Appendices (Onshore)

Appendix 22.1
Flood Risk Assessment

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Appendices

1. Introduction

1.1 Scope of Assessment

North Irish Sea Array Offshore Windfarm Ltd (the Developer) is proposing to develop the North Irish Sea Array (NISA) Offshore Wind Farm (hereafter referred to as the proposed development). The proposed development is an offshore wind farm located off the east coast from counties Dublin, Meath and Louth. The proposed development is comprised of both onshore and offshore infrastructure. The location of the proposed development is illustrated in Figure 22.1 in volume 7 of the Environmental Impact Assessment Report (EIAR), also added in Appendix A of this document.

This report sets out the analysis and findings of a site-specific Flood Risk Assessment (FRA), which will be included as an appendix of the EIAR, to support the planning application for the proposed development. This FRA assesses the risk of flooding to and from the onshore infrastructure of the proposed development, as flood risk assessment is not applicable to the offshore infrastructure. The FRA includes the following:

- Identification and confirmation of the sources of flooding which may affect the proposed development, and/or be affected by the development
- Qualitative assessment of the risk of flooding to the proposed development and/or to adjacent areas because of the proposed development
- Identification of possible measures which could mitigate the flood risk to acceptable levels

1.2 Summary of Data Sources

Data relating to flood risk relevant to the proposed development boundary and adjacent areas has been obtained from the following sources:

- Eastern Catchment Flood Risk Assessment and Management Hydrologic and Hydraulics Reports for Unit of Management (UoM) 07 and predictive flood mapping
- Eastern Catchment Flood Risk Management Plan
- Fingal East Meath Flood Risk Assessment and Management Study (FEM-FRAMS) Hydrology and Hydraulics Reports
- Strategic Flood Risk Assessment (SRFA) – Louth County Development Plan (CDP) 2021-2027
- Flood Risk Assessment and Management Plan for the Meath CDP 2021-2027 – SFRA report
- SFRA for the Fingal Development Plan 2023-2029
- National Flood Hazard Mapping produced by the OPW
- Irish Coastal Wave and Water level modelling Study (ICWWS) by the OPW
- Topographical Survey of the proposed development carried out in September 2022 by Paul Corrigan & Associates (PCA); and
- Proposed Development Planning Application Drawings

This assessment should be read in conjunction with the EIAR. In particular, the following documents are referenced:

- Volume 2, Chapter 7 - Onshore Description of Development
- Volume 2, Chapter 9 - Onshore Construction Strategy
- Volume 4, Chapter 22 - Water

- Volume 4, Chapter 21: Land, Soils, Geology and Hydrogeology; and
- Volume 7, Figures

1.3 Proposed Development

The proposed development is a combination of offshore infrastructure and onshore infrastructure, as depicted in schematic format in Image 1.1. The interface between onshore and offshore infrastructure is delineated by the high-water mark (HWM) as defined by Ordnance Survey Ireland mapping. For the purposes of this FRA, only the proposed development above the HWM (the onshore infrastructure) needs to be assessed.

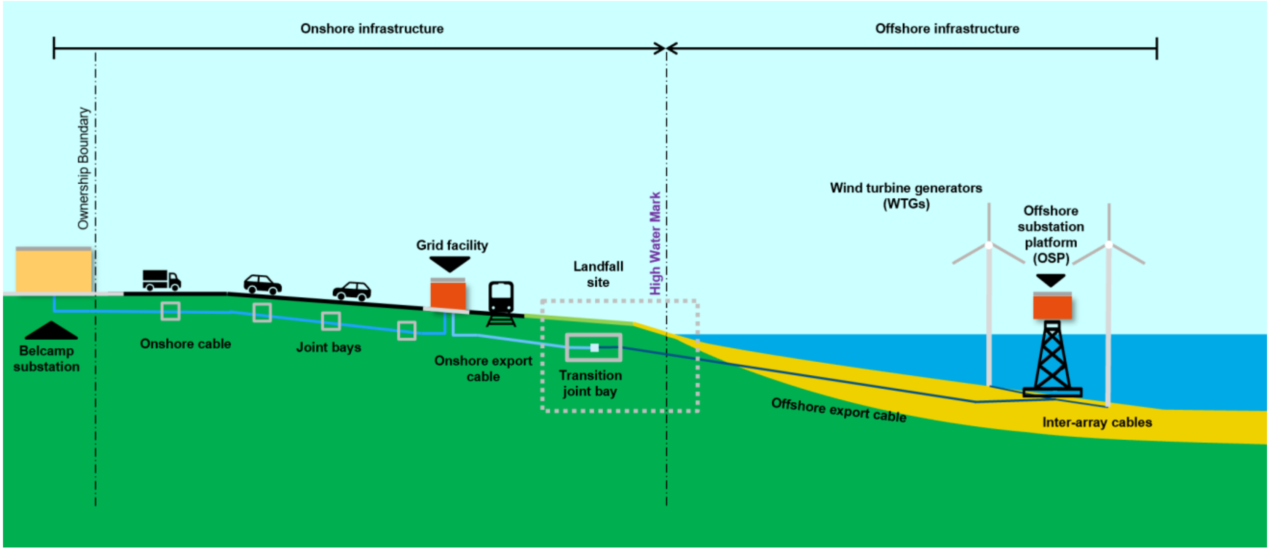


Image 1.1: Outline project infrastructure

This FRA references figures which accompany Chapter 22 - Water (22.1-22.3) and which are presented in A3 format in Volume 7 of the EIAR. For ease to the reader, this FRA has replicated the same figures (22.1-22.3) in A4 format in Appendix A. The onshore infrastructure and any associated construction works will be located within the proposed development boundary. Figure 22.1 shows the proposed development boundary onshore and its location in north Co. Dublin.

The onshore infrastructure of the proposed development will consist of the following:

- Landfall site: This is where the two offshore export cables from the offshore wind farm come ashore and transition to the onshore export cables at the transition joint bays (TJBs). The landfall site will be located in the townland of Bremore, north of Balbriggan, Dublin
- Grid facility: This will be comprised of two distinct substations, the compensation substation and the Bremore substation. When the onshore export cables enter the grid facility, they will be connected to the compensation substation. A connection will then be made between the compensation substation and the Bremore substation via an approximately 100m length of cable. Electricity will then leave the Bremore substation via the onshore cables. The grid facility site will also be located in the townland of Bremore, north of Balbriggan, Dublin
- Onshore cable route and grid connection: This will consist of an approximately 33-35km underground 220kV cable route which will connect the new grid facility to the grid connection point at an existing substation at Belcamp, Co. Dublin

Most of the onshore infrastructure (with the exception of the grid facility) will be located below ground. Access covers to below ground access pits, cable marker posts and a limited number of permanent access tracks will be visible following completion of the works, but the remainder of the lands required for cable construction will be reinstated to its original condition and ground level, following completion of the works. The grid facility contains infrastructures which is predominantly above ground and includes buildings, electrical equipment and access roads.

1.4 Structure of Report

This report will analyse the risk of flooding from fluvial, tidal, pluvial and groundwater sources to all parts of the onshore infrastructure for the permanent stage of the development. Furthermore, risk of flooding during the temporary stage (construction) has been assessed for the Landfall site and onshore cable route, as excavations are proposed, some of which interact with watercourses. Additionally, it includes considerations of the potential impact of the proposed infrastructure on flood risk mechanisms in the surrounding areas of the development. The report is divided into the following sections:

1. Introduction
2. Planning Context
3. Overview of Flood Risk Sources and Mechanisms
4. Landfall site: Assessment of flood risk and proposed mitigation measures for the landfall site
5. Grid facility site: Assessment of flood risk and proposed mitigation measures for the grid facility site
6. Onshore cable route: Assessment of flood risk and proposed mitigation measures for the onshore cable route
7. Conclusion

2. Planning Context

2.1 The Planning System and Flood Risk Management

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public Works jointly published a Guidance Document for Planning Authorities entitled 'The Planning System and Flood Risk Management', referred to hereafter as the guidelines.

The guidelines are issued under Section 28 of the Planning and Development Act 2000. Planning Authorities and An Bord Pleanála are therefore required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The guidelines require the planning system to avoid development in areas at risk of flooding, unless they can be justified on wider sustainability grounds, where the risk can be reduced or managed to an acceptable level.

They require the adoption of a Sequential Approach (to Flood Risk Management) of Avoidance, Reduction, Justification and Mitigation and they require the incorporation of Flood Risk Assessment into the process of making decisions on planning applications and planning appeals. Fundamental to the guidelines is the introduction of flood risk zoning and the classification of different types of development having regard to their vulnerability. The management of flood risk is now a key element of any development proposal in an area of potential flood risk and shall therefore be addressed as early as possible in the site master planning stage.

2.1.1 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types of flood zones defined in the guidelines as follows:

Table 1: Description of Flood Zones

Zone category	Description
Flood Zone A	Probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
Flood Zone B	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 year and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding).
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.1.2 Definition of Vulnerability Classes

The following table summarises the Vulnerability Classes defined in the guidelines and provides a sample of the most common type of development applicable to each.

Table 2: Vulnerability classes

Vulnerability Class	Land Uses and Types of Development which include;
Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water-based recreation facilities, amenity open spaces and outdoor sport and recreation facilities.

The guidelines allow consideration of uses not listed in the above table on their own merits. As explained in the guidelines, "*the classification of different land uses and types of development as highly vulnerable, less vulnerable and water-compatible is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings*". The vulnerability classification of the onshore infrastructure is not explicitly covered by the above table and has therefore been considered by the authors with respect to its ability to operate or not during a flood event and whether flooding can cause damage to the infrastructure.

2.1.3 Sequential Approach and Justification Test

The guidelines outline the sequential approach that is to be applied to all levels of the planning process.

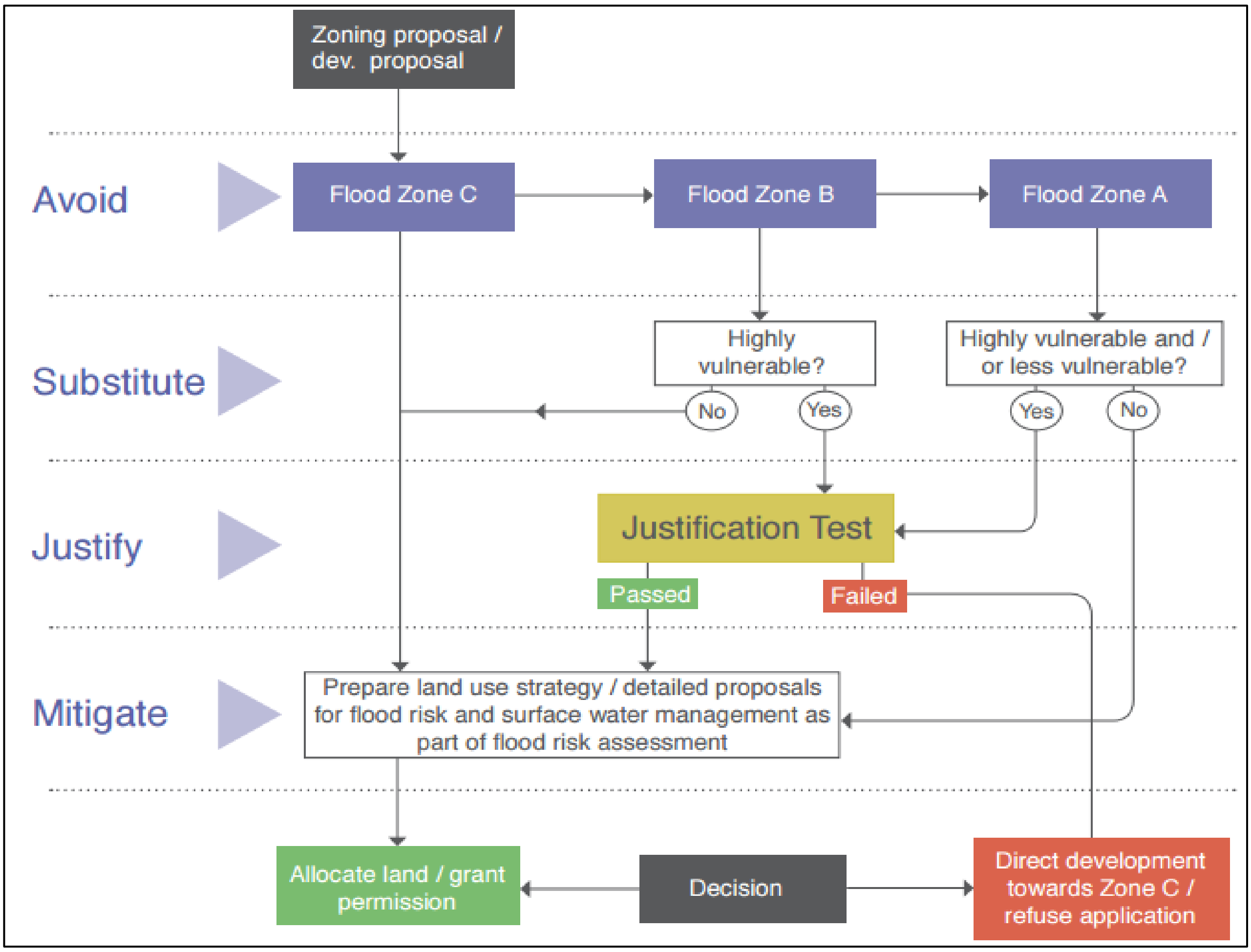


Image 2.1: Sequential approach (reproduced from the guidelines)

This approach should also be used in the design and layout of a development and the broad philosophy is shown in Image 2.1. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes:

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land

Table 3 illustrates the different types of Vulnerability Class appropriate to each zone and indicates where the Justification Test is required.

Table 3:Justification Test Matrix (The Planning System and Flood Risk Management - Guidelines for Planning Authorities)

Vulnerability	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

3. Overview of Flood Risk Sources and Mechanisms

The following potential sources of flood risk have been assessed for the proposed development:

- Fluvial flooding (river or stream) – Fluvial flooding can occur when excessive rainfall creates a situation where the flow capacity of the river is exceeded and bank overtopping occurs, flooding nearby areas
- Coastal/ Tidal flooding – Coastal/ Tidal flooding can occur when tides are high and/or during a storm surge, where an abnormal rise in water generated by high winds and low atmospheric pressure due to a storm which increases sea level above the astronomical tide. There could be a risk of coastal/tidal flooding from the Irish Sea
- Pluvial flooding/urban drainage – Pluvial flooding can occur when the capacity of the local surface water drainage network is exceeded during periods of intense rainfall and results in surface water ponding in low spots in the ground surface topography
- Groundwater flooding – Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

Past flood events, available predictive fluvial and tidal flood risk maps as well as other sources of information relevant to fluvial, tidal, pluvial, and groundwater flooding have been assessed.

4. Landfall Site

4.1 Description of the Proposed Development

The landfall site is where the two offshore export cables reach the shore and extends landward from the high water mark (HWM) as far as the grid facility. The site identified for landfall is located north of Balbriggan, immediately south of Bremore Point in the townland of Bremore in North County Dublin.

The location and main elements of the proposed development within the landfall site are shown on Image 4.1 below.

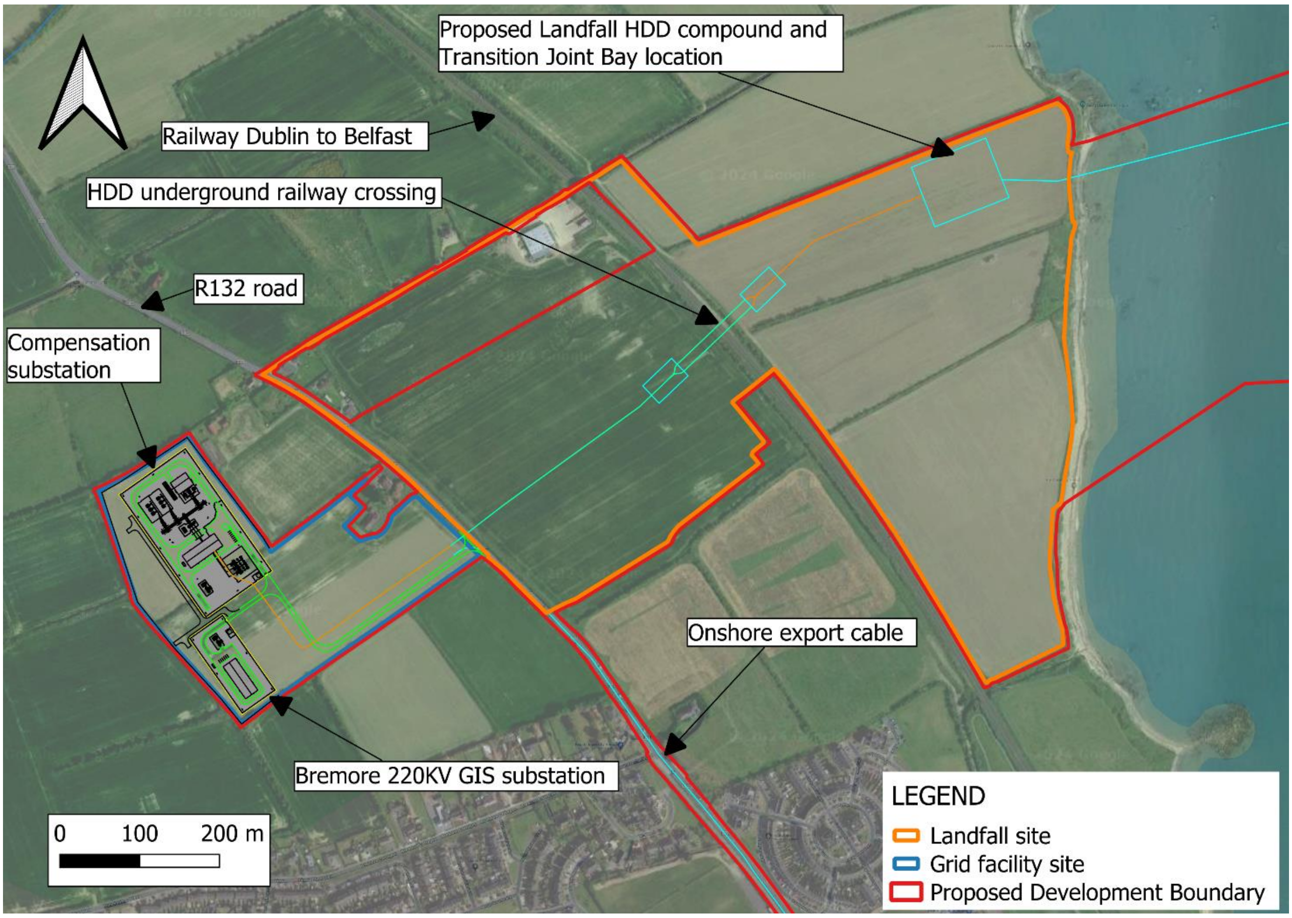


Image 4.1: Landfall site and grid facility site proposals

The landfall site consists of undulating agricultural fields. The site is bounded to the east by Bremore Beach and to the north, west and south by agricultural land with relatively few dwellings in the immediate vicinity. The Dublin to Belfast railway line passes through the agricultural fields in a north-south direction. The M1 motorway lies approximately 3km to the west of the landfall site. The R132 road lies immediately to the west of the landfall site.

4.1.1 Landfall Site – Overview of Permanent Infrastructure

The permanent infrastructure within the landfall site is not considered vulnerable to flooding. Infrastructure buried underground is designed to withstand water exposure. The access track, used for maintenance, will have appropriate slopes to facilitate water runoff and prevent ponding.

The landfall site permanent infrastructure consists of:

- Two transition joint bays (TJBs): this is where the two offshore export cables transition to the onshore export cables occur. The location of these is shown indicatively in Image 4.1

  The TJBs are each typically 20m in length, 5m in width and 2.5m in depth. Within each TJB, the three-core offshore export cable is split out and jointed to a single onshore export cable comprising of three single-core cables. The TJBs are underground concrete chambers, which, after cable installation, will be reinstated to the original surface, with marker posts and an access road being the only permanent above ground infrastructure

  The TJBs will be backfilled with sand, with the ducts being locally surrounded in concrete and suitable backfill material being provided immediately below the existing surface layers to be reinstated

  The electrical cables pass through the TJBs with smaller communications chambers provided adjacent to the TJBs to accommodate the fibre optic cables

Earth link boxes will also be provided adjacent to the TJBs with both the earth link boxes and communications chambers being finished with an access cover at ground level

- Access track: Permanent access to the landfall site for maintenance purposes will be from the junction of the R132 and Bell's Lane - where a bituminous bellmouth will be formed to facilitate safe vehicular access along Bell's Lane - then along Bell's Lane to a point just to the east of the Dublin to Belfast railway line. From this point, permanent access tracks will be constructed to the Railway HDD entry site and to the landfall TJBs

  The tracks will be approximately 5 m wide and will consist of crushed stone with a stone blinding surface layer. During the operational phase of the proposed development, traffic using the access track for maintenance is expected to be minimal, other than for maintenance purposes

- Onshore export cables: Two 220kV high voltage alternating current (HVAC) underground onshore export cables (comprising of three cores each) will connect the TJBs to the compensation substation within the grid facility

  The onshore export cable route commences at the TJBs with the cables routed through private lands including an underground HDD crossing of the Dublin-Belfast railway line and an open cut trench crossing of the R132 to connect to the compensation substation within the grid facility. This section of the cable route, from the TJBs to the compensation substation is approximately 1km to 1.5km long, depending on the final landfall and TJBs location

  Each cable is normally installed within ducts, in either flat or trefoil formation

4.2 Proposed Construction Methodology

The proposed construction methodologies of the various elements are set out below.

4.2.1 Horizontal Directional Drilling

Horizontal Directional Drilling (HDD) is the method of underground cable installation proposed at the land-sea interface for the proposed development (offshore export cable) and for the crossing of the Dublin-Belfast railway line at the landfall site.

HDD generally comprises of drilling a bore underground between two points, into which an electrical cable can be installed, without needing to excavate an open trench along the route. To achieve this, a drill rig drills from an onshore entry pit, toward the offshore exit site (reception pit) of the HDD.

To do so, the contractor will set up a HDD compound within an agricultural field on the landward side of the coastline (i.e. above the HWM). It will be located at least 50m from the edge of the sea hills/cliffs. Within this HDD contractor compound the contractor will excavate an entry pit to allow the HDD drilling rig to commence drilling at an appropriate cable burial depth. The HDD entry pit will be approximately 2.5m long x 1m wide x 1m deep.

A separate HDD compound will be located on either side of the railway line to facilitate the rail line HDD.

4.2.2 Open-Cut Trenching

Open-cut trenching is the method of underground cable installation proposed to be used from the two Transition Joint Bays (TJBs) to the grid facility, including the R132 road crossing.

Open-cut trenching involves excavating a trench approximately 2 m wide and 1.4 m deep. This excavation is designed to accommodate buried ducts while also providing additional width for working space or a trench box, which serves to support the excavation and prevent collapse. The process begins with the removal of topsoil, followed by the use of tracked excavators to dig the cable trench. The excavated subsoil is temporarily stored, and the cable ducts are subsequently installed. Finally, the trench is backfilled to complete the process.

4.2.3 Transition Joint Bays

The two Transition Joint Bays (TJBs) will comprise a buried concrete chamber, typically 20m long x 5m wide x 2.5m deep. The chambers will be constructed within an excavated pit, approximately 2.5m deep. The sides of the excavations for the TJBs will be profiled to a safe angle of repose or safely shored using trench support or sheet piling. The TJBs walls will be constructed using reinforced concrete, potentially pre-cast, and the floor of each will be concrete lined to provide a flat, clean working environment. The TJBs may be constructed prior to, or in tandem with, the HDD works in order to minimise construction delays and reduce the length of time for the offshore export cable pull in works.

The area around the TJBs will be backfilled with the excavated material upon completion of the jointing works, but permanent access will be required to the earth link boxes during the operational lifetime of the proposed development for maintenance purposes. In addition to the earth link boxes, there will be a requirement for a separate small communications chamber that will house jointing of the fibre optic cables.

After installation and reinstatement of the onshore TJBs, the only visible above ground equipment will be manhole covers to allow access to the earth link boxes and communication chambers. There will be four manhole covers which, where possible, will be positioned close to field boundaries.

The access track to the TJBs for construction will be maintained for permanent access during the operational phase.

4.3 Site Description

4.3.1 Site Topography

Topographic information depicting the existing ground levels across the site is presented in Image 4.2 below with levels and contours shown as mOD to Malin Head datum. This image has been created using the information obtained from the topographic survey that was carried out in September 2022 by Paul Corrigan & Associates (PCA).

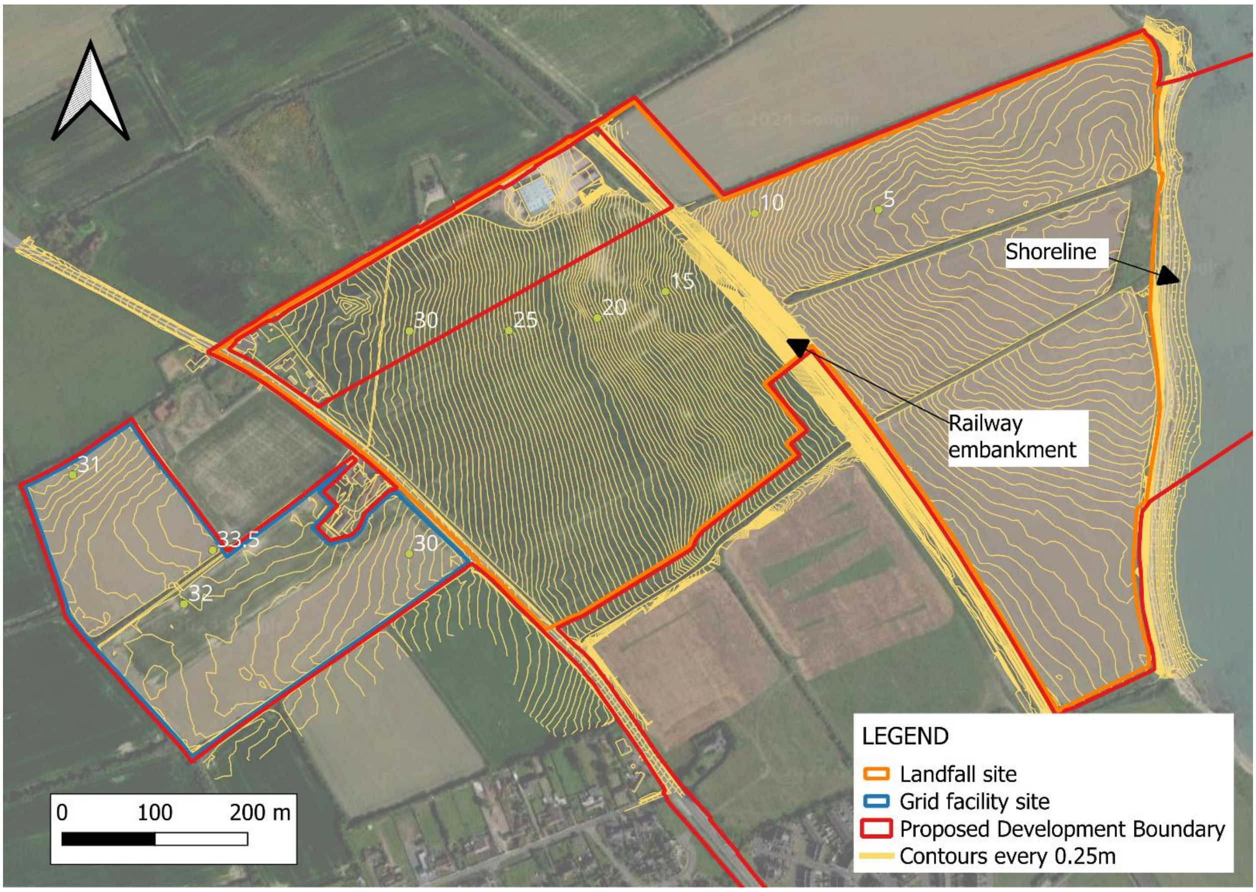


Image 4.2: Landfall site and grid facility indicative topography

The overall topography at the landfall site descends from northwest to southeast, failing towards the coastline. On the western side of the Dublin to Belfast railway line, ground elevations vary between 12mOD and 33 mOD. To the east of the railway line, where the two Transition Joint Bays (TJBs) will be, ground levels range from 3.7mOD to 10mOD approximately.

4.4 Past Flood Events

Records of past fluvial, tidal, and pluvial floods were obtained from the OPW National Flood Hazard Mapping website. There are no recorded flood events within or reasonably adjacent to the landfall site.

4.5 Assessment of Existing Flood Risk

4.5.1 Overview

During the construction phase of the landfall site, there is a potential vulnerability to flooding. This vulnerability arises when laying cables or constructing Transition Joint Bays (TJBs) chambers within excavated trenches or pits. The accumulation of water in the excavated areas can also present threat to life for personnel. This risk has been considered below in the context of each source of potential flood risk and the various elements to be constructed and their construction methodology.

4.5.2 Fluvial Flood Risk

No streams or rivers cross the landfall site, as illustrated in Figure 22.2 (1). The closest river water body identified is the Flemingtown stream which is located 500 meters northwest of the landfall site. This is a first order stream with a very small catchment area. The landfall site is approximately 6m higher than the waterbody, and therefore it is highly unlikely that the stream will impose a risk of flooding to the site even in the most extreme events.

The stream has not been modelled by the CFRAMS, as it was considered too small to justify detailed modelling given the low likely of significant flooding that could arise and the absence of any significant risk receptors in its vicinity.

Therefore, the landfall site is considered to be at a very low risk of fluvial flooding.

4.5.3 Coastal Flood Risk

The coastal map viewer on floodinfo.ie presents National Coastal Extreme Water Level Estimation Points around the coast. These points provide an estimate of extreme water levels for present day sea levels, and different flood events, as summarised in Table 4 below.

Table 4: North East Point NE11 – Water Level (mOD OSGM15 in meters) (www.floodinfo.ie)

AEP	Water Level (Present Day)
0.5%	3.43
1%	3.6

These levels are then used to create the coastal flooding map presented in Image 4.3 below.

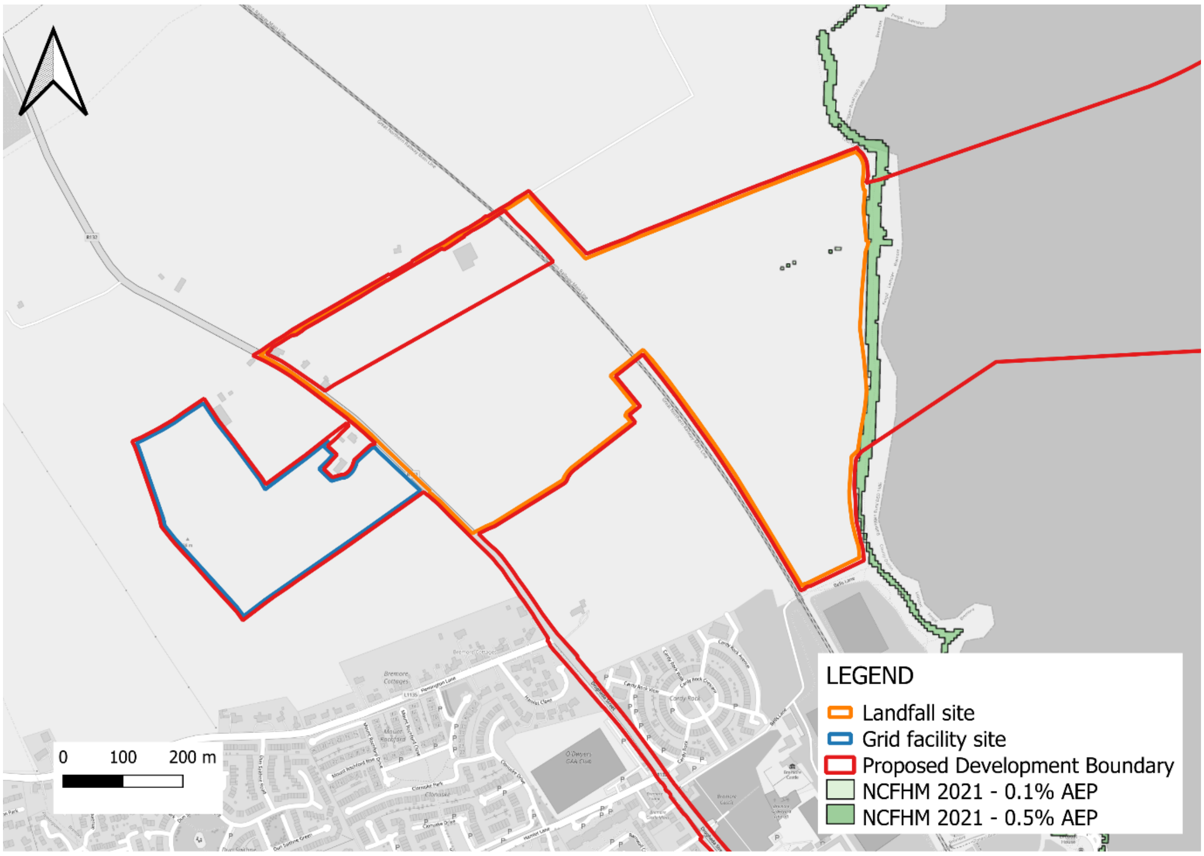


Image 4.3: National Coastal Flood Hazard Mapping 2021 – Landfall site

As outlined in section 4.1.1, the ground levels in the landfall site (where infrastructure is planned), range from 3.7mOD to 10mOD. Due to the existing cliff along the coastline, the landfall site is then naturally protected from coastal flooding for events such as 0.5% AEP (Annual Exceedance Probability) and the 0.1% AEP.

4.5.4 Pluvial Flood Risk

To assess the risk of pluvial flooding to the development, the existing topography included in Image 4.2 has been reviewed to identify any localised ground depressions within the site where water might accumulate.

As described in section 4.3.1, the ground generally slopes from northwest to southeast, leaning towards the coastline, and thus will facilitate water runoff in cases of intense rainfall. A small depression east of the Dublin to Belfast railway line, within the development boundary has been identified. If the intensity of the rain is higher than the soil's infiltration rate, some pluvial flooding could be expected to occur in this area.

The risk of pluvial flooding for the permanent state of the TJBs can be considered low, as the infrastructure will be buried underground and designed to withstand water exposure.

There is a risk of pluvial flooding during the construction phase of the TJBs as they will be constructed within an excavated pit, approximately 2.5m deep, which could be inundated during an intense rainfall event, presenting a threat to life for personnel and damage to infrastructure.

From a review of the topography, it is clear that the landfall site is generally somewhat higher than the adjacent agricultural fields, indicating a low likelihood of overland flows into the site from adjoining lands.

The risk of any significant pluvial flooding is considered low and shall be mitigated during construction with appropriate measures such as de-watering and pumping, as explained in Section 4.6.

4.5.5 Groundwater Flood Risk

To assess the risk of groundwater flooding to the development, the Geological Survey Ireland (GSI), groundwater flooding data maps and groundwater resources (Aquifers) maps were reviewed (GSI, 2019).

Groundwater flooding maps do not show any extent of groundwater flooding within this development.

Groundwater resources (Aquifers) maps show the potential of areas in Ireland to provide water supplies and this information can be used as an indication of the risk of groundwater flooding. Groundwater flooding is generally associated with regionally important aquifers, but not locally important aquifers.

In the locally important aquifers, the groundwater levels are generally relatively shallow (often following topography) and bedrock has a limited capacity to accept more rainwater falling on the land. In this geology, once the bedrock aquifer is "full", the excess rainfall flows across the ground surface as water runoff. This is not considered groundwater flooding, but purely surface water runoff.

In regionally important aquifers, the network of fractures and faults which can carry the groundwater is much bigger and can carry water at greater distance. The groundwater levels may not follow the topography and they show greater fluctuation. When water falls on the ground surface and enters into the bedrock, the bedrock has more open fractures and faults to accept the water. This causes the groundwater levels to rise across an area. Where there is a depression or a low lying area, the groundwater can emerge and cause flooding.

Since the landfall site of the proposed development is not underlain by any regionally important aquifer, and given that the GSI groundwater flood maps do not indicate any groundwater flood extents at the site, it is considered that the risk of groundwater flooding in the landfall site is low.

4.5.6 Flood Risk Summary

The risk of flooding to the landfall site of the proposed development from fluvial, tidal, pluvial, and groundwater sources has been assessed and is summarised as follows:

- The site is at low risk of fluvial flooding. There are no streams or rivers either crossing it or nearby, that could potentially cause flooding to the site. Therefore, the risk of fluvial flooding is considered extremely low and it is evident that the site lies within Flood Zone C
- The ICWWS flood map indicates that the site is located outside the 0.5% AEP coastal flood extent (1 in 200 year event) and the 0.1% AEP coastal flood extent (1 in 1000 year event). Therefore, the risk of tidal flooding is considered to be low and it is evident that the site is located within Flood Zone C
- The existing topography shows a small land depression east of the Dublin to Belfast railway line, which could pose a risk of pluvial flooding during the construction phase of the TJBs. Measures shall be taken to mitigate the risk of pluvial flooding, as described in section 4.6. The risk of pluvial flooding for the permanent state of the TJBs can be considered low as they will be buried underground and designed to withstand water exposure
- The GSI dataset does not show any predicted groundwater flood extent within the development and there are no regionally important aquifers located underneath the development site. Accordingly, the risk of groundwater flooding is considered to be low

4.6 Proposed mitigation measures

The following section outlines mitigation measures which will be used as appropriate to manage flood risk to the proposed development, either by reducing the incidence of flooding both to the development and as a result of it and/or by making the development more resistant/resilient to the effects of flooding. Note that further mitigation measures relating to water and hydrology are contained in chapter 22 (Water) of the EIAR.

4.6.1 During Construction (Temporary)

- Existing drains affected by the works, will be maintained until completion of the works, and restored to their original condition. Where required, local drainage will be temporarily diverted
- Dewatering, if required during excavation works, will be designed such that water will be adequately treated prior to discharge
- Weather warning monitoring and preparedness to ensure timely communication with workers within the site and to remove all the equipment that could be damaged

- The contractor will be required to develop and adhere to an appropriate site-specific Flood Risk Management Plan to incorporate the above mitigation measures to manage flood risk during construction

4.6.2 During Operation (Permanent)

There is no above ground infrastructure within the landfall site. The infrastructure is installed underground and the surface will be reinstated to original form and levels, and as such flooding will not impact the development and the development will have no impact to flooding or surface water runoff.

The permanent access track is made out of crushed stone which will allow surface water infiltration and as such no new surface water drainage is required.

4.7 Application of the Flood Risk Management Guidelines

4.7.1 Sequential Approach

The vulnerability classification of the onshore infrastructure is not explicitly covered by the Guidelines, as explained in Section 2.1.2. The infrastructure at the landfall site includes the TJB and onshore export cables, which will be installed underground. If flooding was to occur, these would not be damaged and operation would not be impacted. There will be no long-term implications for recovery following a flood event. The infrastructure is therefore considered “water compatible" development. Access tracks to the site are only used for maintenance and not for regular traffic. This is also considered “water compatible” development.

Based on the analysis undertaken in section 4.5, the landfall site is within Flood Zone C.

Therefore, the proposed development is considered appropriate within this site and therefore a Justification Test is not required.

5. Grid Facility

5.1 Description of Proposed Development

The grid facility is where the electricity generated by the offshore turbines is processed so that it is suitable to connect into the national electricity transmission system.

The grid facility will be located across two fields currently under agricultural use, in the townland of Bremore, Co. Dublin, as shown in Image 4.1.

There are a number of houses in the vicinity of the grid facility, with two residential properties immediately east of the grid facility and another residential property located approximately 100m north-east of the grid facility. Residential properties are also located along Bremore Cottages and Dun Saithne View roads to the south, with the closest of these being approximately 150m from the grid facility site.

5.1.1 Grid Facility Infrastructure Overview

The grid facility will be comprised of two separate elements as follows:

- The compensation substation will be contained within a rectangular compound approximately 100m by 190m
- The Bremore substation will be contained within a smaller adjacent rectangular compound approximately 50m by 115m

Both the compensation and Bremore substation compounds will include a building of approximately 17m in height (plus 3m lightning rods).

The compensation substation receives the onshore export cables originating from the landfall site. Two cables then connect the compensation substation to the Bremore substation before the onshore cable (as described in Chapter 7 – Description of the Proposed Development – Onshore, Section 7.5) exits the Bremore substation.

The proposed grid facility layout is shown below in Image 5.1

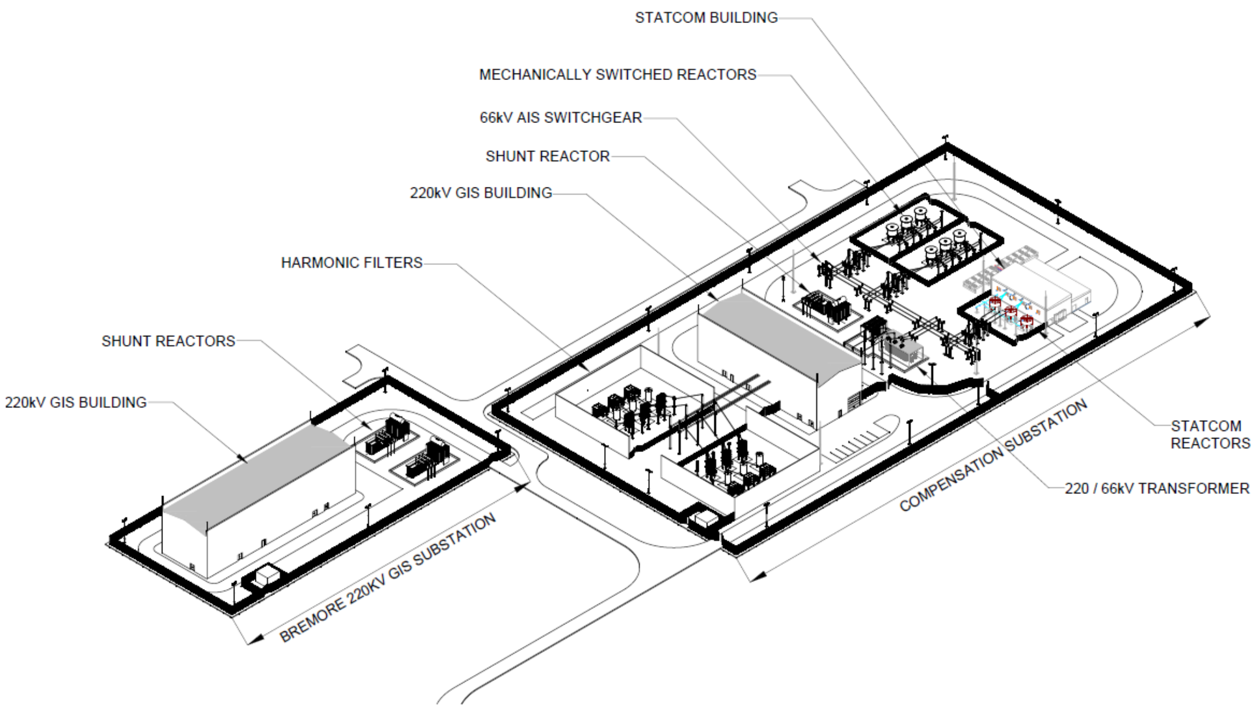


Image 5.1: Proposed grid facility layout, with the Bremore substation on the left of the image and the compensation substation on the right.

5.2 Site Description

5.2.1 Site Topography

The topographic survey outlined in 4.3.1 encompasses the site of the proposed grid facility. As shown in Image 4.2, ground levels within the facility are predominantly flat, averaging 32 mOD. The central northern section of the grid facility exhibits the highest elevations, reaching approximately 33.5 mOD , with a gradual slope extending towards the northwest, leading to agricultural land, and the southeast, eventually descending to the R132 road. Throughout the entire area, the lowest ground levels remain above 30 mOD.

5.3 Past Flood Events

Records of past fluvial, tidal, and pluvial floods were obtained from the OPW National Flood Hazard Mapping website. There are no recorded flood events within or reasonably adjacent to the grid facility site.

5.4 Assessment of Existing Flood Risk

5.4.1 Overview

As the grid facility contains buildings and other critical above ground infrastructure elements, flood risk needs to be considered in the context of both the constriction stage, but more importantly, the operational stage where it will be vital that flood risk in minimised. The location of the facility and its layout have been informed by the consideration of flood risk as described below with respect to the various potential sources of flood risk.

5.4.2 Fluvial Flood Risk

The conclusions drawn in section 4.5.1 in relation to the landfall site are equally applicable to the adjacent grid facility. The site is at low risk of fluvial flooding. There are no streams or rivers either crossing it or nearby, which could potentially cause flooding to the site. Therefore, the grid facility is considered to be at low risk of fluvial flooding.

5.4.3 Pluvial Flood Risk

To assess the risk of pluvial flooding to the development, the existing topography included in Image 4.2 has been reviewed to identify any ground depressions within the site where water might accumulate.

As described in section 5.2.1, the central northern section of the grid facility exhibits the highest elevations and there is a gradual slope extending towards the northwest and southeast, leading towards agricultural land and the R132 road respectively. No significant local ground depressions have been identified.

Similar to the observations made in the landfall site, it is evident that the grid facility is higher than the adjacent agricultural fields, indicating a low likelihood of overland flows onto the site from the adjoining lands.

The new grid facility will introduce an increase in impermeable areas, which if not mitigated, could result in increased rates of runoff to downstream areas. This will be managed by the construction of a new dedicated surface water drainage network and attenuation system, as detailed in section 5.5.1. Accordingly, the risk of pluvial flooding within the site is considered to be low.

In the event of a heavy rainfall scenario, any excess runoff not captured by the new dedicated water network is likely to escape away from grid facility due to the local topography. This water may either infiltrate the agricultural land surrounding the site or be intercepted by the R132 road drainage system.

Nearby houses are expected to remain unaffected by runoff from the grid facility. The residential dwellings immediately east of the grid facility sit slightly above ground level, reducing the risk of impact. The house located north-west of the facility and the Bremore cottages south of the facility benefit from a 300-meter and a 200-meter buffer of agricultural land respectively, making it improbable that they will be affected by runoff.

5.4.4 Groundwater Flood Risk

Since the grid facility is not situated above a regionally significant aquifer, and as groundwater flooding maps from the Geological Survey Ireland (GSI) do not show any groundwater flood extents within the grid facility, it is considered that there is low risk of groundwater flooding at the site.

5.4.5 Flood Risk Summary

The risk of flooding to the grid facility area of the proposed development from fluvial, tidal, pluvial, and groundwater sources has been assessed and is summarised as follows:

- The site has an extremely low risk of fluvial flooding as there are no streams or rivers either crossing it or nearby, which could potentially cause flooding in the area. Accordingly, the site is considered to lie within Flood Zone C
- The ICWWS flood map indicates that the site is located outside the 0.5% coastal flood extent (1 in 200 year event) and the 0.1% AEP coastal flood extent (1 in 1000 year event), and therefore the site is located within Flood Zone C
- The existing topography does not show any significant land depression or risk of overland flows into the grid facility from outside sources and all surface water runoff generated on site will be managed by a new dedicated surface water drainage network and attenuation system, as detailed in section 5.5.2. Therefore, there is a low risk of pluvial flooding within this site
- The GSI dataset does not indicate any groundwater flooding within the development and, as there are no regionally important aquifers located underneath the development site, the risk of groundwater flooding is considered to be low

5.5 Proposed mitigation measures

5.5.1 During Construction (Temporary)

Typical protection measures will be applied by the contractor to protect from surface water runoff during construction, similar to those described above for the landfall site.

5.5.2 During Operation (Permanent)

Surface water runoff at the site will be managed through a dedicated surface water drainage network, with runoff from impermeable areas collected by swales and filter drains before discharging into buried carrier pipes. Rainwater from buildings and equipment slabs will also be directed into the carrier pipe network. Most runoff will discharge to an existing ditch to the northwest, while a small portion near the entrance will be conveyed to the roadside drainage network. Operational runoff will be controlled to match existing rates using a flow control device and an attenuation basin will store and attenuate excess runoff. The attenuation basin is designed to attenuate a 1 in 100 year rainfall event, limiting runoff to existing greenfield rates. Water quality will be maintained through a treatment train approach, including filter drains, a hydrocarbon interceptor, and concrete bunds for fuel tanks to prevent spillages from entering the water network. For details on the surface water drainage measures within the grid facility, refer to Chapter 7 – Description of the Proposed Development – Onshore.

5.6 Application of the Flood Risk Management Guidelines

5.6.1 Sequential Approach

Because of the above ground buildings and other critical above ground electrical assets which could be damaged following a flood event, the proposed development within the grid facility is considered essential infrastructure "highly vulnerable" to flooding, as per the vulnerability classification in Table 2.

As the grid facility is highly vulnerable to flooding, the sequential approach has been followed and the site is located in Flood Zone C, area at low risk of flooding from rivers or the sea.

Therefore, whilst the proposed development is classified as a "Highly vulnerable development", as it is located within Flood Zone C, the proposed development is considered appropriate within this site and a Justification Test is not required.

6. Onshore Cable Route

6.1 Description of Development Proposals

The onshore cable route runs for approximately 33-35km between the proposed grid facility just north of Balbriggan, to an existing electrical substation at Belcamp on the northern outskirts of Dublin. The majority of the route – approximately 29km out of the 33km – is contained within the footprint of existing roads including the R132, the R106 and other local roads. Towards the southern end of the cable route, two options for the route are included (one along the R107 and one via the R124), the alternative route providing flexibility to ensure integration with other existing utilities infrastructure including the planned route for electrical cables associated with the Metrolink project. The route via the R124 would add approximately 2km to the 33km length quoted above.

While the onshore cable route is mainly proposed within public roads, there are several locations where the route deviates offline from the road and crosses private lands. It should be noted that the crossing descriptions contained within this FRA are aligned with terminology and definitions contained in the EIAR. References to 'inline' and 'offline' in this context refer to the cable route being in-road and off-road, respectively.

Over its approximately 33-35km length, the onshore cable must cross 24 watercourses at 25 locations. The onshore cable route boundary and watercourses are shown in Figure 22.1 and Figure 22.2 of the EIAR package, and are also included in Appendix A.

Once construction is completed, the surfacing and levels of the road/ground will be reinstated to their original form and level. The only visible above ground structures along the onshore cable route will be small marker posts to indicate the location of the cables (at field boundaries, watercourse crossing and road crossings), manhole covers associated with joint bays, link boxes and communications chambers. A number of temporary access roads (required for the construction phase) will also be retained, to enable access to joint bays during the operational phase.

The onshore cable from the grid facility will comprise of six core cables placed in buried underground ducts. The cable will be supplied on large reels, with 300m to 800m of cable being carried on a single reel. Joint bays will be required to be installed along the cable route to facilitate cable pulling through pre-installed ducts. The joint bay is a precast concrete chamber placed, or blockwork chamber constructed, in the ground where cable sections are jointed together.

Permanent access tracks will be required for some crossings located outside the road corridor on private lands (offline crossings) to allow access for maintenance to the joint bays. They will be approximately 4.5m wide and constructed of crushed stone.

6.2 Proposed Construction Methodology

As the onshore cable will be underground in its permanent state and is not anticipated to alter the flood mechanism or cause any changes to existing flood risk, it is important to consider the impact its construction might have in terms of flood risk.

An open cut trench method will generally be used to construct the cable route along existing roads and in agricultural lands. A typical construction sequence for duct installation would be as follows: A section of route (road) will be fenced-off, the road excavated, the ducts installed, and the trench backfilled with duct surround material to Eirgrid Specifications and selected backfill to TII Specifications each day. When the backfill is fully installed, the road base and wearing courses will then be reinstated over the completed trench. The surface reinstatement will extend beyond the width of the trench to finish at the centreline of the road in line with local authority requirements.

As noted above, the onshore cable route will cross 24 watercourses at 25 locations from the grid facility to the grid connection point at Belcamp. Each of these watercourses will be crossed using one of a number of construction methodologies with the final methodology at each location being determined prior to construction.

The below crossing methods have been considered for each watercourse crossing and, in some instances, this planning application has included for holding open the option of multiple crossing methods to allow some flexibility given uncertainty over ground conditions and underground utilities etc. A final decision will be chosen and utilised at the detailed design/construction stage. Where the option of multiple methods is retained, we have as part of this FRA, considered each applicable method at each of the individual crossing points. Further details on the construction methodology of the onshore cable can be found in the EIAR Chapter 9 Construction Strategy – Onshore.

The following general principles for each of the different Type and Method of crossing will be adhered to:

- *Crossing over existing bridge / culvert via open cut* (*In-road open cut trench*): Where sufficient trench depth is available above the bridge or culvert of the watercourse, open cut trenching will be used to lay the cables over the bridge/culvert. On occasion, reduced depth of cover, or in isolated, suitable locations, minor localised reprofiling of the road surface to achieve the required cover, may be considered for a shallow trench across a bridge or culvert structure in accordance with Eirgrid requirements. This will be the construction method for most of the watercourse crossings at existing bridges and culverts and in such cases, there will be no direct interaction with the watercourse
- *Crossing under existing culvert via open cu*t: Where it is an option, given the size and structure of the culvert, and where sufficient depth of cover is not available above the culvert, a modified open cut trenching will be used to allow the crossing to be made under the existing culvert

The culvert at the Greenfields Stream watercourse crossing (WX19) is an exception. As it is very small (1m diameter), it is proposed to install the cable duct underneath the culvert by exposing the sides of the culvert through conventional excavation on both sides, temporarily propping the underside of the culvert then excavating locally underneath the propped culvert and installing the duct. Once installed, the excavation will be backfilled (with lean mix concrete and/or self-compacting granular material), and reinstated to original levels

- *Horizontal Directional Drilling (HDD) Crossing*: At certain obstacles along the onshore cable route, duct installation will be undertaken by HDD either within the road corridor (inline HDD) or in private lands adjacent to the road (offline HDD). In the case of a watercourse crossing, this would require a HDD compound either side of the watercourse either within the road corridor (inline HDD) or in third party lands (offline HDD). The HDD length required may vary in length from 50m to 150m and will be at a sufficient depth to pass below existing buried services, riverbed, bridge foundations but above hard ground / solid geology
- *Offline Open Cut Trench:* At locations where the onshore cable route is required to cross a watercourse and the use of HDD is not possible, an open cut trench may be required across the river corridor. Two methodologies for same are proposed as follows
  – *With over-pump methodology :* For some smaller watercourse crossings, damming of the watercourse, together with over-pumping of the river flow would facilitate excavating a trench across the watercourse in the dry
  – *With Culvert/Flume Pipe Methodology:* An alternative to the over-pump methodology, and one which may be more applicable to larger watercourses, will be to locally divert the watercourse into a culverted or piped diversion to the side of the watercourse, thus again allowing construction in the dry

The in-road open cut trench method at bridge locations is the preferred option for most of the crossings, with the inline HDD as the second best option. These two options remove the need for a direct interaction with the watercourse and thus limit the impact during construction. Where the other methods are required, the details will need to be agreed with Inland Fisheries Ireland. Where an open cut excavation is required across a river channel, careful consideration will be needed to ensure that flood risk to the surrounding areas is not worsened. This is discussed further below with respect to each of the 25 watercourse crossings.

6.3 Past Flood Events

There is a historic record of flooding on the R132 from the Oberstown Stream (WX09) on 24/02/2020, as reported in the OPW Past flood event records (floodinfo.ie). No other past flood events are reported within the onshore cable route development, however there are several events reported at close vicinity to the route. These can be viewed on floodinfo.ie.

6.4 Assessment of Existing Flood Risk Along Cable Route

6.4.1 Fluvial Flood Risk

The risk of flooding from rivers across Ireland has been mapped by the CFRAM Studies completed on behalf of the OPW. The fluvial flood maps can be viewed in Figure 22.3 and Appendix A.

CFRAM Studies were undertaken where a potentially significant risk of flooding was identified, following a nationwide screening exercise. Some of the watercourses within the proposed development area have not been modelled as part of the CFRAM Studies. These watercourses are:

- Balrothery Stream (WX04)
- Courtlough Stream (WX08)
- Oberstown Stream (WX09)
- Aldrumman Stream (WX10); and

- Seapoint Stream (WX18)

The 6-inch historic maps have been reviewed at the locations where the route interacts with these five watercourses and their associated flood plains. No areas marked as areas prone to flooding interact with the cable route.

The majority of the onshore cable route and proposed development red line boundary is located outside of the fluvial flood extents areas mapped as part of the CFRAMS process, and thus are in areas with less than a 0.1% AEP probability of flooding occurring.

However, a review of the cable route against the CFRAMS flood maps indicates a number of discrete locations along the corridor of the cable route that are at risk of flooding from either the 1% AEP fluvial flooding (1 in 100 year event) or the 0.1% AEP fluvial flooding (1 in 1000 year event). These includes parts of the R132 in Glebe south, Turvey, Lissenhall, near the Fingallians GAA club, parts of the Estuary Road in Malahide, parts of Chapel Road, parts of the Hole in the Wall road, Balgriffin Park and small areas on the R139 in Belcamp. These areas and the associated probability of flooding are detailed in Table 5 and can be viewed in Figure 22.2 in Appendix A.

Table 5:Areas at risk of fluvial flooding, onshore cable route

Approximate Location (ITM X, ITM Y)	Length of road impacted (m)	Associated waterbody	Probability of flooding
R132 Glebe South (719615, 760945)	80m (two sections of 60m + 20m)	Knock Stream	0.1% AEP
R132 Turvey (719714, 750761)	280m	Turvey Stream	1% AEP
R132 Lissenhall (718655, 748075)	225m	Ward River	0.1% AEP
R132 Fingallians GAA roundabout (718523, 747665)	55m (30m + 25m)	Ward River	0.1% AEP
Estuary road Swords WWTP (718830, 747965)	300m	Ward River	1% AEP
Estuary road (large parts within proposed development boundary)	1,925m (225m + 1,700m)	Seapoint Stream and Greenfields Stream	1% AEP
Chapel Road (722384, 743046)	445m (65m + 380m)	Sluice Stream	1% AEP
Hole in the wall road (722285, 741676)	70m	Cuckoo Stream	1% AEP
Balgriffin Park (722053,741660)	230m	Cuckoo Stream	1% AEP
Hole in the wall road (722242,741456)	70m	Mayne Stream	1% AEP
R139 Belcamp (719227,741303)	800m	Mayne Streem	0.1% AEP

During the operational stage of the project, fluvial flooding will have no impact on the onshore cable route and associated infrastructure, as the infrastructure is largely below ground. Equally, the onshore cable route will not impact the existing flood risk or mechanisms once constructed. There is a limited number of permanent access tracks proposed at offline crossings. These are proposed to allow access to the offline cable route for maintenance. The tracks if not designed appropriately could alter flow paths or if elevated, impound flood waters, thus potentially increasing flood risk to adjacent properties. The design and construction of the tracks will be carefully detailed to prevent impoundment and other hydraulic changes. Such design and detailing considerations are discussed in Section 6.6.1.

During construction, the onshore cable will be constructed for the most part using open cut trench method. In areas prone to flooding, open trenches along the onshore cable route could become flow paths during a flood event.

Such new flow paths could potentially change the flood mechanism and could locally increase the risk of flooding to some areas if not properly mitigated. Mitigation measures are discussed in Section 6.6.1. Equally, a H&S risk could be introduced for workers working within these open cut trenches.

6.4.2 Coastal Flood Risk

The majority of the onshore cable route and proposed development red line boundary is located outside coastal and tidal flood risk, in areas with less than 0.1% AEP, with the exception of two locations as follows.

1. Approximately 2,250m (in three sections of 210m + 260m + 1,780m) of the route lies within the 0.5%AEP (1 in 200 year event) coastal extents originating from the Malahide Estuary
2. Approximately 310m of the route along Chapel road (Approx ITM location: 722407, 743037) lies within the 0.5%AEP (1 in 200 year event) coastal extents originating from the tidally influenced section of the Sluice river (discharging to Mayne Estuary)

These location and flood extents are shown in Image 6.1 and Image 6.2 below.

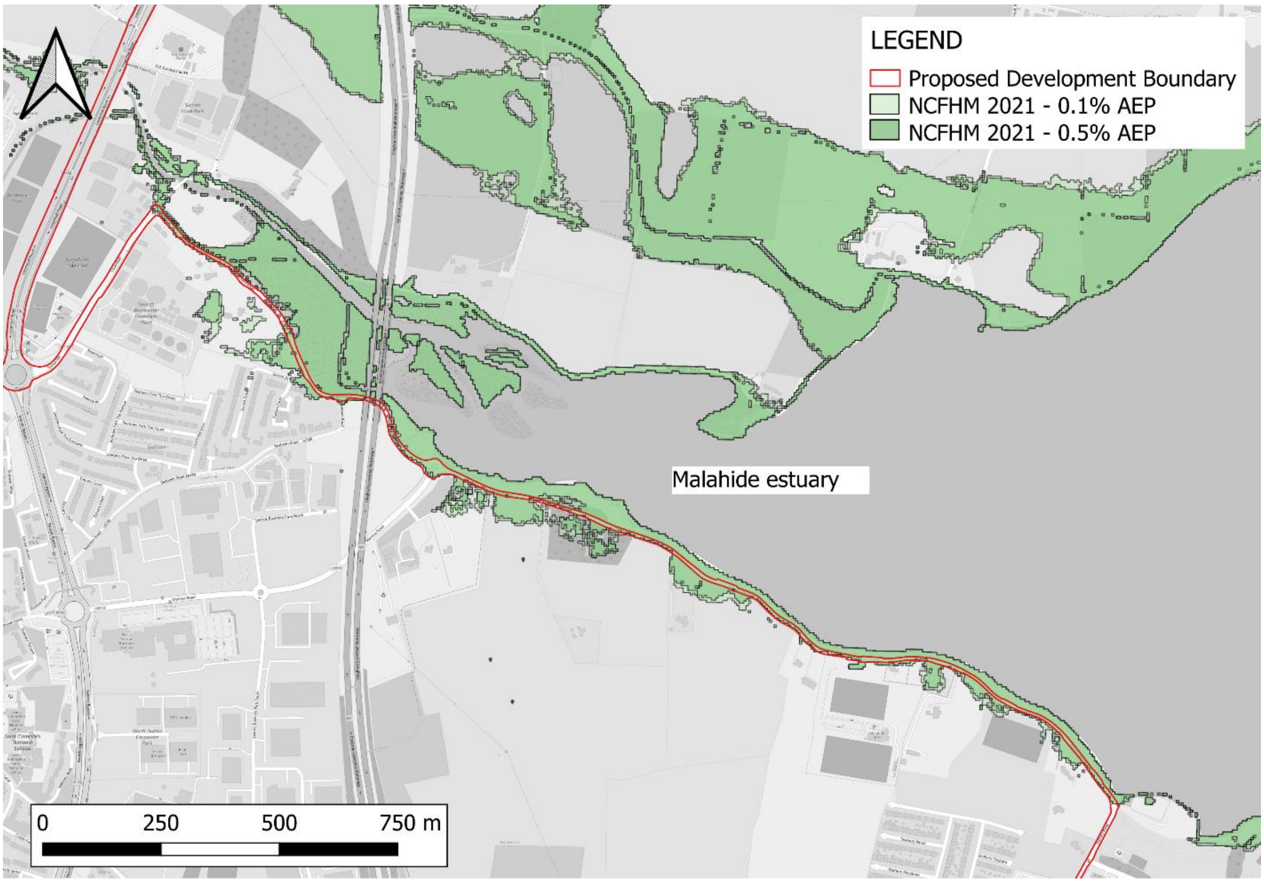


Image 6.1: National Coastal Flood Hazard Mapping 2021 – Malahide estuary

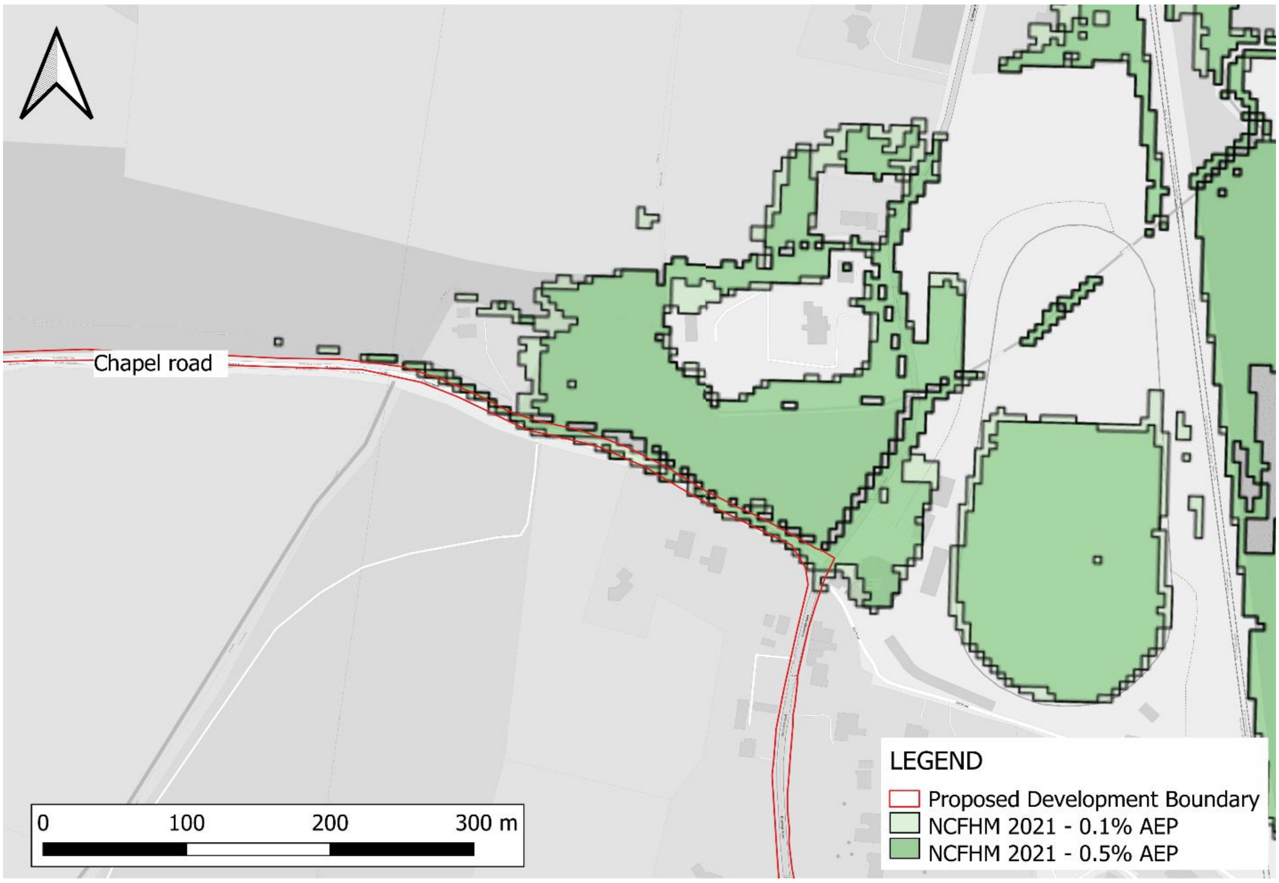


Image 6.2: National Coastal Flood Hazard Mapping 2021 – Chapel Road

During the operational stage of the project, coastal/tidal flooding will have no impact on the onshore cable route and associated infrastructure, as the infrastructure is below ground. None of the above locations propose option for offline construction methodology, and accordingly permanent access tracks will not be required. As such, the onshore cable route will not impact the flood mechanism once constructed. Flood risk during construction will need to be addressed in a similar fashion to the fluvial risk identified above.

6.4.3 Pluvial Flood Risk

Surface water runoff on the onshore cable route is not considered a significant issue, due to the existing road drainage as well as the nature of development (underground cables in ducts).

6.4.4 Groundwater Flood Risk

The onshore cable route is generally underlain only by Locally important aquifer with Bedrock which is moderately Productive in local zones, or Poor aquifers with Bedrock which is moderately unproductive except in local zones. There are no regionally important aquifers beneath the onshore cable route.

Groundwater flooding maps from the Geological Survey Ireland (GSI) do not indicate any groundwater flood extents along the route. Accordingly, groundwater flood risk is considered low.

6.4.5 Flood Risk Summary

The risk of flooding to the onshore cable route of the proposed development is summarised as follows:

- The majority of the route lies in areas at low risk of flooding (less than 0.1% AEP). However, near watercourses, there are parts of the route proposed at areas with medium to high risk of flooding. As such, the route lies within a combination of Flood Zones A, B and C
- Similarly, the majority of the route is at low risk of coastal/tidal flooding (less than 0.1% AEP). However, some extents of the route along Estuary Road and Chapel Road are at risk of coastal inundation during the 0.5%AEP from the Malahide estuary and tidal Sluice River respectively

- The GSI dataset does not show any groundwater flood extent within the development and there are no regionally important aquifers located underneath the development site. Therefore, the risk of groundwater flooding is considered to be low
- The onshore cable route is considered a ‘water compatible development’ and once constructed, flood risk will not impose risk to the infrastructure, and the infrastructure will not impact the existing flood risk and mechanisms. Therefore, the focus of the consideration of flood risk in relation to the cable route relates to the short-term impacts and mitigation required during the construction stage. This is discussed further below

6.5 Flood Risk associated with River Crossings

6.5.1 Overview of Watercourse Crossing Locations and Types

Table 6 below lists the 25 instances of crossings of watercourses by the onshore cable route. The watercourses, onshore cable route and crossings can be viewed in Figure 22.2 (also included in Appendix A). The proposed crossing methodology(s) are also listed below (including as relevant multiple methods in order of preference) for each watercourse crossing, with the **offline open cut crossings** and **offline HDD crossings** marked in bold.

Table 6: List of river or stream crossings and the approximate ITM reference coordinates at each crossing

Water Crossing Ref No.	Stream Name	Crossing ITM X Coordinate	Crossing ITM Y Coordinate	Crossing technique (in order of preference)
WX01	Bremore Stream	719677	764326	In-road Open Cut Trench
WX02	Bracken River	720017	763052	In-road Open Cut Trench Inline HDD
WX03	Knock Stream	719494	760779	In-road Open Cut Trench Inline HDD
WX04	Balrothery Stream	719105	760137	In-road Open Cut Trench Inline HDD
WX05	Balrickard Stream	718601	758553	In-road Open Cut Trench Inline HDD
WX06	Rowans Big Stream	718596	758440	In-road Open Cut Trench Inline HDD
WX07	Rowans Little Stream	718581	758301	In-road Open Cut Trench Inline HDD
WX08	Courtlough Stream	718833	756777	In-road Open Cut Trench Inline HDD
WX09	Oberstown Stream	719280	755878	Inline HDD In-road Open Cut Trench
WX10	Aldrumman Stream	719426	755619	Inline HDD In-road Open Cut Trench **Offline Open Cut Trench**
WX11	Ballough Stream	719594	752665	**Offline HDD**
WX12	Deanestown Stream	719808	751445	Inline HDD (Combined with Wx13) **Offline HDD (Combined with Wx13)**
WX13	Ballyboghil Stream	719802	751378	Inline HDD (Combined with Wx12) **Offline HDD** (Combined with Wx12) **Offline Open Cut Trench**
WX14	Turvey Stream	719770	750896	In-road Open Cut Trench Inline HDD

Water Crossing Ref No.	Stream Name	Crossing ITM X Coordinate	Crossing ITM Y Coordinate	Crossing technique (in order of preference)
WX15	Staffordstown Stream	718979	748793	In-road Open Cut Trench Inline HDD
WX16	Broadmeadow River	718732	748251	In-road Open Cut Trench Inline HDD (combined with Wx17)
WX17	Ward River	718700	748169	In-road Open Cut Trench Inline HDD (combined with Wx16)
WX18	Seapoint Stream	719350	747479	In-road Open Cut Trench Inline HDD
WX19	Greenfields Stream	719482	747414	In-road Open Cut (Underneath watercourse as culvert is small and not unlike a typical utility crossing) In-road Open Cut Trench Inline HDD
WX20	Gaybrook Stream	720900	745787	In-road Open Cut Trench Inline HDD **Offline Open Cut Trench**
WX21	Hazelbrook Stream	721135	744870	In-road Open Cut Trench Inline HDD
WX22	Sluice Stream	721159	743383	In-road Open Cut Trench **Offline Open Cut Trench** **Offline HDD**
WX23A	Cuckoo Stream It should be noted that there are 3 different locations where the Cuckoo Stream may be crossed (Wx23A, Wx23B & Wx23C) as described in the Onshore Construction chapter.	721024	741737	In-road Open Cut Trench Inline HDD
WX23B		722164	741652	In-road Open Cut Trench Inline HDD
WX23C		722262	741513	In-road Open Cut Trench Inline HDD
WX24A	Mayne River It should be noted that there are 3 different locations where the Mayne River may be crossed at Wx24 (Wx24A, Wx24B & Wx24C) as described in the Onshore Construction chapter.	721162	741196	In-road Open Cut Trench Inline HDD
WX24B		722096	741460	In-road Open Cut Trench Inline HDD
WX24C		722233	741430	Inline HDD In-road Open Cut Trench
WX25	Mayne River	719245	741336	**Offline Open-Cut** In-Road Open Cut trench

Inline crossings

The construction methodology chosen for the majority of crossings is in-road open cut trench or inline HDD, as shown in Table 6. Inline construction methods ensure no interference with the watercourses and as such no impact to the flood mechanism during the permanent state or construction stage. The inline method is proposed as the preferred option for 23 out of 25 watercourse crossings: WX01 – WX10, WX12-WX24.

Where inline HDD is being proposed as the preferred or alternative methodology, two compounds will be required on either side of the proposed HDD route and will be located in-road. As the compounds could be prone to flooding, it is proposed that they be located outside the 0.1% AEP flood extents where possible. Where locating the HDD compounds outside the flood extents is not possible (potentially for WX14, WX17, WX19 and WX24C), other protection measures will be required around the compounds to mitigate the risk. This is discussed in Section 6.6.1.

Offline HDD crossings

Offline HDD methodology will require two HDD compounds. This is proposed as the preferred option for WX11 and as secondary option for WX12, WX13 and WX22. Similar to the inline HDD compounds, the offline HDD compounds have been located outside the mapped 0.1% AEP flood extents where available. This will ensure that the compounds are protected from flooding and have no impact on the fluvial or coastal flood mechanisms.

Offline open cut trench crossings

Offline cut and trench methodology is the preferred option for WX25, and an alternative option for WX10, WX13, WX20 and WX22. The construction methodology for these crossings can either consist of damming the watercourse and pumping or diverting the watercourse. As such, there is a risk of increasing upstream or downstream flood risk along these streams during the construction stage and thus impacting nearby properties. Each of these locations is therefore reviewed below in detail.

WX10

The Aldrumman stream (WX10) has a very small catchment area (<0.5km^2) and has a length of 250m upstream of the watercourse crossing (EPA blue lines). Low flows are expected within the channel and the over-pump method could potentially be applicable. The contractor shall estimate the expected flows for the daily flow scenario as well as the 1% AEP to ensure pumps are appropriately sized to convey the flows. There is a residential property 220m upstream of the crossing, which could become a flood risk receptor.

WX13

The Ballyboghil river (WX13) runs in parallel to the Deanestown stream (north) and Turvey stream (south). There are no flow estimates reported on the CFRAMS maps at the location of interest. According to the FEM (Fingal East Meath) FRAMS study, there is significant flood risk upstream of the M1 motorway, primarily caused by the scale of predicted flood flows from the Ballyboghil River spilling into the Turvey River upstream of the M1. The land affected is generally undeveloped agricultural land. From inspection of the river surveys undertaken during CFRAMS, the culvert conveying the Ballyboghil river underneath the M1 is 700mm in diameter. It is likely that the culvert does not have enough capacity to convey the river flows, therefore causing spilling into the floodplain and the Turvey river. This results in throttling of the flows and reduced flows reaching the watercourse crossing location.

The closest properties to the watercourse crossing are 2.5km upstream of the site. Due to the presence of the small culvert under the M1 and the distance between the watercourse crossing and properties, the risk of increased flooding to these properties as a result of the open cut trench method is considered to be low. However, the mitigation measures described in Section 6.6.1 shall still be followed.

WX20

The Gaybrook stream has been modelled as part of the CFRAMS and has an expected flow of 3.96m^3/s (10% AEP) and 6.96m^3/s (1% AEP). Based on the FSU portal, the upstream catchment is reported as 4.56km^2 and the channel slope is 8.3m/km. The Qmed (equivalent to the 50%AEP) is estimated to be 1.1m^3/s.

There is a dense residential development located adjacent to the crossing on both sides (Yellow walls in Malahide). Care needs to be taken to not increase flood risk to these properties during the temporary damming of the Gaybrook stream to construct the crossing. For watercourse crossing WX20, In-road Open Cut Trench and Inline HDD are the two preferred methods to install the cable, both of which don’t interfere with the stream and have minimal impact in terms of flood risk. The Offline Open Cut Trench method is the least preferred method.

If the contractor is limited to this method due to other constraints, it is recommended that the *With culvert/flume pipe methodology* is employed, rather than the *Over-pump methodology* due to the size of the expected flows and the flood risk receptors.

The contractor will be required to employ a flood risk management plan and follow the mitigation measures listed in Section 6.6.1.

WX22

The Sluice stream has been modelled as part of the CFRAMS and has an expected flow of 6.29m^3/s (10% AEP) and 11.03m^3/s (1% AEP). The Qmed (equivalent to the 50%AEP) is estimated at 2.0m^3/s. Such flows, although indicative of a 1 in 2 year flood event, are very high and pumping at this rate would be challenging. The upstream catchment is 8.40km^2 and the channel slope is 6.6m/km. Kinsealy village is located directly downstream of the watercourse crossing. Abbeville House is located 500m upstream and it is the most likely receptor of any increase in flood risk arising from a possible damming of the river.

The preferred construction method for WX22 is In-road Open Cut Trench, followed by Offline Open Cut Trench and Offline HDD. If In-road Open Cut Trench is not found suitable for the site by the contractor and Offline Open Cut Trench is chosen, it is recommended that the *With culvert/flume pipe methodology* is employed, rather than the *Over-pump methodology*, due to the size of the expected flows and the flood risk receptors.

The contractor will be required to employ a flood risk management plan and follow the mitigation measures listed in Section 6.6.1.

WX25

The river Mayne has been modelled as part of the CFRAMS and has an expected flow of 3.68m^3/s (10%AEP) and 4.44m^3/s (1%AEP). The Qmed is estimated at 1.53m^3/s. The rate of pumping is therefore expected to be very high, if such an event was to occur. The upstream catchment is 5.89km^2 and the channel slope is 7.1m/km. The closest properties upstream of the crossing are 500m upstream.

The preferred construction method for WX25 is Offline cut and trench. If the *over-pump methodology* is considered, the contractor will need to estimate the expected flows to be pumped.

For all the above watercourse crossings, appropriate mitigation measures and level monitoring shall be followed, as described in Section 6.6.1.

6.5.2 Potential Flood Risk Impacts to Infrastructure

Construction stage

There is a risk the infrastructure under construction near watercourses becomes inundated and damaged during a flood event. This risk is especially high at open trenches and other open excavations within flood risk areas. Furthermore, there is a risk of personnel being injured during a flood event, especially in areas where the watercourse is dammed and/or working in open excavations. It should be noted that these are typical risks associated with working near and within open water bodies and will be addressed as part of the contractor’s normal Risk Assessment process and Flood Risk Management Plan (FRMP).

Operational Stages

The onshore cable route and joint bays will be underground and designed to be floodable without affecting operations as per Eirgrid specifications. Any potential flooding will have minimal impact to the onshore cable infrastructure and, therefore during its operational phase, it is considered ‘water compatible infrastructure’.

6.5.1 Potential Impact of Infrastructure Construction on Existing Flood Risk and Mechanisms

Construction stage

During excavations, open trenches along the onshore cable route could become flow paths for flood water. The new flow paths can potentially change the flood mechanism and pose risk of flooding to areas that were not at risk before. Furthermore, permanent access tracks, stockpiled material and other ground movement, without appropriate design and mitigation, could cause impoundment of water and increase of water levels to upstream areas, potentially causing flooding. Accordingly appropriate design and mitigation is required as described below.

Operational Stages

The cable and associated infrastructure will be buried with the ground reinstated to its current level and surfacing, and as such will not alter the flood risk to surrounding areas. The impact the onshore cable route could potentially have to flood risk in its operational stage is therefore considered extremely low.

The onshore cable route crosses 25 watercourses along its length. Similar to other locations, once the cable is buried, there will be no changes to the ground levels or surfacing and no permanent impact to the watercourses.

6.6 Proposed Mitigation Measures

6.6.1 During Construction (Temporary)

The contractor will be expected to put in place an FRMP, typical of construction works near or within watercourses, to ensure staff are not exposed to risk of flooding, minimise damages to the construction works in case of flooding and reduce risk of flooding to nearby properties. As part of the FRMP, the following will be included:

- Plan the work near watercourses at appropriate periods when low flow is expected
- Sign up to receive weather warning notifications and regularly check the weather forecast when working near areas at risk of flooding
- Where offline open cut trench method is proposed, water levels upstream of the watercourse crossings shall be monitored by the contractor
- A flood warning system and management plan will be implemented

Further mitigation measures specific to each construction methodology are to be included are outlined below:

Inline open cut trenches

Trenches will be excavated at short lengths and will be backfilled following installation of the onshore cable. Excavated material will be stockpiled outside areas at risk of flooding to prevent impoundment of water or changes to flow paths.

Inline HDD compounds

HDD compounds will be located as much possible outside the 0.1% AEP flood extents.

Offline Open Cut Crossing

- *With Over-pump Methodology:* If expected flows in the watercourse are within the capacity of available pumps, temporary bunding and over-pumping methodology can be adopted. In that case, soil filled sandbags will be used to create a seal and bund both the upstream and downstream sides of the watercourse crossing. Then appropriately sized pumps will be located adjacent to the watercourse crossing, the intake pipe will be positioned upstream of the upstream bund and the discharge pipe downstream of the downstream bund, with appropriate water treatment provided in between, as required. The bunds, pump and treatment will be inspected daily.

Water levels in the watercourse will be monitored to prevent flooding upstream of the bunds, back up pumps may be required. It is recommended that works are undertaken during low flows and avoided if a storm is expected

- *With Culvert/Flume Pipe Methodology:* In this method, the water flow will be diverted into a culvert or flume pipe to the side of the watercourse. The culvert/flume pipe watercourse crossing will be prepared by stripping the topsoil from the banks and areas adjacent to the river at the crossing point and storing it separately within the working area, away from the watercourse
- The excavated bank material and a selection of vegetation will be stored for replacement or reinstatement of the watercourse, after the cable ducts have been laid. A flume pipe bridge will be installed to one side of the watercourse channel. The culvert/flume pipe will be long enough to extend below the haul road to allow safe passage of plant and materials along the cable route. A suitably sized culvert/flume pipe will be installed at the crossing point. The invert of the culvert/flume pipe will typically be 100mm below the existing watercourse invert, to replicate natural free flow through the channel. The culvert/flume pipe will extend on the upstream and downstream sides of the crossing point for a suitable distance. The culvert/flume pipe will then be bedded and packed or surrounded with soil filled sandbags to create a seal or dam across the watercourse, to prevent scouring and to divert the water flow into the flume pipe. The flume pipe will take all the flow to the downstream side of the crossing point and the ducts will be installed beneath the dry watercourse channel

Once the flume pipe or dam bund and over-pump method has been installed and sandbags are securely in place, the construction of the cable trench can proceed by excavating through the bed of the watercourse. Trench supports may be used to facilitate safe excavation and dewatering of the excavation area will be carried out if required. Final reinstatement will use the stored river-bed materials with reinforcement mesh included along with yellow marker warning tape.

The banks of the temporary watercourse crossings will be reformed to their original profile. The excavated bed materials which had been removed for construction, and stored separately, will be reinstated to the original profile. The temporary flume pipe, packing and sand-bags will be removed once the watercourse profile-has been reinstated, ensuring the correct sequencing of substrate reinstatement.

Final bank reinstatement may require further measures to stabilise the banks and prevent erosion. Bank stabilisation works will be discussed with the NPWS/IFI to ensure that suitable materials and methodologies are being used. Any bank protection, where it is required, will be adequately keyed into both the bed and banks. The materials and methods employed will be in keeping with the surrounding environment and will comply with any conditions attached to the planning approval.

6.6.2 During Operation (Permanent)

Permanent access tracks

The limited number of permanent access tracks proposed at offline crossings could potentially alter the flood mechanism at the watercourses if located within the floodplain. Where practicable, the tracks will be positioned outside the flood extents and designed to minimise changes to the existing ground. If encroaching within the floodplain, they shall be constructed at-grade to prevent changes to flow paths or impoundment and will be made of semi-impermeable material (crushed stone) to mimic the natural infiltration potential of the existing land.

6.7 Application of the Flood Risk Management Guidelines

6.7.1 Sequential Approach

Based on the analysis undertaken, the onshore cable route is proposed on land falling within Flood Zones A, B and C.

The onshore cable route will be installed within underground ducts and once installed, it can operate during flooding conditions. The permanent access tracks will only be used for maintenance and not regular traffic. Maintenance is unlikely to take place during a flood event. As such, the onshore cable route and access tracks are considered “water compatible” development.

As such, the onshore cable route is considered appropriate within any flood zones and therefore, a Justification Test is not required.

7. Conclusion

This Flood Risk Assessment was carried out as part of the EIAR (Chapter 22 – Water) submitted as part of the Planning Application for the NISA Offshore Windfarm. This FRA report reviewed the risk of flooding at the landfall site, grid facility and onshore cable route, both during the construction and operational stages.

Flood risk during construction

During construction of the cable onshore route, excavations on-road and offline will be undertaken to lay the onshore cable ducts, some of which will be in areas at risk of fluvial flooding from the 1% AEP or 0.1%AEP. These includes parts of the R132 in Glebe south, Turvey, Lissenhall, near the Fingallians GAA club, parts of the Estuary Road in Malahide, parts of Chapel Road, parts of the Hole in the Wall road, Balgriffin Park and small areas on the R139 in Belcamp. Open trenches along the onshore cable route at areas prone to flooding could become flow paths during a flood event and could otherwise potentially change the flood mechanism and increase risk of flooding to adjoining areas if not appropriately mitigated.

Several watercourses will be crossed by the cable route at 25 watercourse crossings. Inline cut and trench and inline/offline HDD methodology are the preferred options for the majority of watercourse crossings, ensuring no interaction with the watercourses and hence no impact in terms of flood risk. HDD compounds are required at either side of the HDD route and while they are set back from the flood extents at most locations, this might not be possible in some locations.

Offline cut and trench methodology is the preferred option for WX25 (an alternative option for WX10, WX13, WX20 and WX22). The construction methodology for these crossings can either consist of damming the watercourse and pumping, or diverting the watercourse. As such, there is a risk of increasing upstream or downstream flooding along these streams and impacting nearby properties, if not appropriately mitigated.

To address the residual risks identified above during the construction stage, mitigation measure as outlined in this FRA and summarised below, are be implemented by the contractor during construction.

Flood risk during operation

This FRA determined that the risk of flooding to the proposed development during operation (in its permanent state) is acceptable.

The permanent infrastructure within the landfall site and onshore cable route is not vulnerable to flooding, as most of the infrastructure will be buried underground and designed to withstand water exposure. The only infrastructure that is not buried is the permanent access tracks made of crushed stone which are not critical infrastructure. Due to the underground nature of the development, the landfall site and onshore cable route will not be damaged or impacted by flooding and long-term implications for recovery following a flood event are not anticipated. The development in both locations is considered “water compatible development”, and as such are appropriate within any flood zone (A, B or C). A Justification Test is therefore not required.

The proposed access tracks shall be built outside the flood extents where possible. If the tracks need to extend within the floodplain, they will be constructed at-grade with semi-impermeable material to minimise changes to the flood mechanism.

The grid facility is located within Flood Zone C. It is considered essential infrastructure “highly vulnerable” to flooding. As any type of development is permitted within Flood Zone C, a Justification Test is not required. The grid facility will introduce an increase in impermeable areas, which could otherwise result in increased rates of runoff to downstream areas. However, this will be negated by the construction of a new appropriately designed dedicated surface water drainage network and attenuation system.

Mitigation measures

The contractor will be required to put in place a Flood Risk Management Plan, typical of similar construction works near or within watercourses, to ensure staff are not exposed to a high risk of flooding, to minimise the risk of damages to the construction works in case of flooding, and to reduce the potential for increased flood risk to nearby properties. This flood risk management plan will include but not be limited to the following mitigation measures:

- Trenches will be excavated in short intervals and will be backfilled following installation of the onshore cable. Excavated material will be stockpiled outside areas at risk of flooding to prevent impoundment of water or changes to flow paths
- HDD compounds will be located as much possible outside the 0.1% AEP flood extents
- If an offline open cut method using the over-pump method is chosen for some crossing, the pumps need to be appropriately sized, with back up pumps available. Water levels in the watercourse will be monitored to prevent flooding upstream of the bunds

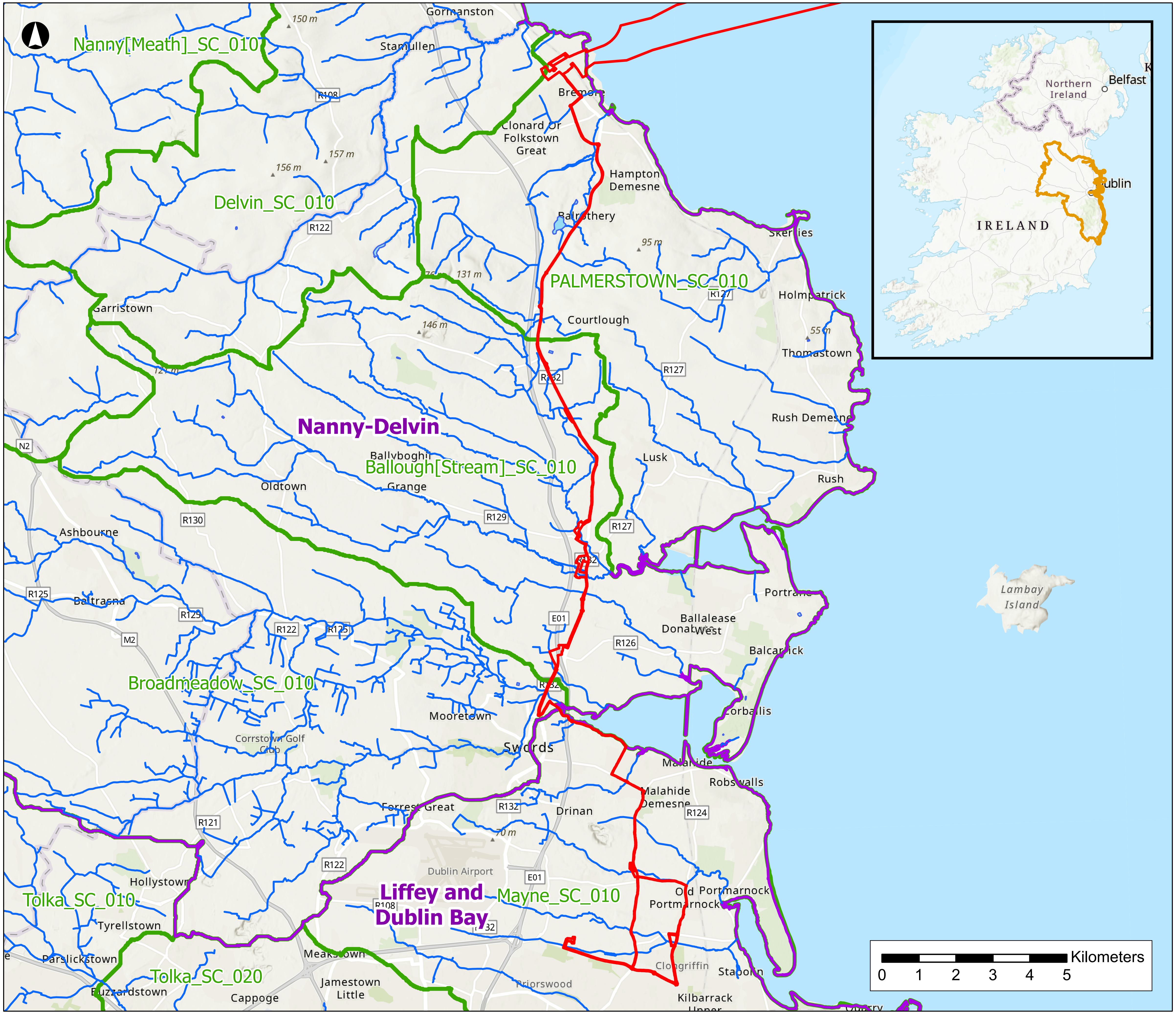
After completion of construction, all construction compounds and associated temporary structures shall be removed and the land reinstated to its original condition and levels.

This FRA demonstrates that the proposed development is compatible with the requirements of The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009) and the relevant Strategic Flood Risk Assessments and that the residual risk is low and can be managed to acceptable levels by adopting the mitigation measures identified herein.

Appendix A

Figures

Figure 22.1



Legend

- Proposed Development Boundary
- Lakes
- Rivers
- Sub-catchment
- Water Framework Directive Catchments
- Eastern River Basin District

Notes

NISA

North Irish Sea Array

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Project

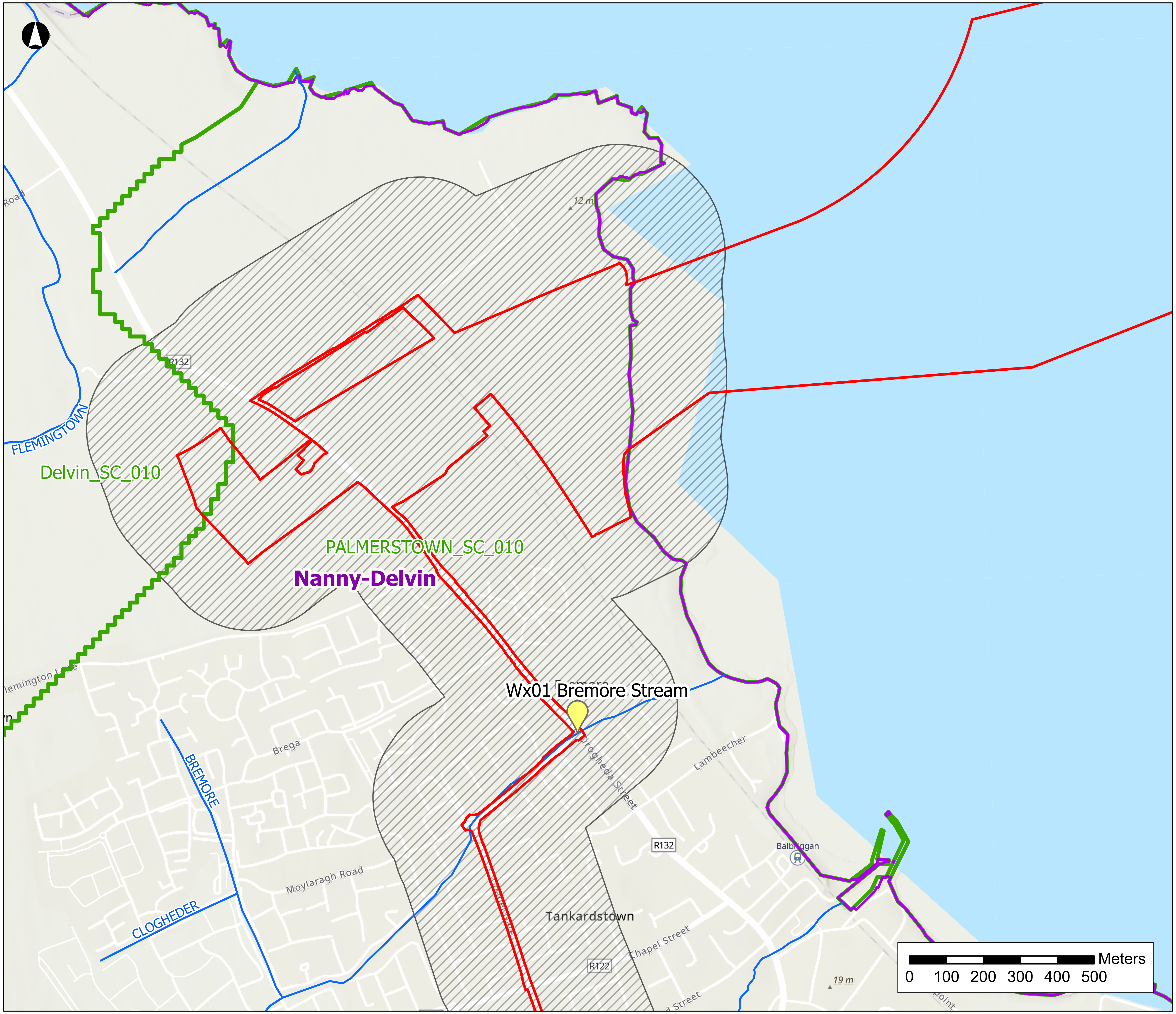
North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Overview

Job No:	281240	Figure No:	22.1
Date:	May 2024		
Scale:	1:100,000		
Status:	Issue		

Figure 22.2



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes
Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA
North Irish Sea Array

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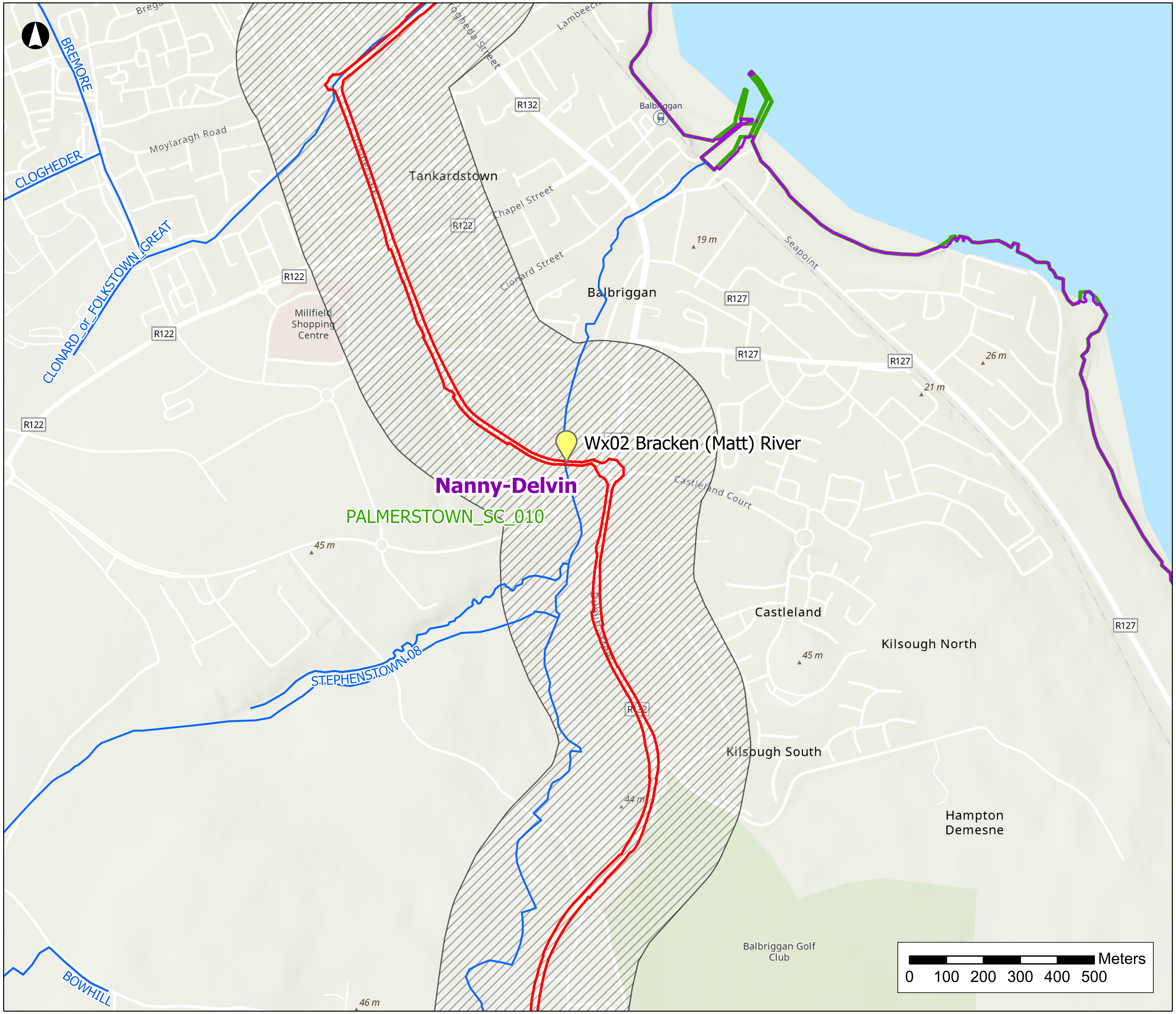
Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Water Assessment: Local Features and Water Crossings

Job No:	281240	**Figure No:**	**22.2 (1)**
Date:	May 2024		
Scale:	1:10,000		
Status:	Issue		



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

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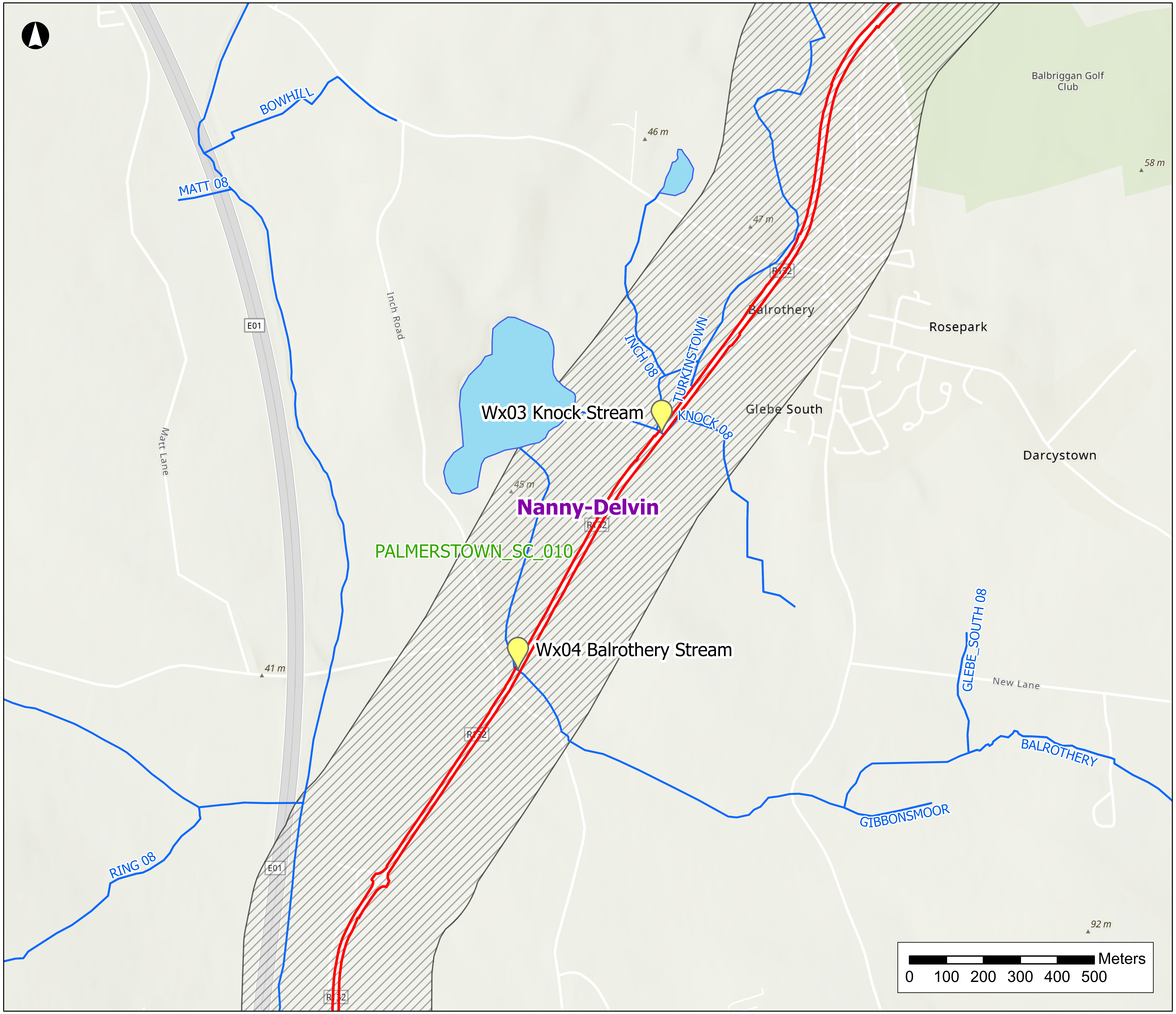
North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240	Figure No:
Date:	May 2024	22.2 (2)
Scale:	1:10,000	
Status:	Issue	



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

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North Irish Sea Array

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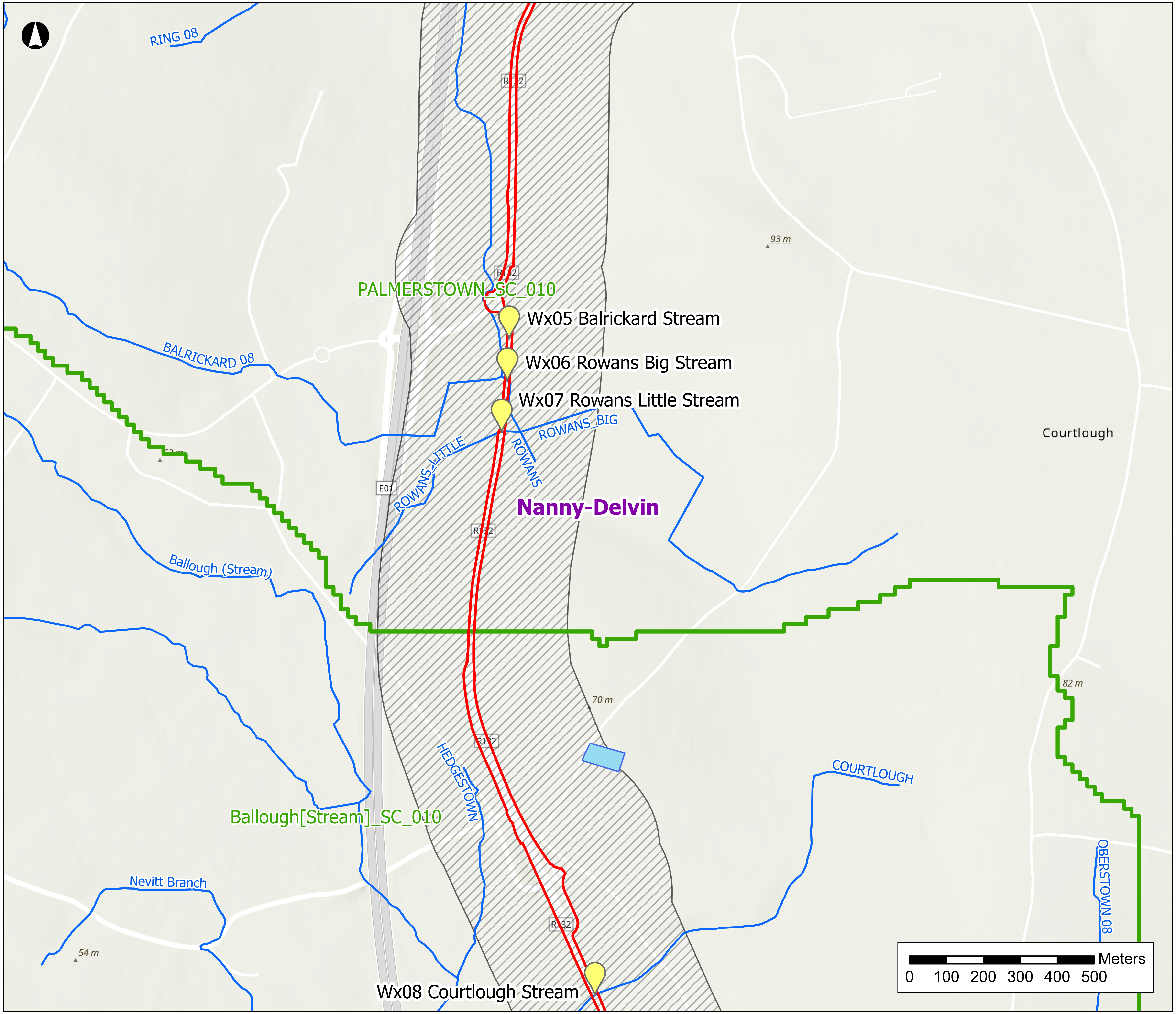
North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240
Date:	May 2024
Scale:	1:10,000
Status:	Issue

Figure No: 22.2 (3)



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

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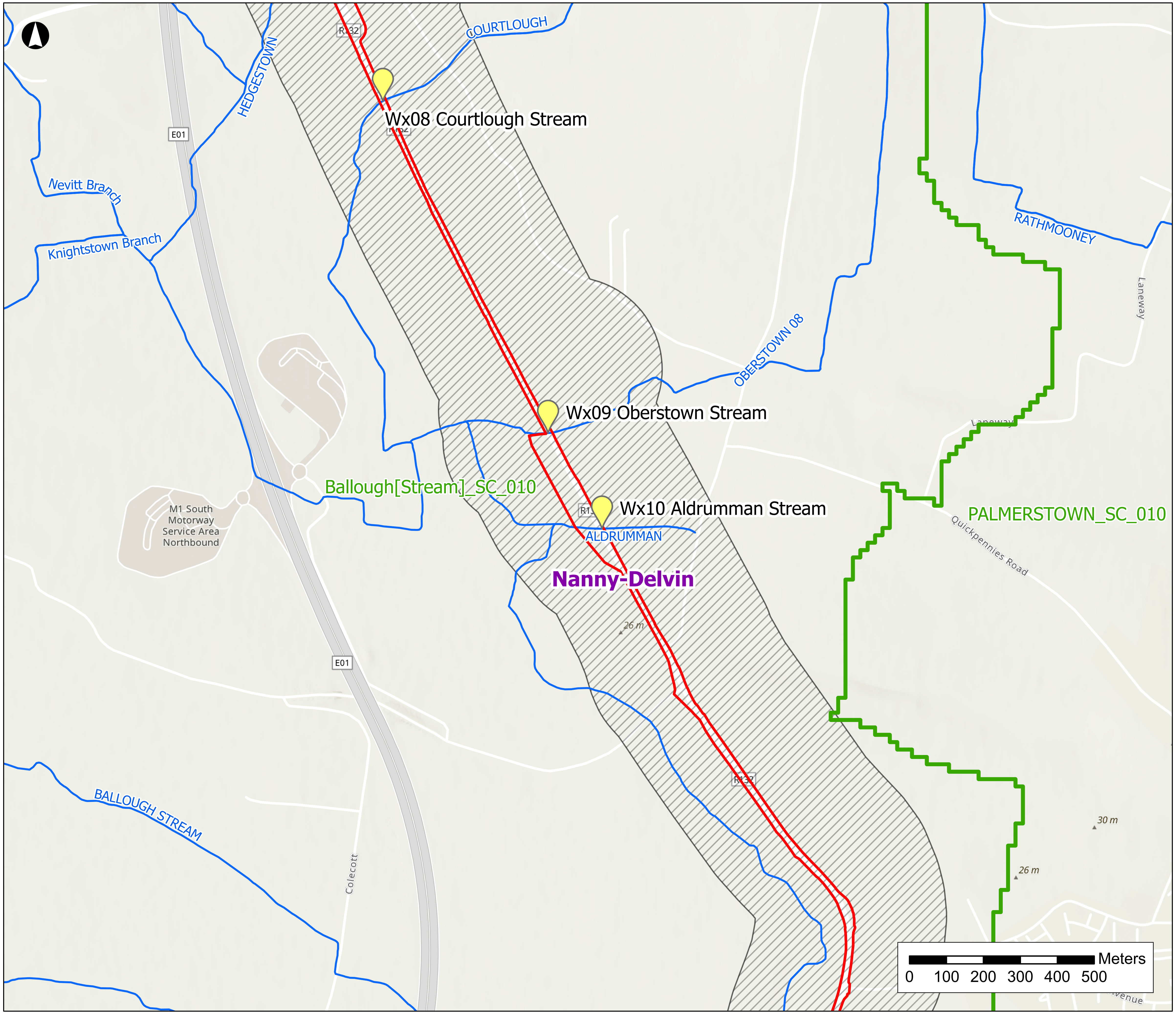
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240	**Figure No:**	
Date:	May 2024		**22.2 (4)**
Scale:	1:10,000		
Status:	Issue		



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

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Project

North Irish Sea Array Offshore Wind Farm

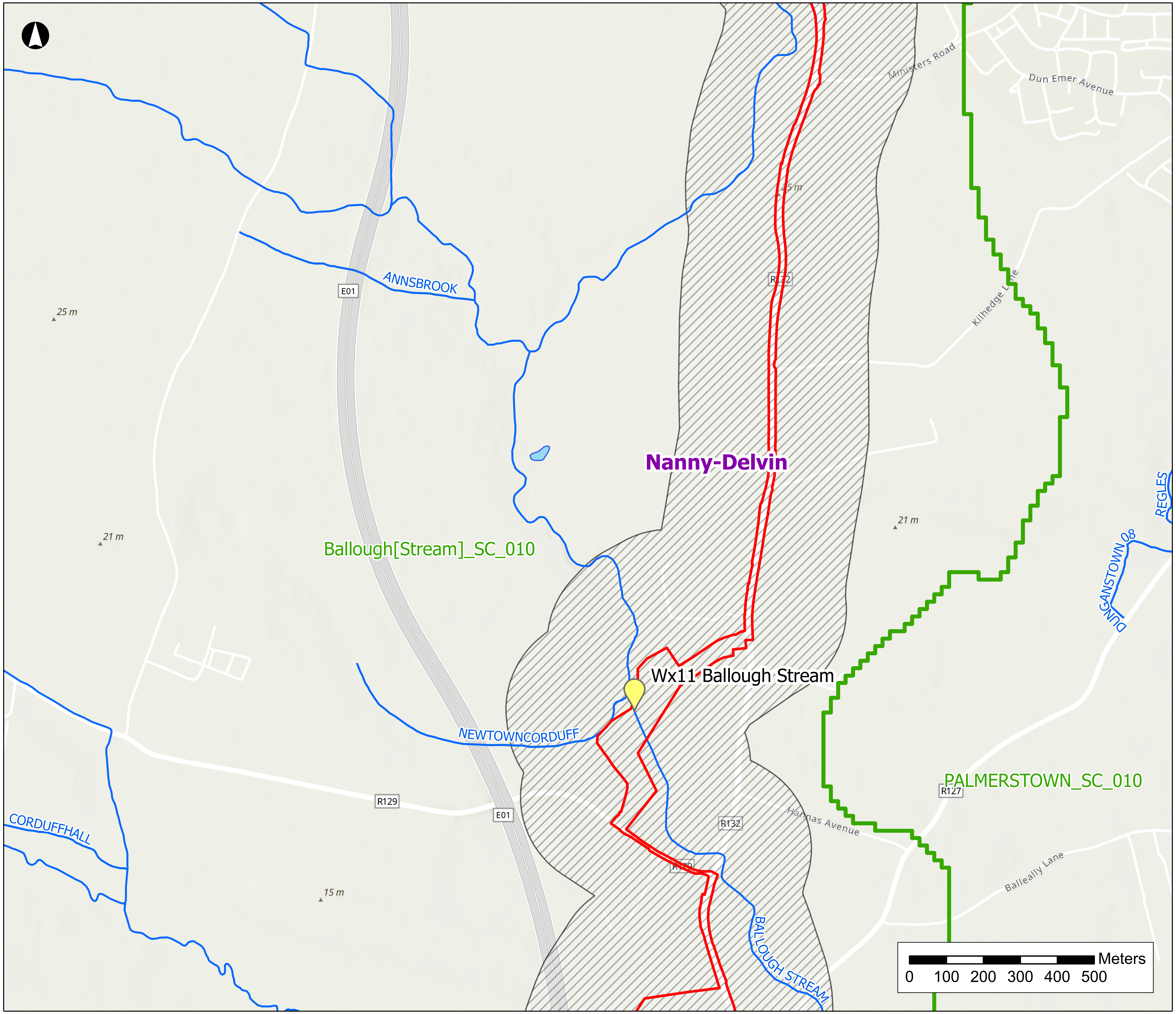
Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240
Date:	May 2024
Scale:	1:10,000
Status:	Issue

Figure No:

22.2 (5)



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

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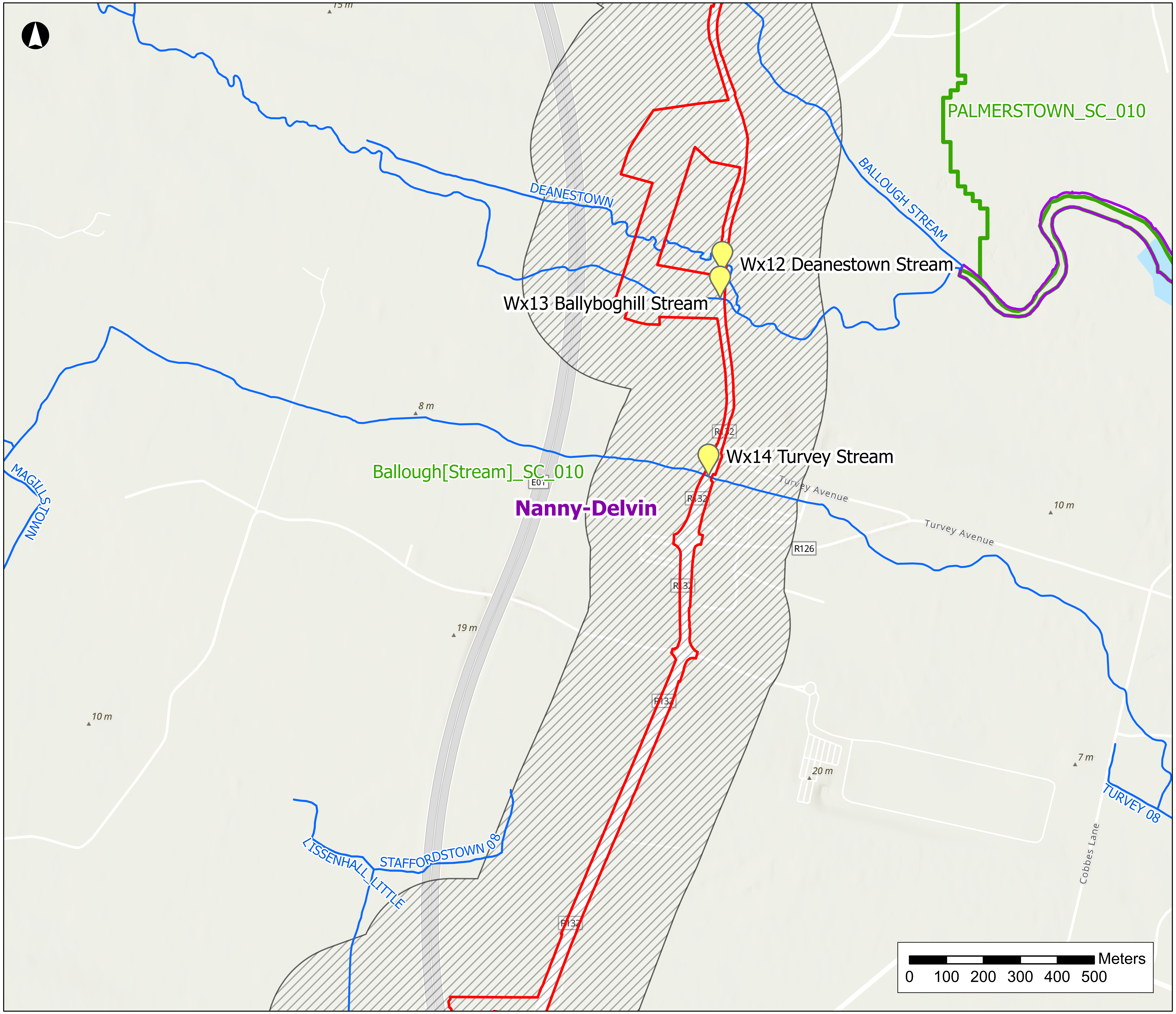
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240	**Figure No:**	
Date:	May 2024		22.2 (6)
Scale:	1:10,000		
Status:	Issue		



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

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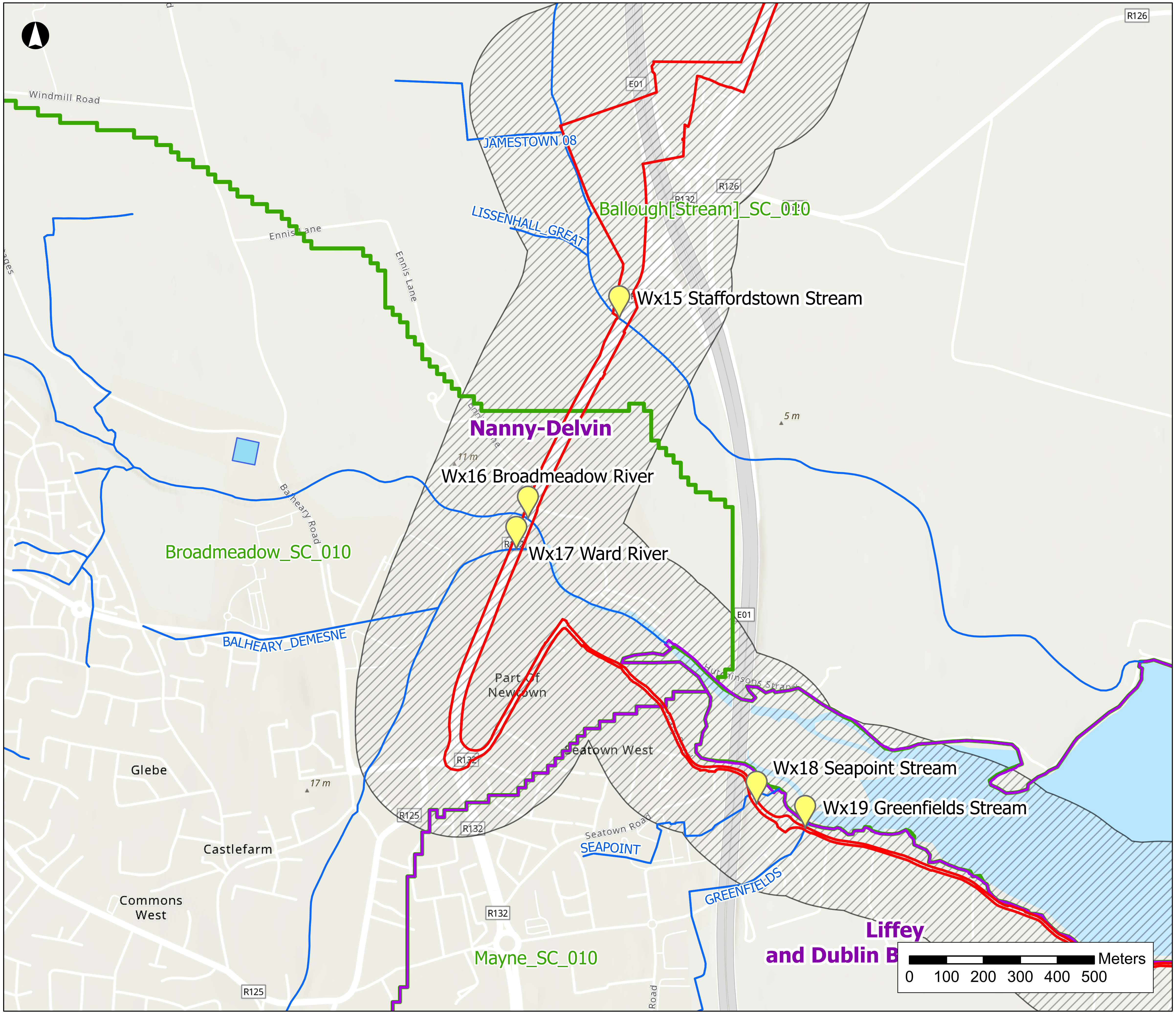
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240	**Figure No:**	
Date:	May 2024		
Scale:	1:10,000		**22.2 (7)**
Status:	Issue		



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes
Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA
North Irish Sea Array

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Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Water Assessment: Local Features and Water Crossings

Job No:	281240	**Figure No:**	
Date:	May 2024		
Scale:	1:10,000	**22.2 (8)**	
Status:	Issue		

Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

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Project

North Irish Sea Array Offshore Wind Farm

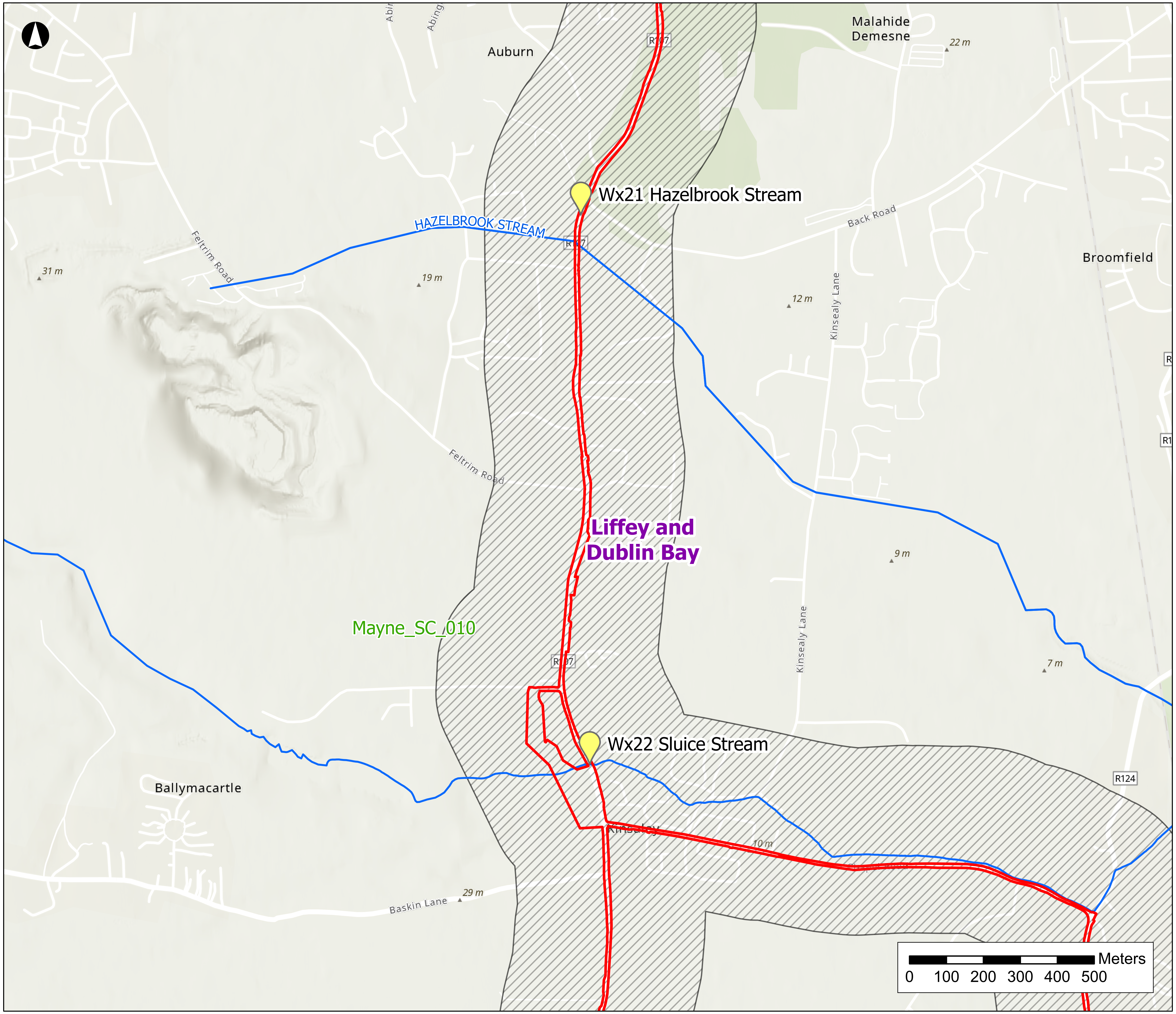
Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240
Date:	May 2024
Scale:	1:10,000
Status:	Issue

Figure No:

22.2 (9)



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA
North Irish Sea Array

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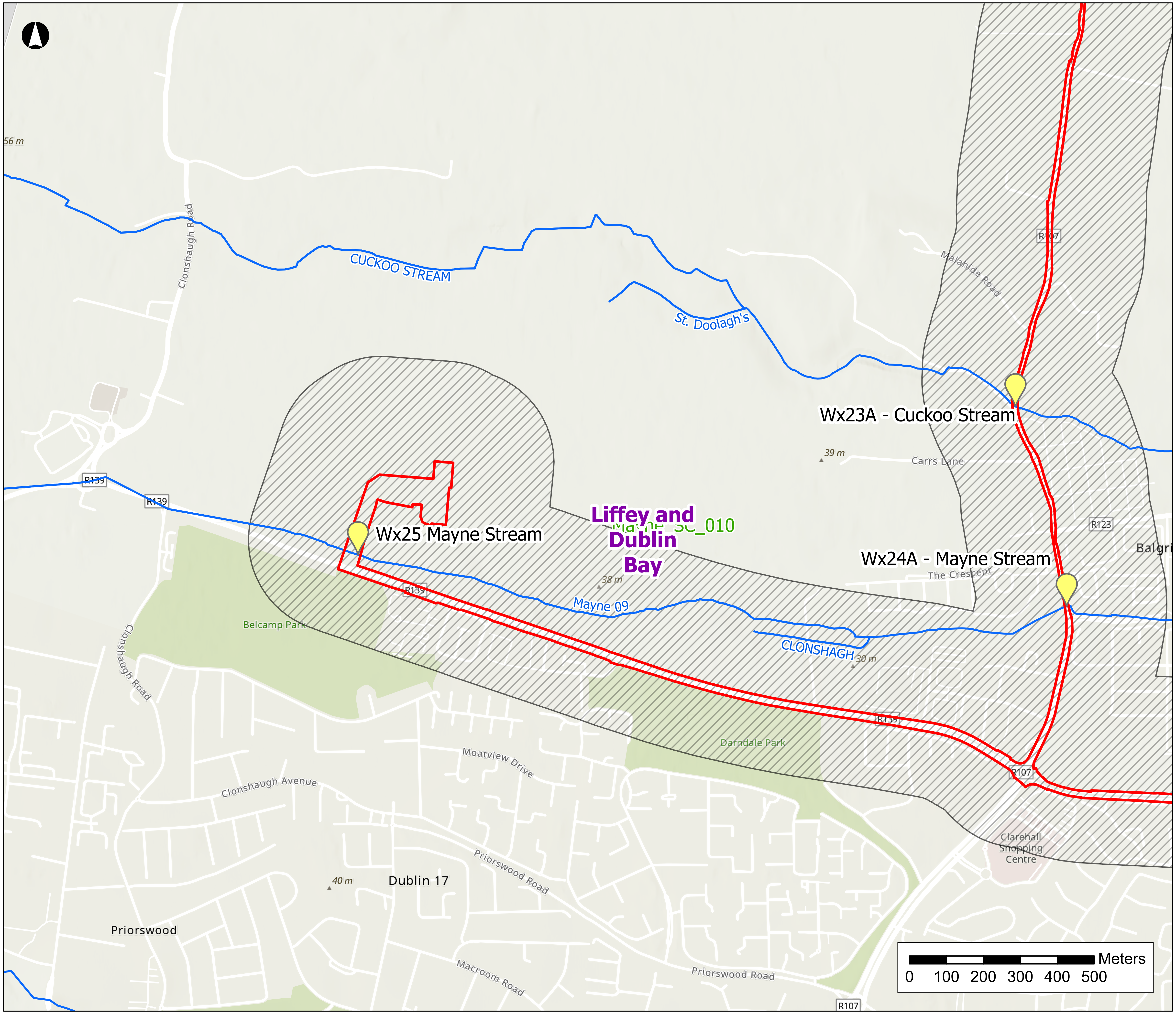
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240	Figure No:	22.2 (10)
Date:	May 2024		
Scale:	1:10,000		
Status:	Issue		



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes
Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA
North Irish Sea Array

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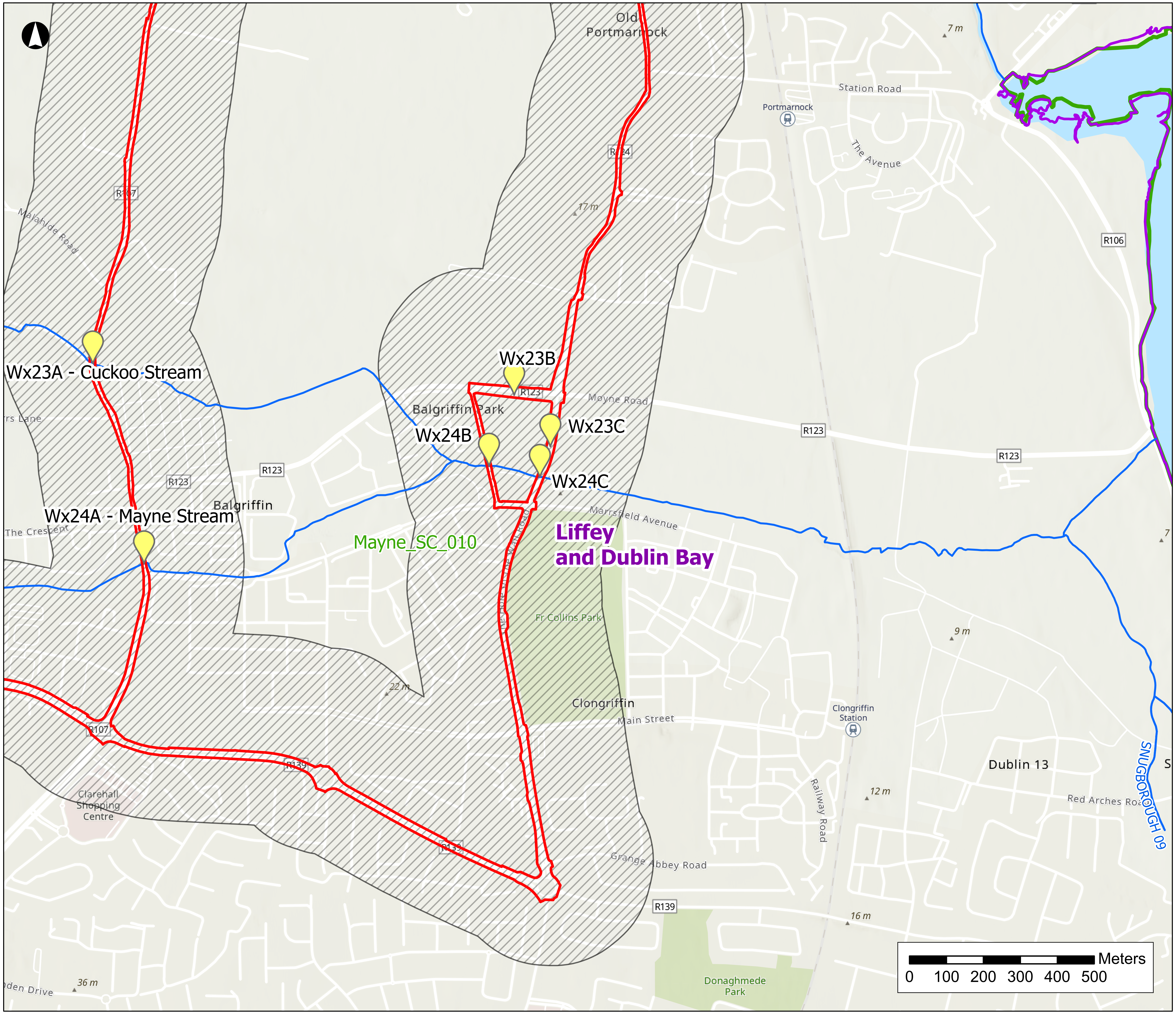
Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Water Assessment: Local Features and Water Crossings

Job No:	281240	**Figure No:**
Date:	May 2024	**22.2 (11)**
Scale:	1:10,000	
Status:	Issue	



Legend

- Proposed Development Boundary
- Water Study Area
- Watercourse Crossings
- Rivers
- Lakes
- Water Framework Directive Catchments
- Sub-catchment

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

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Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Water Assessment: Local Features and Water Crossings

Job No:	281240	**Figure No:**	
Date:	May 2024		
Scale:	1:10,000		**22.2 (12)**
Status:	Issue		

Figure 22.3

Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes
Watercourse lines are taken from the EPA database and are not always accurately positioned.

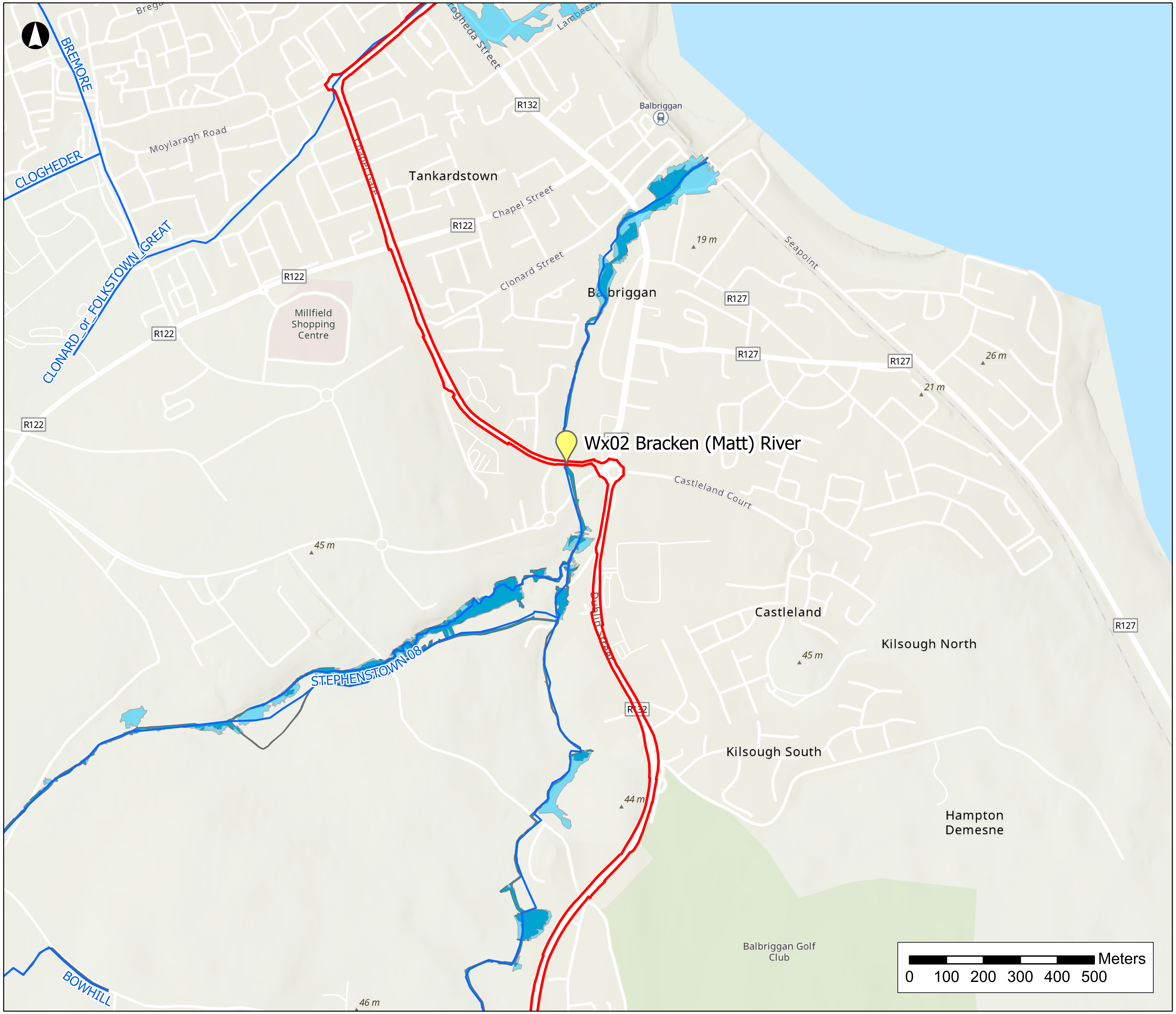
NISA
North Irish Sea Array

ARUP

Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**
Date:	May 2024	
Scale:	1:10,000	**22.3 (1)**
Status:	Issue	



Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

ARUP

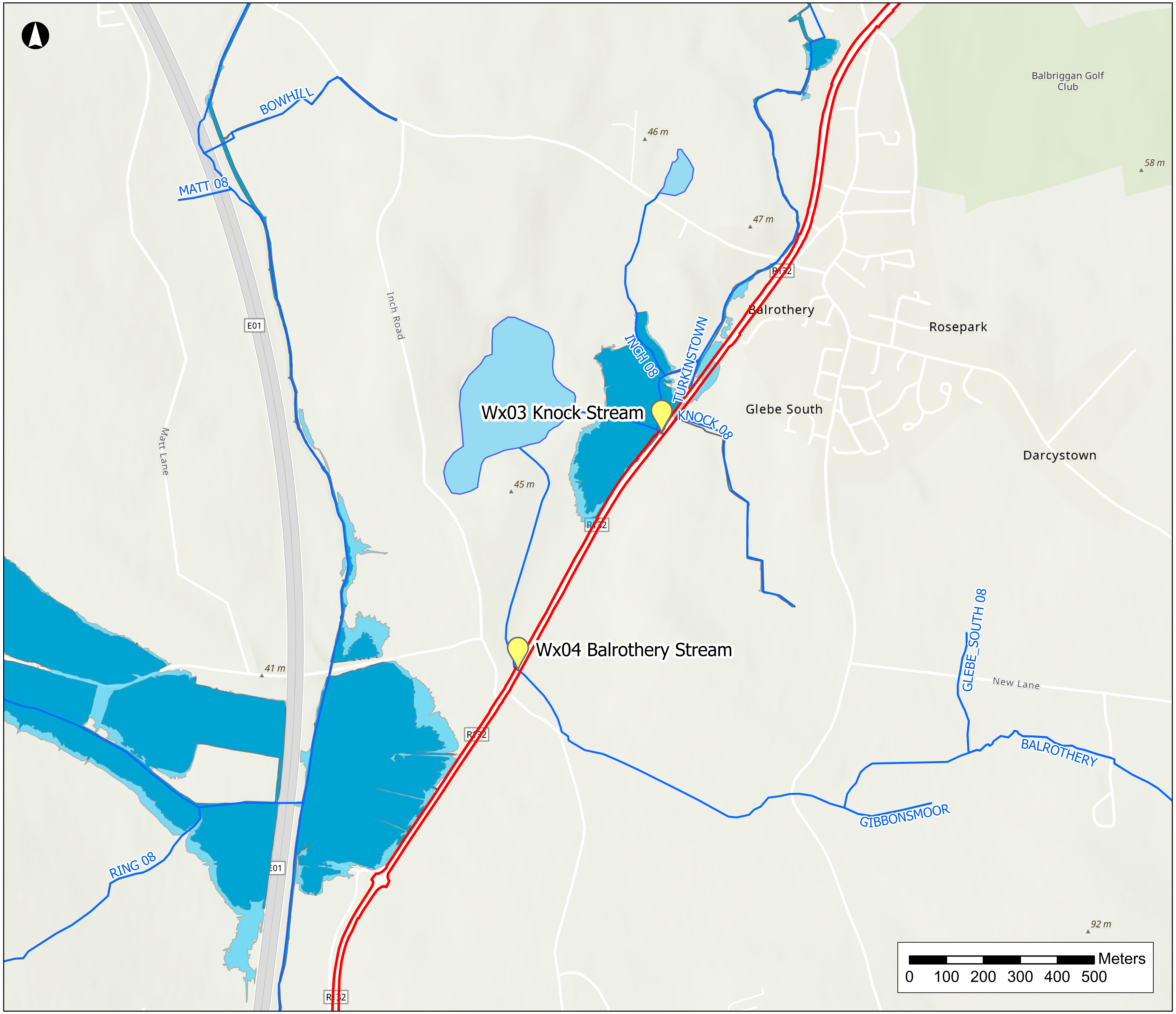
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**
Date:	May 2024	**22.3 (2)**
Scale:	1:10,000	
Status:	Issue	



Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes
Watercourse lines are taken from the EPA database and are not always accurately positioned.

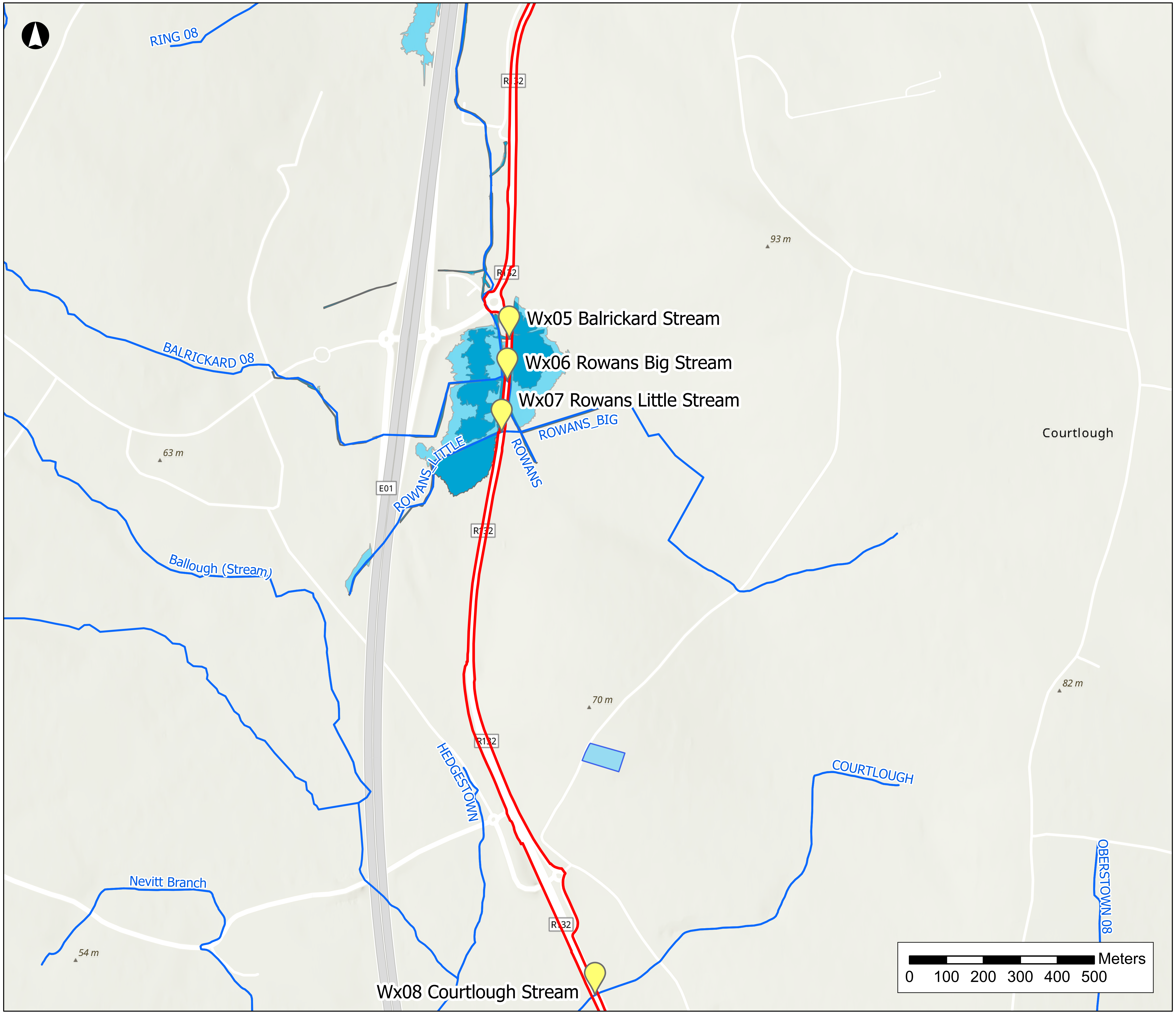
NISA
North Irish Sea Array

ARUP

Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**	**22.3 (3)**
Date:	May 2024		
Scale:	1:10,000		
Status:	Issue		



Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes
Watercourse lines are taken from the EPA database and are not always accurately positioned.

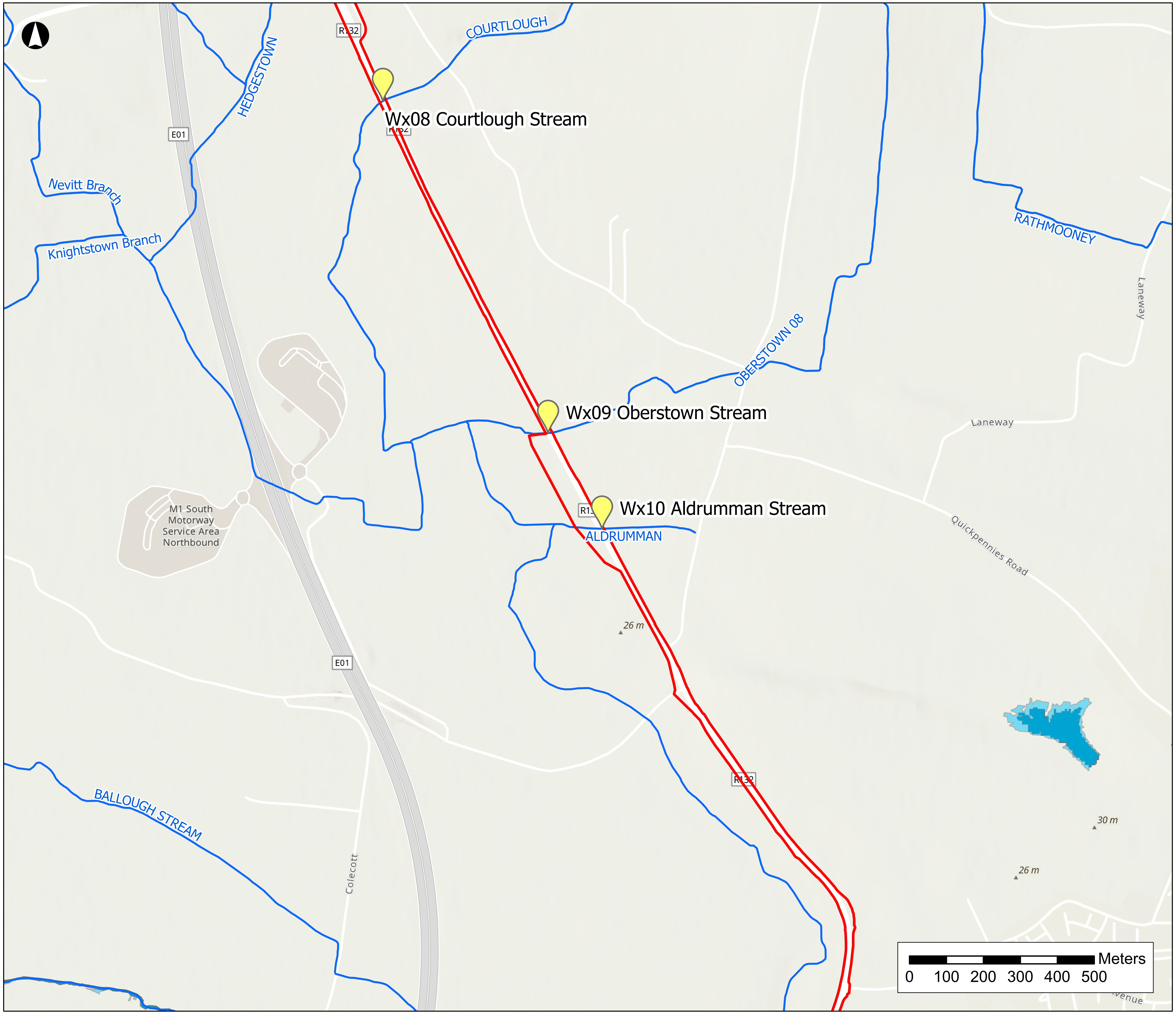
NISA
North Irish Sea Array

ARUP

Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	Figure No:
Date:	May 2024	
Scale:	1:10,000	22.3 (4)
Status:	Issue	



Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

ARUP

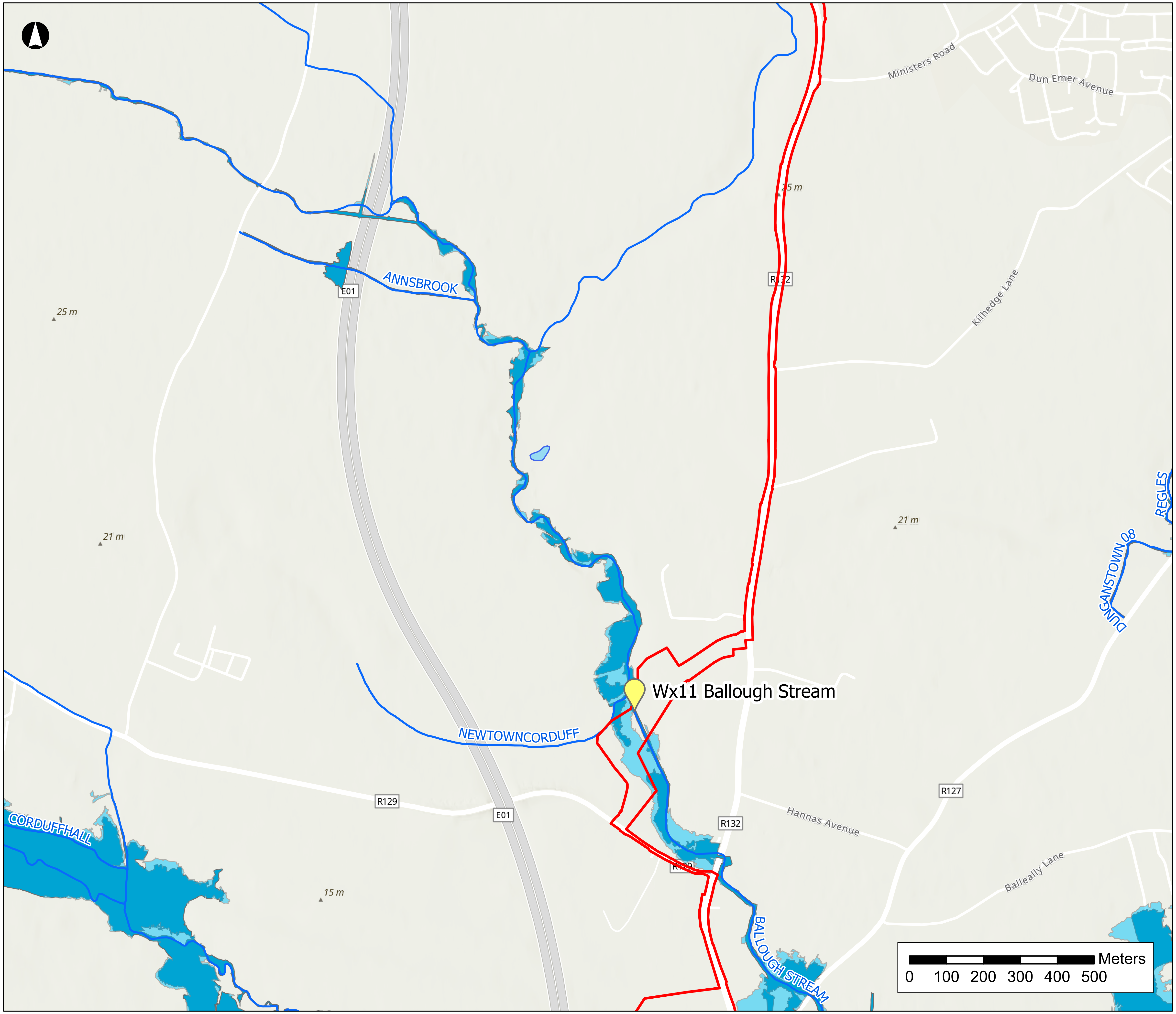
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**
Date:	May 2024	**22.3 (5)**
Scale:	1:10,000	
Status:	Issue	



Legend

Proposed Development Boundary

Watercourse Crossings

Rivers

Lakes

Fluvial Flood Extents

0.1% AEP

1% AEP

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

ARUP

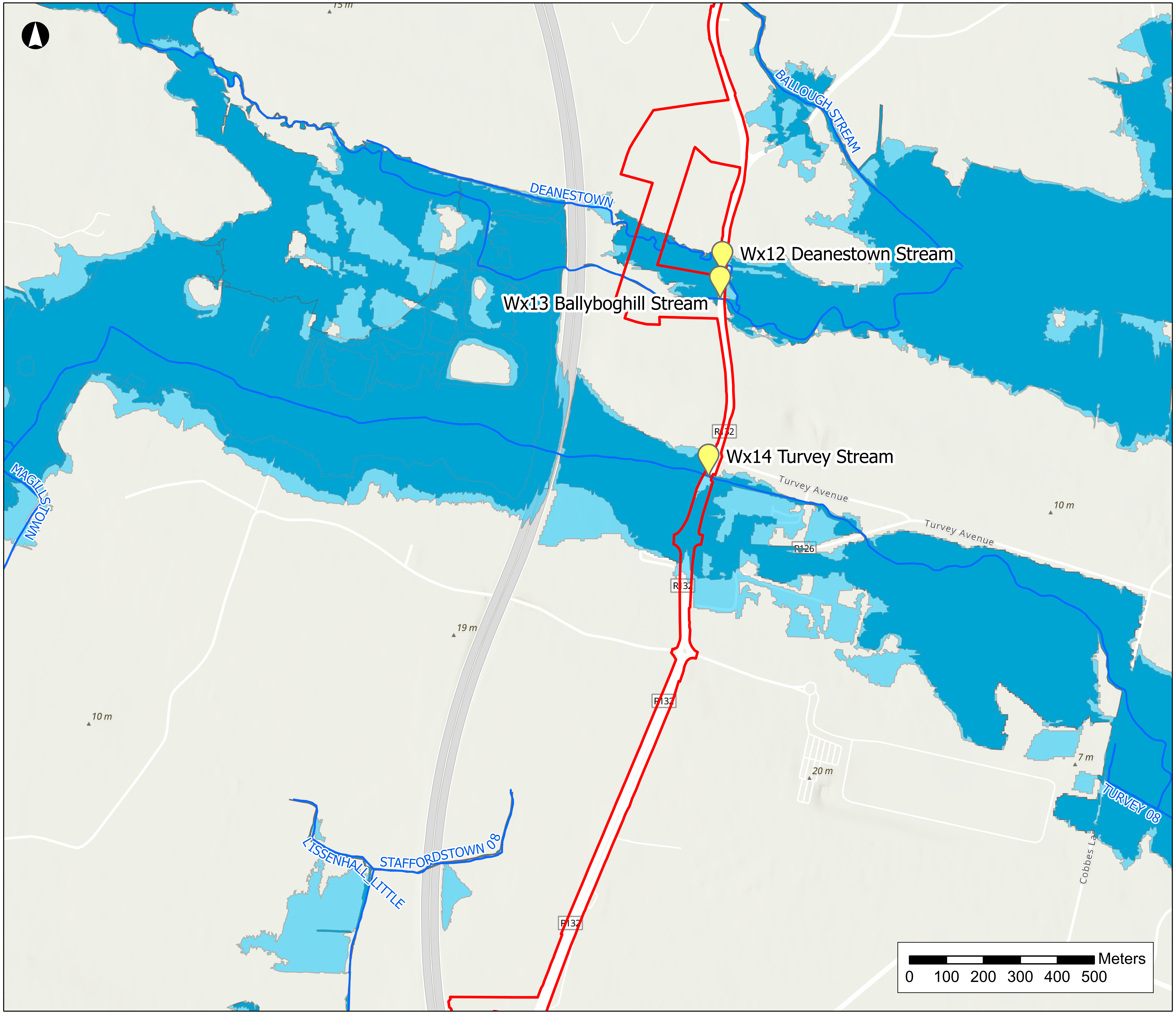
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**
Date:	May 2024	
Scale:	1:10,000	**22.3 (6)**
Status:	Issue	



Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes
Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA
North Irish Sea Array

ARUP

Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**
Date:	May 2024	**22.3 (7)**
Scale:	1:10,000	
Status:	Issue	

Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes

Watercourse lines are taken from the EPA database and are not always accurately positioned.

NISA

North Irish Sea Array

ARUP

Project

North Irish Sea Array Offshore Wind Farm

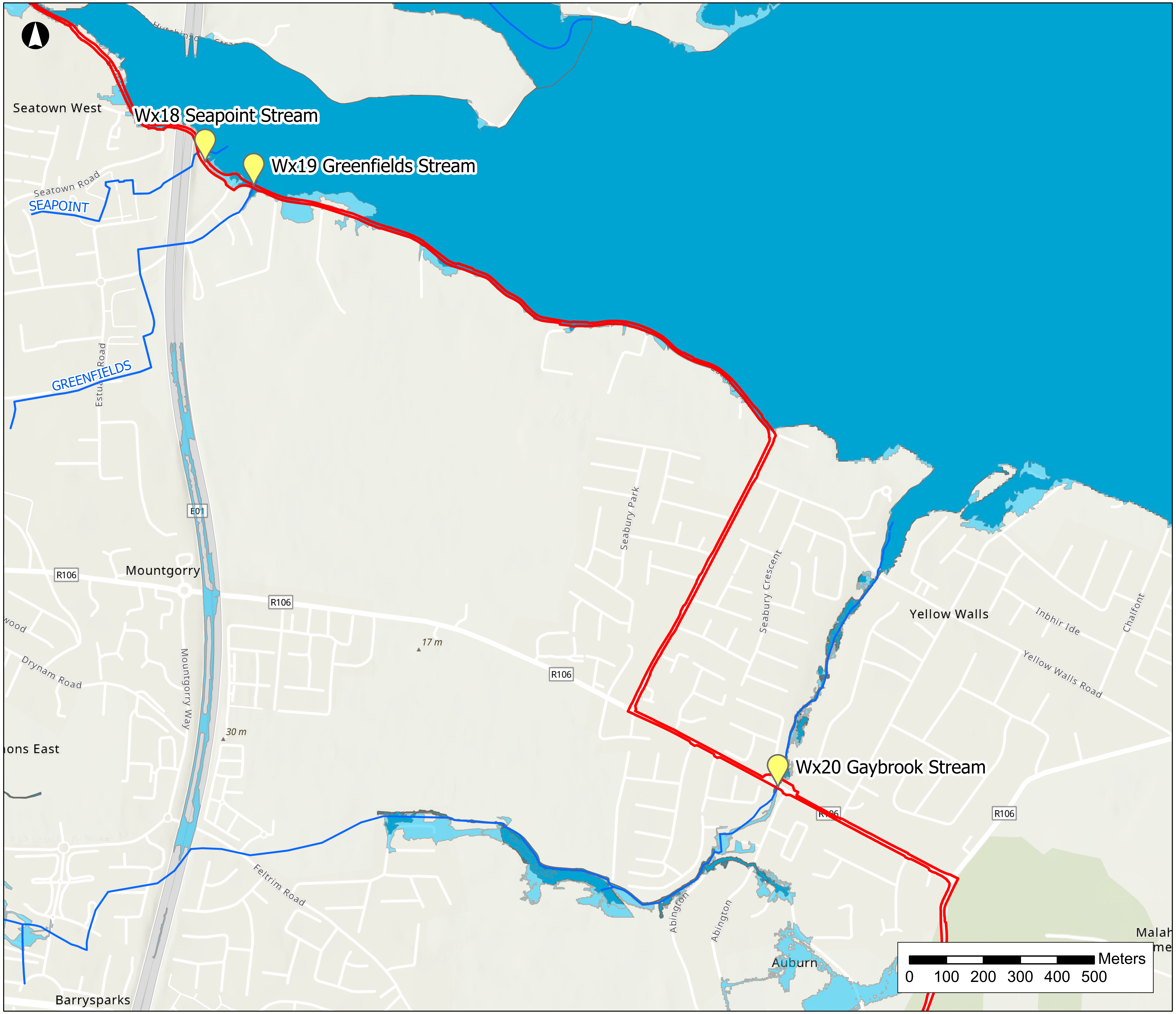
Figure Title

Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240
Date:	May 2024
Scale:	1:10,000
Status:	Issue

Figure No:

22.3 (8)



Legend

Proposed Development Boundary

Watercourse Crossings

Rivers

Lakes

Fluvial Flood Extents

0.1% AEP

1% AEP

Notes

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NISA

North Irish Sea Array

ARUP

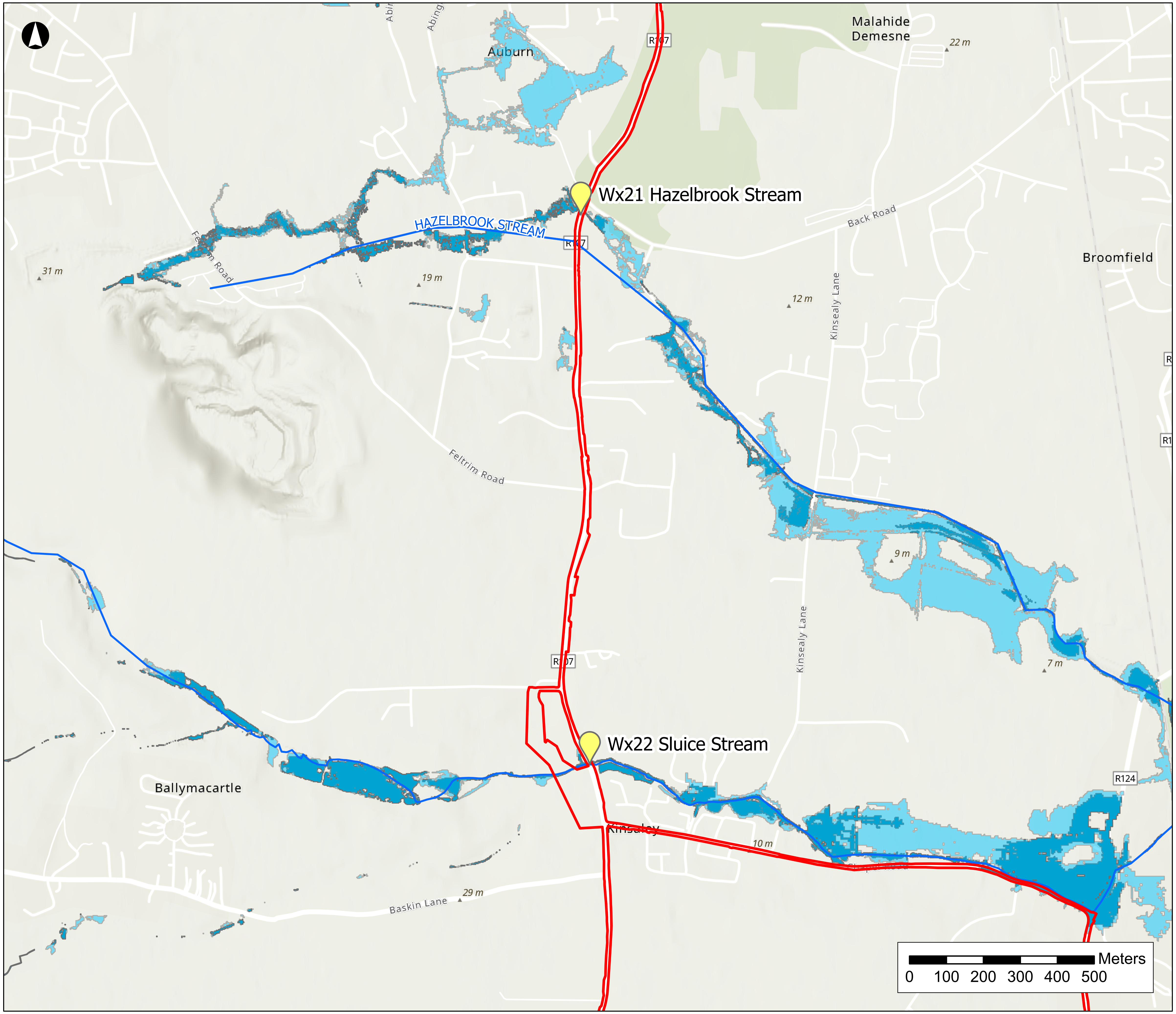
Project

North Irish Sea Array Offshore Wind Farm

Figure Title

Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**
Date:	May 2024	**22.3 (9)**
Scale:	1:10,000	
Status:	Issue	



Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

- 0.1% AEP
- 1% AEP

Notes
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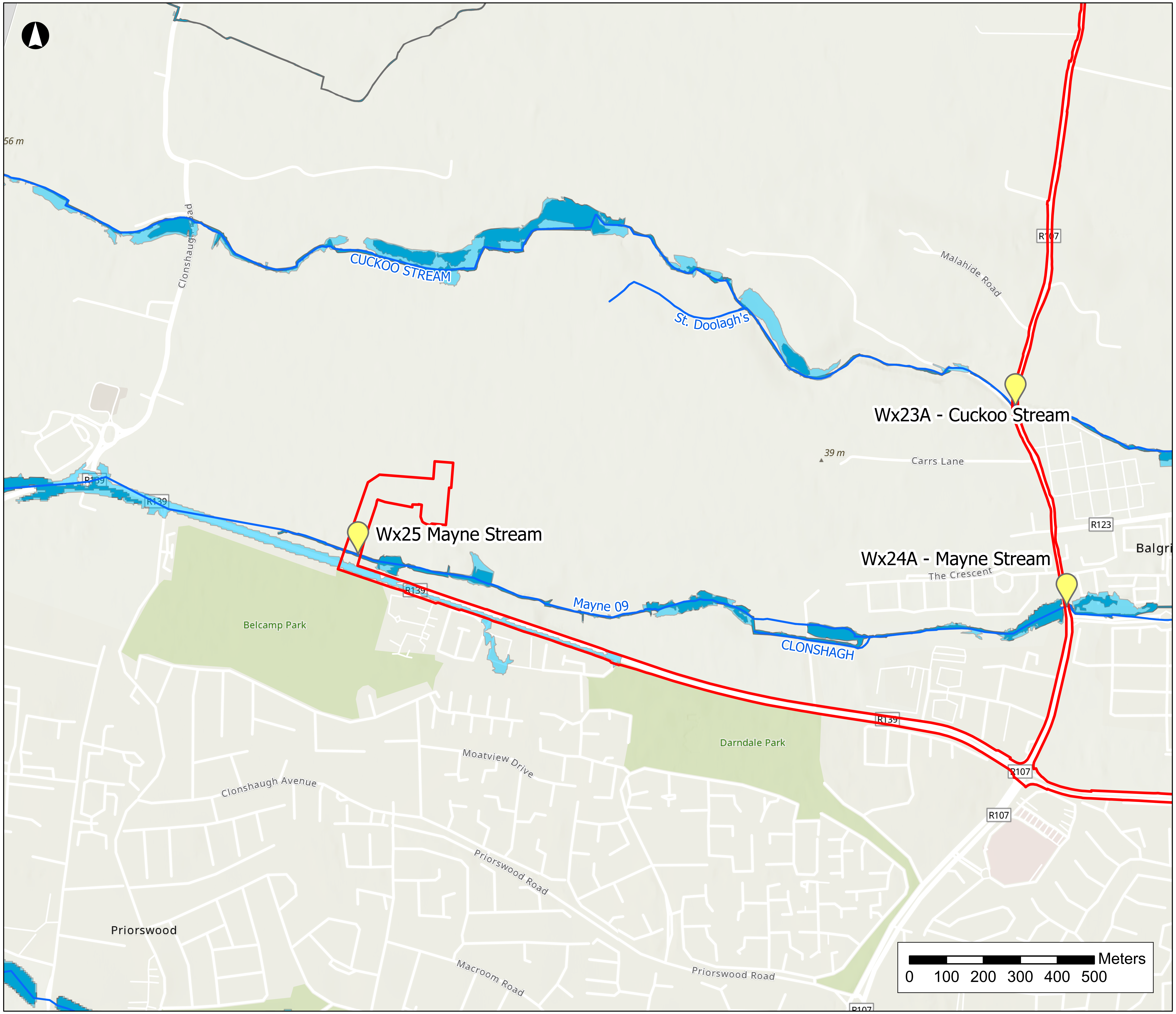
NISA
North Irish Sea Array

ARUP

Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**	22.3 (10)
Date:	May 2024		
Scale:	1:10,000		
Status:	Issue		



Legend

Proposed Development Boundary

Watercourse Crossings

Rivers

Lakes

Fluvial Flood Extents

0.1% AEP

1% AEP

Notes

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NISA

North Irish Sea Array

ARUP

Project

North Irish Sea Array Offshore Wind Farm

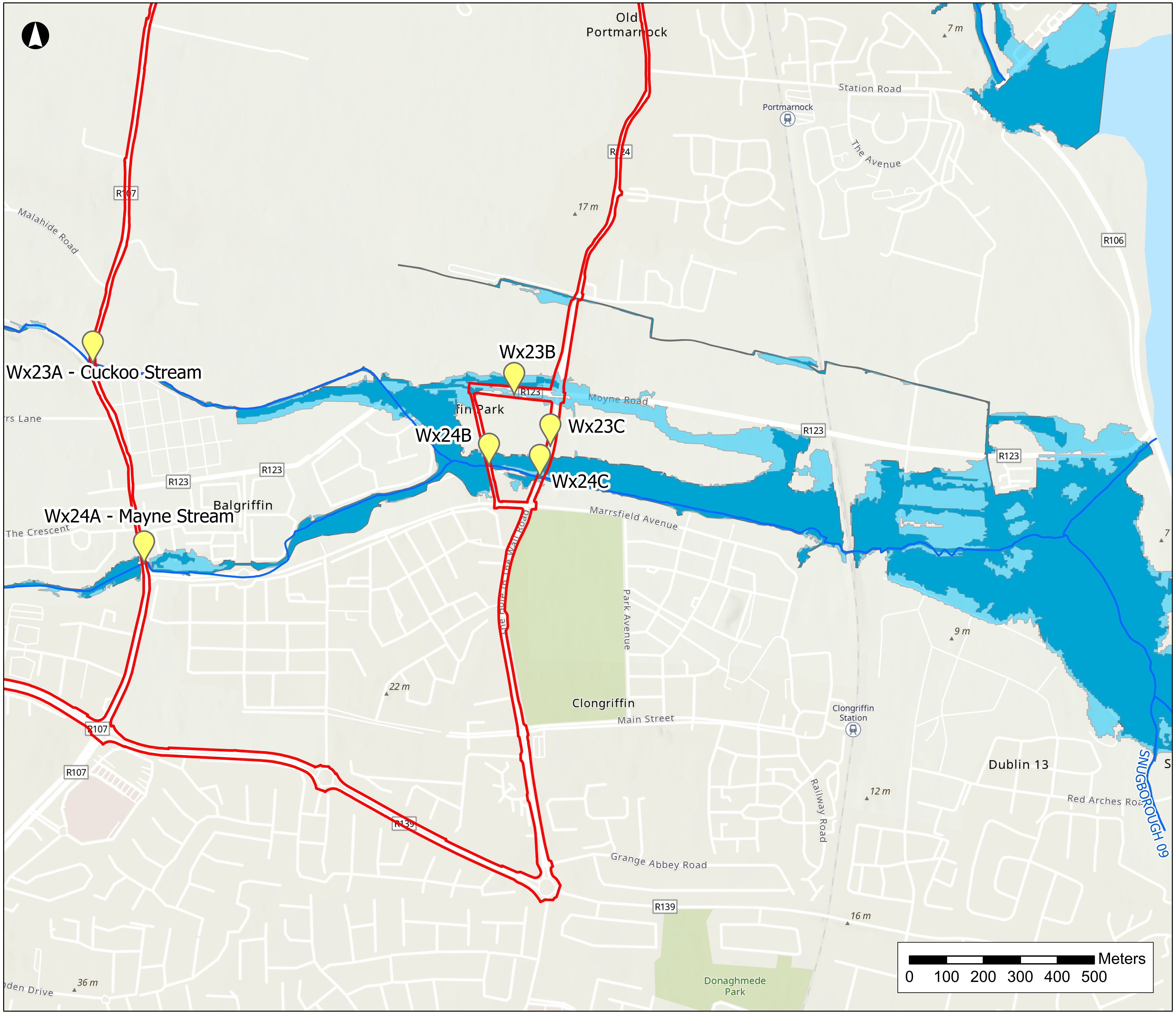
Figure Title

Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240
Date:	May 2024
Scale:	1:10,000
Status:	Issue

Figure No:

22.3 (11)



Legend

- Proposed Development Boundary
- Watercourse Crossings
- Rivers
- Lakes

Fluvial Flood Extents

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- 1% AEP

Notes
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NISA
North Irish Sea Array

ARUP

Project
North Irish Sea Array Offshore Wind Farm

Figure Title
Flood Risk Assessment: Fluvial Flood Extents

Job No:	281240	**Figure No:**
Date:	May 2024	**22.3 (12)**
Scale:	1:10,000	
Status:	Issue	