Appendix 14

Flood Risk Assessment

FEHILY
TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DERRYNADARRAGH WIND FARM

Site Specific Flood Risk Assessment For Derrynadaragh Wind Farm

Prepared for:

Dara Energy Limited

Dara Energy Limited

Date: **September 2025**

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Site Specific Flood Risk Assessment For Derrynadaragh Wind Farm

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
1	Final	SH/KB	PD	TC	17/09/2025

Client: Dara Energy Limited

Keywords: Flood Risk Assessment, flood risk, flood zones, Climate Change, mitigation, management, Derrynadaragh

Abstract: Fehily Timoney and Company (FT) was commissioned by Dara Energy Limited to prepare a Site-Specific Flood Risk Assessment (SSFRA) for Derrynadaragh Wind Farm in County Kildare and County Offaly; this is in response to a request for further information by An Bórd Pleanála with respect to the planning application for the renewable energy development.

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1. INTRODUCTION

Fehily Timoney and Company (FT) was commissioned by Dara Energy Limited to prepare a Site Specific Flood Risk Assessment (SSFRA) for the Proposed Wind Farm Development located within the townlands of Cushina, Clonsast Lower and Chevychase Or Derrynadaragh in County Offaly and Aughrin and Derrylea in County Kildare.

The Proposed Development consists of a 9 no. turbine wind farm and associated infrastructure including internal access tracks, hard standings, onsite 110 kV substation and associated grid connection infrastructure, internal electrical and communications cabling, temporary construction compounds, drainage infrastructure, biodiversity enhancement measures, temporary accommodations works along the Proposed Turbine Delivery Route and all associated works related to the construction of the Proposed Development.

The proposed wind farm site is located in a rural area and the nearest settlement is the village of Bracknagh which is located approximately 2 km to the north of the wind farm site.

Access to the proposed wind farm site is provided by the construction of a new access track located along the R419 regional road in the townland of Cushina.

Figure 1-1: Proposed Wind Farm -Site Location

Figure 1-2 Proposed Wind Farm and TDR

The report aims to confirm if there are any potential flood risks to the subject site and the turbine delivery route (TDR) as well as any potential increase of flood risk elsewhere as they are in a flood risk areas.

As part of the scope of work, FT was commissioned to carry out a flood modelling along the River Cushina and River Daingean, which cross the proposed site and the turbine delivery route, respectively.

2. FLOOD RISK ASSESSMENT METHODOLOGY

2.1 General

The Guidelines for Planning Authorities and its Technical Appendices outline the requirements for a SSFRA. The Guidelines for Planning Authorities requires that works:

- Avoid development in areas at risk of flooding.
- Substitute less vulnerable uses where avoidance is not possible.
- Mitigate and manage the risk where avoidance and substitution are not possible.

The key principles of the Guidelines for Planning Authorities apply the Sequential Approach to the planning process. Figure 2-1 of this report describes the mechanism of the sequential approach for use in the planning process.

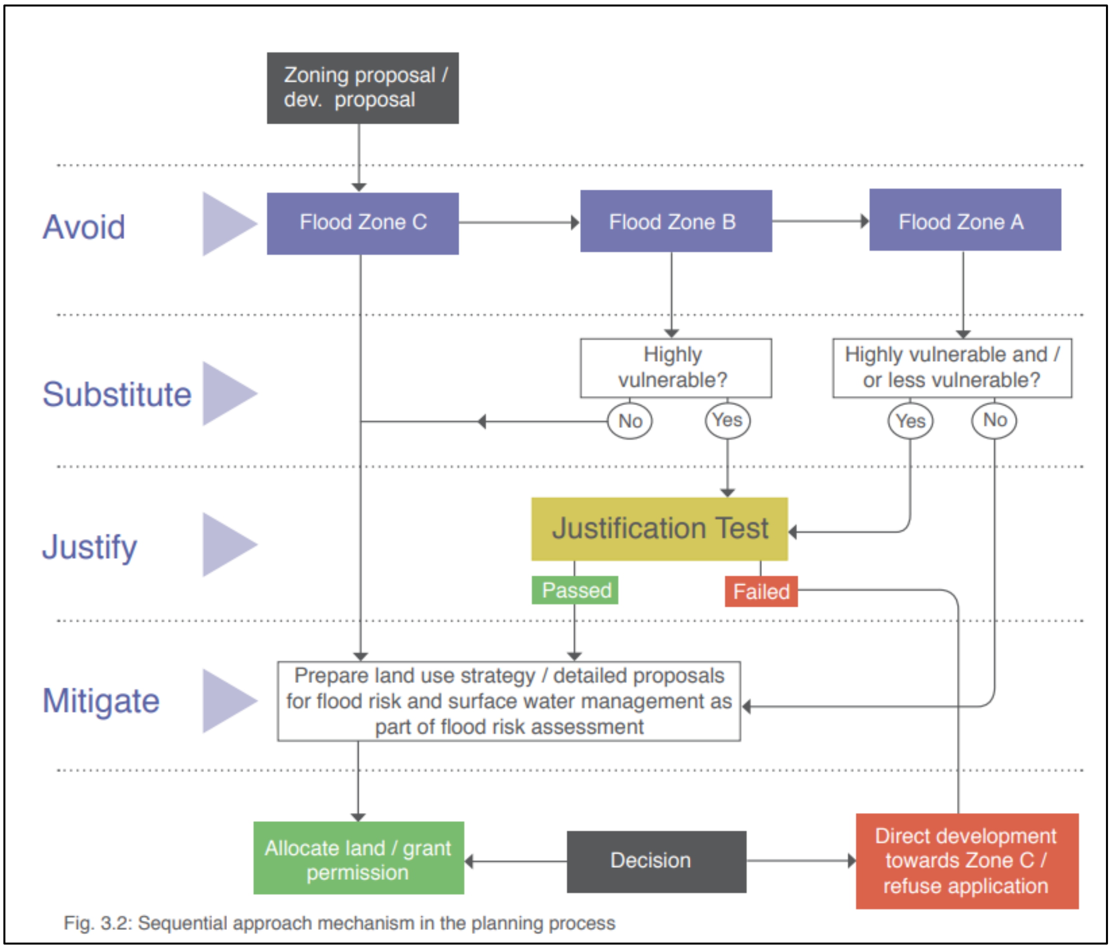


Figure 2-1: Sequential Approach Mechanism[1]

[1] Figure 3.2 of the *Guidelines for Planning Authorities*.

2.2 Source-Pathway-Receptor Model

The assessment of flood risk requires a thorough understanding of the following:

- The sources of flood water (e.g., high sea levels, intense or prolonged rainfall leading to runoff and increased flow in rivers and sewers)
- The pathways by which the flood water reaches those receptors (e.g., river channels, river and coastal floodplains, drains, sewers and overland flow).
- The people and assets affected by flooding (known as the receptors).

The Source-Pathway-Receptor (S-P-R) Model illustrated in Figure 2-2 has become widely used to assess and inform the management of environmental risks.

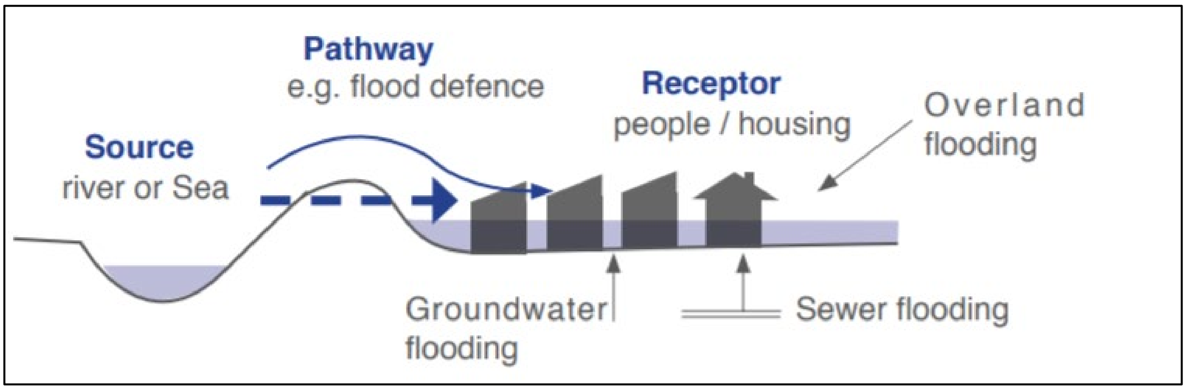


Figure 2-2: Source-Pathway- Receptor Model[2]

2.3 Likelihood of Flooding and Definition of Flood Zones

The Guidelines for Planning Authorities define the likelihood of flooding as the percentage probability of a flood of a given magnitude occurring or being exceeded in any given year. The likelihood of flooding is expressed as a return period or annual exceedance probability (AEP).

Flood Zones are graphical areas within which the likelihood of flooding is in a particular range. They are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. The Guidelines for Planning Authorities split these flood zones into three categories:

- Flood Zone A – where the probability of flooding from rivers and the sea is high (greater than 1% AEP for river flooding or 0.5% AEP for coastal flooding).
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP and 1% AEP for river flooding and between 0.1% AEP and 0.5% AEP for coastal flooding).
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP for both river and coastal flooding).

[2] Source: Fig 2.2 of the *Guidelines for Planning Authorities*.

2.4 Classification of the Proposed Development and Justification Test

The Guidelines for Planning Authorities categorises all types of development as either:

- Highly Vulnerable (garda, ambulances, schools, hospitals, dwelling houses, student halls…).
- Less Vulnerable (buildings used for: retail leisure, warehousing, commercial, industrial, and non-residential institutions,).
- Water Compatible (flood control infrastructure, docks, marinas, amenity open spaces...).

The Guidelines classify potential development in terms of its vulnerability to flooding. The types of development falling within each vulnerability class are described in Table 2.1 of the Guidelines, which is reproduced in Table 2-2:Matrix of Vulnerability Versus Flood Zone.

Table 2-1: Vulnerability Class[3]

Highly vulnerable development (Including essential infrastructure)	• Garda, ambulance and fire stations and command centres required to be operational during flooding; • Hospitals; • Emergency access and egress points; • Schools; • Dwelling houses, student halls of residence and hostels; • Residential institutions such as residential care homes, children's homes and social services homes; • Caravans and mobile home parks; • Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; • Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	• Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; • Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; • Land and buildings used for agriculture and forestry; • Waste treatment (except landfill and hazardous waste); • Mineral working and processing; • Local transport infrastructure.

[3] Source: Table 3.1 of the *Guidelines for Planning Authorities*.

Water-compatible development	• Flood control infrastructure; • Docks, marinas and wharves; • Navigation facilities; • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; • Water-based recreation and tourism (excluding sleeping accommodation); • Lifeguard and coastguard stations; • Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; • Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

*Uses which are not listed in the table should be considered on their own merits.

The Sequential Approach restricts development types to occur within the flood zone appropriate to their respective vulnerability classes. Table 2-2 identifies the types of development appropriate for each flood zone and those that will require a Justification Test.

Table 2-2: Matrix of Vulnerability Versus Flood Zone[4]

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

The Justification Test has been designed to rigorously assess the appropriateness of developments that are being considered in areas of moderate or high flood risk. There are two types of Justification Tests:

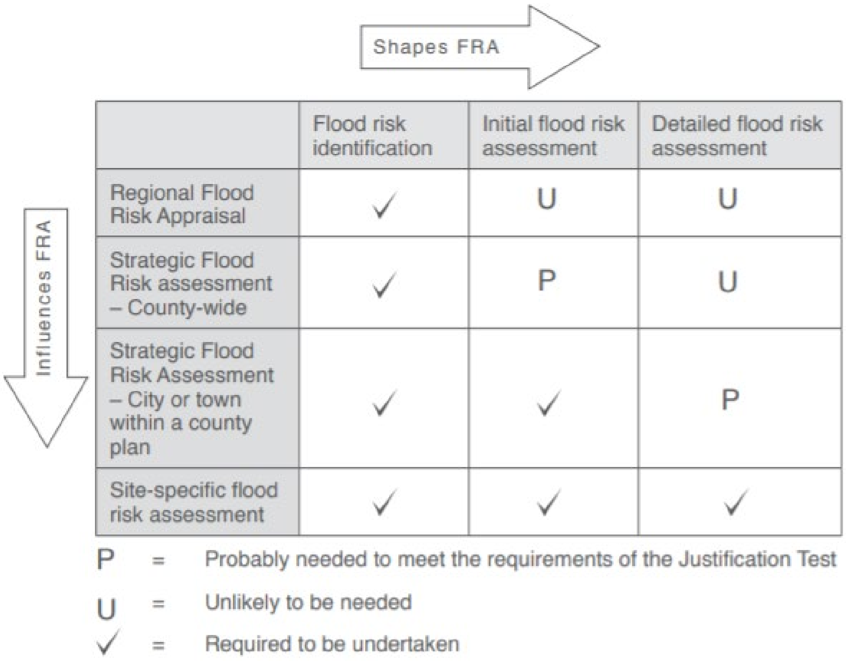
- The first is the Plan-making Justification Test which is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test which is used at the planning 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.

[4] Source: Table 3.2 of the *Guidelines for Planning Authorities*.

2.5 Flood Risk Assessment Stages

The Guidelines for Planning Authorities outline that a staged approach should be adopted when carrying out a SSFRA. These stages are the following:

- Stage 1 Flood Risk Identification.
- Stage 2 Initial Flood Risk Assessment.
- Stage 3 Detailed Flood Risk Assessment.



	Flood risk identification	Initial flood risk assessment	Detailed flood risk assessment
Regional Flood Risk Appraisal	✓	U	U
Strategic Flood Risk assessment – County-wide	✓	P	U
Strategic Flood Risk Assessment – City or town within a county plan	✓	✓	P
Site-specific flood risk assessment	✓	✓	✓

P = Probably needed to meet the requirements of the Justification Test
U = Unlikely to be needed
✓ = Required to be undertaken

Figure 2-3: Flood risk assessment stages required per scale of study undertaken[5]

Stage 1: Flood risk identification – to identify whether there may be any flooding or surface water management issues relating to the Proposed Development site that may warrant further investigations. The flood risk identification stage uses existing information to identify whether there may be any flooding or surface water management issues related to the site. Flood risks identified in this stage are then addressed in Stage 2.

Stage 2: Initial flood risk assessment – to confirm sources of flooding that may affect the development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. This stage involves the review of data addressed in Stage 1. Data where the flood risk at the site is recognised as being low is screened out and it is not further addressed in the report, data which recognised the flood risk on the site to be medium or high is further analysed in the report.

Stage 3: Detailed flood risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve the use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological process involved.

[5] Source: Appendix A of *Guidelines for Planning Authorities*, Table A3.

3. EXISTING SITE

3.1 Description of Catchments

This section addresses catchment characteristics of the proposed wind farm site and the turbine delivery route.

3.1.1 Proposed Wind Farm

The proposed wind farm site is located within the Barrow Catchment (ID 14) and the Barrow_SC_040 sub-catchment as defined by the WFD. The waterbody in this sub-catchment that is crossing the proposed site is known as FIGILE_080 (EPA Name: Cushina 14).

In addition, the wind farm is located within two sub-basins:

- *FIGILE_070- IE_SE_14F010510.*
- FIGILE_080- IE_SE_14F010600.

The elevation range of the overall wind farm site varies between approximately 66 m OD and 59 m OD, and it generally has a flat topography. Turbines will be installed in the range between approximately 64 m OD and 60 m OD.

The main hydrology feature within the wind farm site is the Cushina River (FIGILE_080). A large area of the surface runoff drains into this river within FIGILE_080 sub-basin. The Cushina River runs in an easterly direction, and it is a tributary of the Figile River (FIGILE_080). The remaining of the site drains into FIGILE_070 sub-basin or directly into Figile River. In addition, there are no lakes or reservoirs within the wind farm site study area.

Rainfall data from Met Éireann was analysed and recorded at Casement Station, which is c.46 km northeast of the Site and associated infrastructure.

The 30-year annual average rainfall at Casement weather station, recorded from 1991 to 2020, was calculated to be 783.5 mm. The average rainfall at the proposed wind farm site may vary due to its geographical location.

The Standard Average annual Rainfall (SAAR) of the site from the FSU Portal is approximately 827 mm, which gives a more conservative output and it will be used for the Hydraulic Analysis in Section 7.1.

Following further research into the Rainfall data from Met Éireann , Table 3-1 below shows the average annual rainfall recorded from the closest weather station with more available data which is in Lullymore, Co. Kildare. This station is approximately 15 km north-east of the subject site and associated infrastructure.

Table 3-1: Rainfall Data - Lullymore Nature Centre Station

Total rainfall in millimetres for Lullymore Nature Centre Station															
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Average
Rainfall	839	976	818	848	1025	868	877	747	986	1008	845	834	1038	785	892

This station is closer to the Site than Casement weather station, but it is still 15 km away and at a different elevation, therefore the Standard Average Annual Rainfall (SAAR) from the FSU Portal was chosen.

The M5-60 at development location is 16.5 mm according to the Met Éireann rainfall data. This is the predicted rainfall depth in a sixty-minute storm that will occur with a frequency of once every five years.

3.1.2 Turbine Delivery Route (TDR)

The watercourse crossing of the Turbine Delivery Route is located within the Barrow Catchment (ID 14) and the Figile_SC_020 sub-catchment as defined by the WFD. *The waterbody in this sub-catchment that is affected by the TDR is named as Daingean_030 (also known as Philipstown). This watercourse runs in an easternly direction, and it is a tributary of the Figile River.*

This watercourse crossing is located approximately 5 km east of Daingean town and is bordered by the R402 to the north, where the TDR branches off, and the R400 to the east.

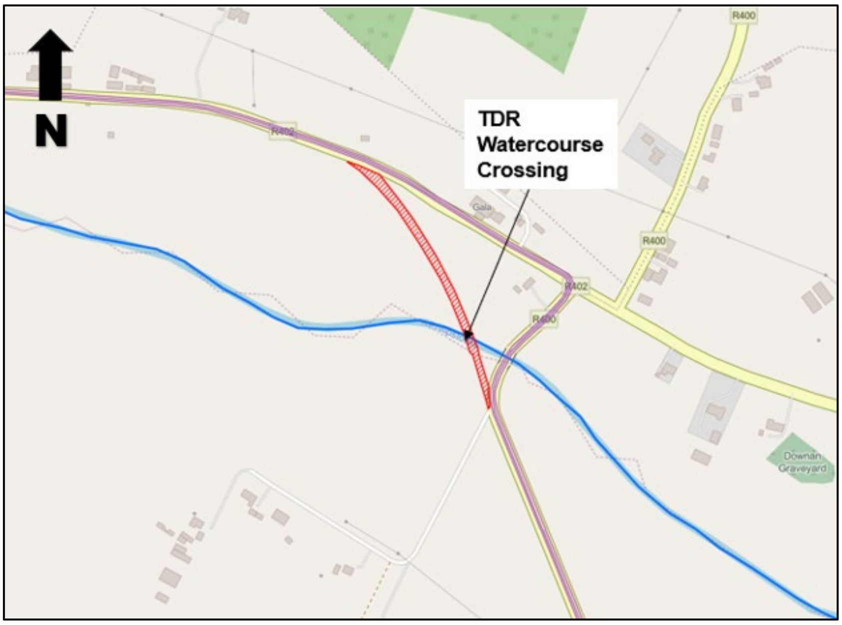


Figure 3-1: TDR Watercourse Crossing

Rainfall data from Met Éireann was also analysed, including records from the Lullymore Nature Centre Station, located approximately 18 km east of the watercourse crossing. However, due to the distance and difference in elevation, the Standard Average Annual Rainfall (SAAR) value from the FSU Portal was used instead

3.2 Subsoil and Hydrogeology

A desk study was undertaken to gather relevant background information prior to undertaking the site walkovers and ground investigations. The mapping data of the area produced by the Geological Survey of Ireland (GSI) was examined.

According to the GSI, the local deposits are mainly comprised of cut over raised peat and lake marl. To the north of the site, but outside of the boundary, alluvium deposits are identified.

The figure below shows the distribution of Quaternary deposits from the GSI.

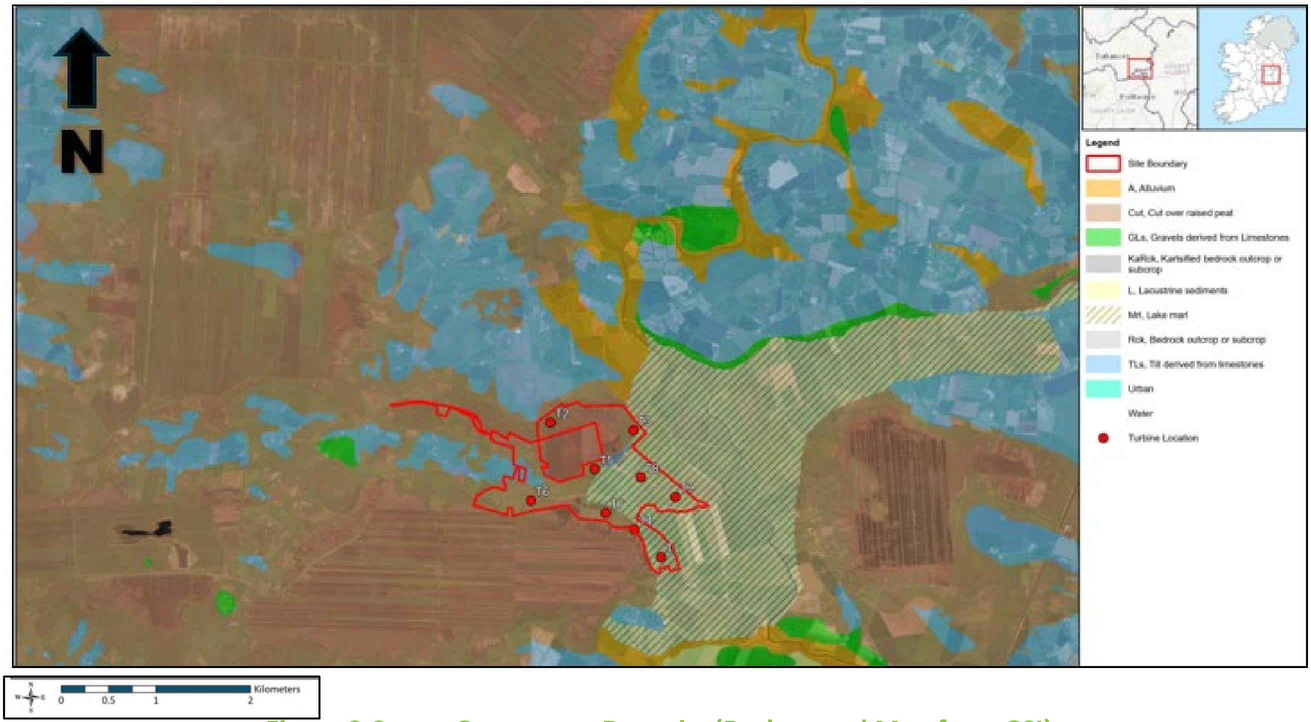


Figure 3-2: Quaternary Deposits (Background Map from GSI)

According to GSI, there is one main bedrock formation underlying the site:

- Lucan Formation: Dark limestone and shale. The formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded.

The figure below shows the bedrock formation distribution according to GSI.

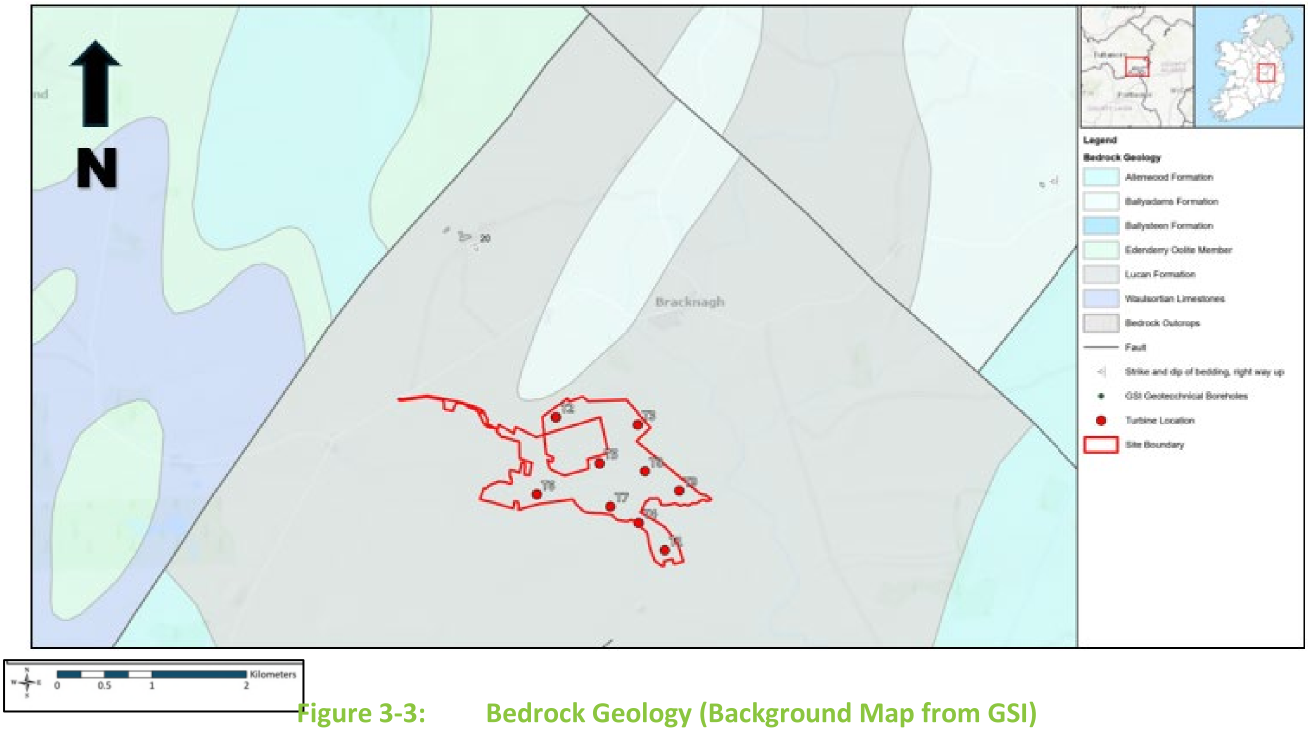


Figure 3-3: Bedrock Geology (Background Map from GSI)

According to GSI Subsoil Permeability mapping, the overburden deposits of till and peat are mapped as having low permeability. These strata may therefore act as a confining layer (where present), preventing the free movement of surface water to the underlying Aquifer.

Findings from the walkover surveys confirm that the site is predominantly underlain by peat with the eastern area of the site underlain by a thin layer of peaty topsoil overlying a soft clay/ marl. It also confirmed that there are no bedrock outcrops or subcrops across the site.

In addition, the ground investigation works concluded that the groundwater levels across the site are shallow and that the predominant Quaternary deposits across the proposed wind farm comprise low permeability fine grained till.

Further information and details on subsoil and hydrogeology can be found in Chapter 10 of Volume 2 of the EIAR, titled "Soils, Geology and Hydrogeology".

3.3 Hydrological Features

A site walkover survey was conducted in April 2023 to establish the drainage pattern and to record existing hydrology features; a collection of the site visit photos can be found in Appendix 7, lodged with this report. The site of the proposed wind farm has a generally flat slope, with a flood plain that starts widening on both sides approximately 470 m east of a proposed bridge crossing, following the downstream direction of the Cushina River. This is the main river within the site which flows in an easternly direction and is a tributary of the Figile River.

The Turbine Delivery Route (TDR) intersects the Daingean River and its flood plain and a bridge is also proposed here. This river flows in an easternly direction, and the surrounding area generally follows a flat slope.

3.3.1 Proposed Wind Farm-Surface Water Crossings

As part of this SSFRA, a detailed review of the proposed internal wind farm watercourse crossings was carried out to ensure the designs would be in accordance with OPW requirements.

There is one main watercourse crossing on the western side of the subject site for which a detailed flood modelling and hydrological analysis were carried out and are shown in Sections 7.1 and 7.2. As a result of this assessment, a single span bridge is proposed with a span of 19.00 m.

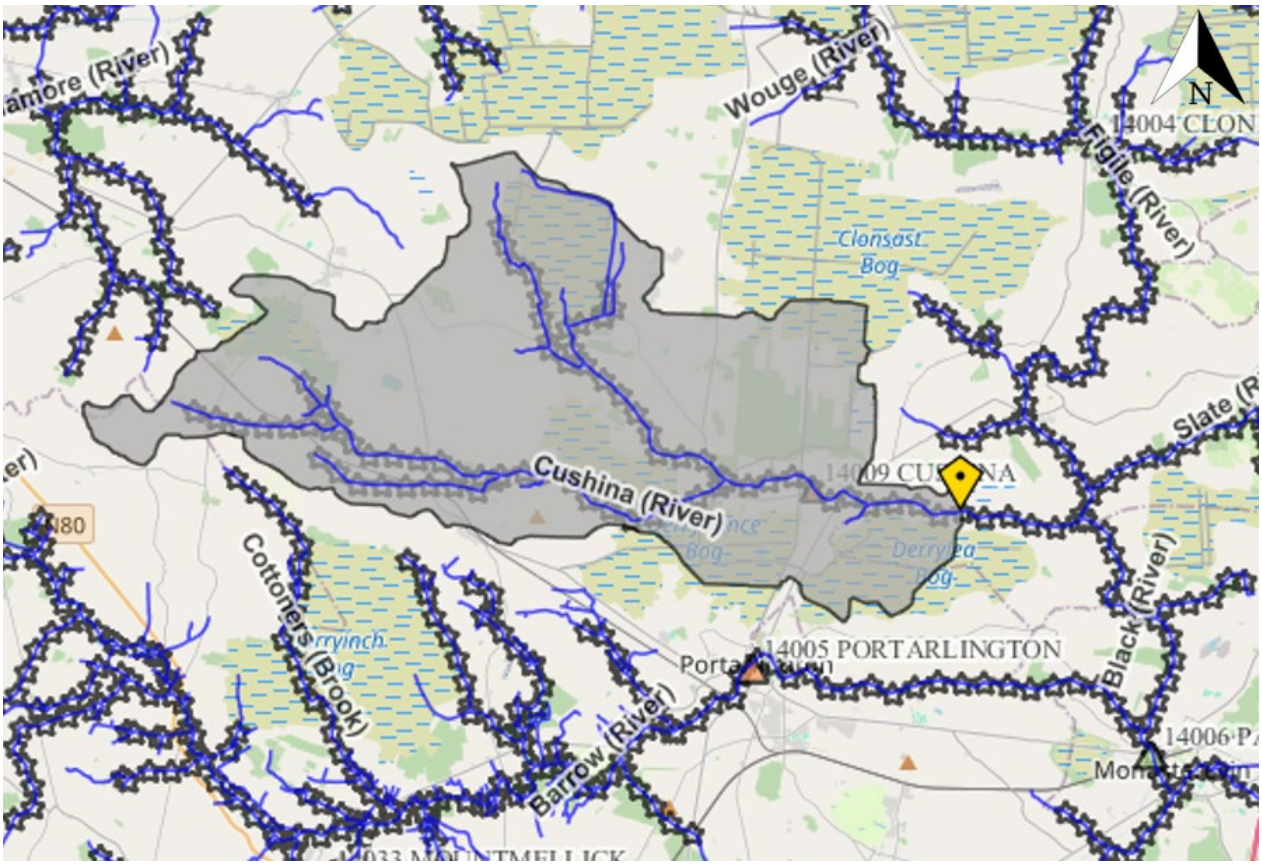


Figure 3-4: Proposed Structure Location (Map from https://opw.hydronet.com)

3.3.2 Proposed Surface Water Drainage

The proposed development requires surface water drainage systems to manage and collect overland flow, as well as surface water from infrastructure elements such as access tracks, turbine bases, the substation and other hardstanding areas. The main components of the proposed drainage network are:

- Interceptor Drains: they collect the overland flow and discharge it through access tracks via cross drains. It will then be directed to areas where it can be redistributed over the ground or discharge to existing land drains or streams.
- Swales: they are installed along access tracks and other hardstanding areas to collect the surface water from these areas and separate them from the overland flow.
- Settlement Ponds: the surface water collected by the swales will pass through these settlement ponds to reduce the concentration of suspended solids before discharging over the ground.

- Diffuse outfall: discharge from settlement ponds and interceptor drains will be provided by a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains.
- Check Dams: at slopes greater than 1%, check dams will be required in the swales and interceptor drains to slow down the velocities of flows and prevent erosion occurring.

The proposed surface water drainage systems utilises sustainable drainage elements that aim to reduce or minimise any impact on the existing drainage conditions.

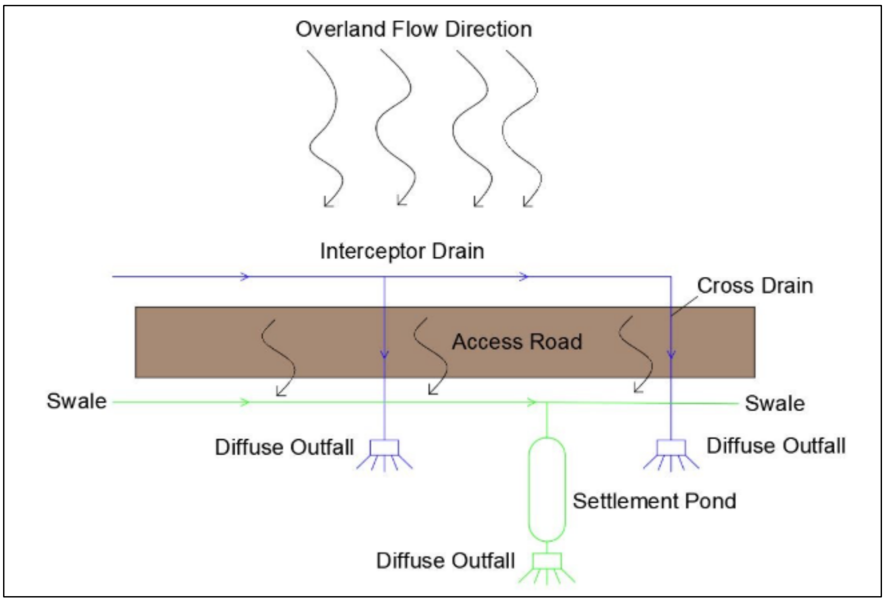


Figure 3-5: Drainage Design Principles

3.3.3 Turbine Delivery Route (TDR)

A detailed review of the proposed watercourse crossing of Daingean River was carried out to ensure the design is in compliance with OPW requirements.

A detailed flood modelling and a hydrological analysis were carried out where a single span bridge with a span of 20.00 m and five relief culverts were proposed.

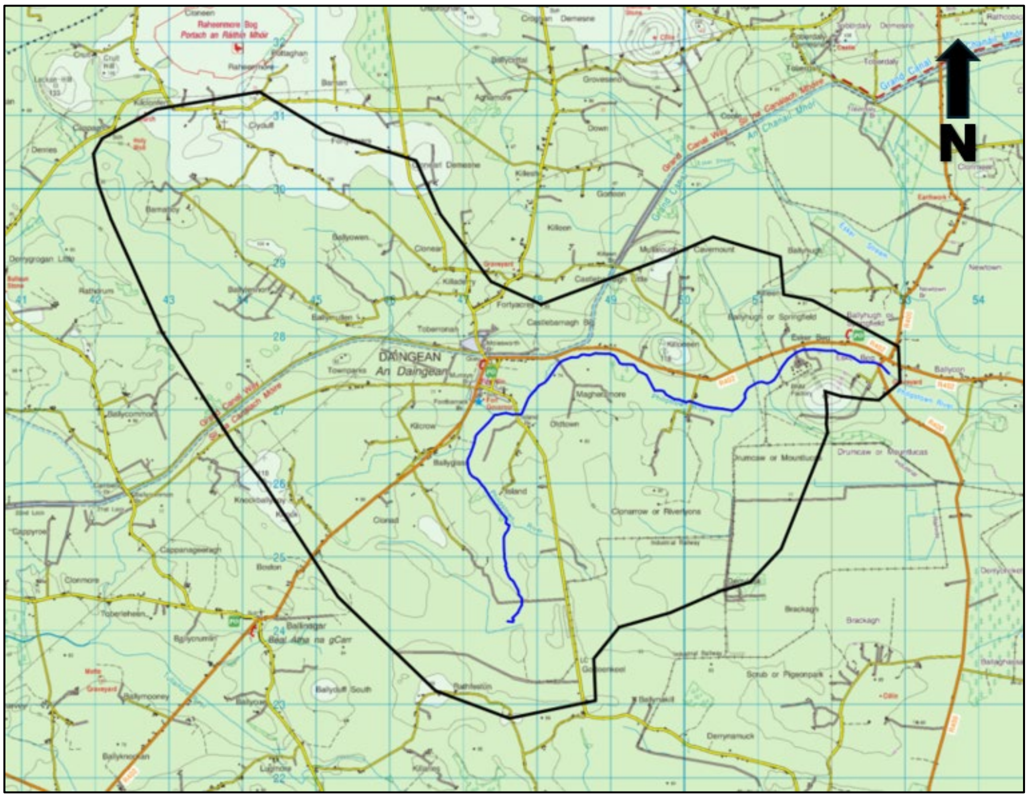


Figure 3-6: Catchment- Proposed TDR Watercourse Crossing

4. OFFALY AND KILDARE COUNTY DEVELOPMENT PLANS

The proposed wind farm is located under the jurisdiction of two counties: Offaly and Kildare.

Offaly County Development Plan (2021-2027) came into effect in October 2021 and Kildare County Development Plan (2023-2029) came into effect in January 2023. They both sets out the proposed policies and objectives for the Development of the County over the Plan period. The Development Plans seek to develop and improve, in a sustainable manner, the social, economic, environmental and cultural assets of the Counties. The approach to Flood Risk Management is set out in Chapter 3 Climate Action and Energy -Volume 1 (Offaly CDP) and Chapter 6 Infrastructure & Environmental Services - Volume 1 (Kildare CDP) and in their Strategic Flood Risk Assessments (SFRA).

The SFRAs were undertaken by the counties in accordance with the Planning System and Flood Risk Management- Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government and Office of Public Works, 2009) and Department of the Environment, Community and Local Government Circular PL 2/2014. The SFRA provides an assessment of flood risk and includes mapped boundaries for Flood Risk Zones .

Offaly County Council shows on their GIS Viewer the flood extents around the proposed development but only within the Offaly County. Also, it shows that this a rural area that hasn't been land zoned for but provides Landscape Sensitivity zones.

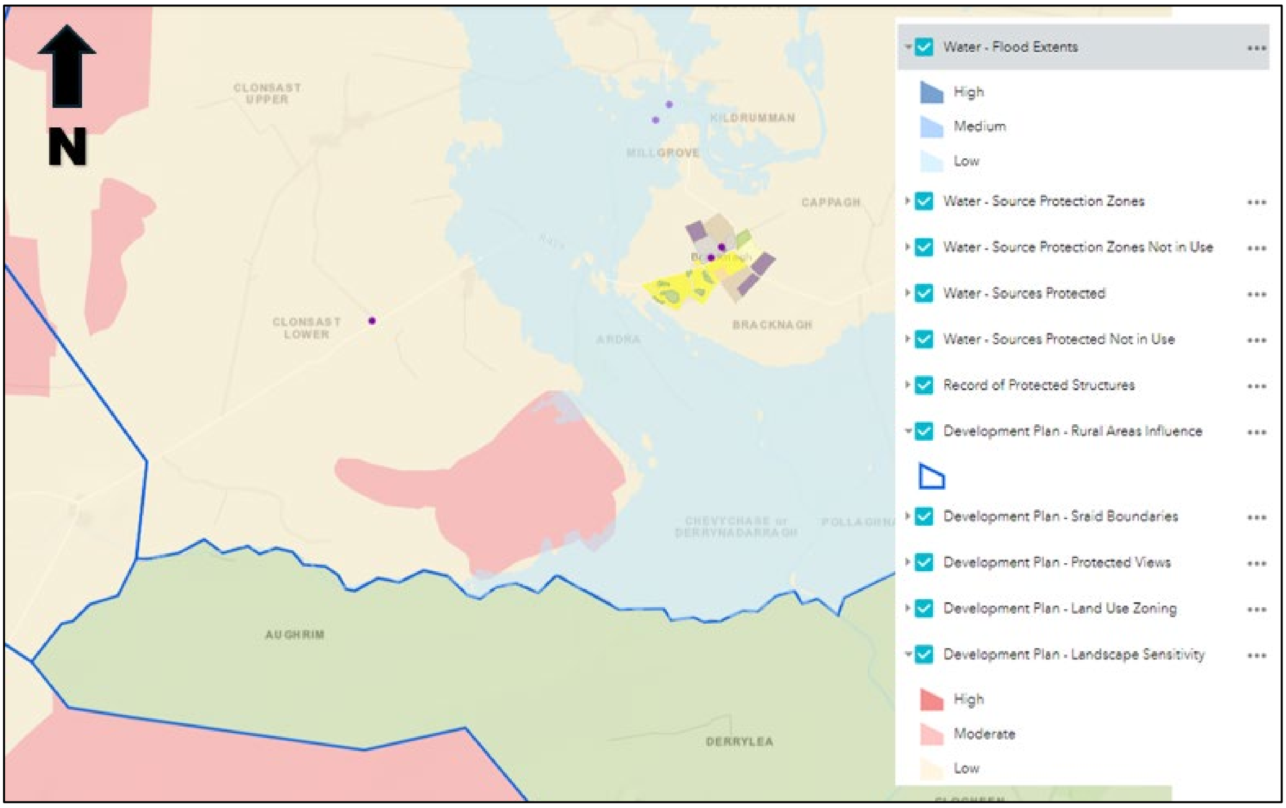


Figure 4-1: Offaly County Flood Extents and Land Zones

Both counties have developed a Wind Energy Strategy document as part of the County Development Plan which identify key areas within the county for the development of Wind Energy and also identifies unsuitable areas for these types of developments.

The Figure below was taken from Offaly Wind Energy Strategy document and shows that part of the proposed development lies in an area that is "Open For Consideration" for Wind Energy Development. These areas are characterised by low housing densities, they do not conflict with European or National designated sites and have the ability by virtue of their landscape characteristics to absorb wind farm developments. Notwithstanding this designation, wind farm developments in these areas are to be evaluated on a case-by-case basis.

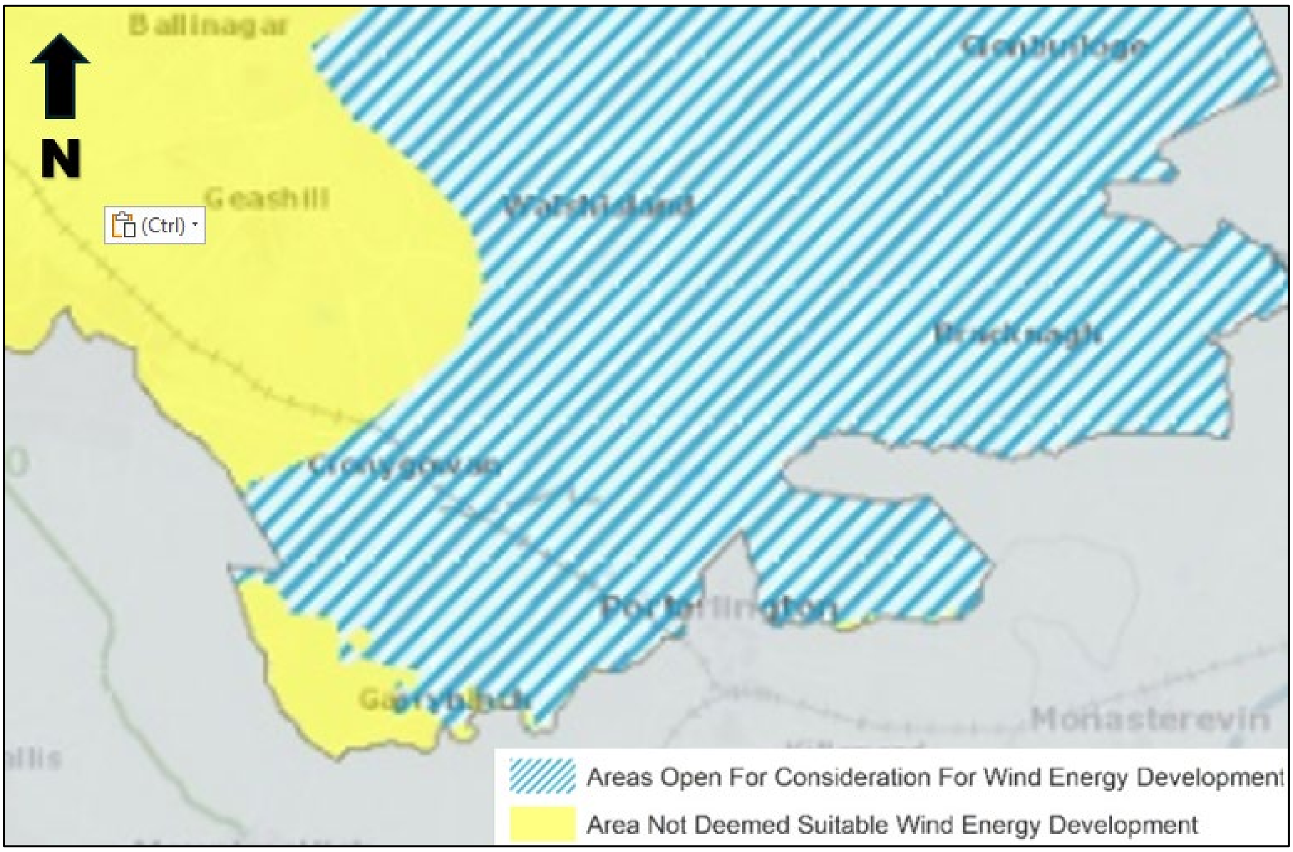


Figure 4-2: Offaly Wind Energy Strategy

Kildare Wind Energy Strategy classifies the other side of proposed development as "Acceptable in Principle"for windfarm development which are areas that are predominantly flat, rural and well serviced by the existing electricity transmission grid.

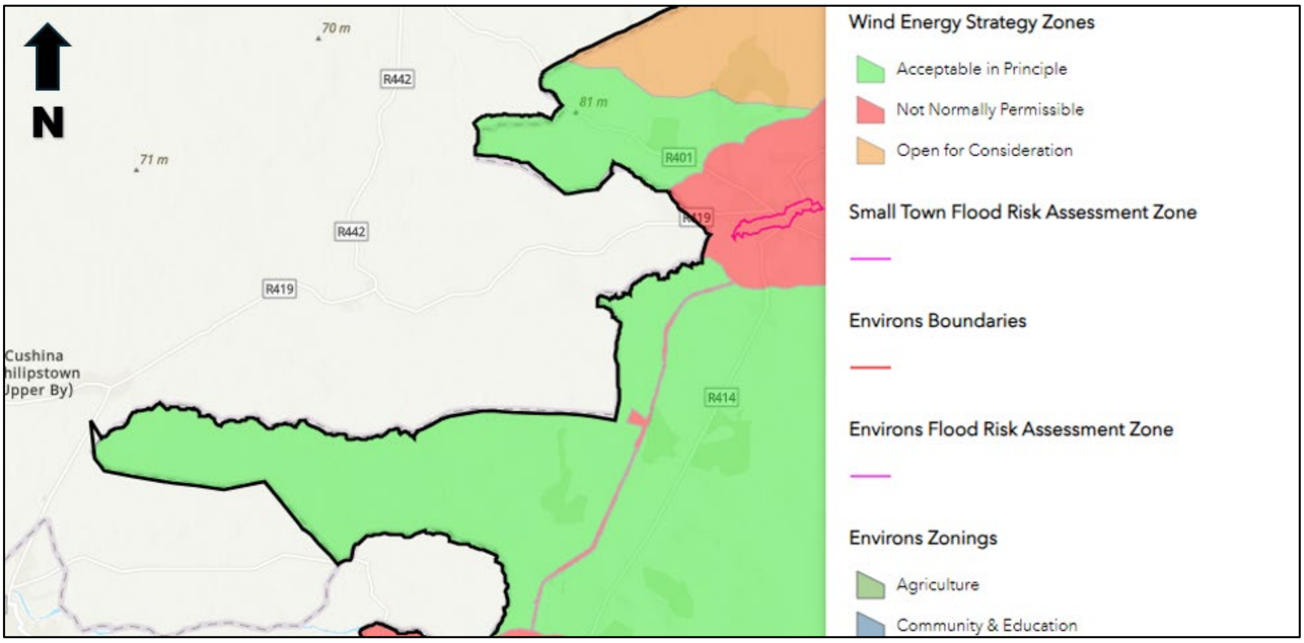


Figure 4-3: Kildare Wind Energy Strategy

5. STAGE 1 - FLOOD RISK IDENTIFICATION

5.1 Areas for Further Assessment and Benefiting Lands

The National Catchment Flood Risk Management (CFRAM) Programme has examined the flood risk, and possible mitigation measures to address it in 300 communities throughout the country at potentially significant flood risk. These communities were identified through the Preliminary Flood Risk assessment (PFRA), which was a national screening assessment of flood risk. The communities recognized as being at a significant flood risk are called Areas for Further Assessment (AFA). For the AFAs a detailed hydraulic modelling has been carried out to produce indicative flood maps (CFRAM Maps).

The subject site and the TDR watercourse crossing are within an AFA and therefore, flooding maps have been produced as part of the CFRAM mapping.

Local Authority is charged with responsibility of maintaining Drainage Districts. According to the OPW database, the Cushina, Figile and Daingean Rivers as well as a number of local drains in the area form part of the Drainage Districts.

5.2 Coastal Flooding

The ground levels within the site range from 66 mOD to 59 mOD and it is located approximately 68 km from the coast at its nearest point. As such, the site is not considered to be at risk of coastal flooding. Similarly, the TDR watercourse crossing is not impacted by coastal flooding, as it lies approximately 75 km from the sea and is situated at an elevation of around 70 mOD.

5.3 Groundwater Flooding

Based on the information described in Section 3.2, Subsoil and Hydrogeology, which was gathered from a desktop study, site walkovers, and ground investigation works, the subject site is, in general, not at risk of groundwater flooding. The ground investigation revealed that groundwater levels across the site are shallow; however, the predominant overburden deposits of till and peat across the proposed wind farm comprise low permeability which indicate a low risk of groundwater flooding.

5.4 Fluvial Flooding

5.4.1 CFRAM and NIFM Maps

The CFRAM Programme extends to the subject site and the TDR watercourse crossing showing that both locations are vulnerable to fluvial flooding. Figure 5-1 below shows the flood extents for the 1 % annual exceedance event-Current Scenario.

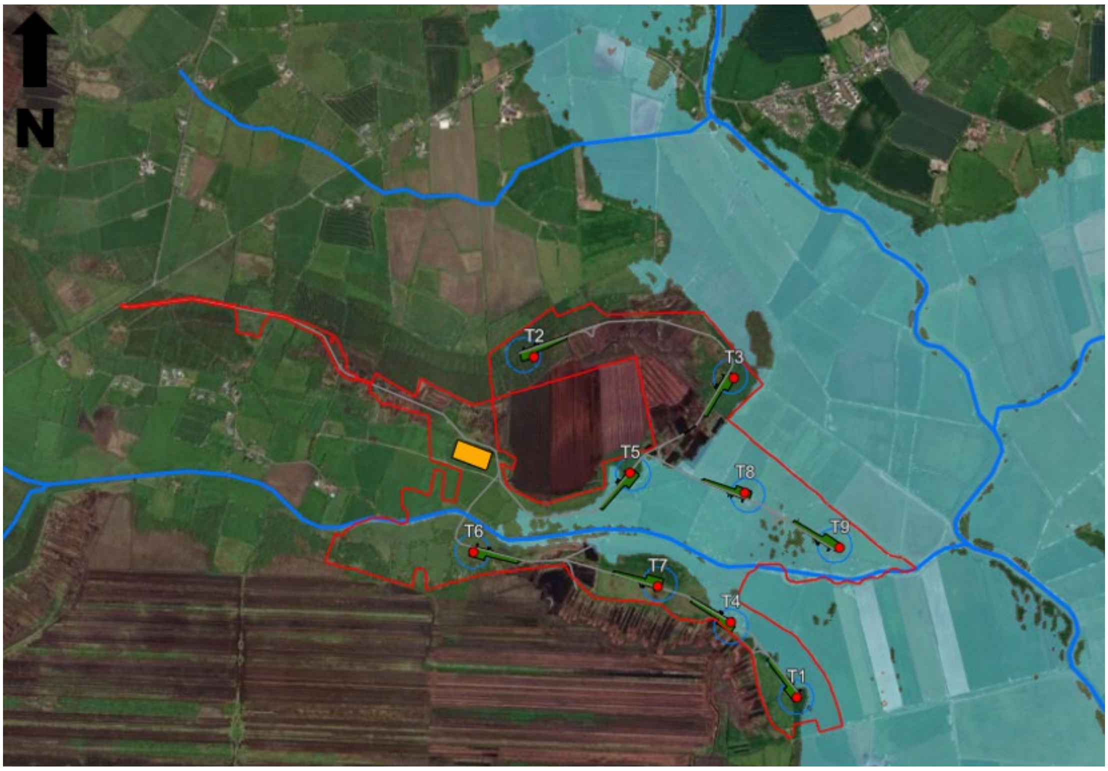


Figure 5-1: CFRAM Flood Map - Medium Probability-Proposed Wind Farm Location (Map from www.floodmaps.ie)

Figure 5-2: CFRAM Flood Map -Medium Probability-TDR Watercourse Crossing (Map from www.floodmaps.ie)

5.5 Pluvial Flooding

The Winter 2015/2016 Surface Water Flooding map shows fluvial (rivers) and pluvial (rain) floods, excluding urban areas, during the winter 2015/2016 flood event. Figure 5-3 below shows that there was pluvial flooding in combination with fluvial within the site boundary, probably due to the overland flow in these low lying and flat areas.

Pluvial flood risk should be considered, and the proposed development should not increase the flood risk elsewhere due to the construction of new access tracks, hardstanding areas, and the proposed discharge points.

Figure 5-3: GSI Winter 2015/2016 Surface Water Flooding-Proposed Wind Farm Location (Map from www.floodmaps.ie)

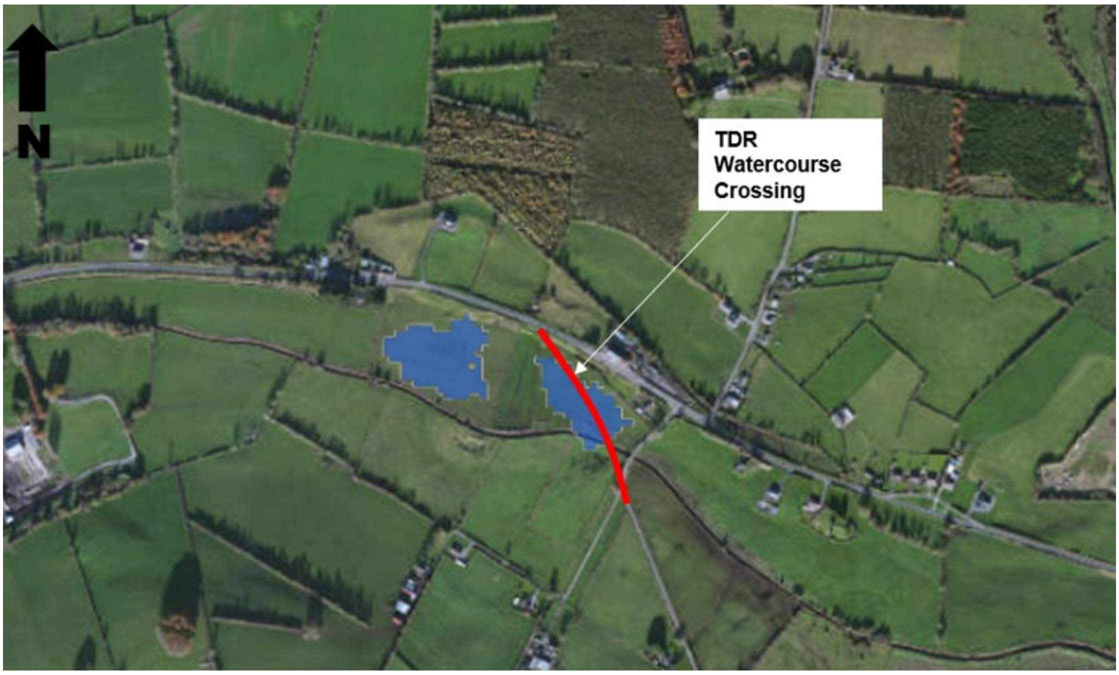


Figure 5-4: GSI Winter 2015/2016 Surface Water Flooding-TDR Watercourse Crossing

5.6 Historical Flooding

The national flood hazard mapping (www.floodmaps.ie), indicates that there are historical or past flooding events within the proposed site boundary . This past flood event has been mapped defining the extend of the flood along the Cushina River. There are also some single and recurring flood events in the area but are outside of the proposed site boundary.

The past flood event that has been mapped as shown in Figure 5-4 below appears to extend only within County Kildare. However, the floodplain also extends towards County Offaly on the north side of the Cushina River. Therefore, this map is considered only as part of the information gathered and a more detailed assessment will be required.

Figure 5-5: Past Flood Event-Proposed Wind Farm Location (Map taken from www.floodmaps.ie)

Figure 16 below shows a recurring flood event to the west of the TDR Watercourse Crossing, approximately less than 1 km away, which appears to be associated with the Daingean River.

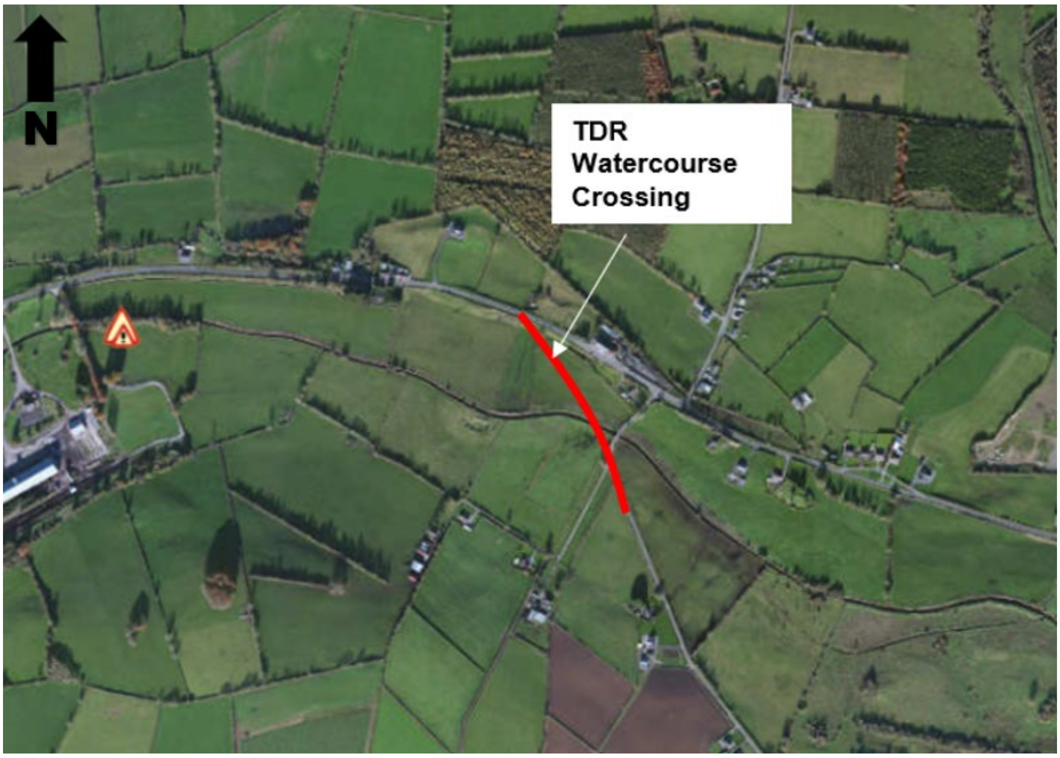


Figure 5-6: Past Flood Event-TDR Watercourse Crossing (Map taken from www.floodmaps.ie)

There are areas defined as 'benefiting lands' within the subject site and the TDR watercourse crossing. Benefiting lands were lands that were drained as part of the Drainage District to improve land for agriculture and to mitigate flooding.

Figure 5-7: Drainage Districts, Benefitting Lands and Channels-Proposed Wind Farm (Map from www.floodmaps.ie)

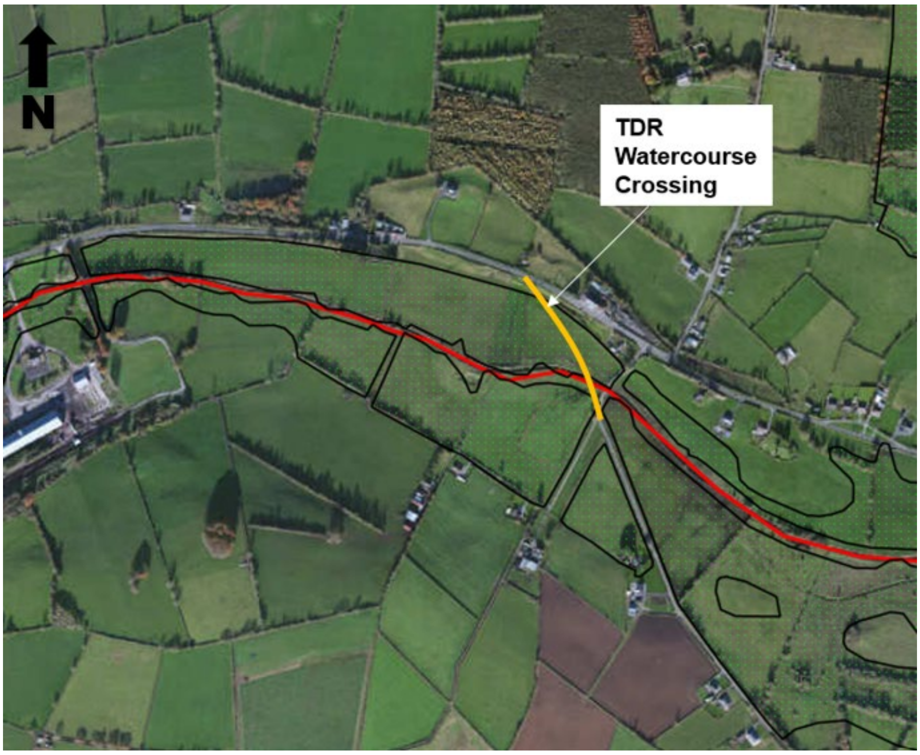


Figure 5-8: Drainage Districts, Benefitting Lands and Channels - TDR Watercourse Crossing (Map from www.floodmaps.ie)

6. STAGE 2 - INITIAL FLOOD RISK ASSESSMENT

The primary objective of conducting an initial flood risk assessment is to investigate flood-related concerns identified during Stage 1 Flood Risk Identification. Based on the information recorded in Stage 1, it has been determined that the Site is at risk of fluvial and pluvial flooding.

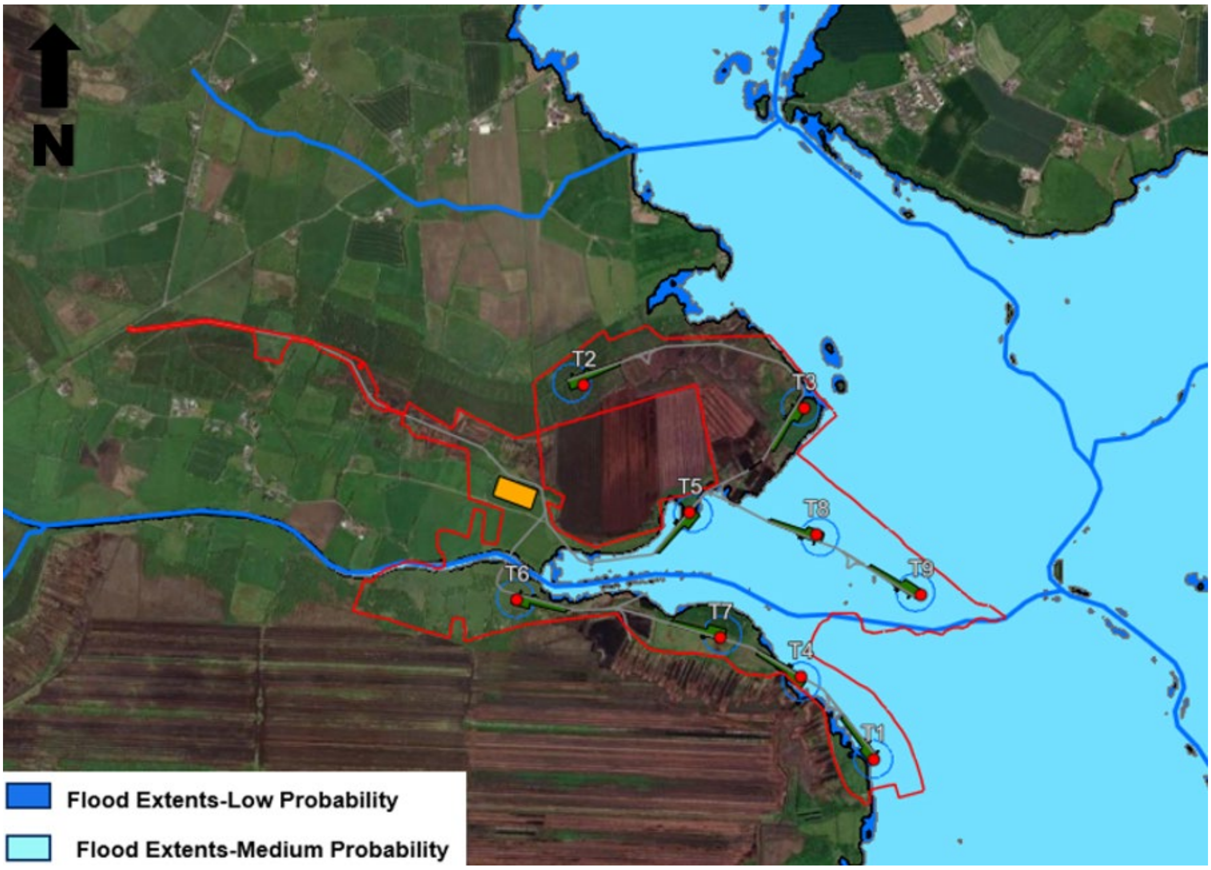


Figure 6-1: CFRAM Fluvial Flood Map - Medium and Low Probability-Mid Range Future Scenario (Map from www.floodmaps.ie)

Figure 6-2: Winter 2015/2016 Surface Water Flooding (Map from www.floodmaps.ie)

According to the CFRAM, some areas of the site are within Flood Zones A and B which are T1, T4, T8 and T9 and their access roads. Other access roads and infrastructure are also within the flood zones or are very close to it such as T5. However, the critical or essential parts of the windfarm such as the substation and the grid route connection joint bays are outside of the flood zones.

The proposed wind farm is classified as a Less Vulnerable Development in accordance with Table 2-1, as the critical infrastructure—such as the substation and the grid connection joint bays—is located outside the flood zones. However, some elements, including turbines and access roads, are within Flood Zone A. Therefore, a Justification Test is required, as outlined in Table 5-1.

Table 6-1: Matrix of Vulnerability Versus Flood Zone - Case of Study

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

A Stage 3 Detailed Flood Risk Assessment will be carried out to determine the flood levels and extends; also, there is a proposed bridge that crosses the Cushina River and the design of this structure is required to comply with the OPW requirements.

The TDR watercourse crossing is also affected by fluvial and pluvial flooding as identified in the previous section.

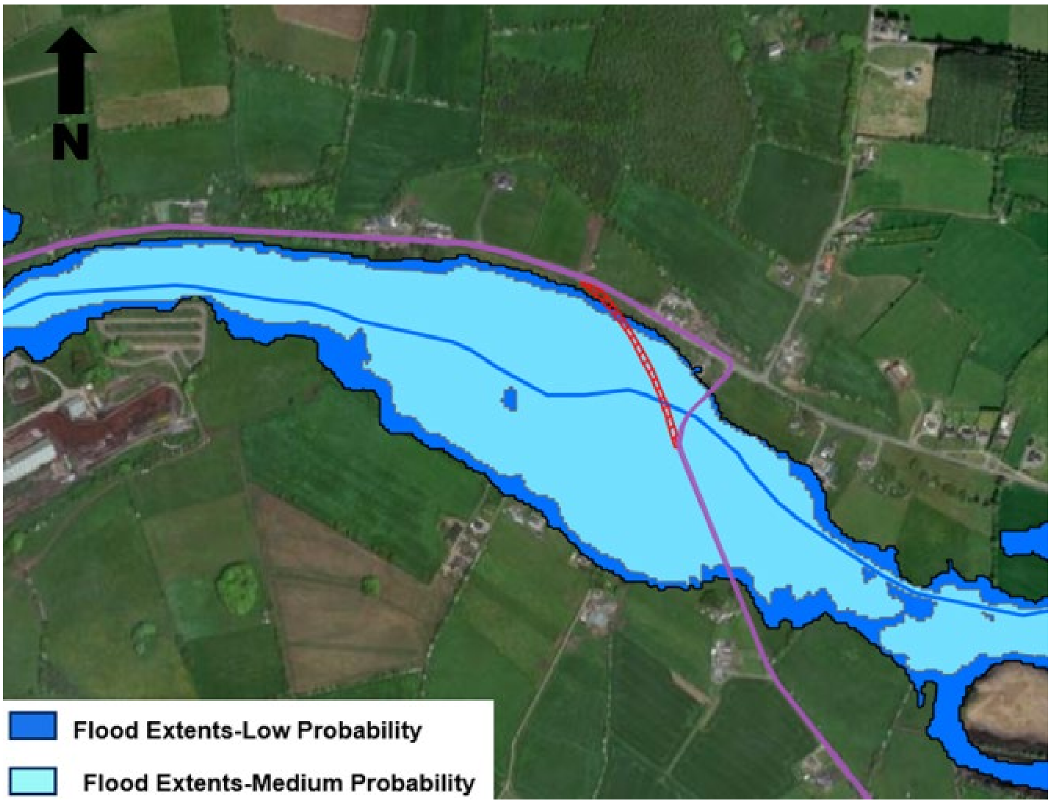


Figure 6-3: CFRAM Fluvial Flood Map- Medium and Low Probability-Mid Range Future Scenario (Map from www.floodmaps.ie)

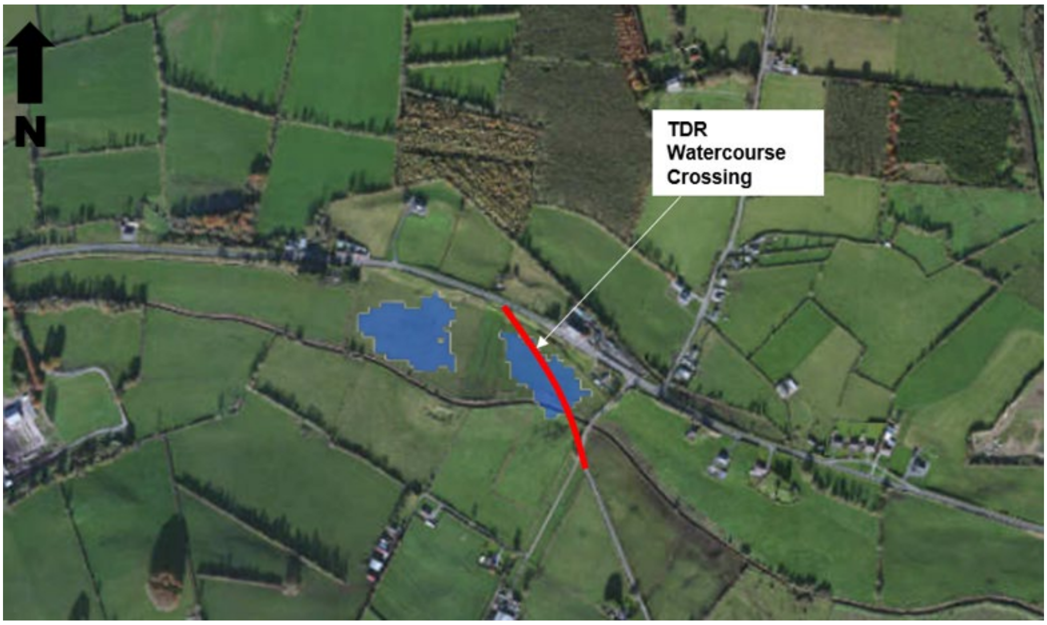


Figure 6-4: Winter 2015/2016 Surface Water Flooding (Map from www.floodmaps.ie)

This watercourse crossing is located within Flood Zones A and B and is classified as "Less vulnerable development" as per Table 2-1, therefore, a Justification Test is required as shown in Table 5-1. This will be included as part of the Justification Test for the overall project.

A Stage 3 Detailed Flood Risk Assessment will be carried out to determine the flood levels and extents, and to design the proposed bridge crossing the Daingean River, which is also required to comply with OPW requirements. In addition, any mitigation measures required will also be determined as the access road crosses a flood plain.

7. STAGE 3- DETAILED FLOOD RISK ASSESSMENT

7.1 Proposed Wind Farm- River Cushina

A site-specific hydraulic model was developed as part of this FRA to quantify the flood levels at the site and to design the proposed bridge crossing. Hydrological and hydraulic analysis were undertaken along the specific reach of the Hydrological Features to enable the delineation of appropriate flood zones. This model also allowed to quantify the water depths at the locations where relevant infrastructure were located in flood zones such as some of the turbines.

In order to undertake the hydraulic modelling, the peak flood flows were estimated along Two Hydrological Estimation Flows (HF's) as per the following figures below. The estimated peak flows, in conjunction with a digital terrain model (DTM) were used to generate the flood extent and flood depth maps for 1% AEP (annual exceedance probability) and 0.1%AEP.

The first Hydrological Estimation Flow is located near the end of the Cushina River, before joining the Figile River.

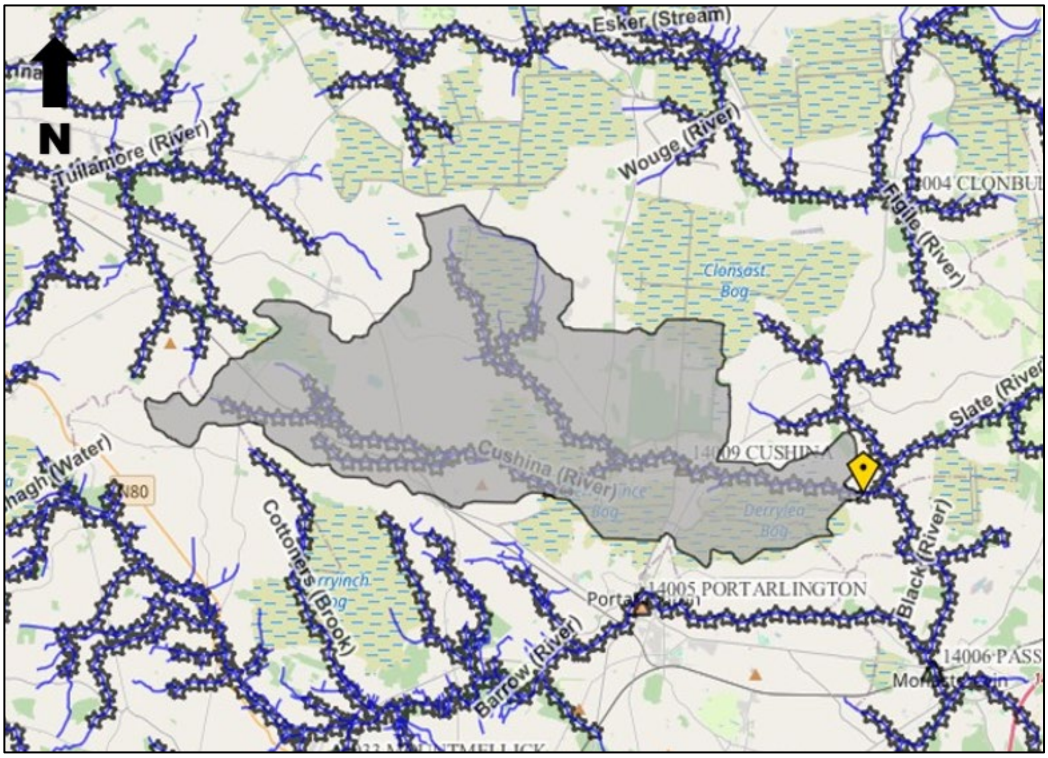


Figure 7-1: Location of First Hydrological Estimation Flow (HEF-1)

The second Hydrological Estimation Flow is located along the Figile River, before the junction with the Cushina River.

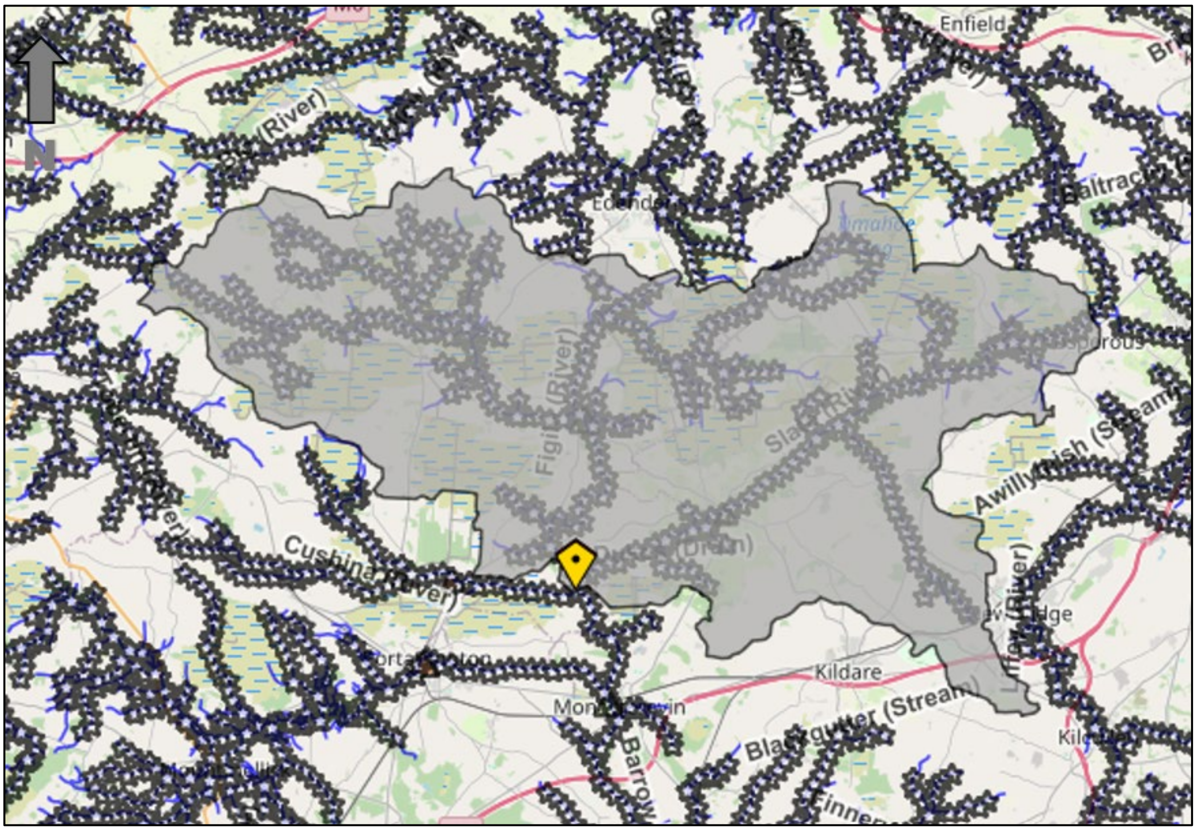


Figure 7-2: Location of Second Hydrological Estimation Flow (HEF-2)

7.1.1 Hydrology Analysis

The proposed development is located within an ungauged catchment; therefore, the flow estimations are based on ungauged methods. The FSU method was considered to estimate the peak flow of the watercourses as per OPW guidelines and in particular the FSU-7 Variable Equation was applied. This method is recommended for catchment sizes over 25 km2 and estimates the flow (Qmed) based on seven catchment descriptors.

The catchment descriptors are summarised in Table 6-1 below:

Table 7-1: Catchment Descriptors for the Hydrological Estimation Flow Locations

Feature ID	Area	BFSOIL	SAAR	FARL	DRAIND	S1085	ARTDRAIN	URBEXT
	Km2		mm		Km/Km2	m/km		
HEF-1	83.683	0.6069	827.12	1	0.577	2.1191	0	0.001
HEF-2	521.706	0.5981	829.34	0.999	0.508	0.56	0	0.0132

The Hydrology Analysis will be conducted to ascertain the flow values corresponding to the Annual Exceedance Probabilities (AEP) of 1% and 0.1%, plus 20% of Climate Change. This analysis aims to simulate a flooding event and generate flood zone scenarios A and B. Below the Table 6-2 shows these flow values for the different return periods.

Table 7-2 Flood Estimations for the different return periods

Hydrological Estimation Flows	AEP (%)	
	1% AEP +20 % CC (m3/s)	0.1%AEP +20%CC (m3/s)
HEF-1	42.30	54.79
HEF-2	143.65	181.41

7.1.2 Hydraulic Analysis

7.1.2.1 Model Details

A flood model of the Cushina River in the vicinity of the subject site was constructed using the software package HEC-RAS. This software was developed by the Hydraulic Engineering Centre of the US Army Corps of Engineers.

The primary inputs into the HEC-RAS Model are summarised below:

- Geometric Data:

Cushina River- channel cross sections and part of the flood plain. Surveyed by Murphy Geospatial in November 2023.

Terrain: DTM.

- Inflow Data - estimated using the FSU- 7 Variable Equation:
  100-year Mid-Range Future Scenario.
  1000-year Mid-Range Future Scenario.
- Boundary Conditions:
  HEF-1 Flow applied at the upstream end of the model.

  Normal depth (downstream channel).

  HEF-2 Flow applied as a downstream boundary condition.

The proposed bridge is designed for the 100 years return period (1% AEP) with a 20% inclusion for climate change and aims to have a minimal impact on the flood levels upstream and downstream of the structure. This consists of a single span bridge with a span of 19.00 m and a minimum soffit level of 62.30 m OD to provide a minimum freeboard of 300 mm as per the OPW requirements. The 0.1 % AEP (1 in 1000 years) was also modelled in order to map the flood zones A and B.

The Manning's values for the river channel and flood plain were determined by identifying the different type of materials encountered during a site visit and site survey where photos were taken; this assisted in selecting the appropriate manning's coefficient from the Hec-Ras Reference Manual. The contraction and expansion coefficients utilized were likewise drawn from the recommendations of the same manual.

Table 7-3: Design parameter used in the Hydraulic Analysis.

Parameter	Value	Source
Manning's Value (Channel)	0.08 0.12	Hec-Ras Reference Manual
Manning's Value (Flood Plain)	0.08 0.10	Hec-Ras Reference Manual
Contraction Coefficient	0.1	Hec-Ras Reference Manual
Expansion Coefficient	0.3	Hec-Ras Reference Manual

Two separate scenarios were modelled to compare the existing conditions or pre-development and post-development scenario which includes the proposed bridge.

7.1.2.2 Flood Zone A

7.1.2.2.1 Comparison Between Existing and Proposed Scenarios with Proposed Bridge

Upon completion of the hydraulic modelling, a comparison has been undertaken between the water levels obtained from the existing and proposed scenarios. This comparison allowed for conclusions to be drawn regarding the potential impact of the proposed bridge. The table below compares the result of the existing and proposed scenarios at each cross-section.

Table 7-4: Water Level Comparison – Existing VS Proposed - 1% AEP+ CC

River Station	Location	ES	PS	Diff (PS-ES)	Observations
		W.S. Elev	W.S. Elev	W.S. Elev	
2735.71	Upstream	62.19	62.23	0.04	Slight increase of water level
2678.54	Upstream	62.14	62.18	0.04	Slight increase of water level
2604.70	Upstream	62.06	62.12	0.06	Slight increase of water level
2535.23	Upstream	62.00	62.07	0.07	Slight increase of water level
2498.64	Upstream	61.96	61.98	0.02	Slight decrease of water level
2494.67	Proposed Bridge				
2490.70	Development	61.95	61.95	0.00	No variation of water level
2450.07	Development	61.89	61.89	0.00	No variation of water level
2397.96	Development	61.80	61.80	0.00	No variation of water level
2342.83	Development	61.67	61.67	0.00	No variation of water level

*The model extends further downstream but only the relevant cross sections have been shown in this Table

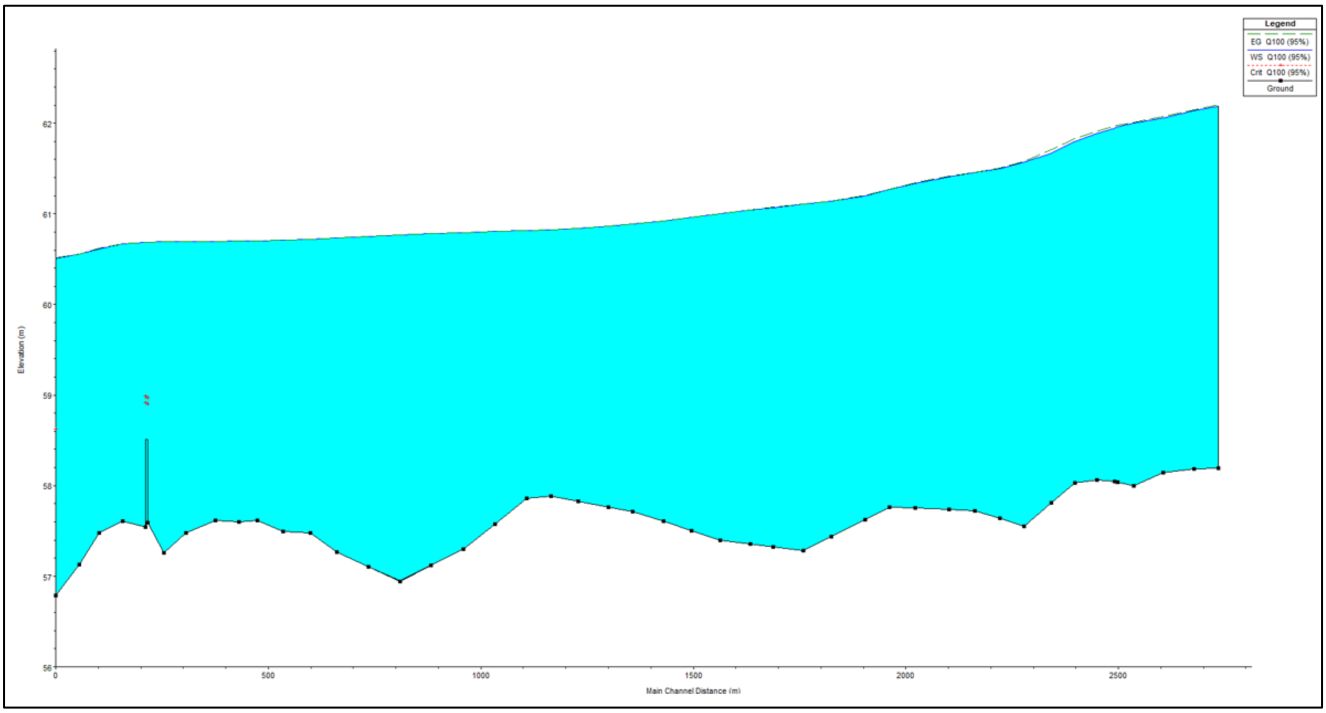


Figure 7-3: Longitudinal Section - 1% AEP + CC - Existing Scenario

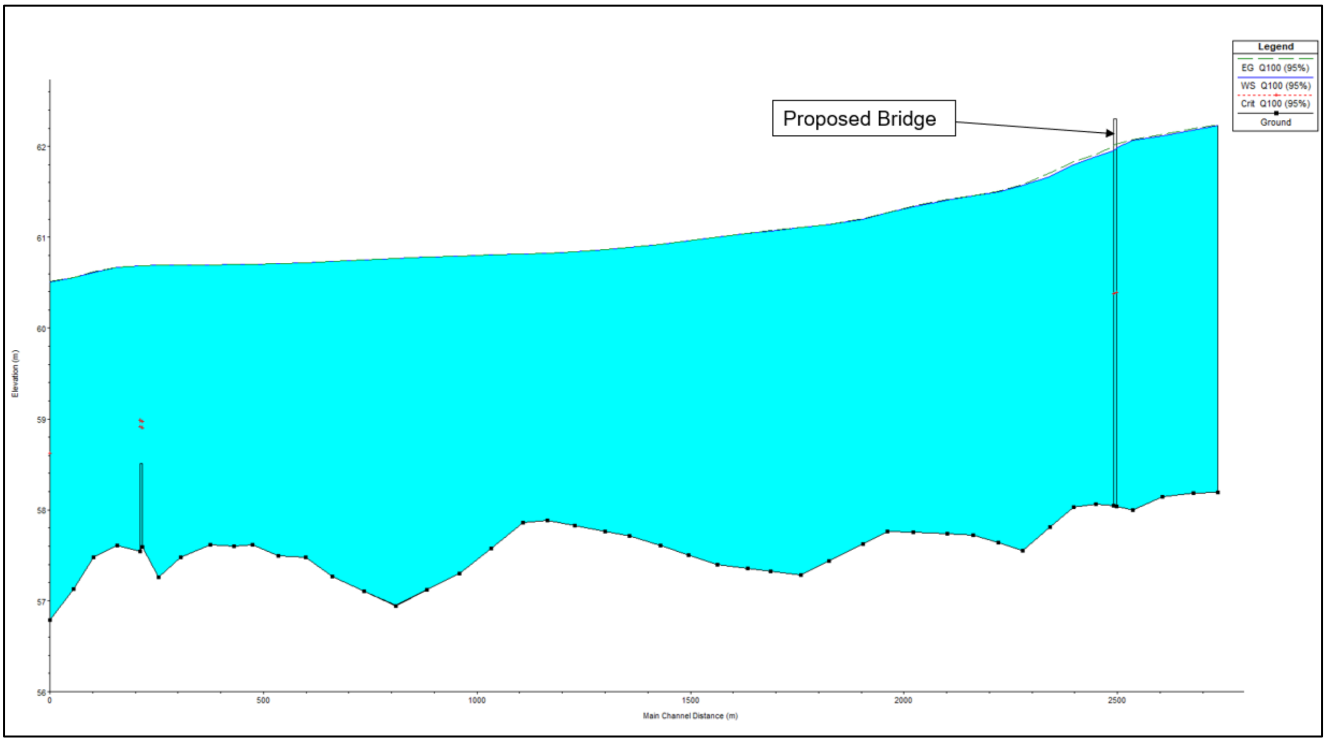


Figure 7-4: Longitudinal Section - 1% AEP+CC - Proposed Scenario

7.1.2.3 Flood Zone B

7.1.2.3.1 Comparison Between Existing and Proposed Scenarios with Proposed Bridge

Upon completion of the hydraulic modelling, a comparison has been undertaken between the water levels obtained from the existing and proposed scenarios. This comparison allowed for conclusions to be drawn regarding the potential impact of the proposed bridge. The table below compares the result of the existing and proposed scenarios at each cross-section.

Table 7-5: Water Level Comparison - Existing VS Proposed -0.1%AEP + CC

River Station	Location	ES	PS	Diff (PS-ES)	Observations
		W.S. Elev	W.S. Elev	W.S. Elev	
2735.71	Upstream	62.19	62.23	0.04	Slight increase of water level
2678.54	Upstream	62.14	62.18	0.04	Slight increase of water level
2604.7	Upstream	62.06	62.12	0.06	Slight increase of water level
2535.23	Upstream	62.00	62.07	0.07	Slight increase of water level
2498.64	Upstream	61.96	61.98	0.02	Slight increase of water level
2494.67	Proposed Bridge				
2490.7	Development	61.95	61.95	0	No variation of water level
2450.07	Development	61.89	61.89	0	No variation of water level
2397.96	Development	61.80	61.80	0	No variation of water level
2342.83	Development	61.67	61.67	0	No variation of water level

*The model extends further downstream but only the relevant cross sections have been shown in this Table

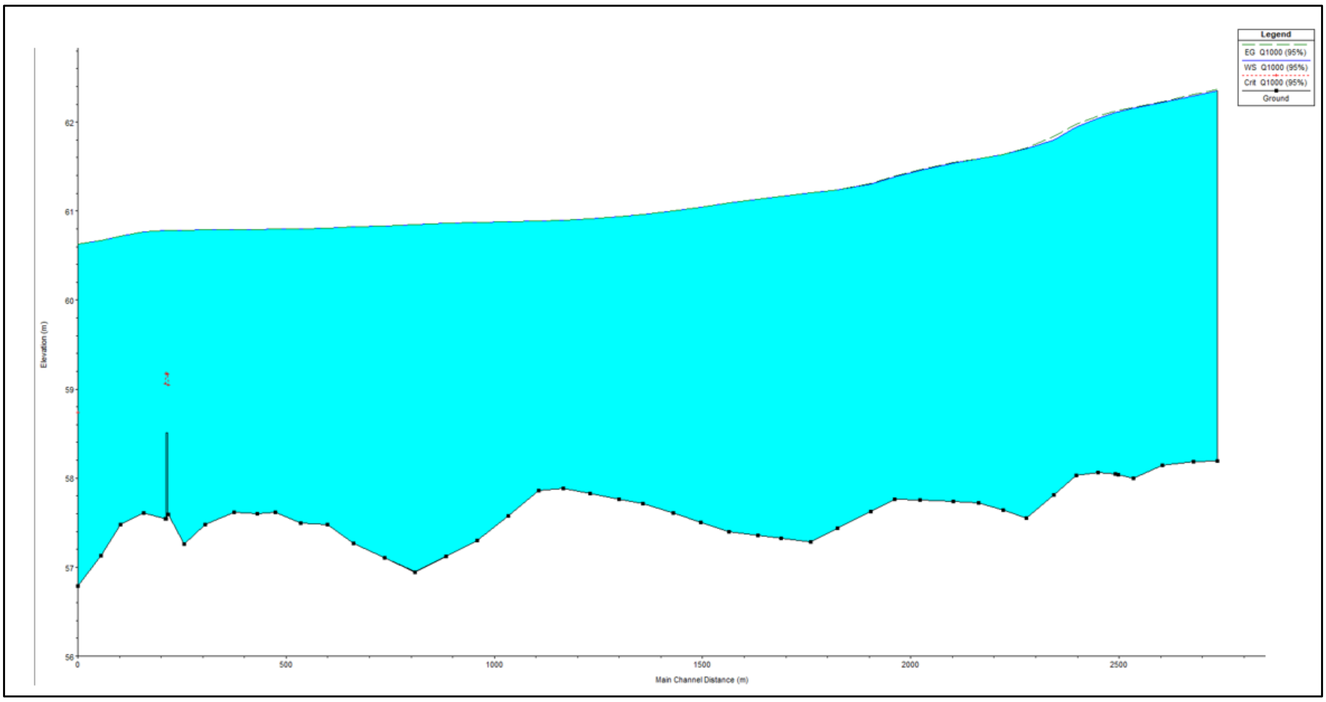


Figure 7-5: Longitudinal Section -0.1% AEP +CC - Existing Scenario

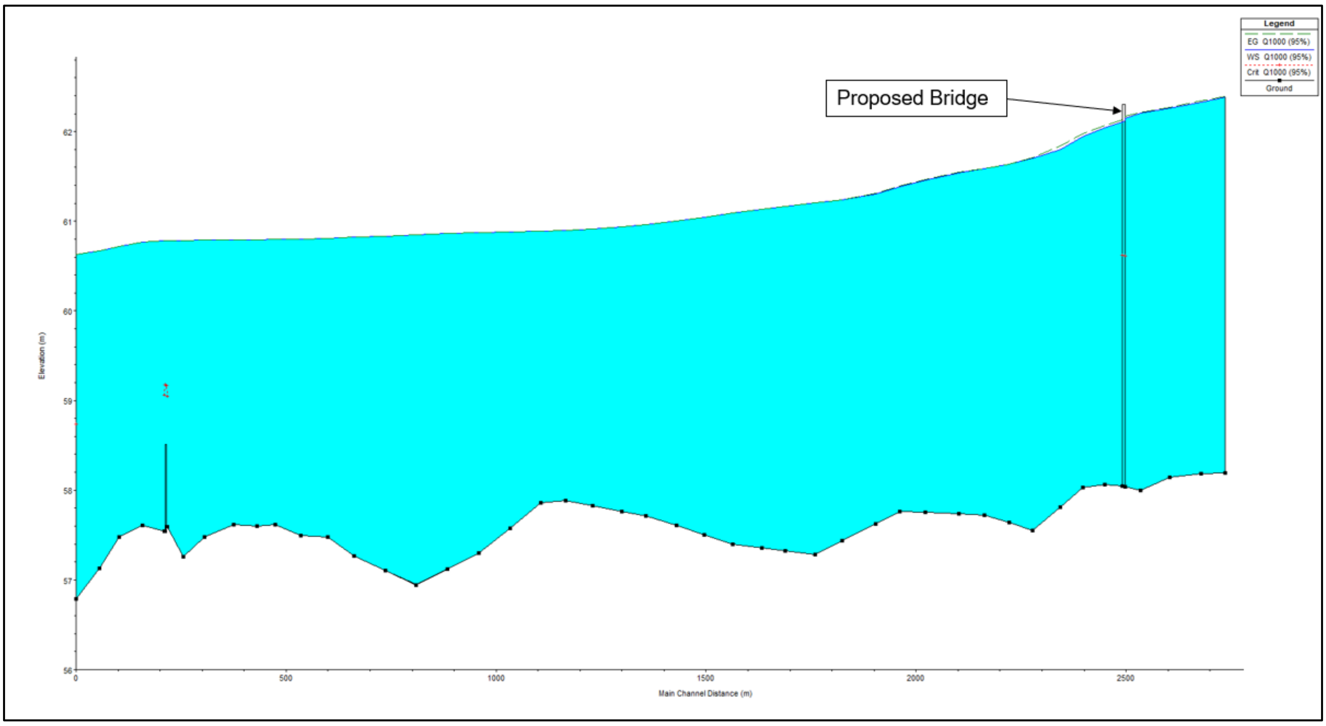


Figure 7-6: Longitudinal Section - 0.1% AEP + CC - Proposed Scenario

7.2 Turbine Delivery Route-Daingean River

A site-specific hydraulic model was developed as part of this FRA to quantify the flood levels at the TDR watercourse crossing and to design the proposed bridge. Hydrological and hydraulic analysis were undertaken along the specific reach of the Hydrological Features to enable the delineation of appropriate flood zones.

In order to undertake the hydraulic modelling, the peak flood flow was estimated along one Hydrological Estimation Flows (HF's) as per the following figure below. The estimated peak flow, in conjunction with a digital terrain model (DTM) were used to generate the flood extent and flood depth maps for 1% AEP (annual exceedance probability) and 0.1%AEP.

The Hydrological Estimation Flow is located downstream of the existing bridge, which is approximately 35 m downstream of the proposed bridge crossing.

Figure 7-7: Location of the Hydrological Estimation Flow (HEF-1)

7.2.1 Hydrology Analysis

The TDR watercourse crossing is located within an ungauged catchment; therefore, the flow estimations are based on ungauged methods. The FSU method was considered to estimate the peak flow of the watercourse as per OPW guidelines and in particular the FSU-7 Variable Equation was applied. This method is recommended for catchment sizes over 25 km2 and estimates the flow (Qmed) based on seven catchment descriptors.

The catchment descriptors are summarised in Table -7-6 below:

Table 7-6: Catchment Descriptors for the Hydrological Estimation Flow Locations

Feature ID	Area	BFSOIL	SAAR	FARL	DRAIND	S1085	ARTDRAIN	URBEXT
	Km2		mm		Km/Km2	m/km		
HEF-1	49.25	0.608	841.37	1	0.612	1.288	0	0.0075

The Hydrology Analysis will be conducted to ascertain the flow values corresponding to the Annual Exceedance Probabilities (AEP) of 1% and 0.1%, plus 20% of Climate Change. This analysis aims to simulate a flooding event and generate flood zone scenarios A and B. Below the Table 7-7 shows these flow values for the different return periods.

Table 7-7: Flood Estimations for the different return periods

Hydrological Estimation Flows	AEP (%)	
	1% AEP +20 % CC (m3/s)	0.1%AEP +20%CC (m3/s)
HEF-1	21.10	27.11

7.2.2 Hydraulic Analysis

7.2.2.1 Model Details

A flood model of the Daingean River in the vicinity of the TDR river crossing was constructed using the software package HEC-RAS.

The primary inputs into the HEC-RAS Model are summarised below:

- Geometric Data:
  Daingean River- channel cross sections and part of the flood plain. Surveyed in February 2025.

  Terrain: DTM.
- Inflow Data - estimated using the FSU- 7 Variable Equation:
  100-year Mid-Range Future Scenario.
  1000-year Mid-Range Future Scenario.
- Boundary Conditions:
  HEF-1 Flow applied at the upstream end of the model.

Normal depth (downstream channel).

The proposed bridge is designed for the 100 years return period (1% AEP) with a 20% inclusion for climate change and aims to have a minimal impact on the flood levels upstream and downstream of the structure. This consists of a single span bridge with a span of 20.00 m and a minimum soffit level of 70.61 m OD to provide a minimum freeboard of 300 mm as per the OPW requirements. The 0.1 % AEP (1 in 1000 years) was also modelled in order to map the flood zones A and B.

As the TDR crosses a flood plain and in order to minimise the impact on the existing flood levels, five flood relief culverts were also modelled together with the bridge. These culverts consist of five 900 mm dia. Pipes.

The Manning's values for the river channel and flood plain were determined by identifying the different type of materials encountered during a site survey where photos were taken; this assisted in selecting the appropriate manning's coefficient from the Hec-Ras Reference Manual. The contraction and expansion coefficients utilized were likewise drawn from the recommendations of the same manual.

Table 7-8: Design parameter used in the Hydraulic Analysis.

Parameter	Value	Source
Manning's Value (Channel)	0.08	Hec-Ras Reference Manual
Manning's Value (Flood Plain)	0.045	Hec-Ras Reference Manual
Contraction Coefficient	0.1	Hec-Ras Reference Manual
Expansion Coefficient	0.3	Hec-Ras Reference Manual

Two separate scenarios were modelled to compare the existing conditions or pre-development and post-development scenario which includes the proposed bridge and the access track leading to it.

7.2.2.2 Flood Zone A

7.2.2.2.1 Comparison Between Existing and Proposed Scenarios with Proposed Bridge

Upon completion of the hydraulic modelling, a comparison has been undertaken between the water levels obtained from the existing and proposed scenarios. This comparison allowed for conclusions to be drawn regarding the potential impact of the proposed bridge and access track. The table below compares the result of the existing and proposed scenarios at each cross-section.

Table 7-9: Water Level Comparison – Existing VS Proposed - 1% AEP+ CC

River Station	Location	ES	PS	Diff (PS-ES)	Observations
		W.S. Elev	W.S. Elev	W.S. Elev	
505.91	Upstream	70.42	70.42	0.02	Negligible increase in water level
455.88	Upstream	70.35	70.36	0.01	Negligible increase in water level
405.01	Upstream	70.33	70.34	0.02	Negligible increase in water level
389.99	Upstream	70.31	70.33	0.02	Negligible increase in water level
382.49	Upstream	70.31	70.32	0.02	Negligible increase in water level
375.95	Upstream	70.30	70.32	0.01	Negligible increase in water level
371.05	Proposed Bridge + Flood Relief Culverts				
366.15	Downstream	70.3	70.3	0.00	No variation of water level
356.15	Downstream	70.3	70.3	0.00	No variation of water level
346.15	Downstream	70.3	70.3	0.00	No variation of water level

*The model extends further upstream and downstream but only the relevant cross sections have been shown in this Table

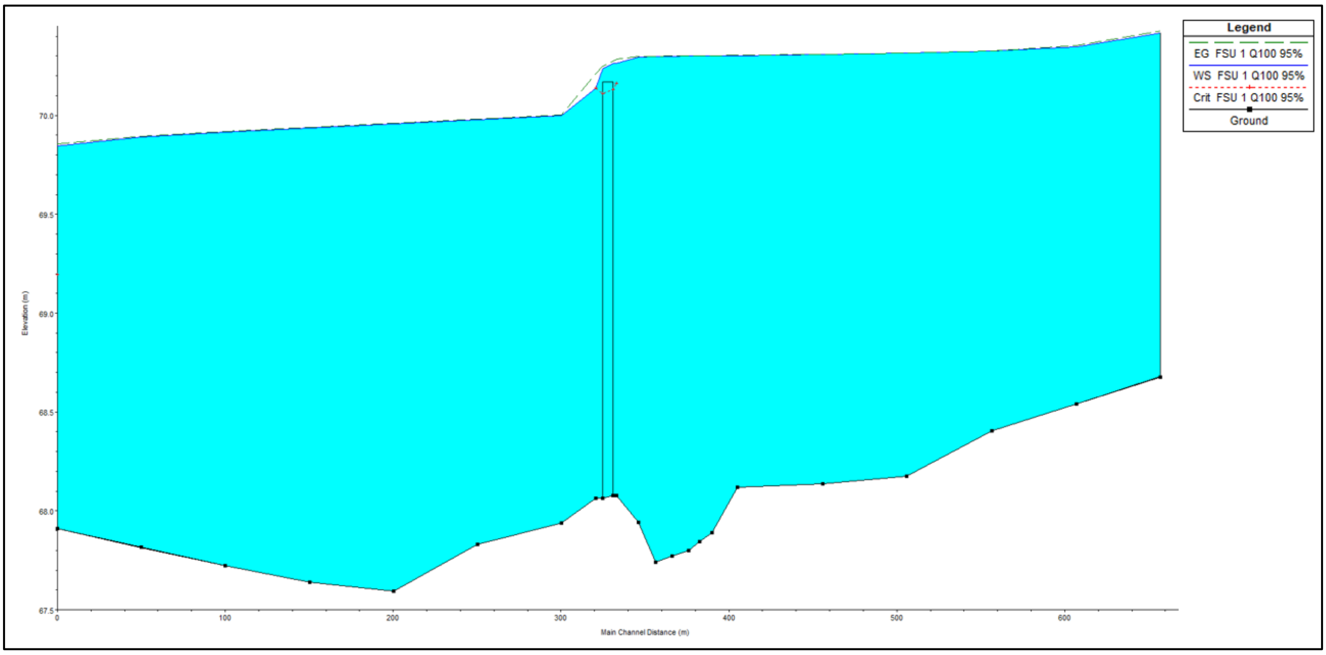


Figure 7-8: Longitudinal Section - 1% AEP + CC - Existing Scenario

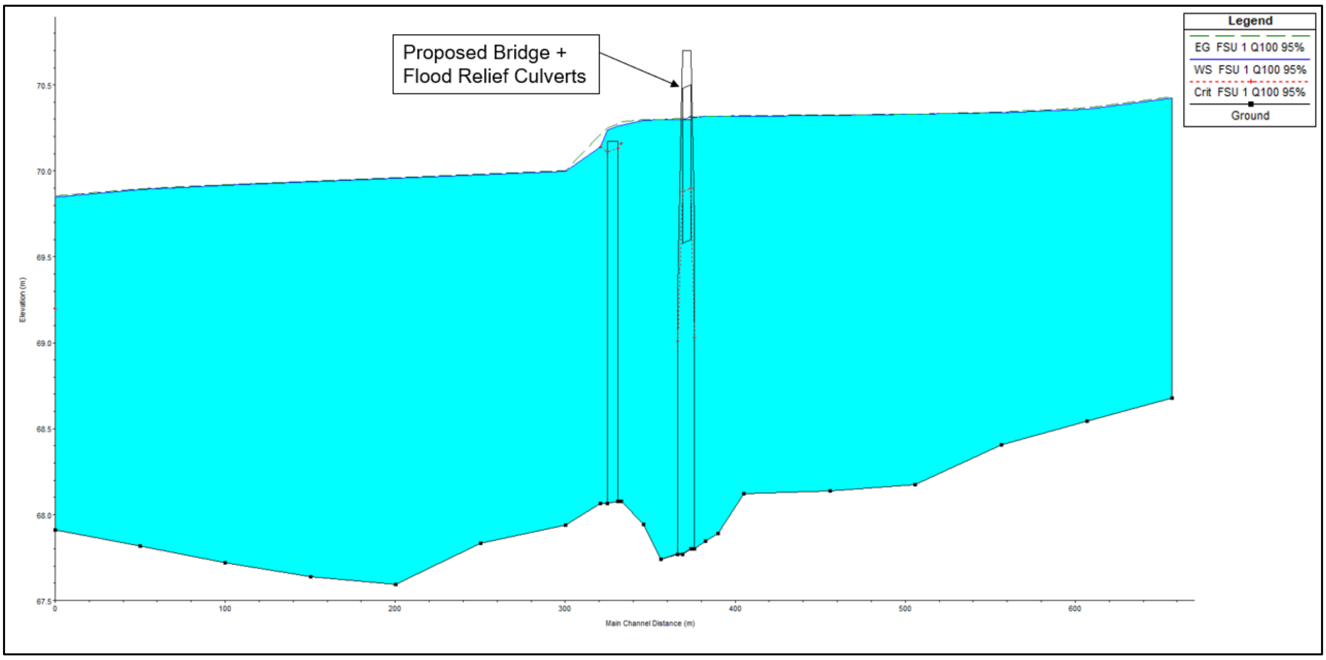


Figure 7-9: Longitudinal Section - 1% AEP+CC - Proposed Scenario

7.2.2.3 Flood Zone B

7.2.2.3.1 Comparison Between Existing and Proposed Scenarios with Proposed Bridge

Upon completion of the hydraulic modelling, a comparison has been undertaken between the water levels obtained from the existing and proposed scenarios. This comparison allowed for conclusions to be drawn regarding the potential impact of the proposed bridge. The table below compares the result of the existing and proposed scenarios at each cross-section.

Table 7-10: Water Level Comparison - Existing VS Proposed -0.1%AEP + CC

River Station	Location	ES	PS	Diff (PS-ES)	Observations
		W.S. Elev	W.S. Elev	W.S. Elev	
505.91	Upstream	70.36	70.37	0.01	Negligible increase in water level
455.88	Upstream	70.35	70.36	0.01	Negligible increase in water level
405.01	Upstream	70.35	70.36	0.01	Negligible increase in water level
389.99	Upstream	70.35	70.36	0.01	Negligible increase in water level
382.49	Upstream	70.35	70.36	0.01	Negligible increase in water level
375.95	Upstream	70.34	70.35	0.01	Negligible increase in water level
371.05	Proposed Bridge + Flood Relief Culverts				

River Station	Location	ES	PS	Diff (PS-ES)	Observations
		W.S. Elev	W.S. Elev	W.S. Elev	
366.15	Downstream	70.34	70.34	0	No variation of water level
356.15	Downstream	70.34	70.34	0	No variation of water level
346.15	Downstream	70.34	70.34	0	No variation of water level

*The model extends further upstream and downstream but only the relevant cross sections have been shown in this Table

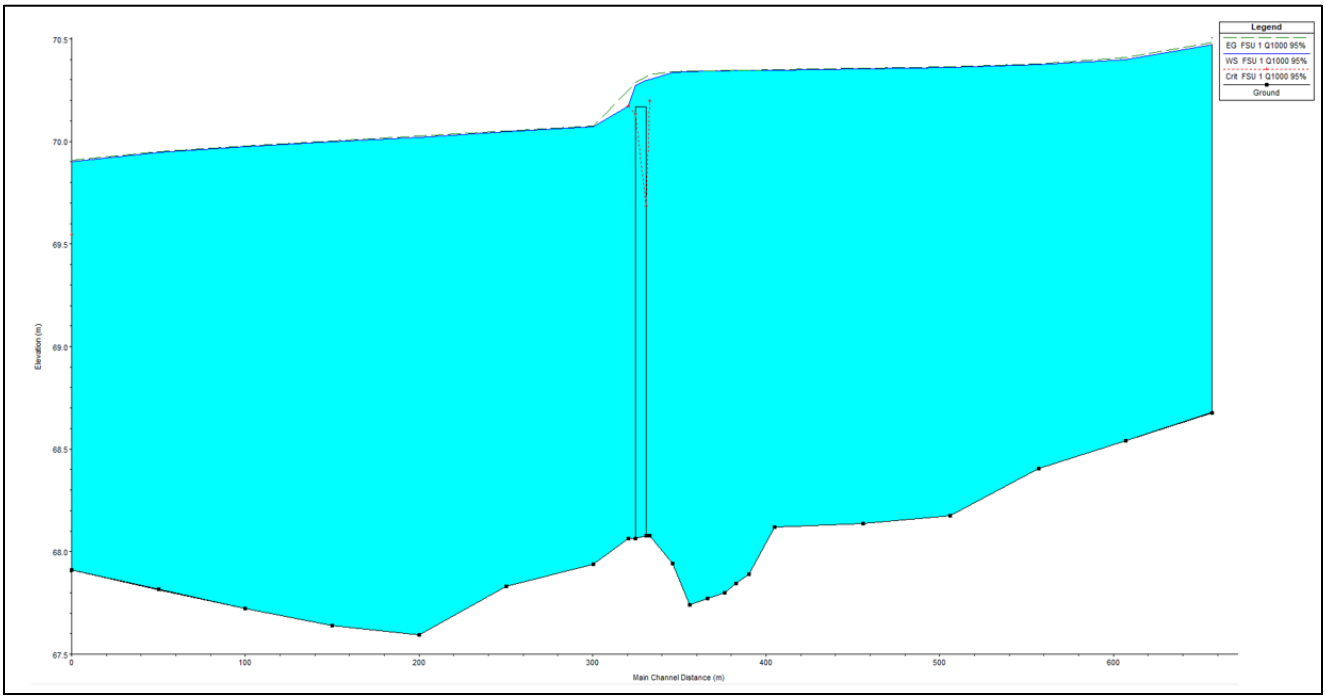


Figure 7-10: Longitudinal Section -0.1% AEP +CC - Existing Scenario

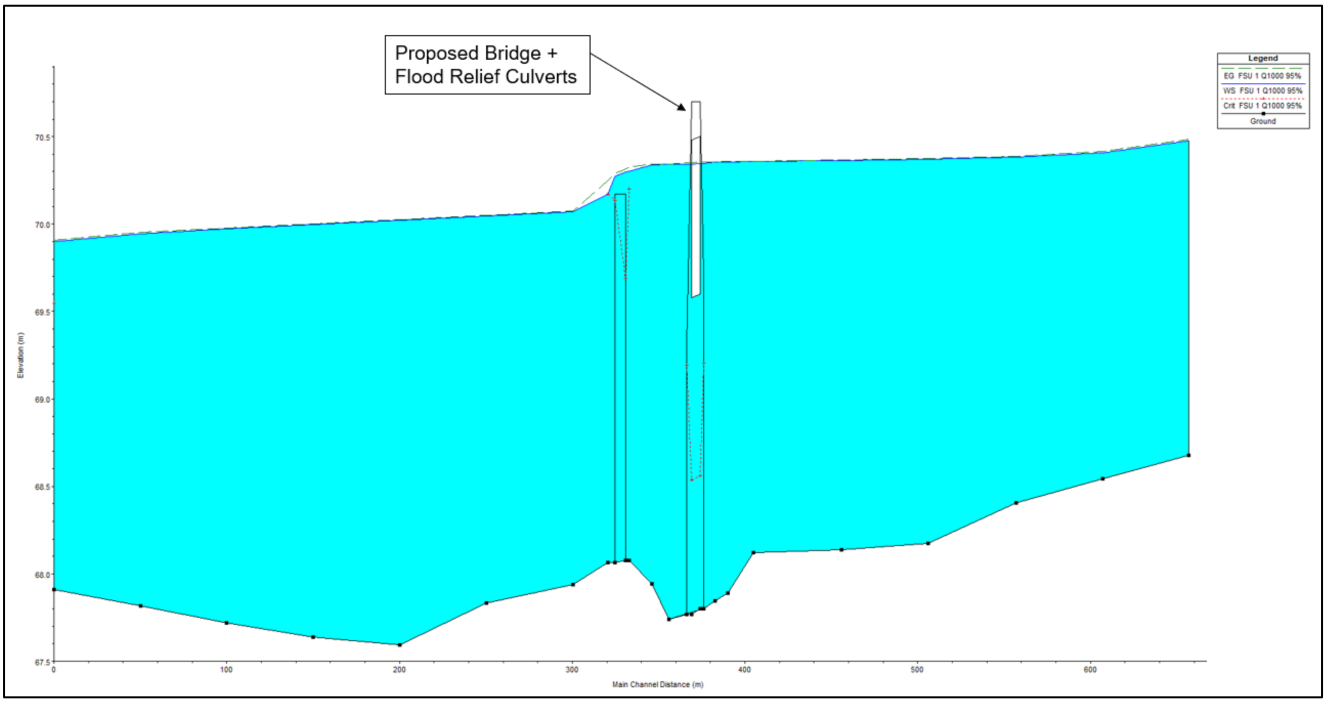


Figure 7-11: Longitudinal Section - 0.1% AEP + CC - Proposed Scenario

8. MITIGATION MEASURES

Some areas of the proposed development as well as a section of the TDR are within the Flood Zones A and B; therefore, mitigation measures have been proposed to reduce the flood risk to the development, the TDR and elsewhere. The following measures have been included:

- The proposed bridge that crosses the Cushina River has been designed with a minimum freeboard of 300 mm between the 1% AEP +CC flood level and the bridge deck to reduce the likelihood of debris blockage and also allows for uncertainties in hydrological and hydraulic design calculations. Sufficient span has been designed to minimise the afflux.
- The proposed bridge for the section of the TDR crossing the Deangean River has been designed following the same principles as the other bridge; however, flood relief culverts have also been included, as the TDR crosses a floodplain in this area.
- Some wind farm infrastructure, such as certain access tracks and turbines, is located within Flood Zones A and B. To minimise any impact on existing flood levels, the access tracks and hardstanding areas within these zones will be constructed at ground level. For turbines located within or very close to flood zones—such as T1, T4, T5, T8, and T9—the plinths to which the towers will be bolted will be raised above the design flood levels with a minimum clearance of 500 mm. This will guarantee that the critical electrical and mechanical components housed in the base of the turbine tower will be protected.
- Other essential and critical elements of the proposed development such as the susbstation and the grid connection route joint bays will be placed outside of the flood zones.
- The proposed drainage design for the various elements of the wind farm aims to replicate the existing hydrological regime of the catchment as closely as possible. The proposed outfalls will discharge to the same catchments or watercourses as they would have prior to the development. On one hand, overland flow is collected by interceptor drains and discharged to the nearest watercourse or over the ground through outfall diffusers. Check dams are also incorporated into the interceptor drains where required on steep slopes to slow down velocities, and the outfall diffusers help distribute and slow down the discharge. On the other hand, surface water from the access tracks and other hardstanding areas will be collected by a swale and conveyed to settlement ponds, with an outfall diffuser to discharge into the nearest watercourse or over the ground. Although the primary function of the settlement ponds is to separate particles and reduce pollution, the settlement ponds along with the outfall diffuser will also help slow down velocities and provide some attenuation.
- Monitoring and maintenance of the proposed bridges, flood connectivity culverts and proposed drainage is required to reduce or minimise any residual risk.

9. JUSTIFICATION TEST

Box 5.1 Justification Test for development management (to be submitted by the applicant)	
1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	The proposed wind farm and the TDR watercourse crossing are located in unzoned rural areas. However, the site falls within the designated zoning areas for Wind Energy Development as defined in the respective County Councils' boundaries and in accordance with the Counties' Wind Energy Strategies: • Kildare County Council - Site falls within the 'Zone 1 - Acceptable in Principle'; and • Offaly County Council - Site falls within an area identified as 'Open to Consideration for Wind Energy Development'.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:	
(i)The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;	The proposed wind farm will slightly increase the water levels locally and within acceptable levels (<150 mm afflux as per OPW requirements) and the proposed TDR watercourse crossing will have a negligible impact on flood levels.
(ii)The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;	The proposed wind farm has been designed so that critical or essential infrastructure, such as the substation and the joint bays along the grid connection route, are located outside of flood zones. However, other elements of the development, such as some turbines and access tracks, are situated within flood-prone areas. In these cases, turbine plinths have been elevated above the 1-in-100-year flood level, accounting for the effects of climate change and incorporating a freeboard (clearance) of 500 mm. This design ensures that floodwaters will not impact the electrical or mechanical components of the turbines. Access tracks have not been raised above flood levels in order to avoid obstructing the floodplain and to preserve its storage capacity. Since these tracks will primarily be used for maintenance rather than emergency access, and during known weather conditions, this approach has been deemed acceptable.

Box 5.1 Justification Test for development management (to be submitted by the applicant)	
	The development does not increase the risk to human life, as access will be controlled and managed during adverse conditions. There will be no permanent human occupation within the flood zone. At the TDR watercourse crossing, which traverses a floodplain, five relief culverts have been designed alongside the proposed bridge to minimize any impact on existing flooding conditions. All proposed bridges, both for the wind farm and the TDR watercourse crossing, have been designed to comply with OPW requirements. They are designed for a 1-in-100-year return period, including a 20% allowance for climate change, and a minimum freeboard of 300 mm.
(iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and	The residual risks to the area and the proposed development can be managed to an acceptable level, as mitigation measures have been incorporated into the design. Access to essential infrastructure, such as the substation and joint bays for the grid connection, is possible outside of flood conditions. For other infrastructure located within flood zones, such as some turbines, access is only required for periodic maintenance, which will be restricted during flood events. Appropriate maintenance should be carried out on the proposed bridge, flood connectivity culverts, and drainage systems associated with the access roads and tracks.
(iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	The Offaly and Kildare Wind Energy Strategies support this renewable energy source which can play a vital role in achieving national targets in relation to reductions in fossil fuel dependency and greenhouse emissions. The proposed development helps achieve this target.

10. CONCLUSION

This Site-Specific Flood Risk Assessment (SSFRA) has investigated the local hydrological conditions relevant to the proposed wind farm and the TDR watercourse crossing. The study indicates that the proposed development, including a section of the TDR, is susceptible to fluvial flooding during 1-in-100-year (Flood Zone A) flood events, as identified in Stage 1 – Flood Risk Identification and further analysed in Stage 2 – Initial Flood Risk Assessment. It was also established that the site is affected by pluvial flooding, as evidenced by historical records.

The areas particularly affected include turbines T1, T4, T5, T8, and T9, along with their associated access tracks, as well as other areas where localised impacts on access roads were identified. A proposed bridge crossing the River Cushina is necessary to access the turbines located on the southern side of the site and to facilitate the grid connection route.

As the proposed development is considered a 'Less Vulnerable Development' under the Planning Guidelines (with the exception of the substation and the joint bays of the grid connection), and some infrastructure lies within Flood Zone A, it was determined that a Justification Test is required in accordance with the Guidelines.

A Stage 3 Detailed Flood Risk Assessment was undertaken to establish design flood levels and assess any potential impacts that the proposed bridge structures—for both the wind farm and the TDR watercourse crossing—may have on existing flood conditions. Hydraulic modelling concluded that a single-span bridge of 19.0 m clear span is required to cross the River Cushina, while a 20.0 m clear span bridge with five flood relief culverts is required to cross the Daingean River and its associated floodplain.

Mitigation measures have been incorporated to minimise potential impacts, protect the proposed development and its surroundings, and reduce any residual flood risks. It is therefore considered that any residual risks associated with the development can be managed to an acceptable level and that the proposed works are not expected to have a negative impact on flood extents or levels either on-site or elsewhere. The increase in flood levels resulting from the inclusion of the proposed bridge and associated infrastructure is within acceptable limits and not considered significant. In the case of the TDR watercourse crossing, the increase in flood levels is considered negligible.

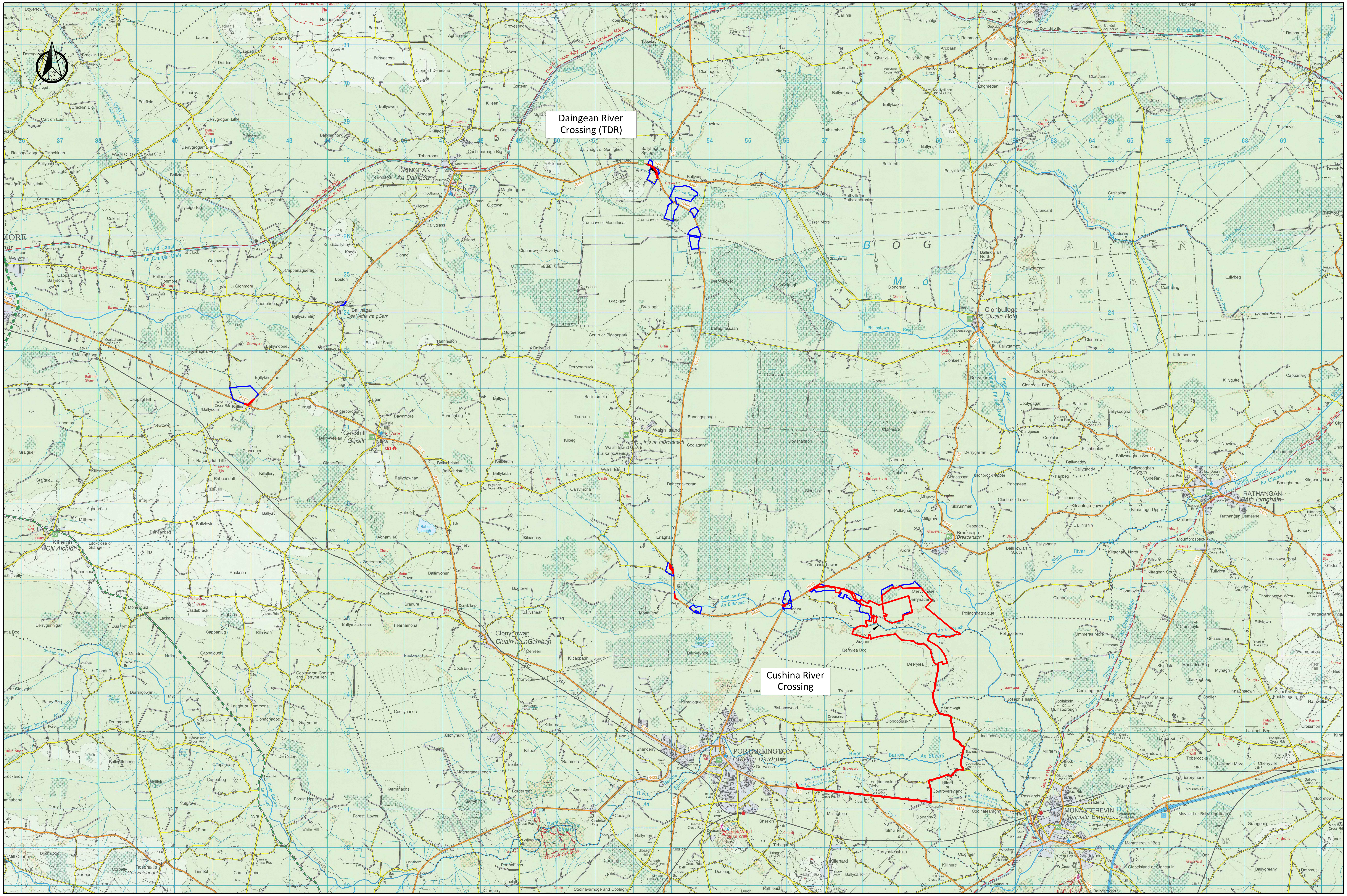
Accordingly, the proposed development is considered to comply with the core principles of the Planning System and Flood Risk Management Guidelines.

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 1

SITE LAYOUT PLAN



LEGEND:

Planning Site Boundary

Ownership Boundary

0m 500m 1000m 1500m 2000m 2500m 3000m 3500m 4000m 4500m 5000m

Scale 1:50000

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Rev.	Description	App By	Date
A	ISSUE FOR INFORMATION	JH	27.06.25

PROJECT

DERRYNADARRAGH WIND FARM

SHEET

PROJECT OVERVIEW

CLIENT

Dara Energy Limited

Date	27.06.25	Project number	P22-145	Scale (@ A1-)	1:50000
Drawn by	CS	Drawing Number	P22-145-INFO-0001	Rev	A
Checked by	SHS	(Sheet set subset INFO)			

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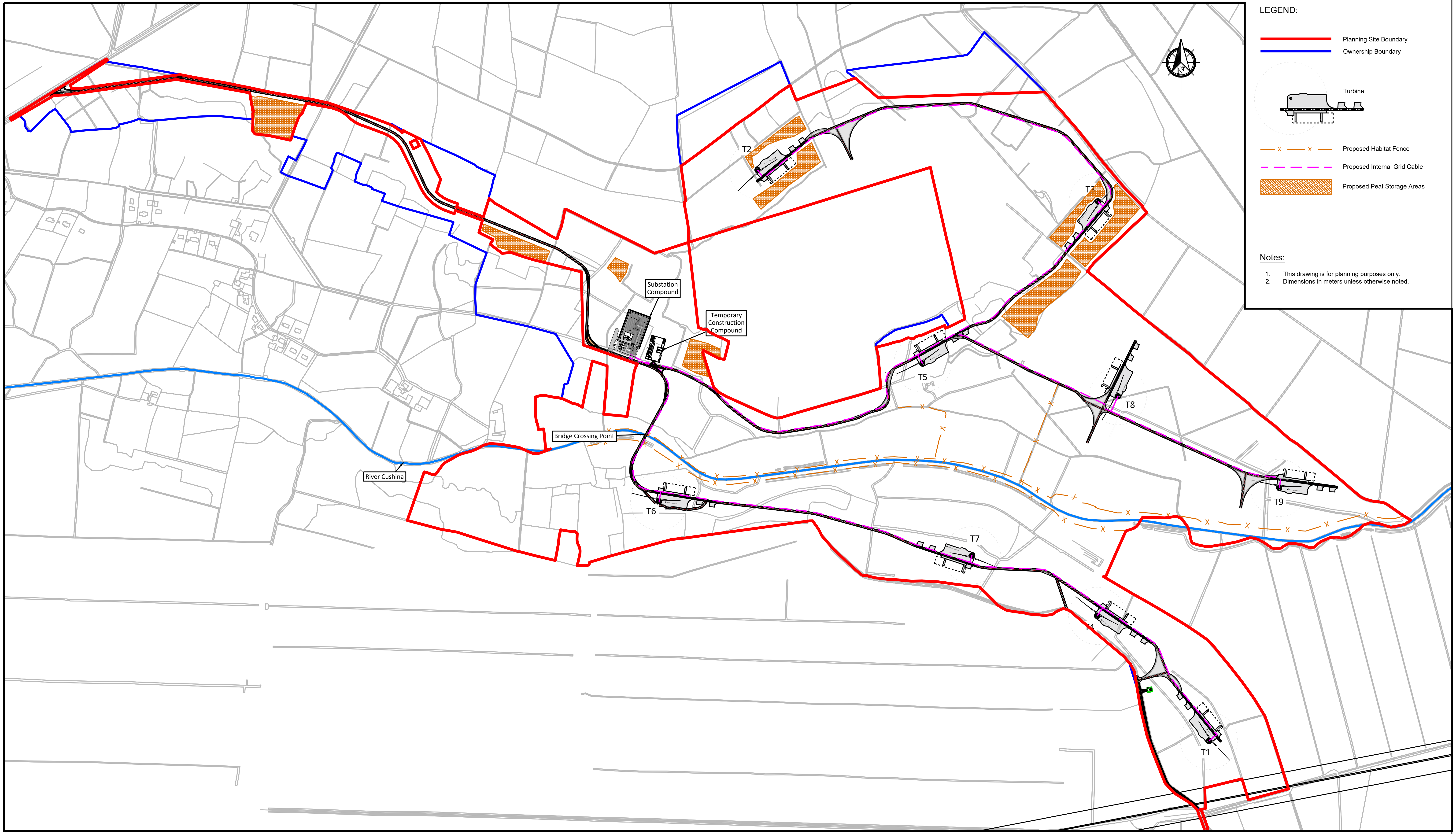
27 June 2025



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Rev.	Description	App By	Date
A	ISSUE FOR INFORMATION	JH	27.06.25

PROJECT

DERRYNADARRAGH WIND FARM

SHEET

1:10000 SITE LAYOUT

CLIENT

Dara Energy Limited

Date	Project number	Scale (@ A3-)
27.06.25	P22-145	1:10000

Drawn by	Drawing Number	Rev
CS	P22-145-INFO-0002	A
Checked by SHS		

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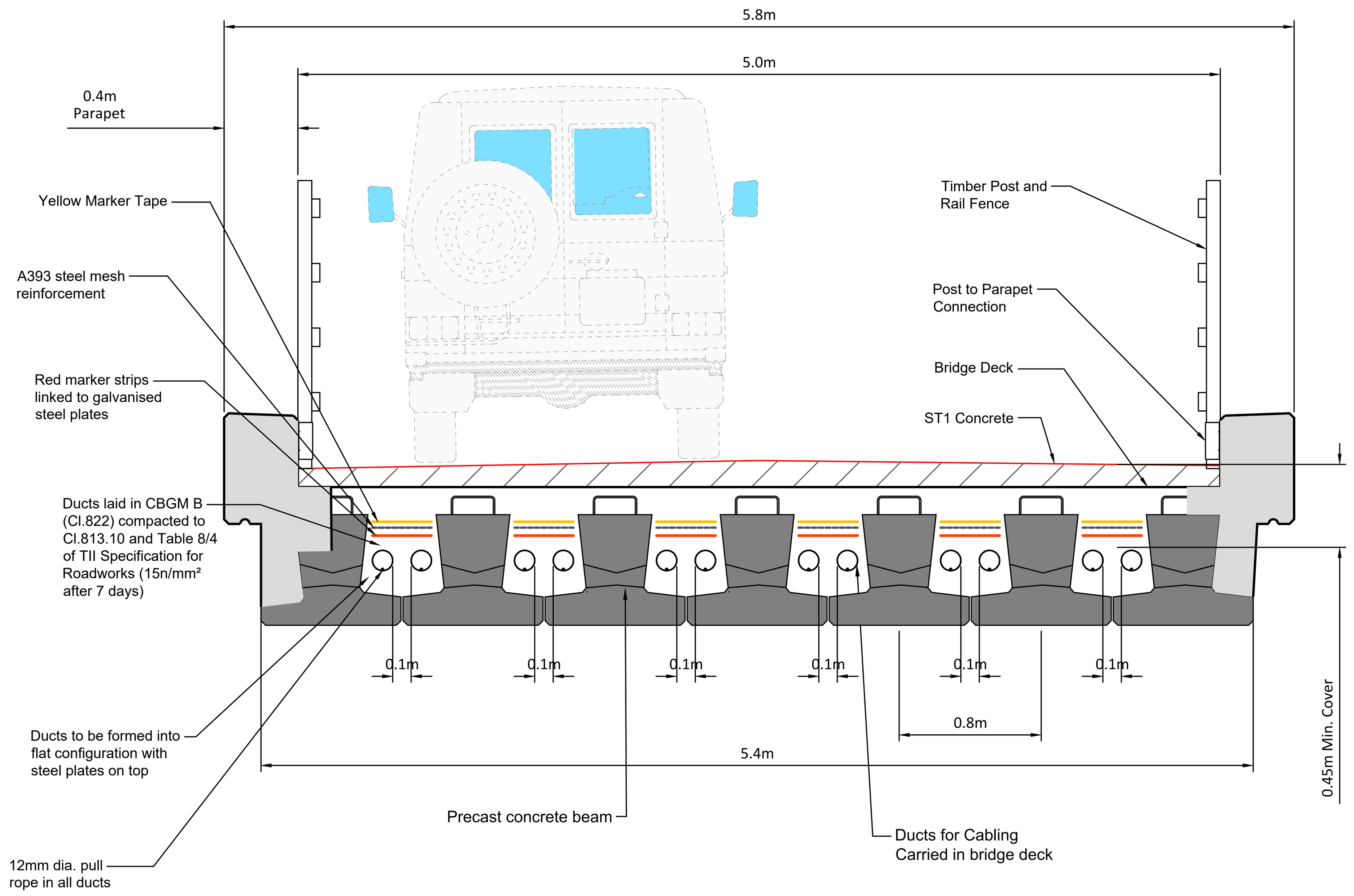
24 July 2025

FEHILY TIMONEY

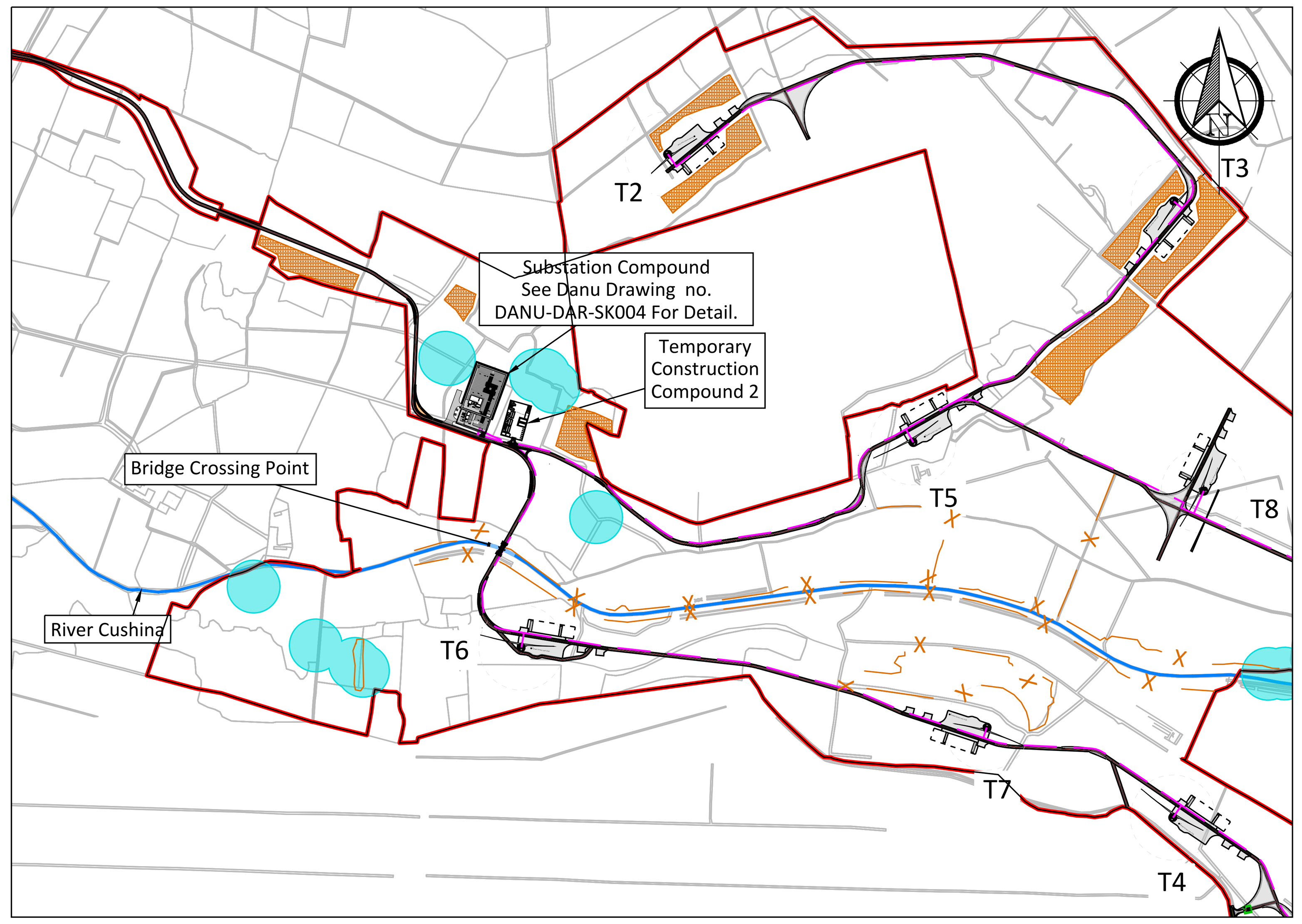
DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 2

PROPOSED STRUCTURES



SECTION B-B
Scale 1:25

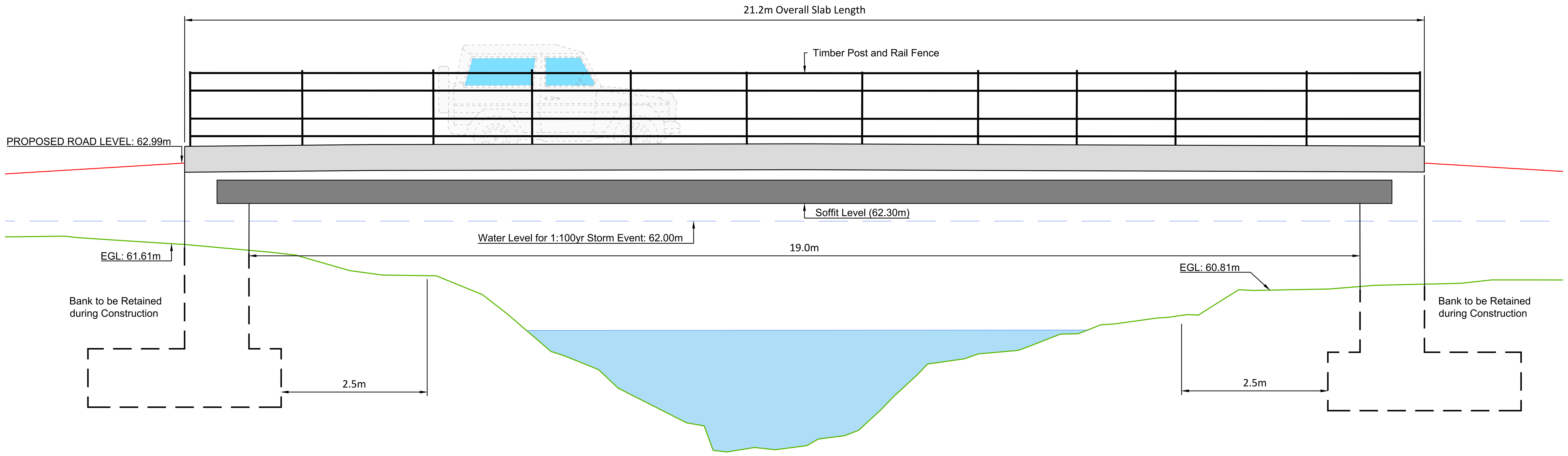


LOCATION PLAN
Scale 1:10000

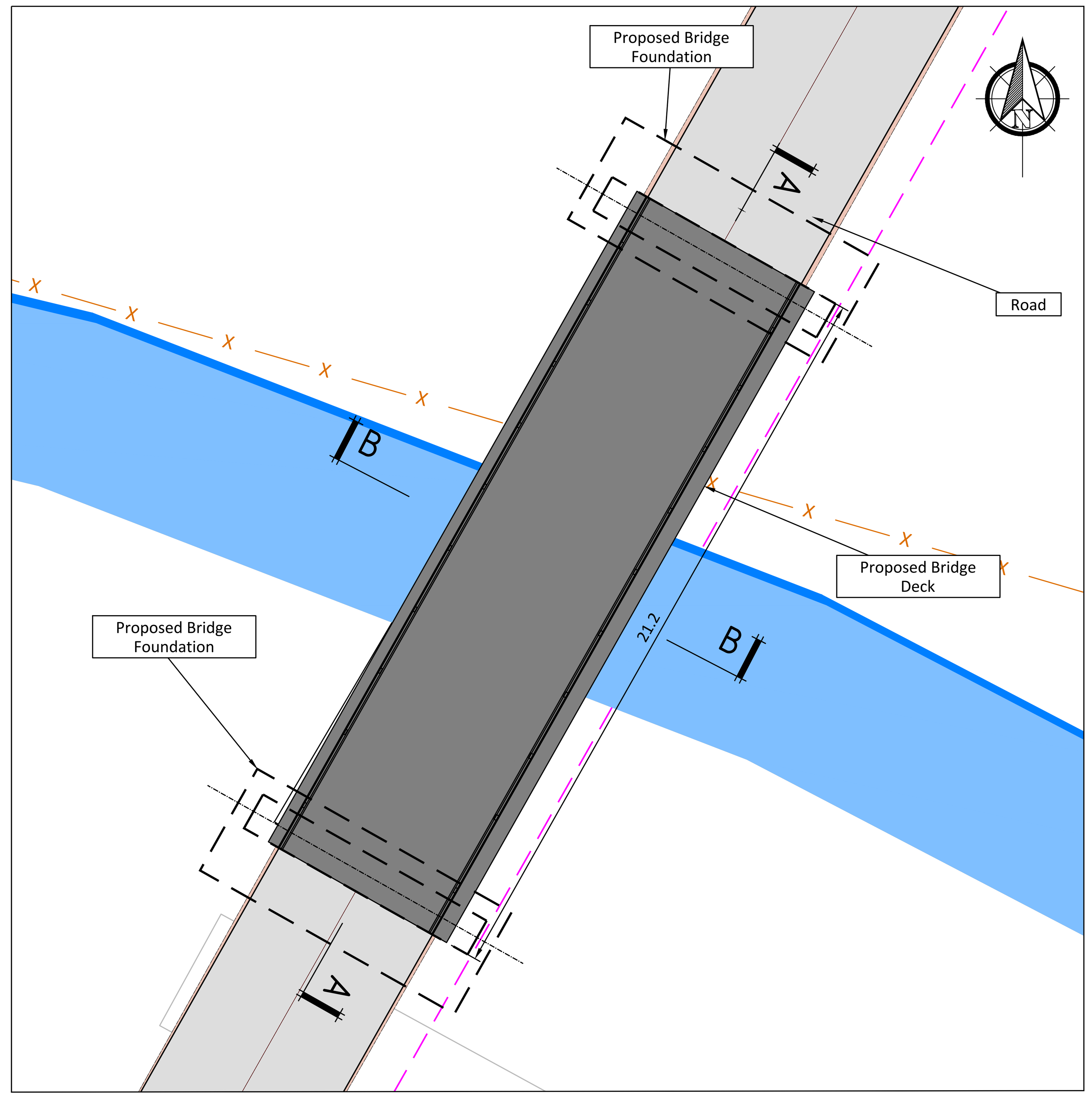
LEGEND:

- Planning Site Boundary
- Proposed Habitat Fence

Notes:
1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).
5. Extent of earthworks not shown.
6. Foundation to be designed according to geotechnical engineers, specification at detailed design.



SECTION A-A
Scale 1:50



BRIDGE PLAN
Scale 1:125

0m 1.3m 2.5m 3.8m 5.0m 6.3m 7.5m 8.8m 10.0m 11.3m 12.5m

Scale 1:125

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Rev.	Description	App By	Date
A	ISSUE FOR CLIENT COMMENTS	JH	15.09.25

PROJECT
DERRYNADARRAGH WIND FARM

CLIENT
Dara Energy Limited

SHEET
PRELIMINARY DESIGN - CUSHINA BRIDGE CROSSING DETAIL

Date	Project number	Scale (@ A1-)
15.09.25	P22-145	1:10000

Drawn by	Checked by	Drawing Number	Rev
CS	LD	P22-145-0300-0001	A

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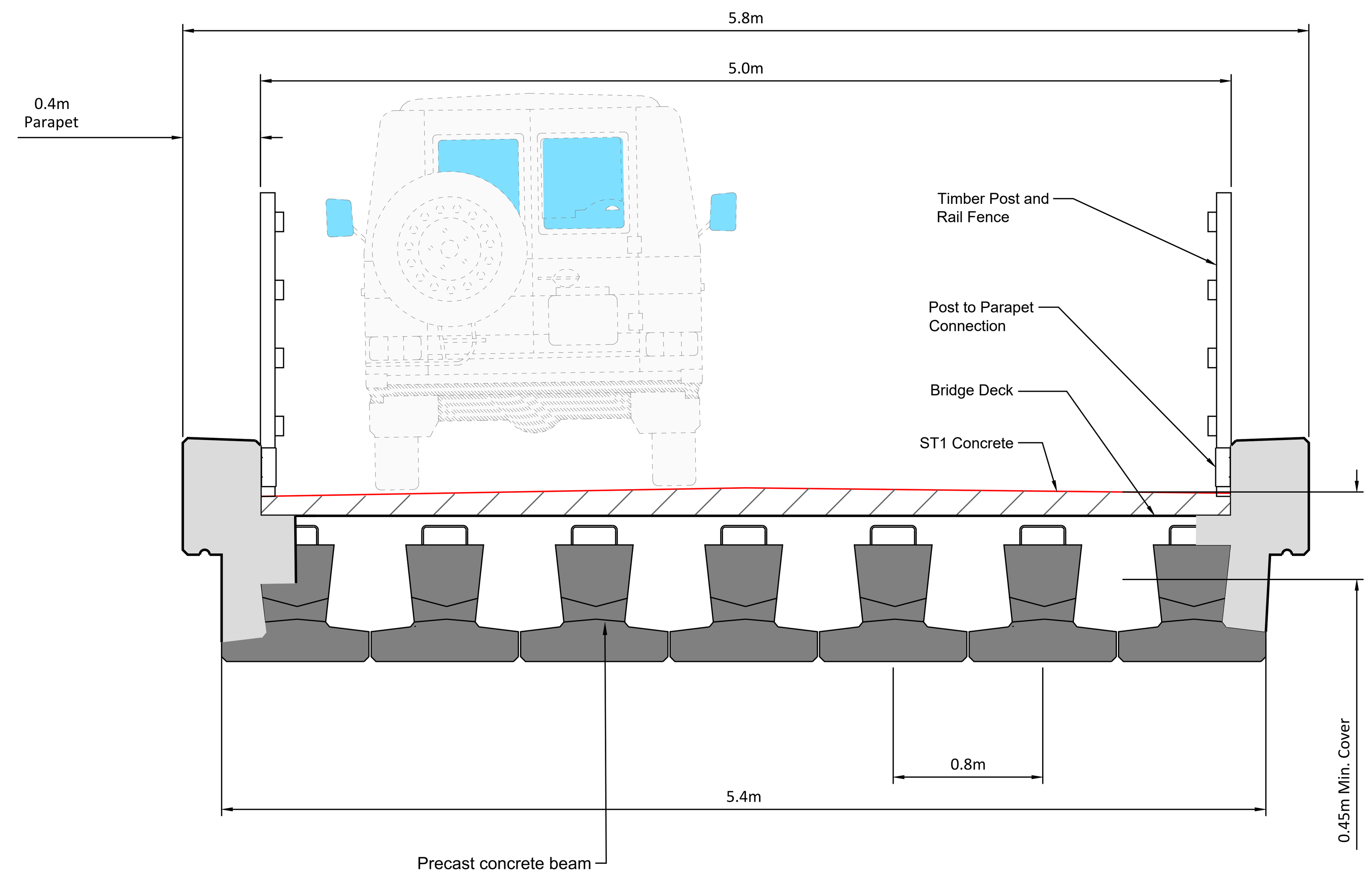
16 September 2025



SECTION B-B

Scale 1:25

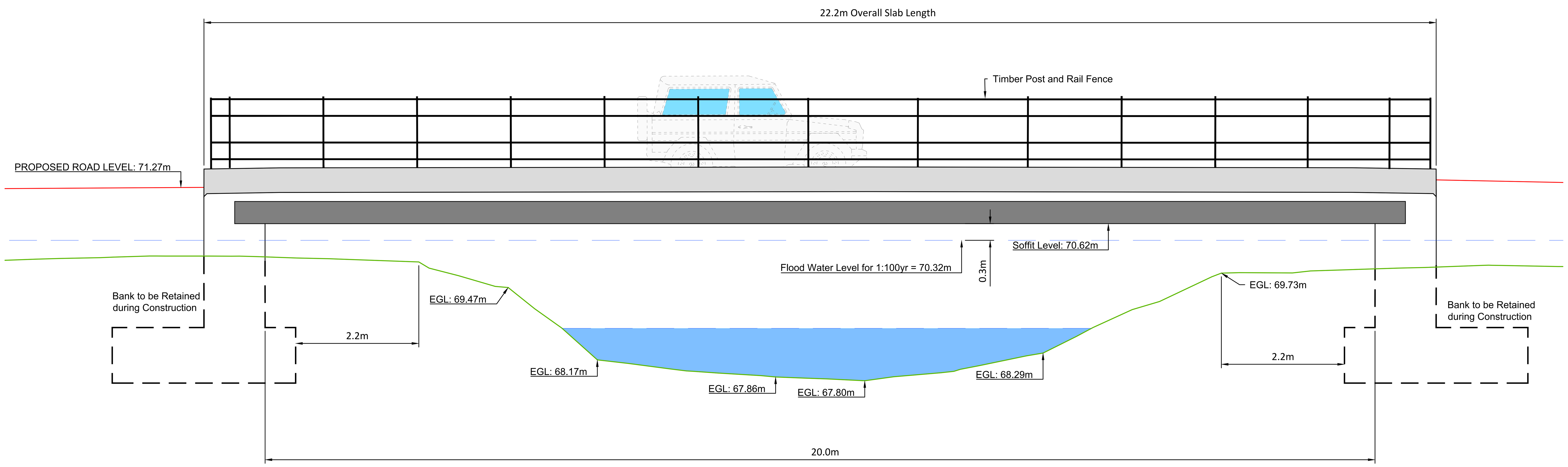
LOCATION PLAN

Scale 1:10000

LEGEND:

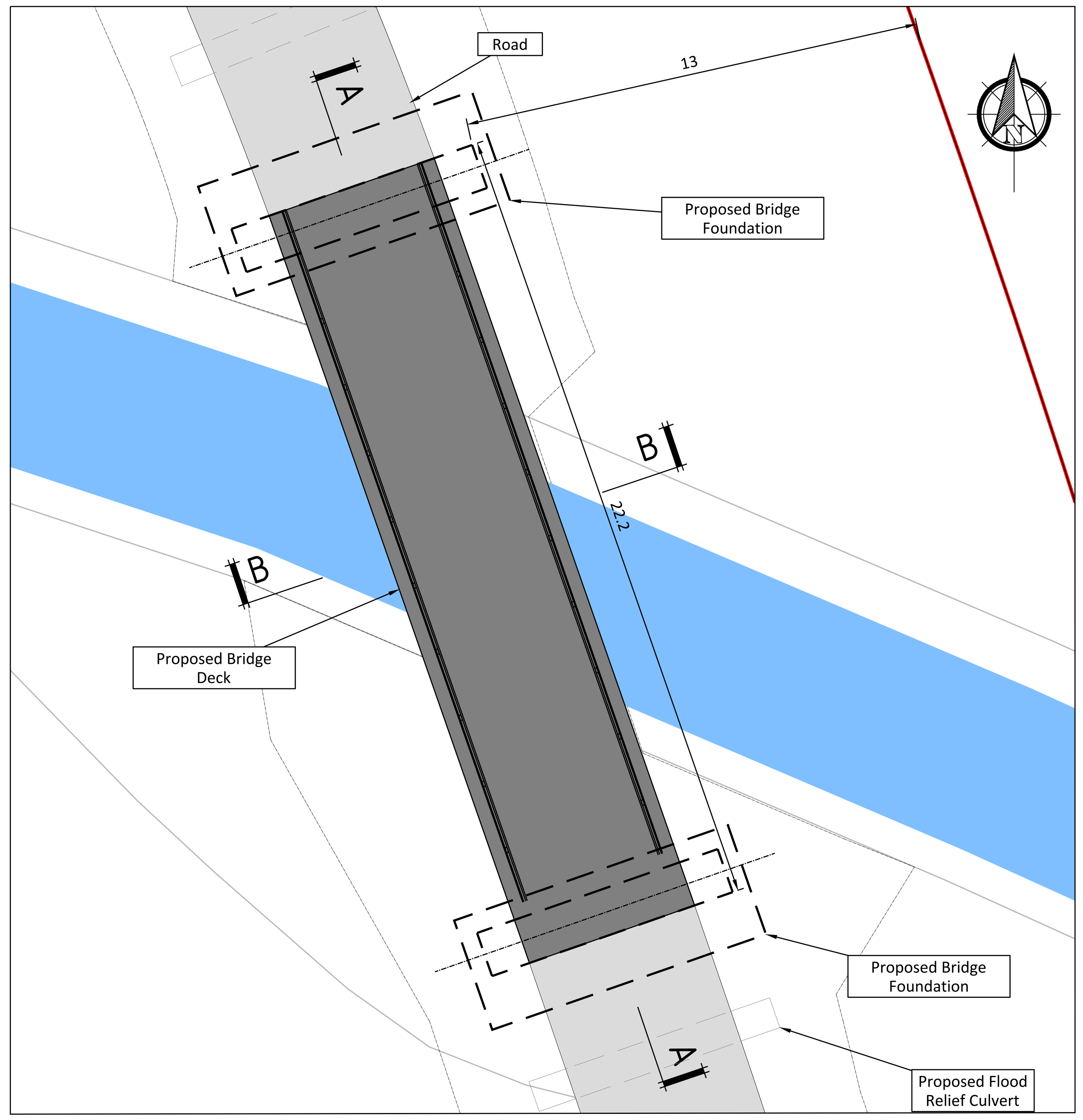
- Planning Site Boundary
- Ownership Boundary

Notes:
1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).
5. Extent of earthworks not shown.
6. Foundation to be designed according to geotechnical engineers, specification at detailed design.



SECTION A-A

Scale 1:50



BRIDGE PLAN

Scale 1:125

0m 1.2m 2.5m 3.7m 5.0m 6.2m 7.5m 8.7m 10.0m 11.2m 12.5m

Scale 1:125

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OSI 3497,3437,3376,3439,3550,3599,3600,3601,3657,3656

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Rev.	Description	App By	Date
A	ISSUE FOR CLIENT COMMENTS	JH	15.09.25

PROJECT

DERRYNADARRAGH WIND FARM

SHEET

PRELIMINARY DESIGN - TDR BRIDGE CROSSING DETAIL - SHEET 1 OF 2

CLIENT

Dara Energy Limited

Date	Project number	Scale (@ A1-)
15.09.25	P22-145	As Shown

Drawn by	Drawing Number	Rev
CS	P22-145-0300-0002	A
Checked by LD		

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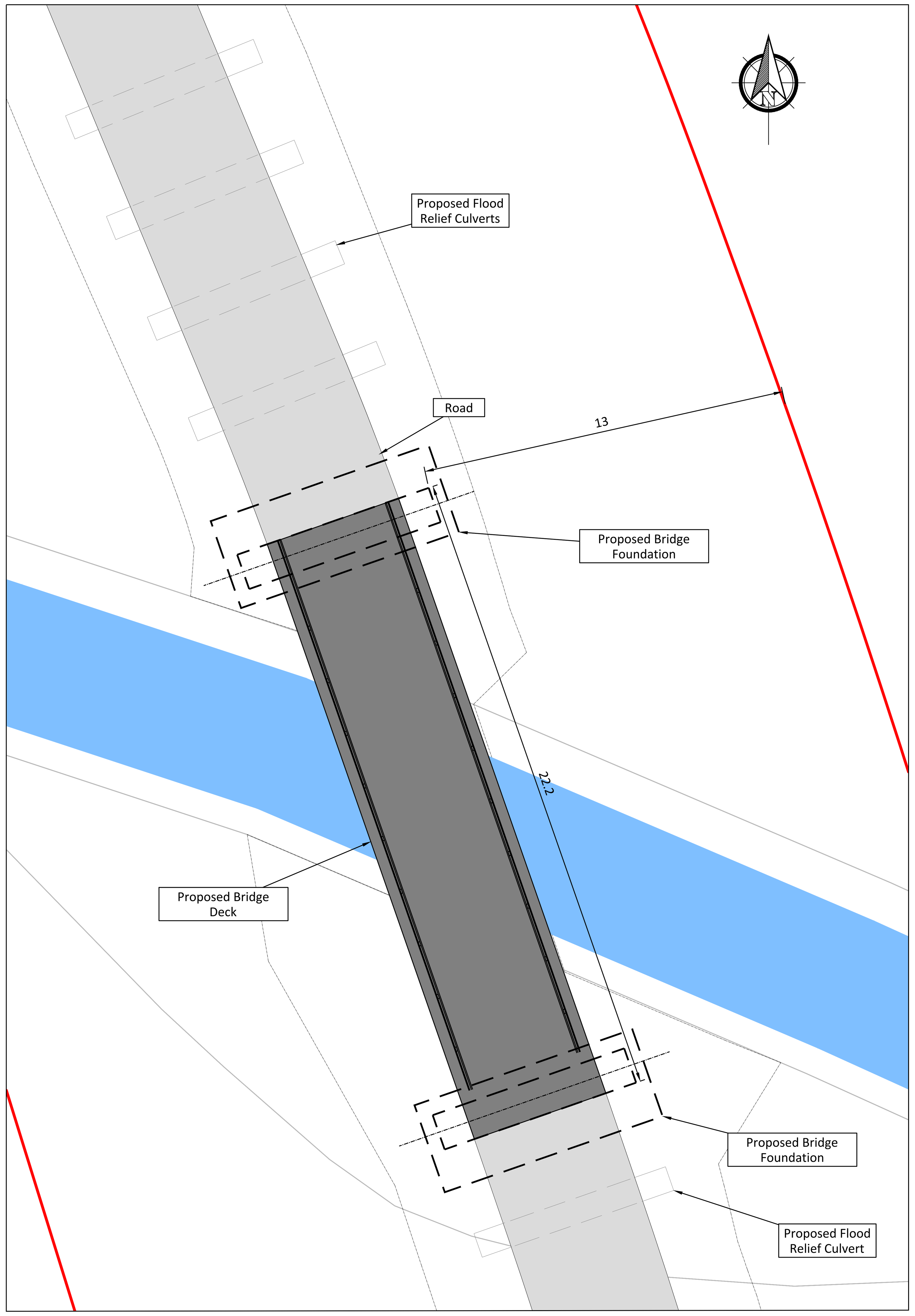
16 September 2025

LEGEND:

Planning Site Boundary

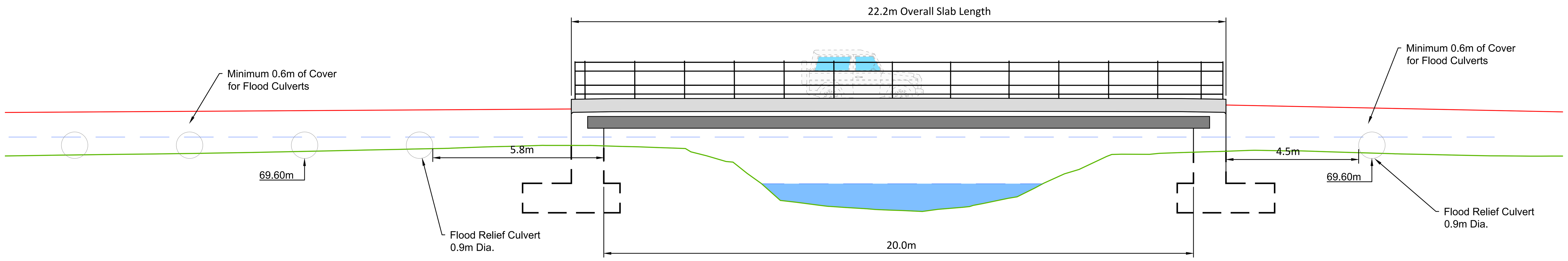
Ownership Boundary

Notes:
1. This drawing is for planning purposes only.
2. Dimensions in meters unless otherwise noted.
3. Levels shown relative to ordinance datum (Malin Head).
4. Co-ordinates are to Irish Transverse Mercator (ITM).
5. Extent of earthworks not shown.
6. Foundation to be designed according to geotechnical engineers, specification at detailed design.



BRIDGE PLAN

Scale 1:125



SECTION

Scale 1:100

0m 1.2m 2.5m 3.7m 5.0m 6.2m 7.5m 8.7m 10.0m 11.2m 12.5m

Scale 1:125

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Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	15.09.25

PROJECT

DERRYNADARRAGH WIND FARM

CLIENT

Dara Energy Limited

SHEET

PRELIMINARY DESIGN - TDR BRIDGE CROSSING DETAIL - SHEET 2 OF 2

Date 15.09.25	Project number P22-145	Scale (@ A1-) As Shown	
Drawn by CS	Drawing Number P22-145-0300-0003		Rev A
Checked by LD			

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16 September 2025

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 3

HYDROLOGY ANALYSIS

Project	Derrynadaragh Wind Farm		
Subject	Flood Risk Assessment		
	Calculation of Flow Estimation		
Prepared by:	SH	Job No	P22-145
Checked by:	PD	Date	05/12/2023
Approved by:	PD	Revision	P01

1.0 PHYSICAL CATCHMENT DESCRIPTORS (PCD'S):

1.1 Hydrological PCD's

S1085 - Mainstream Slope	2.119	m/km

1.2 Spatial PCD's

AREA - Catchment Area	83.68	km^2	
SAAR - Standard Annual Average Rainfall	827.12	mm	*
FARL - Flood Attenuation by Rivers and Lakes	1		

1.3 Spatial PCD's Representing Soil, Subsoil & Aquifer Types

BFI_{SOIL}	0.6069		*
URBEXT	0.001		*
SOIL			
DRAIND	0.577	km/km^2	
ARTDRAIN2	0		*

7.0 FSU - 7 VARIABLE EQUATION

$$QMED_{rural} = 1.237x10^{-5}\ AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185}\ (1+ARTDRAIN2)^{0.408}$$

$QMED_{RURAL}$ 7.640 m^3/s

$$QMED_{urban} = QMED_{rural}(1+URBEXT)^{1.482}$$

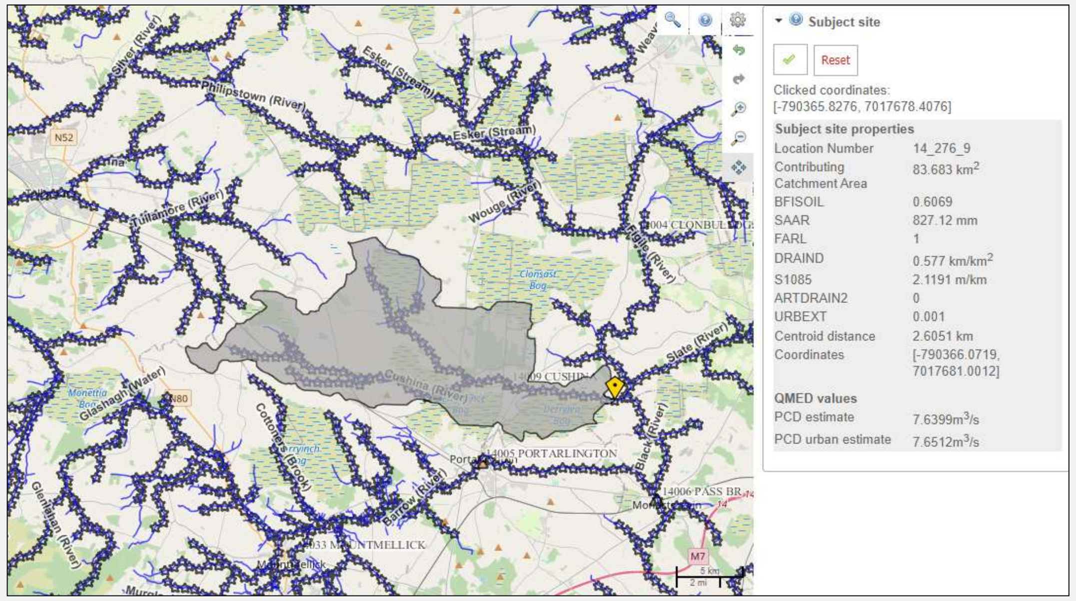
QMED 7.651 m^3/s

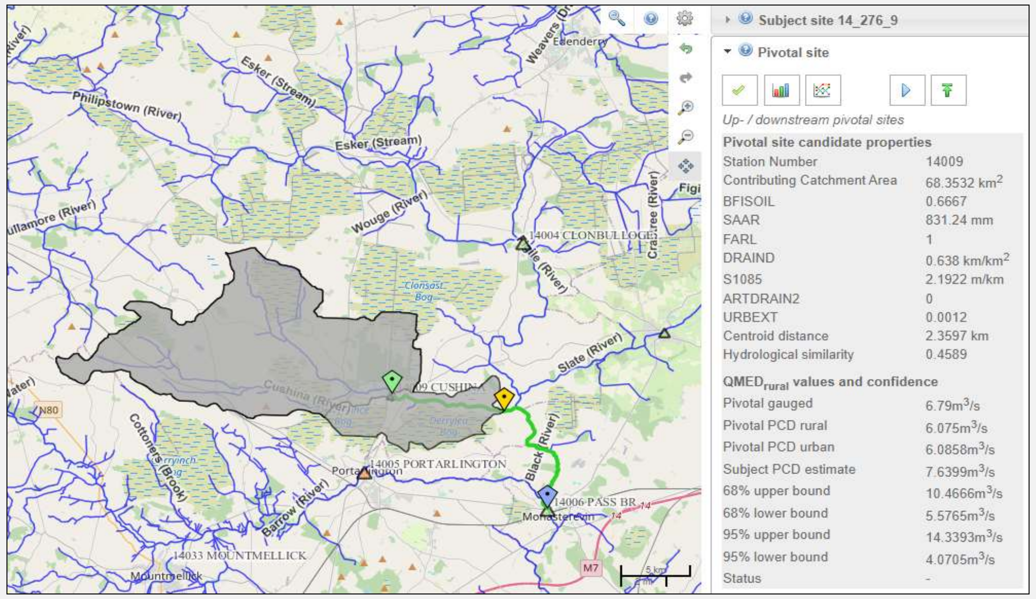
River Cushina

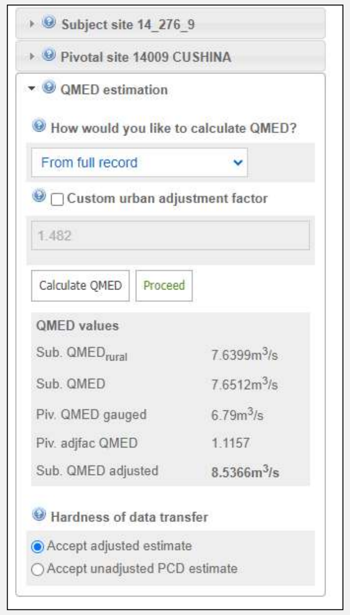
Using Pivotal/ Pooled Analysis Factors

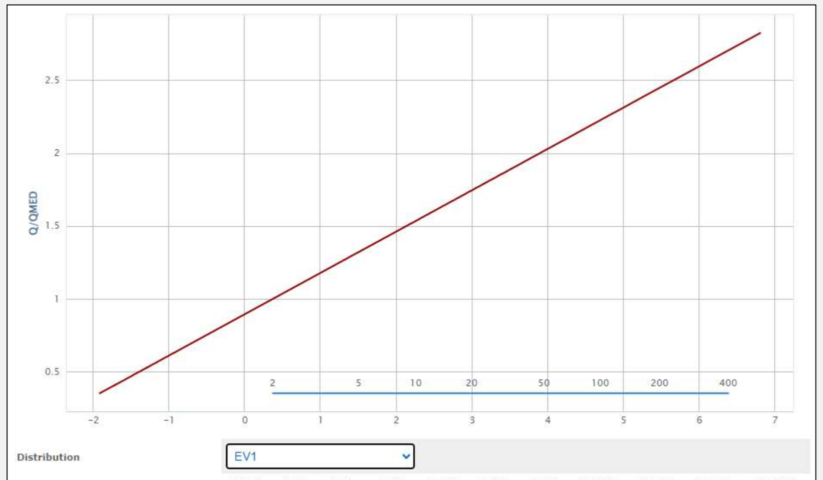
Calculation of Flow Estimation

Method	QMED	FSE	QMED (68% C.I.)	QMED (95% C.I.)	Growth Factor Q100	Growth Factor Q1000	FSU Adjustment Factor	Climate Change		Q100 Design Flow (95% C.I.)	Q1000 Design Flow (95% C.I.)
FSU - 7 Variable Equation	7.651 m3/s	1.37	10.48 m3/s	14.36 m3/s	2.2	2.85	1.116	1.2		42.30 m3/s	54.79 m3/s









	t=1.3	t=2	t=5	t=10	t=20	t=30	t=50	t=100	t=200	t=500	t=1000
Growth Factors	0.79	1	1.32	1.53	1.74	1.85	2	2.2	2.4	2.66	2.85
Design Peak Flows (m^3/s)	6.72	8.54	11.28	13.09	14.83	15.84	17.09	18.78	20.46	22.68	24.36

Project	Derrynadaragh Wind Farm		
Subject	Flood Risk Assessment Calculation of Flow Estimation	FEHILY TIMONEY	
Prepared by:	SH	Job No	P22-145
Checked by:	PD	Date	05/12/2023
Approved by:	PD	Revision	P01

1.0 PHYSICAL CATCHMENT DESCRIPTORS (PCD'S):

1.1 Hydrological PCD's

S1085 - Mainstream Slope	0.560	m/km	

1.2 Spatial PCD's

AREA - Catchment Area	521.71	km^2	
SAAR - Standard Annual Average Rainfall	829.34	mm	*
FARL - Flood Attenuation by Rivers and Lakes	0.999		

1.3 Spatial PCD's Representing Soil, Subsoil & Aquifer Types

BFI_{SOIL}	0.5981		*
URBEXT	0.0132		*
SOIL			
DRAIND	0.508	km/km^2	
ARTDRAIN2	0		*

7.0 FSU - 7 VARIABLE EQUATION

$$QMED_{rural} = 1.237x10^{-5}\ AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185}\ (1+ARTDRAIN2)^{0.408}$$

$QMED_{RURAL}$ 32.242 m^3/s

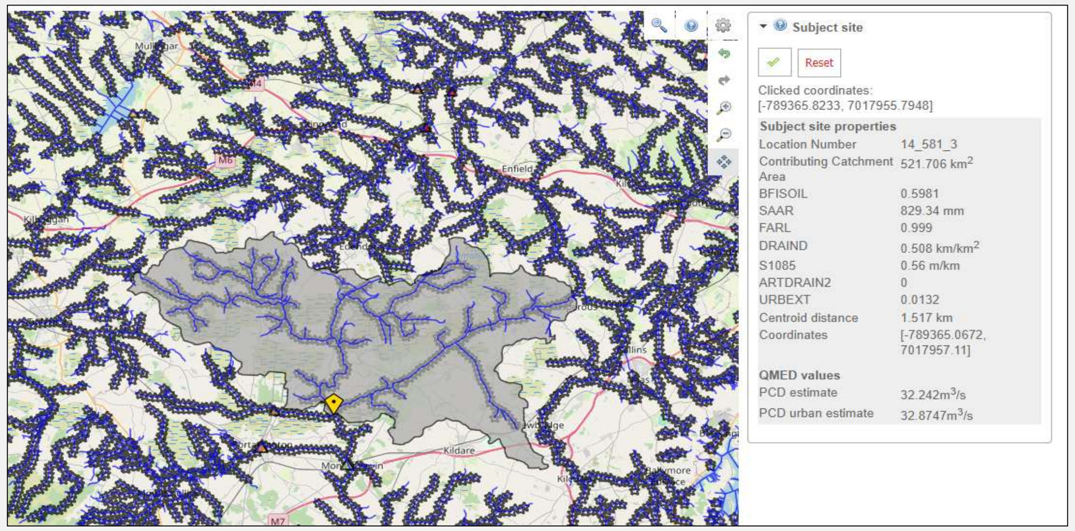
$$QMED_{urban} = QMED_{rural}(1+URBEXT)^{1.482}$$

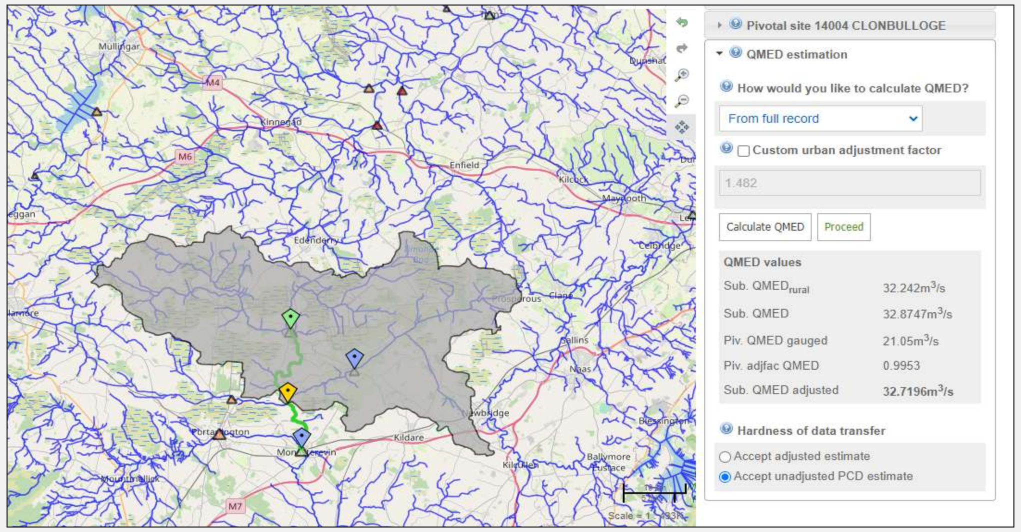
QMED 32.875 m^3/s

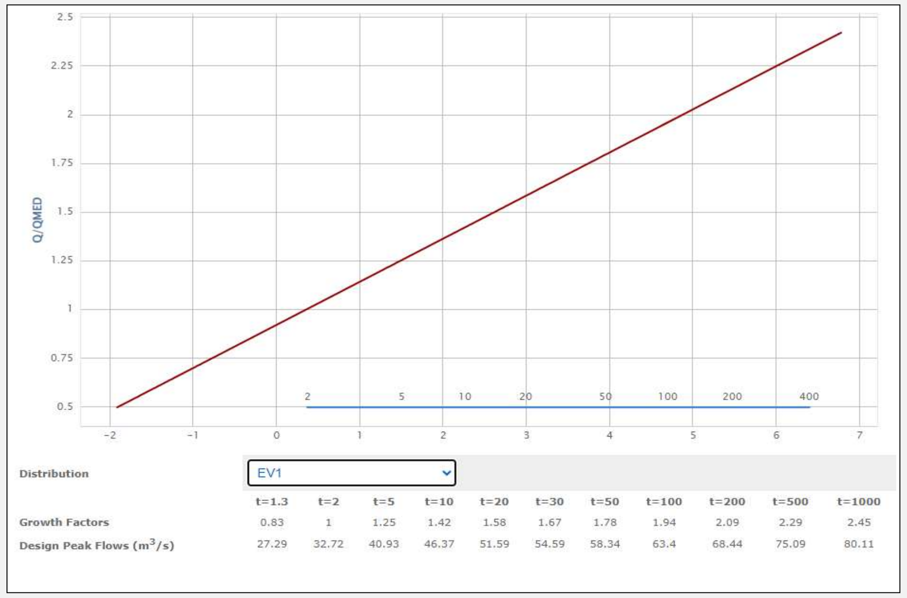
River Figile

Using Pivotal/ Pooled Analysis Factors

Calculation of Flow Estimation											
Method	QMED	FSE	QMED (68% C.I.)	QMED (95% C.I.)	Growth Factor Q100	Growth Factor Q1000	FSU Adjustment Factor	Climate Change		Q100 Design Flow (95% C.I.)	Q1000 Design Flow (95% C.I.)
FSU - 7 Variable Equation	32.875 m3/s	1.37	45.04 m3/s	61.70 m3/s	1.94	2.45	1.000	1.2		143.65 m3/s	181.41 m3/s







Project	Derrynadarragh		
Subject	Flood Risk Assessment Calculation of Flow Estimation		
Prepared by:	SH	Job No	P22-145
Checked by:	PD	Date	15/04/2025
Approved by:	PD	Revision	P01

FEHILY TIMONEY

1.0 PHYSICAL CATCHMENT DESCRIPTORS (PCD'S):

1.1 Hydrological PCD's

S1085 - Mainstream Slope	1.288	m/km

1.2 Spatial PCD's

AREA - Catchment Area	49.25	km^2	
SAAR - Standard Annual Average Rainfall	841.37	mm	*
FARL - Flood Attenuation by Rivers and Lakes	1		

1.3 Spatial PCD's Representing Soil, Subsoil & Aquifer Types

BFI_{SOIL}	0.608		*
URBEXT	0.0075		*
SOIL			
DRAIND	0.612	km/km^2	
ARTDRAIN2	0		*

7.0 FSU - 7 VARIABLE EQUATION

$$QMED_{rural} = 1.237x10^{-5}\ AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185}\ (1+ARTDRAIN2)^{0.408}$$

$QMED_{RURAL}$	4.416	m^3/s

$$QMED_{urban} = QMED_{rural}(1+URBEXT)^{1.482}$$

QMED	4.465	m^3/s
QBAR	**4.651**	m^3/s

River Daingean

Calculation of Flow Estimation

Method	QMED	FSE	QMED (68% C.I.)	QMED (95% C.I.)	Growth Factor Q100	Growth Factor Q1000	Climate Change		Q100 Design Flow (95% C.I.)	Q1000 Design Flow (95% C.I.)
FSU 1 - 7 Variable Equation	4.465 m3/s	1.37	6.12 m3/s	8.38 m3/s	2.098	2.696	1.2		**21.10 m3/s**	**27.11 m3/s**

Table1: Automatically generated upon selection of ungauged node			
Physical Catchment Descriptors			
AREA	47.39	Node East	252826
BFIsoils	0.608	Node North	227453
SAAR	841.37	Centroid East	247100
FARL	1	Centroid North	227030
DRAIND	0.612	ALLUV	0.0116
S1085	1.28839	ARTDRAIN	0
ARTDRAIN2	0	FOREST	0.0242
URBEXT	0.0075		

EV1		
Return Period (T)	Growth Factors	Design Flows
1.3	0.806	2.492
2	1.000	3.093
5	1.294	4.002
10	1.488	4.604
20	1.675	5.181
25	1.734	5.364
30	1.782	5.513
35	1.823	5.639
50	1.917	5.928
100	2.098	6.488
200	2.278	7.046
500	2.516	7.782
1000	2.696	8.338

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 4

HYDRAULIC ANALYSIS

River Cushina

Existing Scenario -100-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
2735.71	Upstream	62.19	42.3	0.64
2678.54	Upstream	62.14	42.3	0.63
2604.7	Upstream	62.06	42.3	0.69
2535.23	Upstream	62	42.3	0.59
2498.64	Development	61.96	42.3	0.69
2490.7	Development	61.95	42.3	0.73
2450.07	Development	61.89	42.3	0.91
2397.96	Development	61.8	42.3	0.92
2342.83	Development	61.67	42.3	1.08
2277.97	Development	61.57	42.3	0.68
2221.17	Development	61.5	42.3	0.47
2162.4	Development	61.45	42.3	0.31
2101.8	Development	61.41	42.3	0.35
2022.09	Development	61.34	42.3	0.34
1960.5	Development	61.27	42.3	0.38
1903.7	Development	61.2	42.3	0.39
1824.65	Development	61.14	42.3	0.29
1759.46	Development	61.11	42.3	0.28
1688.42	Development	61.07	42.3	0.32
1633.35	Development	61.04	42.3	0.28
1563.84	Development	61	42.3	0.32
1496.01	Development	60.96	42.3	0.32
1430.35	Development	60.92	42.3	0.29
1357.05	Development	60.89	42.3	0.27
1299.7	Development	60.86	42.3	0.27
1229.75	Development	60.84	42.3	0.21
1165.15	Development	60.82	42.3	0.16
1107.38	Development	60.82	42.3	0.13
1033.05	Development	60.81	42.3	0.11
959.34	Development	60.79	42.3	0.15
883.45	Development	60.78	42.3	0.16
809.83	Development	60.77	42.3	0.2
736.4	Development	60.75	42.3	0.19
661.8	Downstream	60.73	42.3	0.18
598.62	Downstream	60.72	42.3	0.19
534.53	Downstream	60.71	42.3	0.11
474.38	Downstream	60.7	42.3	0.1
430.91	Downstream	60.7	42.3	0.08
374.88	Downstream	60.7	42.3	0.08
306.55	Downstream	60.69	42.3	0.08
254.81	Downstream	60.69	42.3	0.09
216.68	Downstream	60.69	42.3	0.1
213.58	Existing Structure			
210.48	Downstream	60.69	42.3	0.09
157.89	Downstream	60.67	185.95	0.27
102.64	Downstream	60.61	185.95	0.34
55.77	Downstream	60.55	185.95	0.38
0	Downstream	60.51	185.95	0.3

River Cushina

Proposed Scenario Structure - 100-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
2735.71	Upstream	62.23	42.3	0.61
2678.54	Upstream	62.18	42.3	0.59
2604.7	Upstream	62.12	42.3	0.64
2535.23	Upstream	62.07	42.3	0.54
2498.64	Upstream	61.98	42.3	1.02
2494.67	Proposed Bridge			
2490.7	Development	61.95	42.3	1.09
2450.07	Development	61.89	42.3	0.91
2397.96	Development	61.8	42.3	0.92
2342.83	Development	61.67	42.3	1.08
2277.97	Development	61.57	42.3	0.68
2221.17	Development	61.5	42.3	0.47
2162.4	Development	61.45	42.3	0.31
2101.8	Development	61.41	42.3	0.35
2022.09	Development	61.34	42.3	0.34
1960.5	Development	61.27	42.3	0.38
1903.7	Development	61.2	42.3	0.39
1824.65	Development	61.14	42.3	0.29
1759.46	Development	61.11	42.3	0.28
1688.42	Development	61.07	42.3	0.32
1633.35	Development	61.04	42.3	0.28
1563.84	Development	61	42.3	0.32
1496.01	Development	60.96	42.3	0.32
1430.35	Development	60.92	42.3	0.29
1357.05	Development	60.89	42.3	0.27
1299.7	Development	60.86	42.3	0.27
1229.75	Development	60.84	42.3	0.21
1165.15	Development	60.82	42.3	0.16
1107.38	Development	60.82	42.3	0.13
1033.05	Development	60.81	42.3	0.11
959.34	Development	60.79	42.3	0.15
883.45	Development	60.78	42.3	0.16
809.83	Development	60.77	42.3	0.2
736.4	Development	60.75	42.3	0.19
661.8	Downstream	60.73	42.3	0.18
598.62	Downstream	60.72	42.3	0.19
534.53	Downstream	60.71	42.3	0.11
474.38	Downstream	60.7	42.3	0.1
430.91	Downstream	60.7	42.3	0.08
374.88	Downstream	60.7	42.3	0.08
306.55	Downstream	60.69	42.3	0.08
254.81	Downstream	60.69	42.3	0.09
216.68	Downstream	60.69	42.3	0.1
213.58	Existing Structure			
210.48	Downstream	60.69	42.3	0.09
157.89	Downstream	60.67	185.95	0.27
102.64	Downstream	60.61	185.95	0.34
55.77	Downstream	60.55	185.95	0.38
0	Downstream	60.51	185.95	0.30

River Cushina

Water Level Comparison - Existing Vs. Proposed Scenario 100-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (Existing) (m)	Water Surface Elevation (Proposed) (m)	Difference of Water Surface Elevation (Proposed - Existing) (m)
2735.71	Upstream	62.19	62.23	0.04
2678.54	Upstream	62.14	62.18	0.04
2604.70	Upstream	62.06	62.12	0.06
2535.23	Upstream	62.00	62.07	0.07
2498.64	Upstream	61.96	61.98	0.02
2494.67	Proposed Bridge			
2490.70	Development	61.95	61.95	0
2450.07	Development	61.89	61.89	0
2397.96	Development	61.80	61.80	0
2342.83	Development	61.67	61.67	0
2277.97	Development	61.57	61.57	0
2221.17	Development	61.50	61.50	0
2162.40	Development	61.45	61.45	0
2101.80	Development	61.41	61.41	0
2022.09	Development	61.34	61.34	0
1960.50	Development	61.27	61.27	0
1903.70	Development	61.20	61.20	0
1824.65	Development	61.14	61.14	0
1759.46	Development	61.11	61.11	0
1688.42	Development	61.07	61.07	0
1633.35	Development	61.04	61.04	0
1563.84	Development	61.00	61.00	0
1496.01	Development	60.96	60.96	0
1430.35	Development	60.92	60.92	0
1357.05	Development	60.89	60.89	0
1299.70	Development	60.86	60.86	0
1229.75	Development	60.84	60.84	0
1165.15	Development	60.82	60.82	0
1107.38	Development	60.82	60.82	0
1033.05	Development	60.81	60.81	0
959.34	Development	60.79	60.79	0
883.45	Development	60.78	60.78	0
809.83	Development	60.77	60.77	0
736.40	Development	60.75	60.75	0
661.80	Downstream	60.73	60.73	0
598.62	Downstream	60.72	60.72	0
534.53	Downstream	60.71	60.71	0
474.38	Downstream	60.70	60.70	0
430.91	Downstream	60.70	60.70	0
374.88	Downstream	60.70	60.70	0
306.55	Downstream	60.69	60.69	0
254.81	Downstream	60.69	60.69	0
216.68	Downstream	60.69	60.69	0
213.58	Existing Structure			
210.48	Downstream	60.69	60.69	0
157.89	Downstream	60.67	60.67	0
102.64	Downstream	60.61	60.61	0
55.77	Downstream	60.55	60.55	0
0	Downstream	60.51	60.51	0

River Cushina

Existing Scenario - 1000 year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
2735.71	Upstream	62.35	54.79	0.67
2678.54	Upstream	62.30	54.79	0.67
2604.7	Upstream	62.22	54.79	0.73
2535.23	Upstream	62.15	54.79	0.63
2498.64	Development	62.11	54.79	0.73
2490.7	Development	62.10	54.79	0.77
2450.07	Development	62.04	54.79	0.99
2397.96	Development	61.94	54.79	1.01
2342.83	Development	61.80	54.79	1.15
2277.97	Development	61.70	54.79	0.70
2221.17	Development	61.63	54.79	0.47
2162.4	Development	61.59	54.79	0.33
2101.8	Development	61.54	54.79	0.37
2022.09	Development	61.46	54.79	0.37
1960.5	Development	61.38	54.79	0.42
1903.7	Development	61.31	54.79	0.42
1824.65	Development	61.24	54.79	0.31
1759.46	Development	61.20	54.79	0.30
1688.42	Development	61.16	54.79	0.35
1633.35	Development	61.13	54.79	0.31
1563.84	Development	61.09	54.79	0.34
1496.01	Development	61.04	54.79	0.34
1430.35	Development	61.00	54.79	0.31
1357.05	Development	60.96	54.79	0.28
1299.7	Development	60.94	54.79	0.27
1229.75	Development	60.91	54.79	0.21
1165.15	Development	60.90	54.79	0.16
1107.38	Development	60.89	54.79	0.13
1033.05	Development	60.88	54.79	0.12
959.34	Development	60.87	54.79	0.15
883.45	Development	60.86	54.79	0.16
809.83	Development	60.85	54.79	0.18
736.4	Development	60.83	54.79	0.18
661.8	Downstream	60.82	54.79	0.17
598.62	Downstream	60.81	54.79	0.16
534.53	Downstream	60.80	54.79	0.10
474.38	Downstream	60.80	54.79	0.09
430.91	Downstream	60.79	54.79	0.08
374.88	Downstream	60.79	54.79	0.08
306.55	Downstream	60.79	54.79	0.08
254.81	Downstream	60.78	54.79	0.09
216.68	Downstream	60.78	54.79	0.10
213.58	Existing Structure			
210.48	Downstream	60.78	54.79	0.09
157.89	Downstream	60.76	236.2	0.28
102.64	Downstream	60.71	236.2	0.32
55.77	Downstream	60.67	236.2	0.34
0	Downstream	60.63	236.2	0.31

River Cushina

Proposed Scenario Structure - 1000-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
2735.71	Upstream	62.38	54.79	0.65
2678.54	Upstream	62.33	54.79	0.64
2604.70	Upstream	62.26	54.79	0.69
2535.23	Upstream	62.20	54.79	0.59
2498.64	Upstream	62.15	54.79	0.85
2494.67	Proposed Bridge			
2490.70	Development	62.10	54.79	0.99
2450.07	Development	62.04	54.79	1.01
2397.96	Development	61.94	54.79	1.15
2342.83	Development	61.80	54.79	0.70
2277.97	Development	61.70	54.79	0.47
2221.17	Development	61.63	54.79	0.33
2162.40	Development	61.59	54.79	0.37
2101.80	Development	61.54	54.79	0.37
2022.09	Development	61.46	54.79	0.42
1960.50	Development	61.38	54.79	0.42
1903.70	Development	61.31	54.79	0.31
1824.65	Development	61.24	54.79	0.30
1759.46	Development	61.20	54.79	0.35
1688.42	Development	61.16	54.79	0.31
1633.35	Development	61.13	54.79	0.34
1563.84	Development	61.09	54.79	0.34
1496.01	Development	61.04	54.79	0.31
1430.35	Development	61.00	54.79	0.28
1357.05	Development	60.96	54.79	0.27
1299.70	Development	60.94	54.79	0.21
1229.75	Development	60.91	54.79	0.16
1165.15	Development	60.90	54.79	0.13
1107.38	Development	60.89	54.79	0.12
1033.05	Development	60.88	54.79	0.15
959.34	Development	60.87	54.79	0.16
883.45	Development	60.86	54.79	0.18
809.83	Development	60.85	54.79	0.18
736.40	Downstream	60.83	54.79	0.17
661.80	Downstream	60.82	54.79	0.16
598.62	Downstream	60.81	54.79	0.10
534.53	Downstream	60.80	54.79	0.09
474.38	Downstream	60.80	54.79	0.08
430.91	Downstream	60.79	54.79	0.08
374.88	Downstream	60.79	54.79	0.08
306.55	Downstream	60.79	54.79	0.09
254.81	Downstream	60.78	54.79	0.10
216.68	Downstream	60.78	54.79	
213.58	Existing Structure			
210.48	Downstream	60.78	54.79	0.09
157.89	Downstream	60.76	236.2	0.28
102.64	Downstream	60.71	236.2	0.32
55.77	Downstream	60.67	236.2	0.34
0.00	Downstream	60.63	236.2	0.31

River Cushina

Water Level Comparison - Existing Vs. Proposed Sscenario - 1000-years storm and tide events

Cross Section / Chainages	Location	Water Surface Elevation (Existing) (m)	Water Surface Elevation (Proposed) (m)	Difference of Water Surface Elevation (Proposed - Existing) (m)	Observations
2735.71	Upstream	62.35	62.38	0.03	Slight increase of water level
2678.54	Upstream	62.30	62.33	0.03	Slight increase of water level
2604.7	Upstream	62.22	62.26	0.04	Slight increase of water level
2535.23	Upstream	62.15	62.20	0.05	Slight increase of water level
2498.64	Upstream	62.11	62.15	0.04	Slight increase of water level
2494.67	Proposed Bridge				
2490.7	Development	62.10	62.10	0	No variation of water level
2450.07	Development	62.04	62.04	0	No variation of water level
2397.96	Development	61.94	61.94	0	No variation of water level
2342.83	Development	61.80	61.80	0	No variation of water level
2277.97	Development	61.70	61.70	0	No variation of water level
2221.17	Development	61.63	61.63	0	No variation of water level
2162.4	Development	61.59	61.59	0	No variation of water level
2101.8	Development	61.54	61.54	0	No variation of water level
2022.09	Development	61.46	61.46	0	No variation of water level
1960.5	Development	61.38	61.38	0	No variation of water level
1903.7	Development	61.31	61.31	0	No variation of water level
1824.65	Development	61.24	61.24	0	No variation of water level
1759.46	Development	61.20	61.20	0	No variation of water level
1688.42	Development	61.16	61.16	0	No variation of water level
1633.35	Development	61.13	61.13	0	No variation of water level
1563.84	Development	61.09	61.09	0	No variation of water level
1496.01	Development	61.04	61.04	0	No variation of water level
1430.35	Development	61.00	61.00	0	No variation of water level
1357.05	Development	60.96	60.96	0	No variation of water level
1299.7	Development	60.94	60.94	0	No variation of water level
1229.75	Development	60.91	60.91	0	No variation of water level
1165.15	Development	60.90	60.90	0	No variation of water level
1107.38	Development	60.89	60.89	0	No variation of water level
1033.05	Development	60.88	60.88	0	No variation of water level
959.34	Development	60.87	60.87	0	No variation of water level
883.45	Development	60.86	60.86	0	No variation of water level
809.83	Development	60.85	60.85	0	No variation of water level
736.4	Development	60.83	60.83	0	No variation of water level
661.8	Downstream	60.82	60.82	0	No variation of water level
598.62	Downstream	60.81	60.81	0	No variation of water level
534.53	Downstream	60.80	60.80	0	No variation of water level
474.38	Downstream	60.80	60.80	0	No variation of water level
430.91	Downstream	60.79	60.79	0	No variation of water level
374.88	Downstream	60.79	60.79	0	No variation of water level
306.55	Downstream	60.79	60.79	0	No variation of water level
254.81	Downstream	60.78	60.78	0	No variation of water level
216.68	Downstream	60.78	60.78	0	No variation of water level
213.58	Existing Bridge				
210.48	Downstream	60.78	60.78	0	No variation of water level
157.89	Downstream	60.76	60.76	0	No variation of water level
102.64	Downstream	60.71	60.71	0	No variation of water level
55.77	Downstream	60.67	60.67	0	No variation of water level
0	Downstream	60.63	60.63	0	No variation of water level

River Daingean

Existing Scenario -100-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
656.8	Upstream	70.42	21.1	0.54
606.94	Upstream	70.35	21.1	0.57
556.8	Upstream	70.33	21.1	0.25
505.91	Upstream	70.31	21.1	0.22
455.88	Upstream	70.31	21.1	0.17
405.01	Upstream	70.3	21.1	0.15
389.99	Upstream	70.3	21.1	0.17
382.49	Upstream	70.3	21.1	0.17
375.95	Upstream	70.3	21.1	0.17
366.15	Downstream	70.3	21.1	0.2
356.15	Downstream	70.3	21.1	0.25
346.15	Downstream	70.3	21.1	0.24
333.04	Downstream	70.26	21.1	0.96
326.85	Existing Bridge			
320.67	Downstream	70.14	21.1	1.54
300.37	Downstream	70	21.1	0.33
250.25	Downstream	69.98	21.1	0.33
200.21	Downstream	69.96	21.1	0.35
150.21	Downstream	69.94	21.1	0.34
100	Downstream	69.92	21.1	0.33
50	Downstream	69.89	21.1	0.39
0	Downstream	69.85	21.1	0.51

River Daingean

Proposed Scenario Structure - 100-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
656.8	Upstream	70.42	21.1	0.53
606.94	Upstream	70.36	21.1	0.54
556.8	Upstream	70.34	21.1	0.24
505.91	Upstream	70.33	21.1	0.21
455.88	Upstream	70.32	21.1	0.17
405.01	Upstream	70.32	21.1	0.14
389.99	Upstream	70.32	21.1	0.17
382.49	Upstream	70.32	21.1	0.16
375.95	Upstream	70.31	21.1	0.41
371.05	Proposed Bridge + Flood Relief Culverts			
366.15	Downstream	70.3	21.1	0.46
356.15	Downstream	70.3	21.1	0.25
346.15	Downstream	70.3	21.1	0.24
333.04	Downstream	70.26	21.1	0.96
326.85	Existing Bridge			
320.67	Downstream	70.14	21.1	1.54
300.37	Downstream	70	21.1	0.33
250.25	Downstream	69.98	21.1	0.33
200.21	Downstream	69.96	21.1	0.35
150.21	Downstream	69.94	21.1	0.34
100	Downstream	69.92	21.1	0.33
50	Downstream	69.89	21.1	0.39
0	Downstream	69.85	21.1	0.51

River Daingean

Water Level Comparison - Existing Vs. Proposed Scenario 100-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (Existing) (m)	Water Surface Elevation (Proposed) (m)	Difference of Water Surface Elevation (Proposed - Existing) (m)
656.80	Upstream	70.42	70.42	0
606.94	Upstream	70.35	70.36	0.01
556.80	Upstream	70.33	70.34	0.01
505.91	Upstream	70.31	70.33	0.02
455.88	Upstream	70.31	70.32	0.01
405.01	Upstream	70.30	70.32	0.02
389.99	Upstream	70.30	70.32	0.02
382.49	Upstream	70.30	70.32	0.02
375.95	Upstream	70.30	70.31	0.01
371.05	Proposed Bridge + Flood Relief Culverts			
366.15	Downstream	70.30	70.30	0
356.15	Downstream	70.30	70.30	0
346.15	Downstream	70.30	70.30	0
333.04	Downstream	70.26	70.26	0
326.85	Existing Bridge			
320.67	Downstream	70.14	70.14	0
300.37	Downstream	70.00	70.00	0
250.25	Downstream	69.98	69.98	0
200.21	Downstream	69.96	69.96	0
150.21	Downstream	69.94	69.94	0
100.00	Downstream	69.92	69.92	0
50.00	Downstream	69.89	69.89	0
0.00	Downstream	69.85	69.85	0

River Daingean

Existing Scenario -1000-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
656.8	Upstream	70.47	27.11	0.56
606.94	Upstream	70.4	27.11	0.60
556.8	Upstream	70.38	27.11	0.28
505.91	Upstream	70.36	27.11	0.25
455.88	Upstream	70.35	27.11	0.20
405.01	Upstream	70.35	27.11	0.17
389.99	Upstream	70.35	27.11	0.20
382.49	Upstream	70.35	27.11	0.19
375.95	Upstream	70.34	27.11	0.19
366.15	Downstream	70.34	27.11	0.22
356.15	Downstream	70.34	27.11	0.28
346.15	Downstream	70.34	27.11	0.28
333.04	Downstream	70.3	27.11	1.04
326.85	Existing Bridge			
320.67	Downstream	70.17	27.11	1.66
300.37	Downstream	70.07	27.11	0.35
250.25	Downstream	70.05	27.11	0.39
200.21	Downstream	70.02	27.11	0.38
150.21	Downstream	70	27.11	0.38
100	Downstream	69.97	27.11	0.36
50	Downstream	69.95	27.11	0.41
0	Downstream	69.9	27.11	0.52

River Daingean

Proposed Scenario Structure - 1000-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (m)	Flow (m3/s)	Velocity (m/s)
656.8	Upstream	70.48	27.11	0.55
606.94	Upstream	70.41	27.11	0.58
556.8	Upstream	70.38	27.11	0.27
505.91	Upstream	70.37	27.11	0.24
455.88	Upstream	70.36	27.11	0.19
405.01	Upstream	70.36	27.11	0.17
389.99	Upstream	70.36	27.11	0.20
382.49	Upstream	70.36	27.11	0.19
375.95	Upstream	70.35	27.11	0.48
371.05	Proposed Bridge + Flood Relief Culverts			
366.15	Downstream	70.34	27.11	0.52
356.15	Downstream	70.34	27.11	0.28
346.15	Downstream	70.34	27.11	0.28
333.04	Downstream	70.3	27.11	1.04
326.85	Existing Bridge			
320.67	Downstream	70.17	27.11	1.66
300.37	Downstream	70.07	27.11	0.35
250.25	Downstream	70.05	27.11	0.39
200.21	Downstream	70.02	27.11	0.38
150.21	Downstream	70	27.11	0.38
100	Downstream	69.97	27.11	0.36
50	Downstream	69.95	27.11	0.41
0	Downstream	69.9	27.11	0.52

River Daingean

Water Level Comparison - Existing Vs. Proposed Scenario 1000-year storm event

Cross Section / Chainages	Location	Water Surface Elevation (Existing) (m)	Water Surface Elevation (Proposed) (m)	Difference of Water Surface Elevation (Proposed - Existing) (m)
656.80	Upstream	70.47	70.48	0.01
606.94	Upstream	70.40	70.41	0.01
556.80	Upstream	70.38	70.38	0
505.91	Upstream	70.36	70.37	0.01
455.88	Upstream	70.35	70.36	0.01
405.01	Upstream	70.35	70.36	0.01
389.99	Upstream	70.35	70.36	0.01
382.49	Upstream	70.35	70.36	0.01
375.95	Upstream	70.34	70.35	0.01
371.05	Proposed Bridge + Flood Relief Culverts			
366.15	Downstream	70.34	70.34	0
356.15	Downstream	70.34	70.34	0
346.15	Downstream	70.34	70.34	0
333.04	Downstream	70.30	70.30	0
326.85	Existing Bridge			
320.67	Downstream	70.17	70.17	0
300.37	Downstream	70.07	70.07	0
250.25	Downstream	70.05	70.05	0
200.21	Downstream	70.02	70.02	0
150.21	Downstream	70.00	70.00	0
100.00	Downstream	69.97	69.97	0
50.00	Downstream	69.95	69.95	0
0.00	Downstream	69.90	69.90	0

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 5

FLOOD MAPS

FEHILY TIMONEY

Cork | Dublin | Carlow

www.fehilytimoney.ie

Rev.	Description	App By	Date
A	ISSUE FOR INFORMATION	JH	26.06.25

PROJECT

DERRYNADARRAGH WIND FARM

CLIENT

Dara Energy Limited

SHEET

RIVER CUSHINA FLOOD EXTENTS EXISTING & PROPOSED 1 IN 100 YEARS STORM EVENT

Date 26.06.25	Project number P22-145	Scale (@ A1-) 1:5000	
Drawn by CS	Drawing Number P22-145-INFO-0003		Rev A
Checked by SHS			

O:\ACAD\2022\P22-145\P22-145-INFO-0003

5 August 2025

FEHILY TIMONEY

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www.fehilytimoney.ie

Rev.	Description	App By	Date
A	ISSUE FOR INFORMATION	JH	26.06.25

PROJECT

DERRYNADARRAGH WIND FARM

SHEET

RIVER CUSHINA FLOOD EXTENTS EXISTING & PROPOSED 1 IN 1000 YEARS STORM EVENT

CLIENT

Dara Energy Limited

Date 26.06.25	Project number P22-145	Scale (@ A1-) 1:5000	
Drawn by CS	Drawing Number P22-145-INFO-0004		Rev A
Checked by SHS			

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5 August 2025

0m 13m 25m 38m 50m 63m 75m 88m 100m 113m 125m

Scale 1:1250

FEHILY TIMONEY

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www.fehilytimoney.ie

Rev.	Description	App By	Date
A	ISSUE FOR PLANNING	JH	26.06.25

PROJECT

DERRYNADARRAGH WIND FARM

CLIENT

Dara Energy Limited

SHEET

DAINGEAN RIVER FLOOD EXTENTS EXISTING & PROPOSED 1 IN 100 YEARS STORM EVENT

Date	Project number	Scale (@ A1-)
26.06.25	P22-145	1:1250

Drawn by	Drawing Number	Rev
CS	P22-145-INFO-0005	A

Checked by
SHS

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5 August 2025

0m 13m 25m 38m 50m 63m 75m 88m 100m 113m 125m

Scale 1:1250

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DERRYNADARRAGH WIND FARM

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DAINGEAN RIVER FLOOD EXTENTS EXISTING & PROPOSED 1 IN 1000 YEARS STORM EVENT

CLIENT

Dara Energy Limited

Date	Project number	Scale (@ A1-)
26.06.25	P22-145	1:1250

Drawn by	Checked by	Drawing Number	Rev
CS	SHS	P22-145-INFO-0006	A

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5 August 2025

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DESIGNING AND DELIVERING
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APPENDIX 6

SITE PHOTOS

River Cushina- Proposed Bridge Crossing Location

River Cushina- Proposed Bridge Crossing Location

Land Drain crossing T9 hardstanding area and discharging to River Cushina

Substation Location-Standing water

T5 Location-Drain with standing water

Land drain next to T8 hardstanding area and access track

Deep land drain crossing T3 hardstanding area and access track

Deep land drains on the northern side of the Proposed Wind Farm near T2 area

River Daingean-Existing Bridge crossing

River Daingean

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