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Appendix 12.3

Flood Risk Assessment

RWE Renewables Ireland Ltd

Site Specific Flood Risk Assessment

Proposed Windfarm Development & Associated Infrastructure Works at Shancloon, Co. Galway

June 2025

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

Site Specific Flood Risk Assessment

Client: RWE Renewables Ireland Ltd

Location: Shancloon, Co. Galway

Date: 5th June 2025

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1. Introduction

IE Consulting was commissioned by Fehily Timoney, on behalf of RWE Renewables Ireland Ltd, to undertake a Site-Specific Flood Risk Assessment (SSFRA) in support of a planning application for a proposed wind farm development at Shancloon, Co. Galway.

The purpose of this SSFRA is to assess the potential flood risk to the site of the proposed windfarm development and to assess the impact that the development as proposed may or may not have on the existing hydrological regime of the area.

Quoted ground levels or estimated flood levels relate to Ordnance Datum (Malin) unless stated otherwise.

This flood risk assessment study has been undertaken in consideration of the following guidance document:

'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' DOEHLG 2009.

2. Development Description

The development proposed by RWE Renewables Ireland Ltd (the Applicant) is an 11 no. turbine wind farm and associated infrastructure including internal access tracks, hard standings, permanent meteorological mast, onsite 110 kV substation, internal electrical and communications cabling, temporary construction compounds, drainage infrastructure, earthworks and spoil management and all associated works related to the construction of the wind farm as well as measures designed to protect and enhance existing habitats and a loop-in grid connection to the National Electricity Grid (NEG).

The Proposed Development for which consent is being sought as part of this planning application will consist of the following:

- Construction of 11 no. wind turbines with a ground to blade tip height range of 178 m to 180 m. The wind turbines will have a rotor diameter ranging from 149.1 m to 155 m and a hub height ranging from 102.5m to 105m.
- Construction of permanent turbine foundations and crane pad hardstanding areas and associated drainage;
- Construction of 13,725 m of internal access tracks and associated drainage infrastructure (of which 1,770 m will be floated road);
- Upgrading of 3,565 m of existing tracks and road and associated drainage infrastructure;
- Construction of 1,180 m of temporary access track to facilitate HDD cable crossing of the Togher River;
- Creation of 1 no. new construction and operation access to the wind farm Site from the L-2234 local road and one road crossing of the L-2220-21 local road;
- All associated drainage and sediment control including interceptor drains, cross drains, settlement ponds and swales;
- Installation of new watercourse crossings including 1 no. 18.5 m single span bridge crossing and 14 new piped culverts;
- All associated excavation, earthworks and spoil management;
- 3 no. temporary construction compounds and associated ancillary infrastructure including parking;

- Construction of 1 no. permanent onsite 110kV electrical substation, associated new access road off of the L-6100 local road, and associated construction compound including:
    - Welfare facilities;
    - Electrical infrastructure;
    - Parking;
    - Wastewater holding tank;
    - Rainwater harvesting tank;
    - Security fencing;
- Works associated with the connection of the wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection 650 m in length to the existing Cashla-Dalton 110 kV overhead line in the townland of Tonacooleen, with two new 16m high steel loop-in lattice tower end masts for loop-in connection at the connection point.
- Installation of 33 kV medium voltage electrical and communication cabling underground between the proposed turbines and the proposed on-site substation and associated ancillary works including Control Building;
- Erection of 1 no. permanent meteorological mast to a height of 110 m above ground level with a 4m lightning pole on top.
- Turbine Delivery Accommodation works:
    - R332 / L6483 Junction - temporary load bearing surface will be laid and the drainage ditch temporarily culverted. Vegetation will be cleared. One utility pole will be temporarily removed.
    - On the L6483, temporary load bearing surface will be laid to provide a minimum 4.5 m running width and a 5.5 m clearance width for turbine delivery.
    - L6483 – temporary load bearing surface will be laid and vegetation will be cleared. Two road signs will be temporarily removed.
- Felling of 0.54 ha of conifer plantation forestry;
- 2,032 m Treeline/hedgerow removal;
- 9.7 ha of Biodiversity Enhancement lands plus 2,457.50 m of hedgerow/treeline planting.

3. Proposed Site Description

3.1. General

The site of the proposed wind farm development is located within the townlands of Beagh More, Cloonbar, Cloonnaglasha, Corillaun, Derrymore, Shancloon, Toberroe and Tonacooleen, County Galway. Of these, the on-site substation is located within Corillaun and loop-in connection is located within the neighbouring townland of Tonacooleen. The site is bounded by agricultural grazing lands, local access roads and small pockets of commercial forestry around the periphery of the site.

The location of the site of the proposed wind farm development is illustrated on *Figure 1* below and is shown on *Drawing Number IE2661-001-A, Appendix A*.

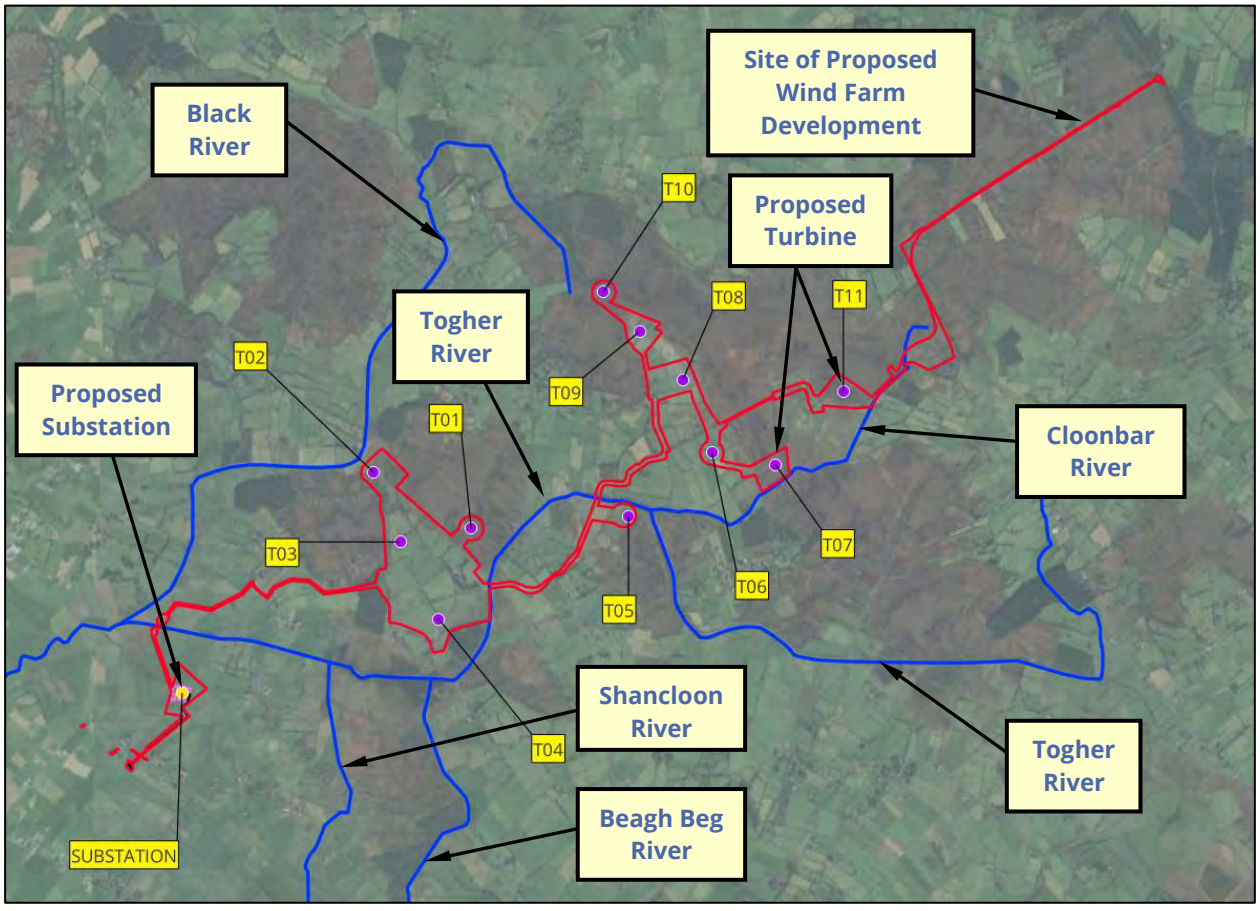


Figure 1 – Site Location

3.2. Existing Topography Levels at Site

The site of the proposed wind farm development consists of 11 proposed turbines as illustrated below in *Figure 2*.

The topography within the vicinity of the proposed turbine T11 slopes gently from the northern boundary of the site (~ 100m north of T11) to the southern boundary of the site (~200m south of T11) at an approximate gradient of 1.371% (1 in 73). Existing ground elevations within the vicinity of T11 range from 38.11m OD (Malin) at a high point along the northern boundary of the site to 34.58m OD (Malin) along the southern boundary of the site.

The topography within the vicinity of the proposed turbines T10, T09, T08, and T06 slope away from where each of these turbines are located as they are situated on top of or in proximity to local high points. The ground generally slopes away from each of these turbines at an average gradient of 1.37% (1 in 74). Existing ground levels within the vicinity of the proposed turbines T10, T09, T08, and T06 range from 39.49m OD 40m west of proposed turbine T08, to 32.11m OD 80m north of proposed turbine T10.

The topography within the vicinity of the proposed turbines T05 slopes gentle from the east to the west at a gradient of 0.45% (1 in 223). Existing ground levels within the vicinity of the proposed turbine T05 range from 30.44m OD 43m east of proposed turbine T05 to 28.11m OD 282m west of proposed turbine T05.

The topography within the vicinity of the proposed turbines T04, T03, T02, and T01 slopes from the centre of the site within the vicinity of these turbines. The ground slopes away from the centre at an average gradient of 3.99% (1 in 25). Existing ground levels within the vicinity of the proposed turbines T04, T03, T02, and T01 range from 41.29m OD 157m south east of proposed turbine T03, to 26.35m OD 88m north east of proposed turbine T01.

The topography within the vicinity of the proposed substation slopes from the southern boundary to the northern boundary at a gradient of 1.49% (1 in 67). Existing ground levels within the vicinity of the proposed substation range from 31.45m OD ~212m south of proposed substation to 25.86m OD 165m north of the proposed substation.

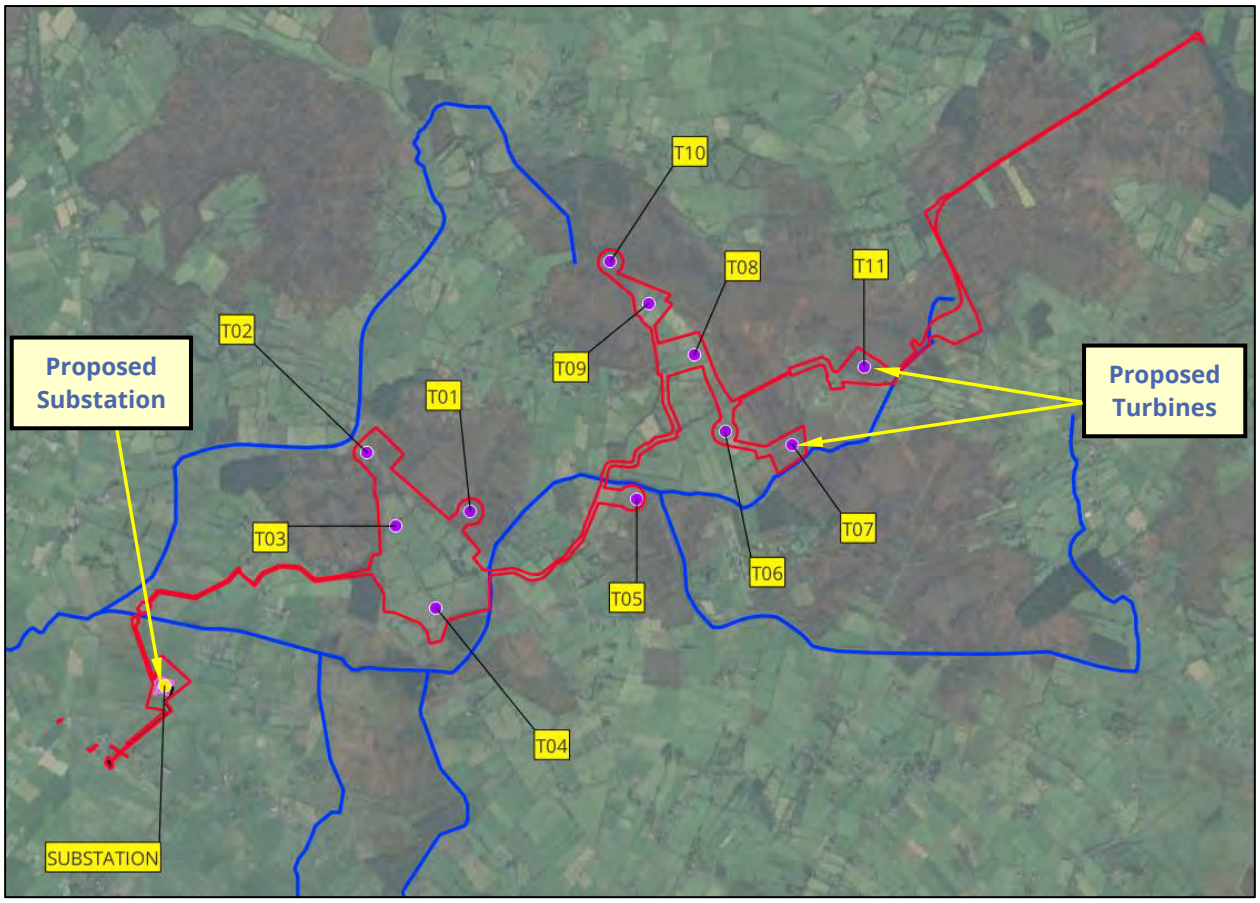


Figure 2 - Proposed Turbine Locations

3.3. Local Hydrology, Land use & Existing Drainage

The most immediate hydrological features in the vicinity of the site of the proposed wind farm development are the Togher River, the Cloonbar River, the Beagh Beg River, the Shancloon River, and the Black River.

The Togher River generally flows in the east to west direction within the vicinity of the proposed Turbines T01, T04, T05, and the proposed substation as illustrated in *Figure 3* below. Utilising the OPW Flood Studies Update (FSU) Portal software, the catchment area for the Togher River was delineated and found to be approximately 29.112km^2 to the point where it converges with the Cloonbar River. An assessment of the catchment area indicates a completely rural catchment with no urban fraction in the upstream catchment area.

The Cloonbar River generally flows in the east to west direction within the vicinity of the proposed Turbines T11, T07, and T06 as illustrated in *Figure 3* below. Utilising the OPW Flood Studies Update (FSU) Portal software, the catchment area for the Cloonbar River was delineated and found to be approximately 7.279km^2 to the point where it converges with the Togher River. An assessment of the catchment area indicates a completely rural catchment with no urban fraction in the upstream catchment area.

The Beagh Beg River generally flows in the south to north direction within the vicinity of the proposed Turbines T04 as illustrated in *Figure 3* below. Utilising the OPW Flood Studies Update (FSU) Portal software, the catchment area for the Beagh Beg River was delineated and found to be approximately 16.557km^2 to the point where it converges with the Togher River. An assessment of the catchment area indicates a completely rural catchment with no urban fraction in the upstream catchment area.

The Shancloon River generally flows in the south to north direction within the vicinity of the proposed Turbines T04 and the proposed substation as illustrated in *Figure 3* below. Utilising the OPW Flood Studies Update (FSU) Portal software, the catchment area for the Shancloon River was delineated and found to be approximately 2.057km^2 to the point where it converges with the Togher River. An assessment of the catchment area indicates a completely rural catchment with no urban fraction in the upstream catchment area.

The Black River generally flows in the north east to south west direction within the vicinity of the proposed Turbines T10 and T02 as illustrated in *Figure 3* below. Utilising the OPW Flood Studies Update (FSU) Portal software, the catchment area for the Black River was delineated and found to be approximately 89.646km^2 to the point where it converges with the Togher River. An assessment of the catchment area indicates a completely rural catchment with no urban fraction in the upstream catchment area.

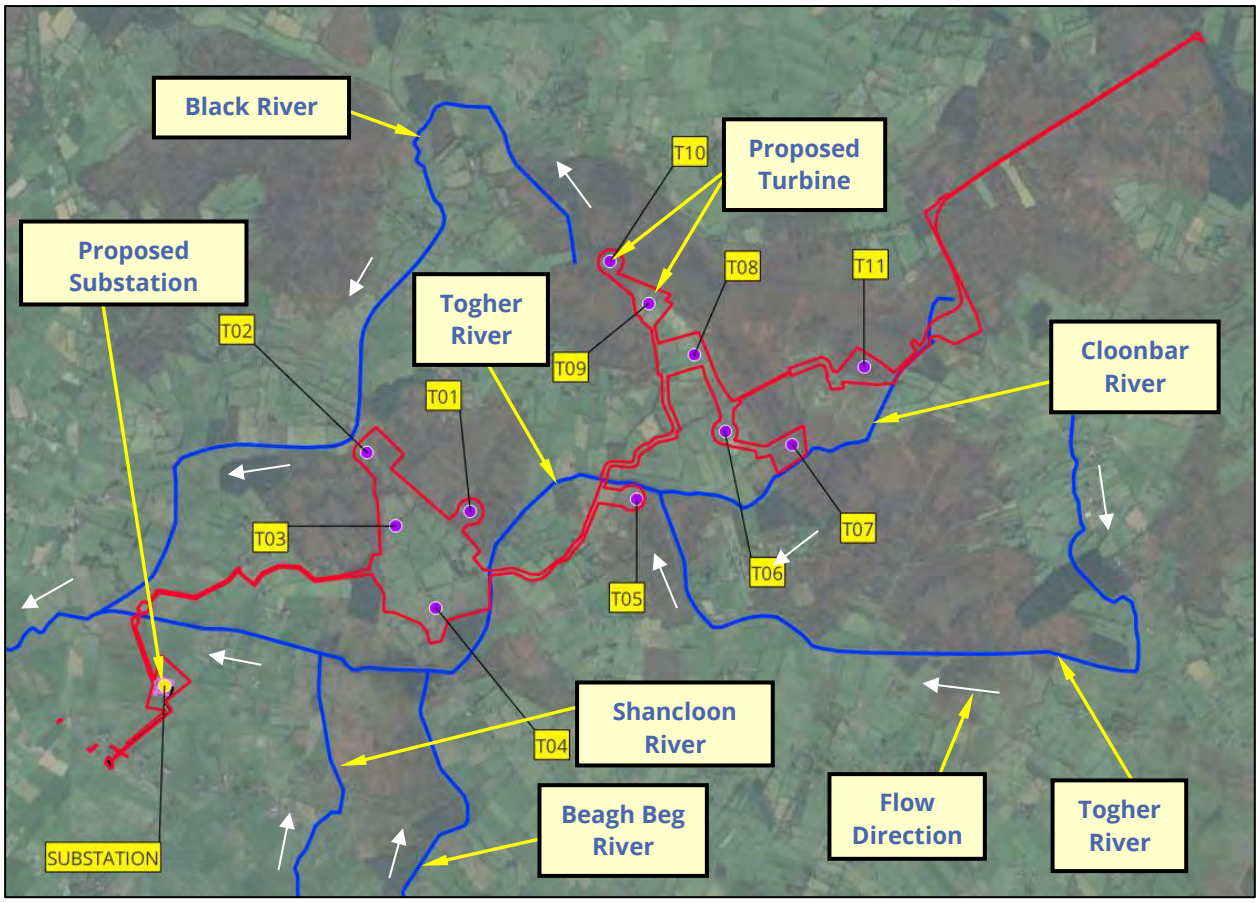


Figure 3 - Local Hydrology

4. Initial Flood Risk Assessment

The flood risk assessment for the site of the proposed wind-farm development is undertaken in three principal stages, these being 'Step 1 – Screening', 'Step 2 – Scoping', and 'Step 3 – Assessing'.

4.1. Possible Flooding Mechanisms

Table 1 below summarises the possible flooding mechanisms in consideration of the site:

Source/Pathway	Significant?	Comment/Reason
Tidal/Coastal	No	The site is not located within a coastal or tidally influenced region.
Fluvial	Yes	The Togher River, the Cloonbar River, the Beagh Beg River, the Shancloon River, and the Black River are located within and in the vicinity of the site of the proposed wind-farm development.
Pluvial (urban drainage)	No	There is no major or significant drainage or water supply infrastructure located in the vicinity of the site.
Pluvial (overland flow)	No	The site is not surrounded by significantly elevated lands and does not provide an important surface water discharge point to adjacent lands.
Blockage	Possible	There are existing hydraulic structures located along the Togher River, the Cloonbar River, and the Black River in the vicinity of the site.
Groundwater	No	There are no significant springs or groundwater discharges mapped or recorded in the immediate vicinity of the site.

Table 1: Flooding Mechanisms

The potential flood risk to the site of the proposed wind-farm development can be attributed to an extreme fluvial flood event in the Togher River, the Cloonbar River, the Beagh Beg River, the Shancloon River, and the Black River. Potential secondary and residual flood risk can be attributed to potential surcharge of the existing hydraulic structures located on the surrounding watercourses due to blockage.

In accordance with 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities - DOEHLG 2009' the potential flood risk to the site of the proposed wind-farm development is analysed in the subsequent 'Screening Assessment' and "Scoping Assessment" section of this study report.

5. Screening Assessment

The purpose of the screening assessment is to establish the level of flooding risk that may or may not exist for a particular site and to collate and assess existing, current, or historical information and data which may indicate the level or extent of any flood risk.

If there is a potential flood risk issue, then the flood risk assessment procedure should move to 'Step 2 – Scoping Assessment' or if no potential flood risk is identified from the screening stage, then the overall flood risk assessment can end at 'Step 1'. The following information and data were collated as part of the flood risk screening assessment for the site of the proposed wind farm development.

5.1. OPW/EPA/Local Authority Hydrometric Data

Existing sources of OPW, EPA and local authority hydrometric data were investigated. This assessment has determined that there are no hydrometric gauging stations located on the Togher River, the Cloonbar River, the Beagh Beg River, the Shancloon River, or the Black River in the general vicinity of the site of the proposed wind farm development.

5.2. OPW Western CFRAM Study Fluvial Flood Mapping

The site of the proposed wind farm development was not included as part of the OPW Western CFRAM study.

5.3. OPW PFRA Indicative Flood Mapping

Preliminary Flood Risk Assessment (PFRA) Mapping for Ireland was produced by the OPW in 2011. OPW PFRA flood map numbers 2019/MAP/263/A illustrate indicative flood zones within this area of County Galway.

Figure 4 below illustrates an extract from the above indicative flood map in the vicinity of the site of the proposed wind farm development.

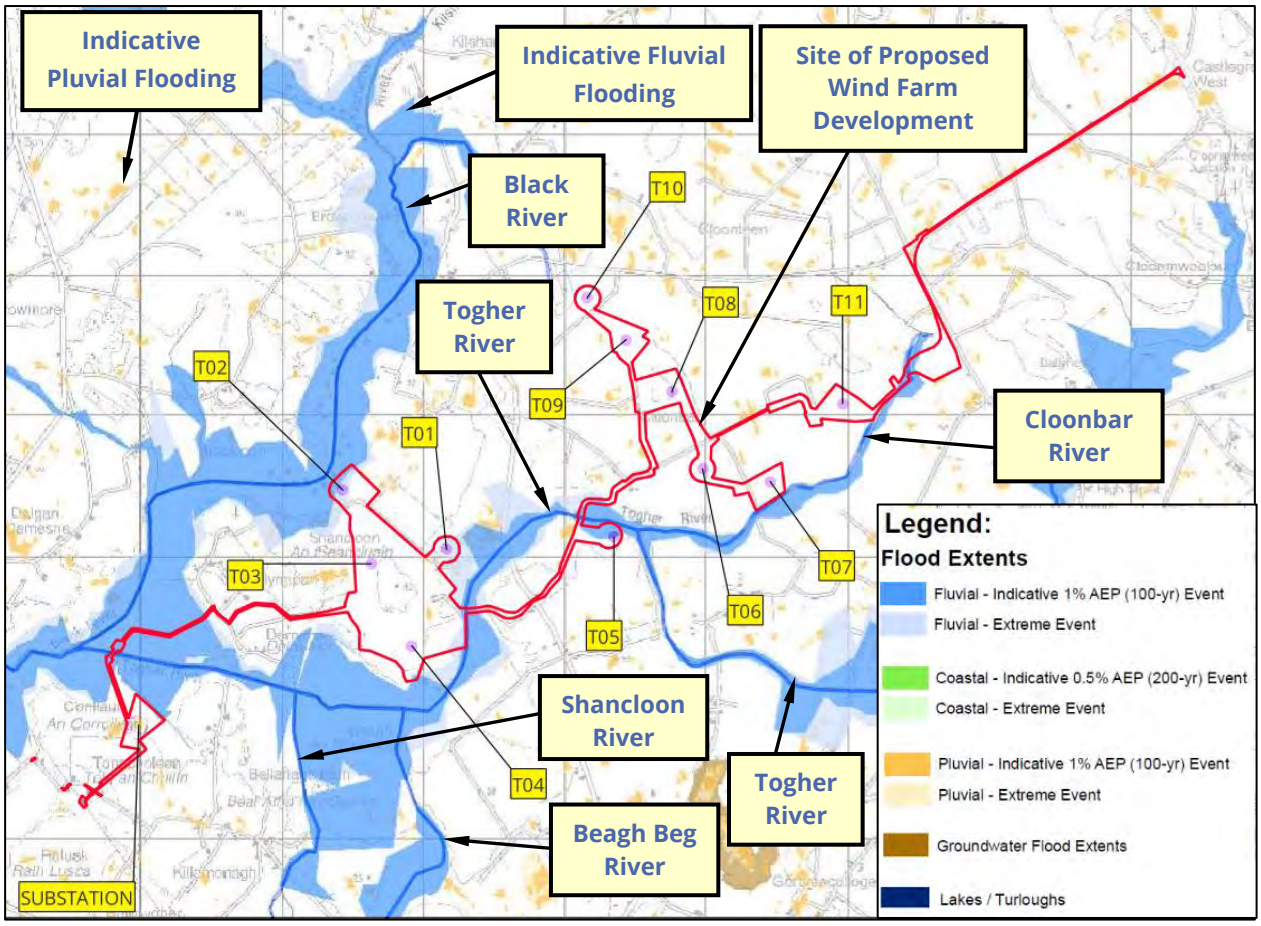


Figure 4 - OPW PFRA Mapping

The PFRA flood mapping indicates that the site of the proposed wind farm development partially falls within an indicative fluvial flood zone. The location of the following proposed turbines fall within a indicative fluvial flood zone; T01, T02, and T05. The remained of the location of proposed turbines T03, T04, T06, T07, T08, T09 T10, T11 and the proposed substation do not fall within an indicative fluvial or pluvial flood zone. The site of the proposed wind farm development does not fall within an indicative groundwater flood zone.

It should be noted that the extent of flooding illustrated on these maps was developed using a low-resolution digital terrain model (DTM) and illustrated flood extents are intended to be indicative only. The flood extents mapped on the PFRA maps are not intended to be used on a site-specific basis.

5.4. OPW Flood Info Past Flood Events

The OPW Flood Info Website (www.floodinfo.ie) was consulted in relation to available historical or anecdotal information on any flooding incidences or occurrences recorded in the vicinity of the site of the proposed wind farm development. Due to the extent of the proposed wind farm development two figures are provided to illustrate relevant flood data over the full extent of the site. *Figure 5* below illustrates mapping from the Flood Info website for the western portion of the site.

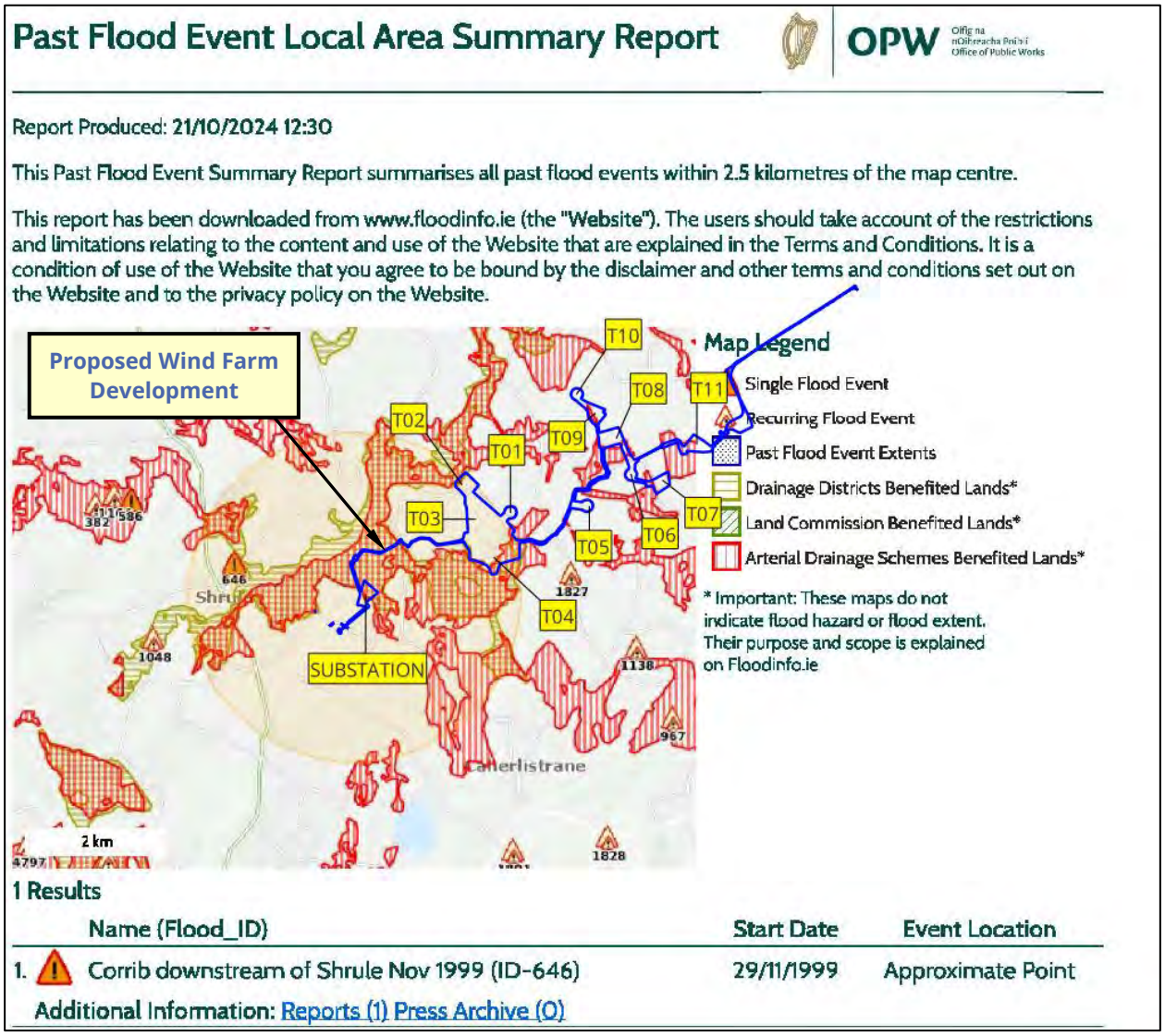


Figure 5 - OPW Flood Info Records Western Portion of the Site

Figure 5 above indicates one flood ID identified within a 2.5km radius of the site of the proposed wind farm development.

Flood ID-646 refers to a specific flood event which occurred on the 29th of November 1999 and is located 1.6km west of the proposed wind farm development. Based on its distance from the site this flood event is not deemed to be relevant.

Figure 6 below illustrates mapping from the Flood Info website for the eastern portion of the site.

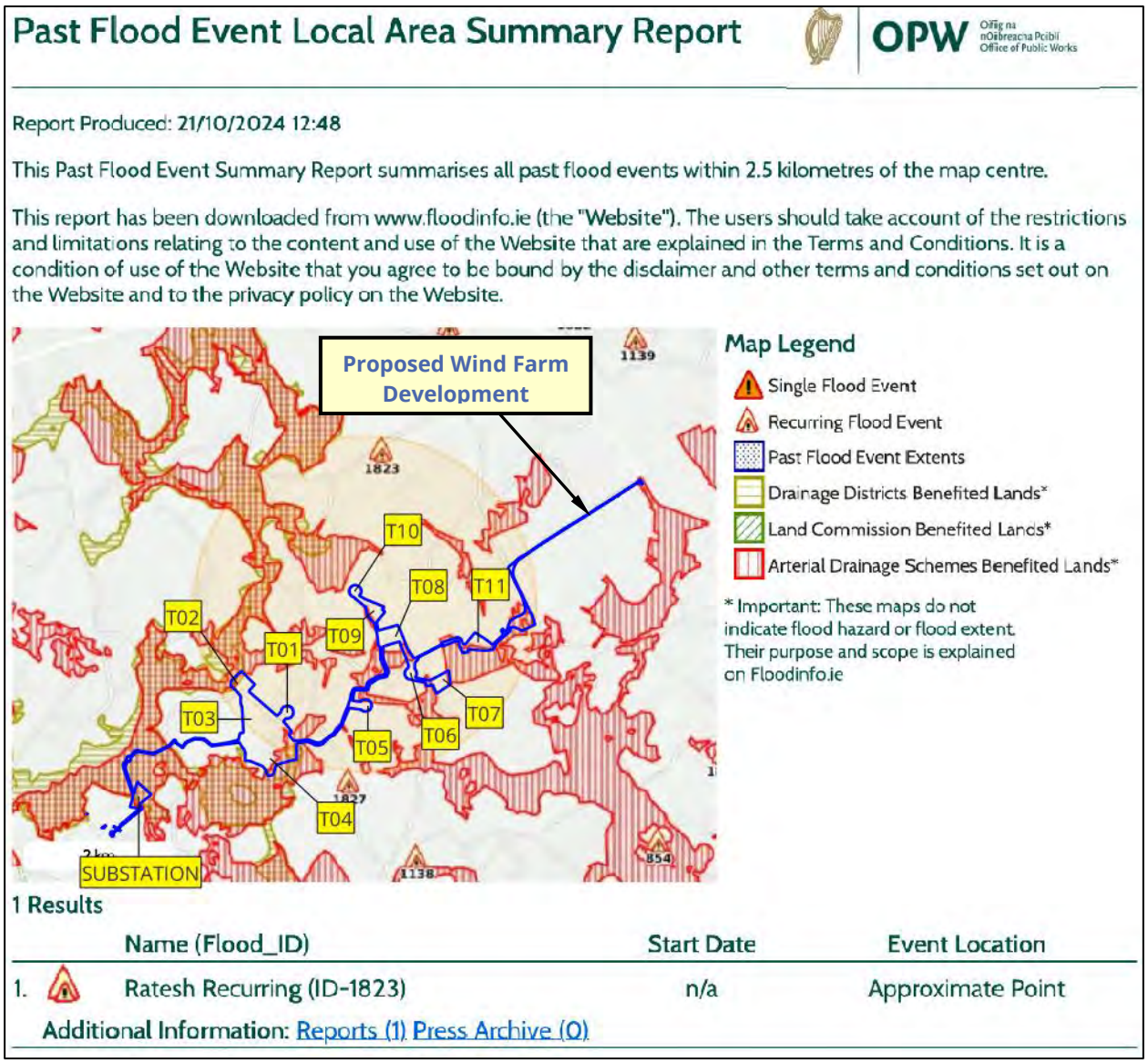


Figure 6 - OPW Flood Info Records Eastern Portion of the Site

Figure 6 above indicates one flood ID identified within a 2.5km radius of the site of the proposed wind farm development.

Flood ID-1823 refers to a specific flood event which occurred on the 8th of May 2005 and is located 2.0km north of the proposed wind farm development. Based on its distance from the site this flood event is not deemed be relevant.

The western portion of the proposed wind farm development falls within an area mapped as a Drainage District. These lands were drained under several drainage and navigation acts from 1842 to the 1930s to improve land for agriculture and to mitigate flooding. Channels and lakes were deepened and widened, weirs removed, embankments constructed, bridges replaced or modified, and various other works carried out. Local authorities are charged with responsibility to maintain Drainage Districts.

A large portion of the site of the proposed wind farm development falls within an area designated as 'Arterial Drainage Schemes Benefited Lands'. Arterial Drainage Schemes were carried out under the Arterial Drainage Act, 1945 to improve land for agriculture and to mitigate flooding. Rivers, lakes weirs and bridges were modified to enhance conveyance, embankments were built to control the movement of flood water and various other work was carried out under Part II of the Arterial Drainage Act, 1945. The purpose of the schemes was to improve land for agriculture, to ensure that the 3 year flood was retained in bank, which was achieved by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows. Flood protection in the benefiting lands was increased as a result of the Arterial Drainage Schemes.

5.5. Ordnance Survey Historic Mapping

Available historic mapping for the area was consulted, as this can provide evidence of historical flooding incidences or occurrences. The maps that were consulted were the historical 6-inch maps (pre-1900), and the historic 25-inch map series.

Figure 7 and *Figure 8* below show the historic mapping for the area of the site of the proposed wind farm development. The historic 6-inch and 25-inch mapping does not indicate any historical or anecdotal instances of flooding within or adjacent to the boundary of the site of the proposed development.

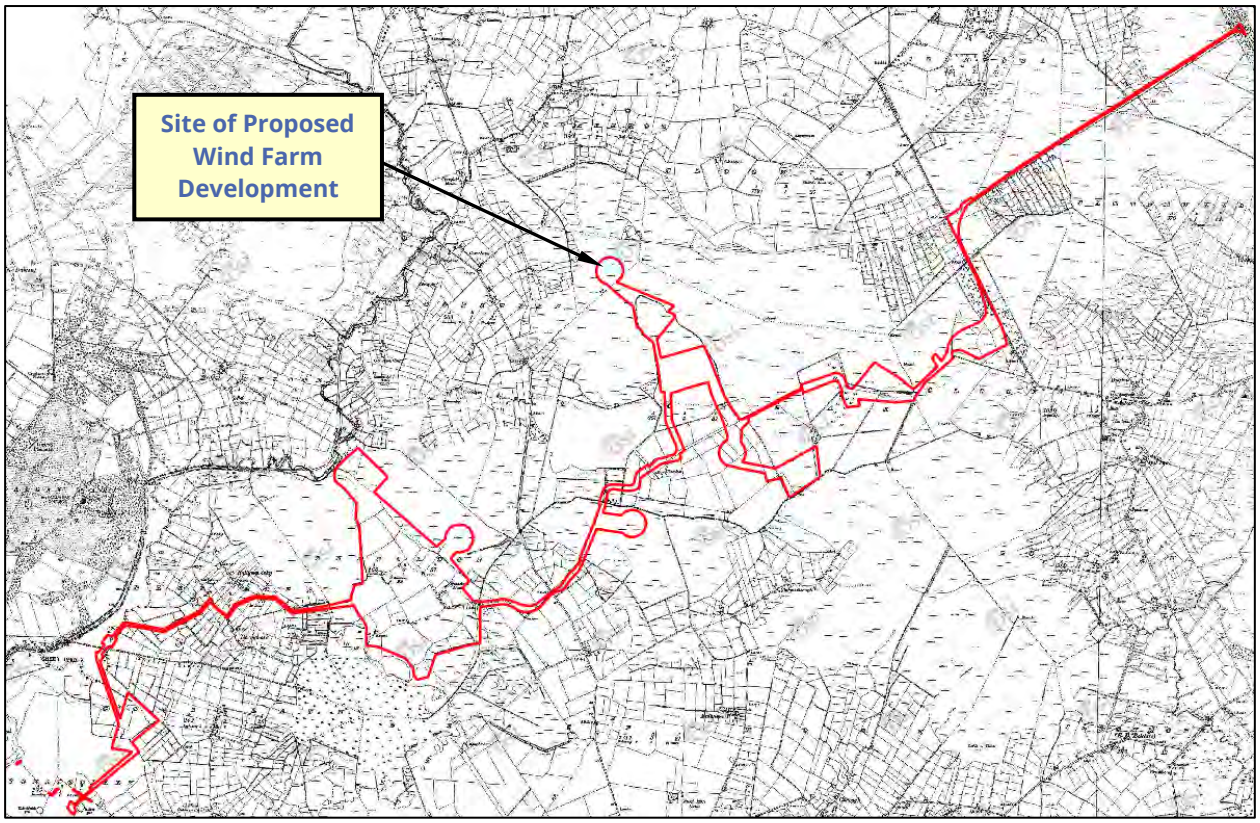


Figure 7 - Historic 6 Inch Mapping

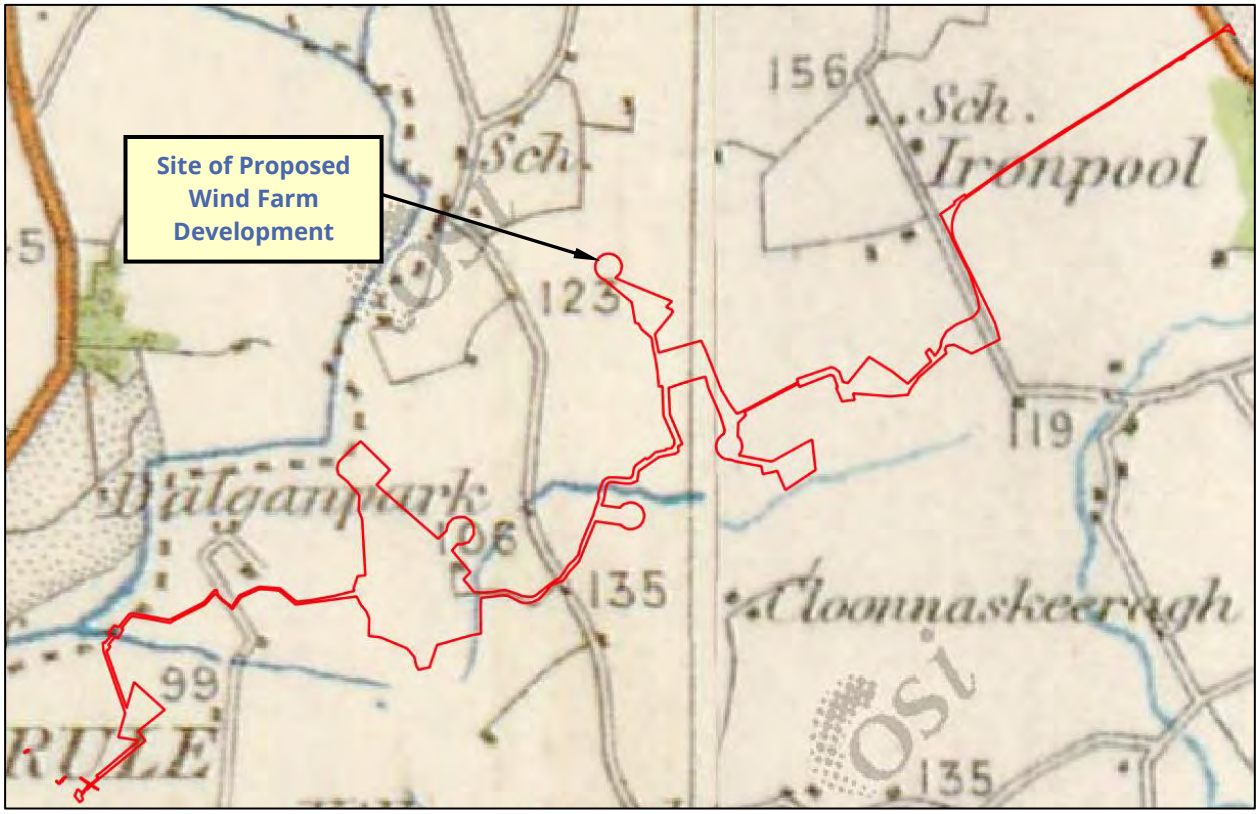


Figure 8 - Historic 25 Inch Mapping

5.6. Geological Survey of Ireland Mapping

The alluvial deposit maps of the Geological Survey of Ireland (GSI) were consulted to assess the extent of any alluvial deposits in the vicinity of the site of the proposed wind farm development. Alluvial deposits can be an indicator of areas that have been subject to flooding in the recent geological past. *Figure 9* below illustrates the sub-soils mapping for the general area of the site.

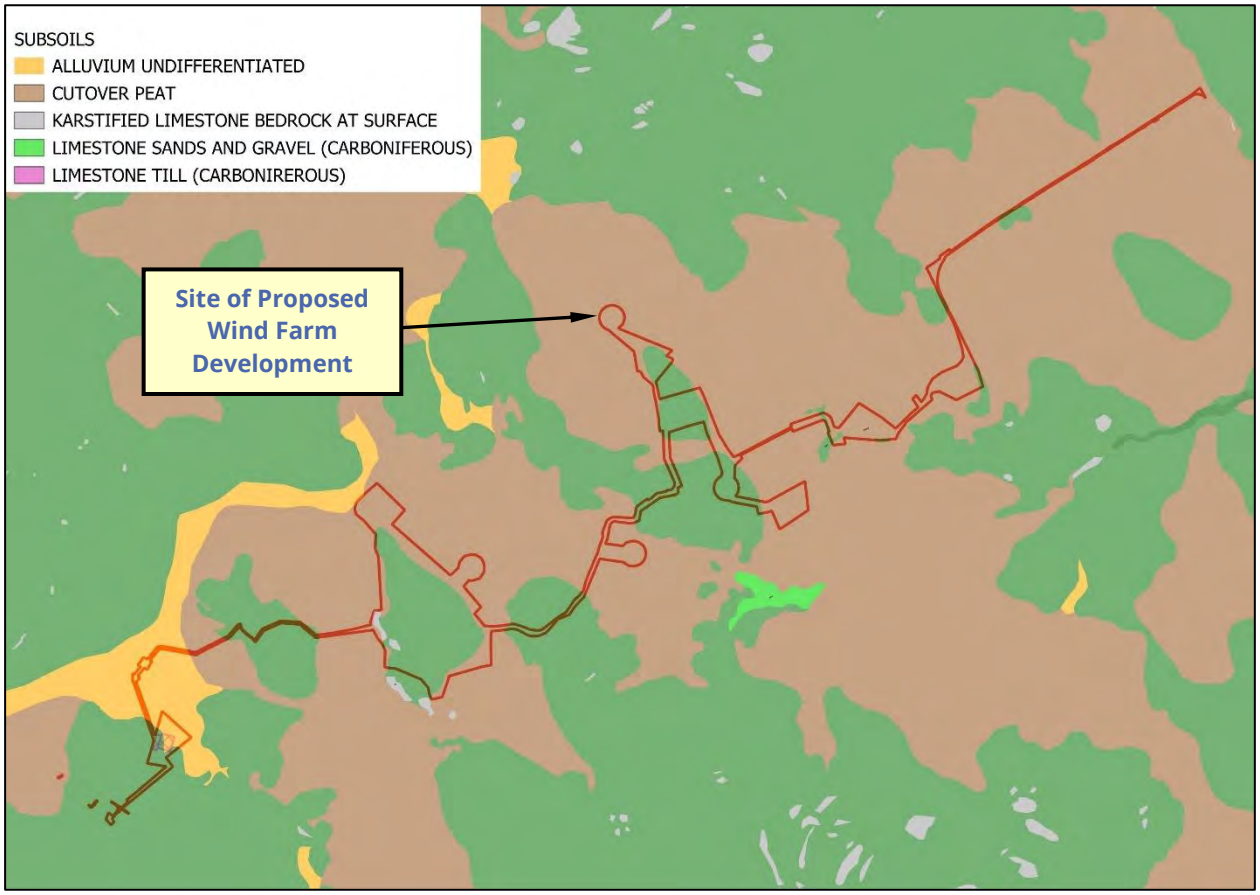


Figure 9 - GSI Subsoil Mapping

Figure 9 above indicates that site is primarily underlain by a mix of cutover peat and limestone till from the Carboniferous period. There is also a small amount of alluvium deposits located in the western portion of the site, next to where the substation is proposed.

5.7. Geological Survey of Ireland Groundwater Flood Mapping

Historic and Predictive Groundwater Mapping for Ireland was prepared by the GSI Department of Communication, Climate Action, and Environment in collaboration with Trinity College Dublin and the Institute of Technology Carlow. The below GSI Groundwater Mapping indicates that there are no areas of predictive or historical groundwater flooding located within or in the vicinity of the site of the proposed wind farm development.

Figure 10 below illustrates an extract from the above groundwater flood mapping in the vicinity of the site.

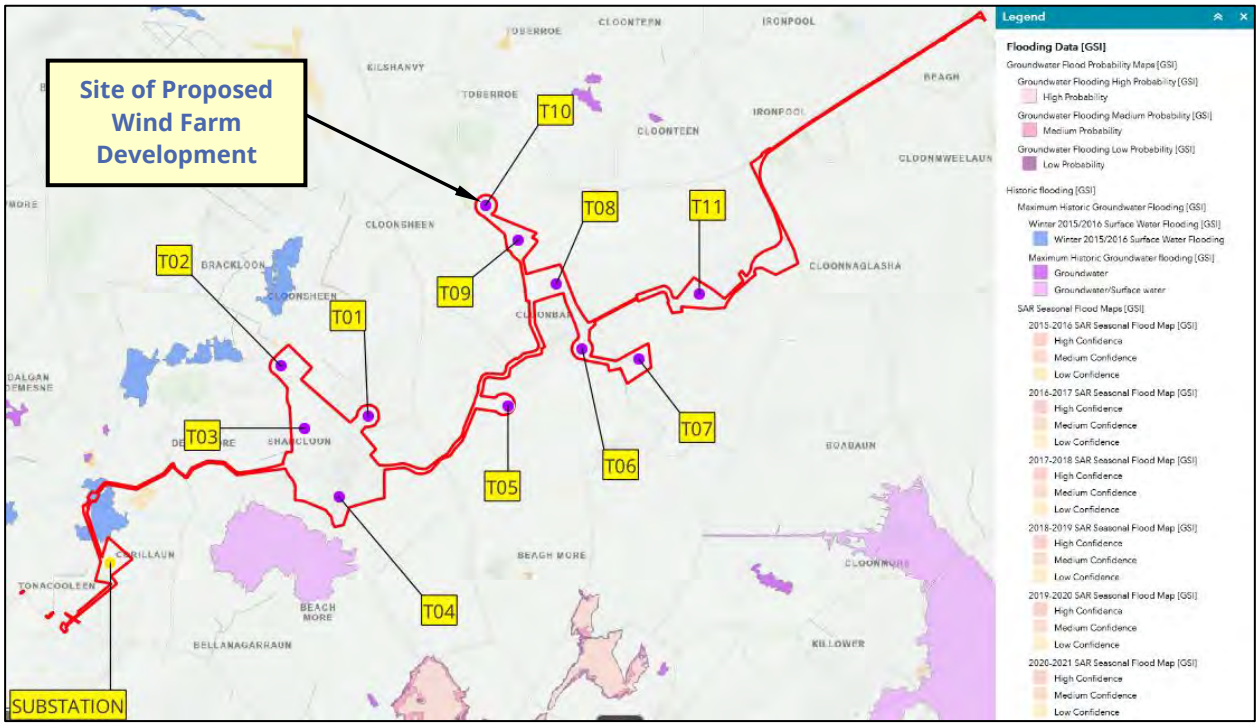


Figure 10 - GSI Groundwater Flood Mapping

Figure 10 above does indicates that a small limited portion in the western area of the site falls within a historic surface water flooding. The flooding is representative of fluvial flooding originating from the Black River and the Togher River and has been attributed to the flooding which occurred in the Winter 2015/2016. The proposed substation and proposed turbines do not fall within a delineated groundwater flood zone.

5.8. National Indicative Flood Mapping Dataset - Flood Extents

The OPW National Indicative Fluvial Mapping (NIFM) set has been produced for catchments greater than 5km^2 in area for which flood maps were not produced under the National CFRAM Programme. This mapping set is intended to supersede the OPW PFRA mapping set by producing a higher quality fluvial mapping set.

Figure 11 below illustrates an extract from the OPW NIFM in the vicinity of the site of the proposed wind farm development for the present-day scenario 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) fluvial flood events.

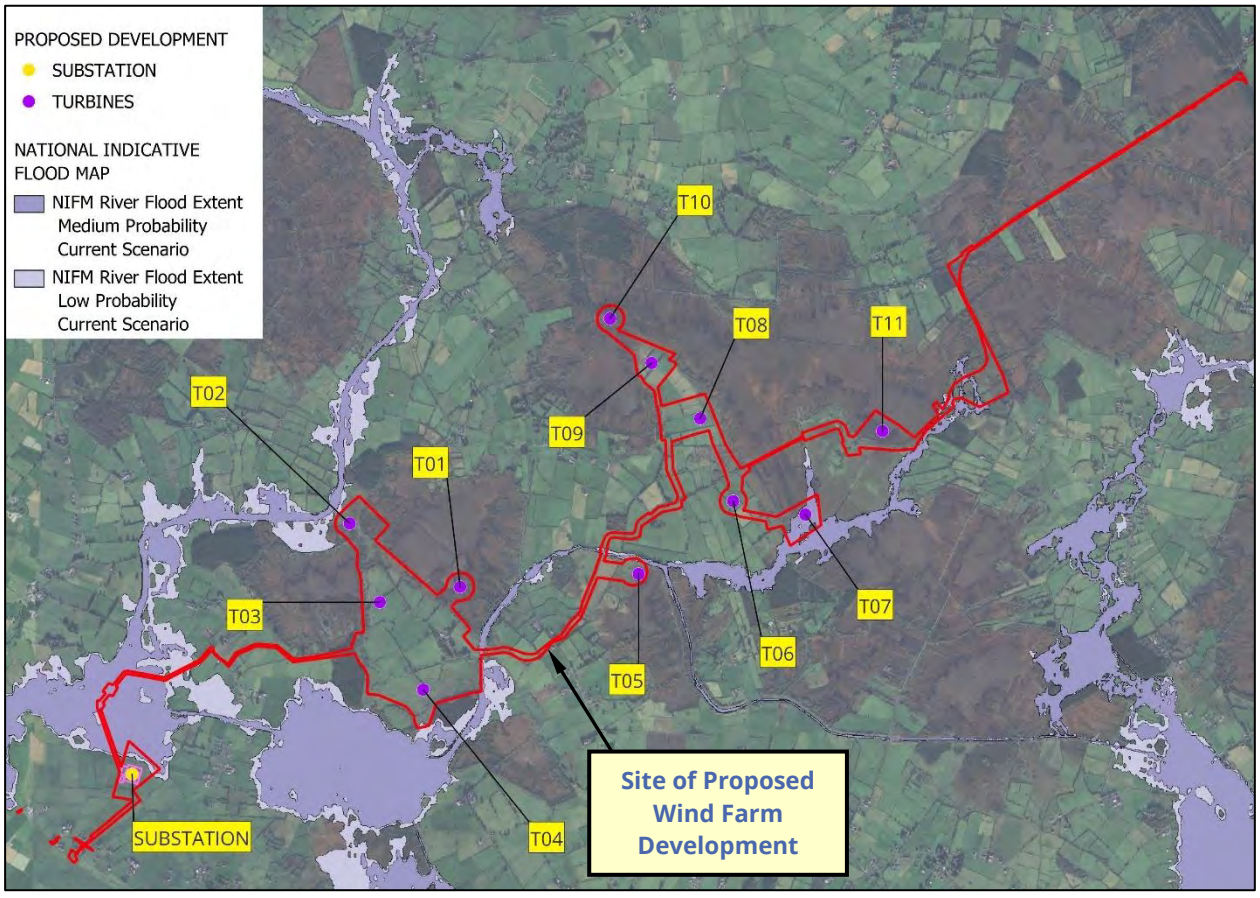


Figure 11 – 1% AEP & 0.1% AEP Present Day Scenario OPW NIFM Fluvial Flood Map

Figure 11 above indicates that the location of proposed turbine no. 7 falls within a indicative present day scenario 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) fluvial flood zone. The location of the other turbines and the proposed substation do not fall within a indicative fluvial flood zone.

Figure 12 below illustrates the indicative 1 in 100 year (1% AEP) and 1 in 1000 year (0.1% AEP) fluvial flood extents at the location of the site of the proposed development for the mid-range future climate change scenario as acquired from the OPW NIFM flood Mapping dataset.

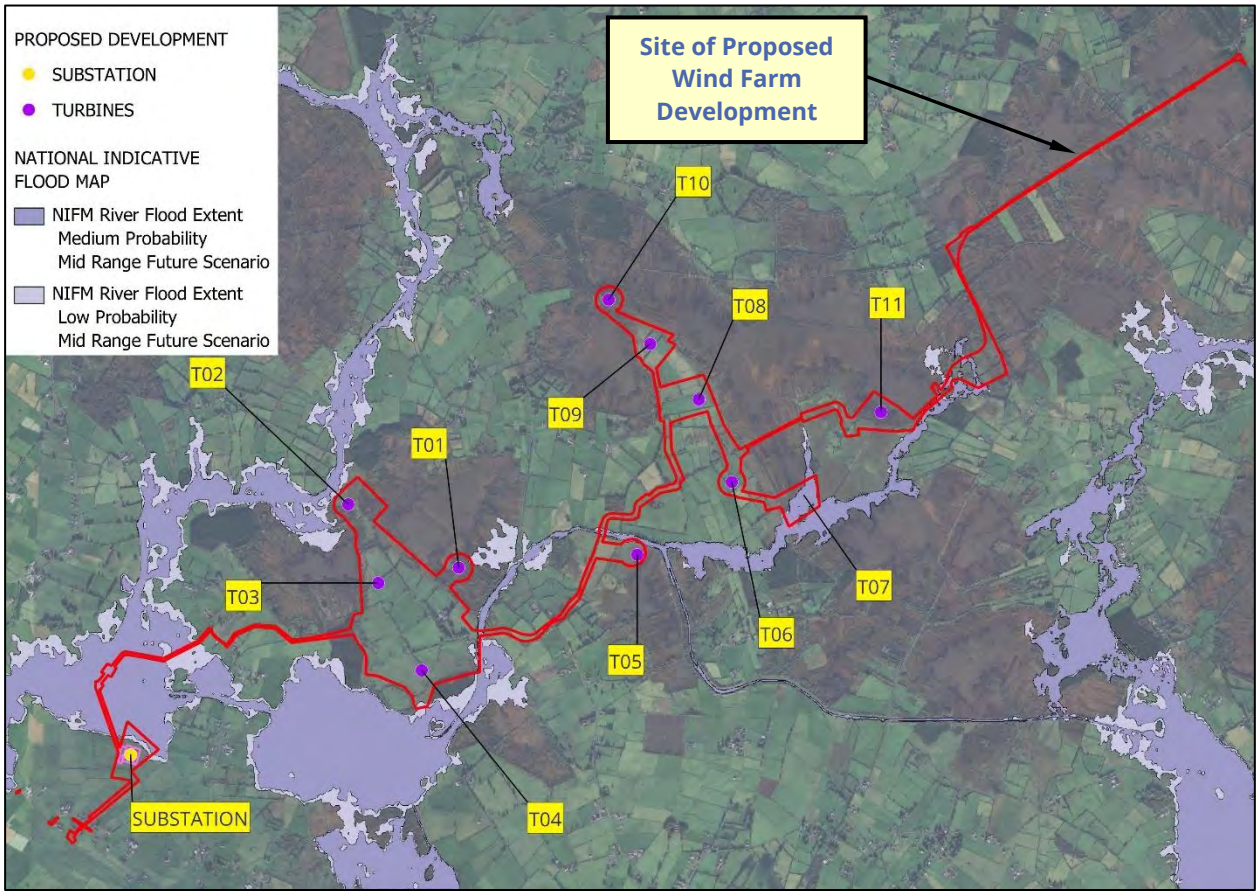


Figure 12 – 1% AEP and 0.1% AEP Mid-Range Future Scenario OPW NIFM Fluvial Flood Map

Figure 12 above indicates that the location of proposed turbine no. no. 7 falls within a indicative mid-range future climate change scenario 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) fluvial flood zone. The rest of the turbines and the proposed substation do not fall within a indicative fluvial flood zone.

6. Scoping Assessment

The purpose of the scoping stage is to identify possible flood risks and to implement the necessary level of detail and assessment to assess these possible risks, and to ensure these can be adequately addressed in the flood risk assessment. The scoping exercise should also identify that sufficient quantitative information is already available to complete a flood risk assessment appropriate to the scale and nature of the development proposed.

The above screening assessment has reviewed the flood risk to the proposed turbines and proposed substation from the surrounding watercourses (the Togher River, the Cloonbar River, the Beagh Beg River, the Shancloon River, and the Black River). The OPW PRFA flood mapping illustrates that three of the proposed turbines (T01, T02, and T05), fall within an indicative flood zone from the Cloonbar River, the Togher River and the Black River. The National Indicative Flood Mapping (NIFM) datasets supersede the OPW PFRA mapping set by producing a higher quality fluvial mapping set. The NIFM mapping illustrates that only one Turbine (T07) falls within a indicative fluvial flood extent from the Cloonbar River. The rest of the proposed turbines, along with the proposed substation do not fall within an indicative fluvial flood extent. The screening assessment also indicates that the site is not at risk of pluvial or groundwater flooding.

It is noted that there are several hydraulic structures located along the Togher River, the Cloonbar River, and the Black River in the vicinity of the site. Based on the PFRA, and NIFM indicative flood mapping, these structures are likely to be overtopped during an extreme flood event and therefore blockage of any of these bridges/culverts is unlikely to pose an additional or residual flood risk to the site.

In consideration of the information collated as part of the screening exercise, and the availability of other information and data specific to the site of the proposed wind farm development, it is considered that sufficient quantitative information to complete an appropriate flood risk assessment cannot be derived from the information collated as part of the screening exercise alone. In particular, the potential impact of the site of the proposed wind farm development to the existing hydrological regime of the area needs to be quantified and assessed in greater detail. In this regard it is required to undertake a more detailed and robust analysis of the fluvial flood regime at and in the vicinity of the site of the proposed wind farm development in consideration of the existing undeveloped scenario and proposed development scenario. The specific flood risk to and from the site of the proposed wind farm development is assessed in the subsequent 'Assessing Flood Risk' stage of this study report.

7. Assessing Flood Risk

Fluvial flood risk from a particular watercourse is normally assessed for a 1% AEP (1 in 100 year) and a 0.1% AEP (1 in 1000 year) flood event, in accordance with most county development plans and in accordance with the DOEHLG guidelines 'The Planning System and Flood Risk Management Guidelines'.

The following sections present an analysis and assessment of the estimated 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) potential fluvial flood events in the Togher River, the Cloonbar River, the Beagh Beg River, the Shancloon River, and the Black River.

7.1. Peak Flow Estimation

Peak flood flows in the watercourses at and in the vicinity of the proposed windfarm were predicted using the OPW Flood Studies Update (FSU) portal software. The FSU methodology can be used with confidence for catchments with areas between 25km^2 and 10,000km^2. Further research conducted under the FSU on a limited number of small catchments indicates that the FSU may also be used, with caution, for catchments with an area between 5km^2 and 25km^2. The catchment names and associated areas have been described in *Table 2* below. The catchment areas delineated for this assessment are illustrated on *Drawing Number IE2611-100-A, Appendix A*.

Name	Watercourse	Catchment Area (km^2)
A	Togher River	29.112
B	Cloonbar River	7.279
C_IA	Intervening area between the watercourses	12.513
D	Beagh Beg River	16.557
E	Shancloon River	2.057
F	Black River	89.646

Table 2 - Modelled Watercourses

For this assessment all catchments included in this study have utilised the FSU equation (Flood Studies Update 7 term equation). One of the catchments does have an area smaller than 5km^2 (Shancloon River catchment E), however to ensure consistency with the flows calculated for the surrounding catchments, it was deemed appropriate to utilised the FSU equation for this catchment.

The FSU portal allows for the estimation of the index flood (or QMED). In the case of ungauged catchments, the Index Flood is first calculated based on the chosen catchments characteristics.

This value is then correlated using flow data recorded on a catchment with similar characteristics. This second catchment is called the pivotal site. A pivotal site should be selected when the catchment being analysed is ungauged. This allows the FSU software to incorporate data from the gauged pivotal site into the ungauged selected site where necessary. All pivotal sites are hydrometric gauging stations that were used in the supporting analysis for the FSU methodology, and the annual maximum (AMAX) series data at these stations has been quality checked and classified. The chosen pivotal site should ideally lie a short distance either upstream or downstream of the selected site, although any site within the country can be deemed suitable if hydrologically similar enough to the selected site.

However, for these catchments a suitable pivotal site was not available. The pivotal site gauges recommended by the FSU software were deemed not to be hydrologically similar enough to any of the watercourses modelled for this assessment. Gauges located further away which better matched the subject site resulted in producing a reduction in the derived model flows. Therefore, no pivotal gauges were applied to this assessment. To ensure a conservative approach for this assessment, the factorial standard error (FSE) was applied to the flows derived for this assessment. The FSU equation has a FSE of 1.37 which provides an confidence limit of 68%. Therefore, all flows calculated for this assessment have had a FSE value of 1.37 applied.

A summary of the catchment characteristics for each watercourses included in this assessment are presented in *Appendix B*.

The resulting QMED for each watercourses assessed is listed below in *Table 3*.

Name	Watercourse	QMED Flood Flows m^3/s
A	Togher River	6.04
B	Cloonbar River	2.01
C_IA	Intervening area between the watercourses	2.37
D	Beagh Beg River	1.57
E	Shancloon River	0.92
F	Black River	18.12

Table 3 - QMED Flood Flows

7.2. Estimated Flows for Different Return Periods

The return period flows 'Q_T' are estimated using the index flood method and multiplying the annual maximum flow by the appropriate growth factor 'X_T' using the FSR (1975) national growth curve for Ireland, as shown in *Figure 13* below: -

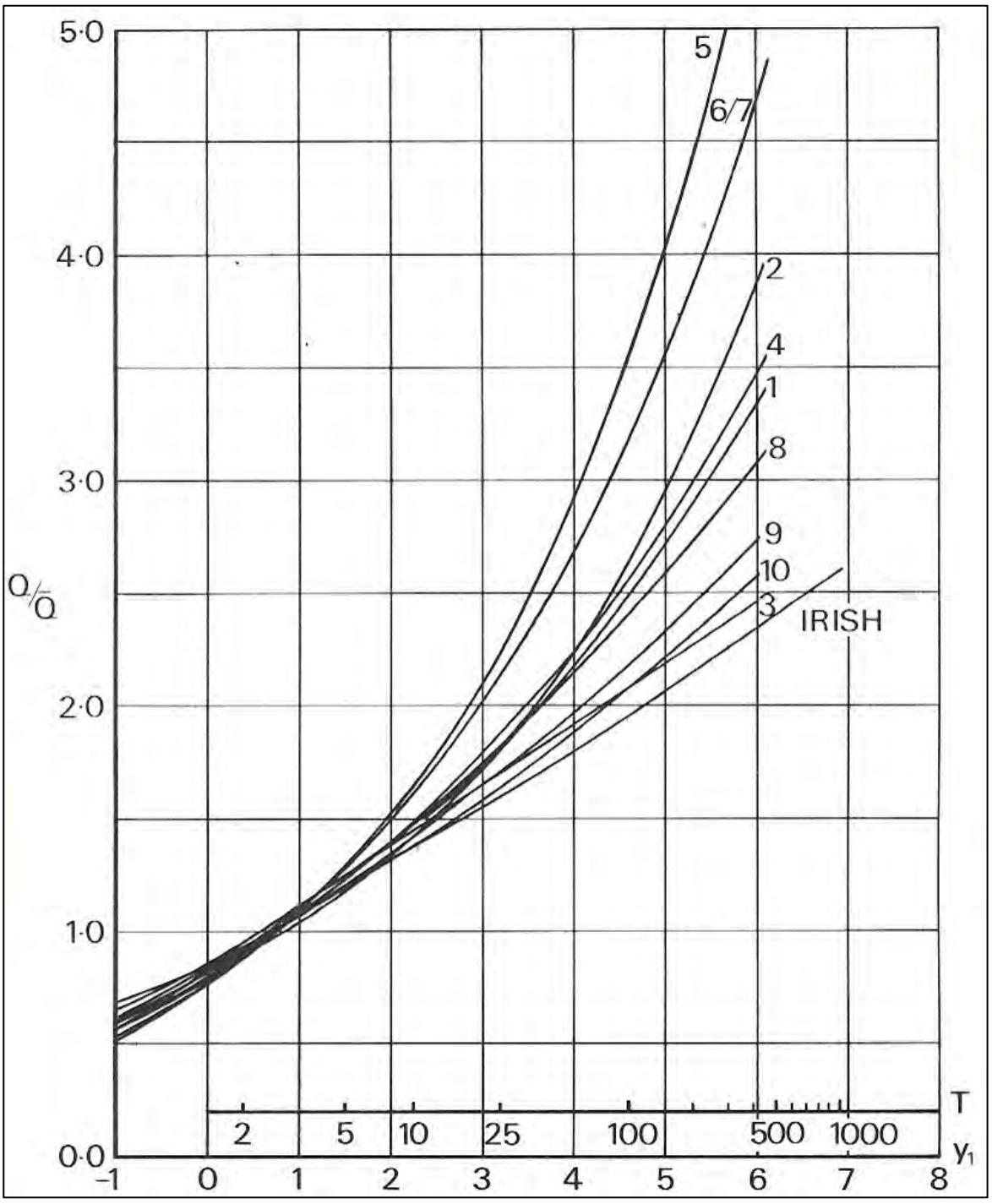


Figure 13 - Regional Growth Factors

For flood return periods 2, 100, and 1000 years the growth factors determined from *Figure 13* are listed in *Table 4* below: -

Flood Return Period (Yrs)	50% AEP (1 in 2 Year)	1% AEP (1 in 100 Year)	0.1% AEP (1 in 1000 Year)
Growth Curve Factor (Q_T/Q_{BAR})	0.95	1.96	2.59

Table 4 - Growth Factors Applied to Irish Catchments for QBAR Discharge Prediction

Table 5 below lists the estimated peak flood flow for each watercourse modelled for different return periods: -

Flood Return Period (Yrs)	50% AEP Peak Flow 1 in 2 Year (m^3/s)	1% AEP Peak Flow 1 in 100 Year (m^3/s)	0.1% AEP Peak Flow 1 in 1000 Year (m^3/s)
A	5.74	11.85	15.66
B	1.91	3.95	5.21
C_IA	2.25	4.64	6.13
D	1.49	3.07	4.06
E	0.87	1.79	2.37
F	17.20	35.49	46.89

Table 5 - Estimated Peak Flows for Different Return Periods

7.3. Climate Change

Flooding is a natural process that can occur from a range of sources at any time in a wide variety of locations. Flooding can impact on people, communities, property, infrastructure, economy, environment, and our cultural heritage. It is likely that severe weather events and sea level rise due to climate change will have a considerable impact on flooding and flood risk in Ireland.

To assess the potential impact of climate change on the proposed wind farm development the Climate Change Sectoral Adaptation Plan was referred to. This Plan considers the impacts of climate change on flooding and flood risk, as well as on flood risk management and what adaptation actions are required to ensure effective and sustainable management of flood risk into the future.

There are a variety of projections which quantify the impacts of climate change in the future. For this study, and as per the recommendations of the OPW document 'The Planning System & Flood Risk Management Guidelines', the Mid-Range Future Climate Change Scenario (MRFS) was applied to the fluvial flows. The MRFS represents the typical or near to the general average future climate projections. The guidelines recommend that based on the MRFS projection a 20% increase should be applied to the peak fluvial flood flows. The resultant MRFS 1% AEP + CC (1 in 100 year + climate change) flood flow in each of the modelled watercourses under consideration is listed in *Table 6* below.

	Watercourse	1% AEP (1 in 100 Year) Peak Fluvial Flood Flow (m^3/s)	1% + CC AEP (1 in 100 Year Plus Climate Change) Peak Fluvial Flood Flow (m^3/s)
A	Togher River	11.85	14.22
B	Cloonbar River	3.95	4.74
C	Intervening area between the watercourses	4.64	5.568
D	Beagh Beg River	3.07	3.684
E	Shancloon River	1.79	2.148
F	Black River	35.49	42.588

Table 6 - Climate Change Flood Flows

7.4. Peak Flow Hydrograph - FSSR

The hydrograph shape for this catchment was generated using the Flood Studies Supplementary Report (FSSR) 16 Unit Hydrograph method.

To derive the hydrograph the FSSR unit in the Flood Modeller Pro software package was applied. The methodology for deriving the hydrograph is described below.

- The Physical Catchment Descriptors for the modelled watercourses, calculated in the previous section, was applied (AREA, MSL, S1085, SAAR and URBEXT).
- The design storm duration is estimated as a function of SAAR and the estimated Time to Peak.
- The rainfall characteristics for the catchment were obtained from MET Éireann (www.met.ie).
- The SPRHOST value was derived from the soil fractions within the catchment boundary.
- Due to the small size of the catchment the storm area is assumed to be zero.
- The aerial reduction factor and the rainfall return period was calculated based on the catchment area.
- Due to the rural nature of the catchment areas (urban < 0.25) the FSR winter profile was chosen as the storm profile.

The calculated flow hydrographs for the predictive 1% AEP (1 in 100 Year), 1% AEP + CC (1 in 100 Year Plus Climate Change) and 0.1% AEP (1 in 1000 Year) fluvial flood events for the modelled watercourses is presented in *Appendix B*.

8. Hydraulic Model Simulation Results

The hydraulic model was run in consideration of the predictive 1% AEP (1 in 100 year), 1% AEP + CC (1 in 100 year Plus Climate Change) and the 0.1% AEP (1 in 1000 year) fluvial flood flows presented in *Section 7* above.

The hydraulic model developed for this assessment calculates flood levels at each cross sectional location along the watercourses assessed. The location of the modelled cross sections is illustrated below in *Figure 14.*

The delineated 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) flood zone extents are illustrated on *Drawing Number IE2611-002-A*, *Appendix A*. The delineated 1% AEP + CC (1 in 100 year Plus Climate Change) fluvial flood extents are illustrated on *Drawing Number IE2611-003-A*, *Appendix A*.

In order to provide a greater level of detail within the site of the proposed wind farm development in respect to flood risk, this assessment has sub-divided the overall site of the proposed wind farm development into three separate Parcels, as illustrated below in *Figure 14*.

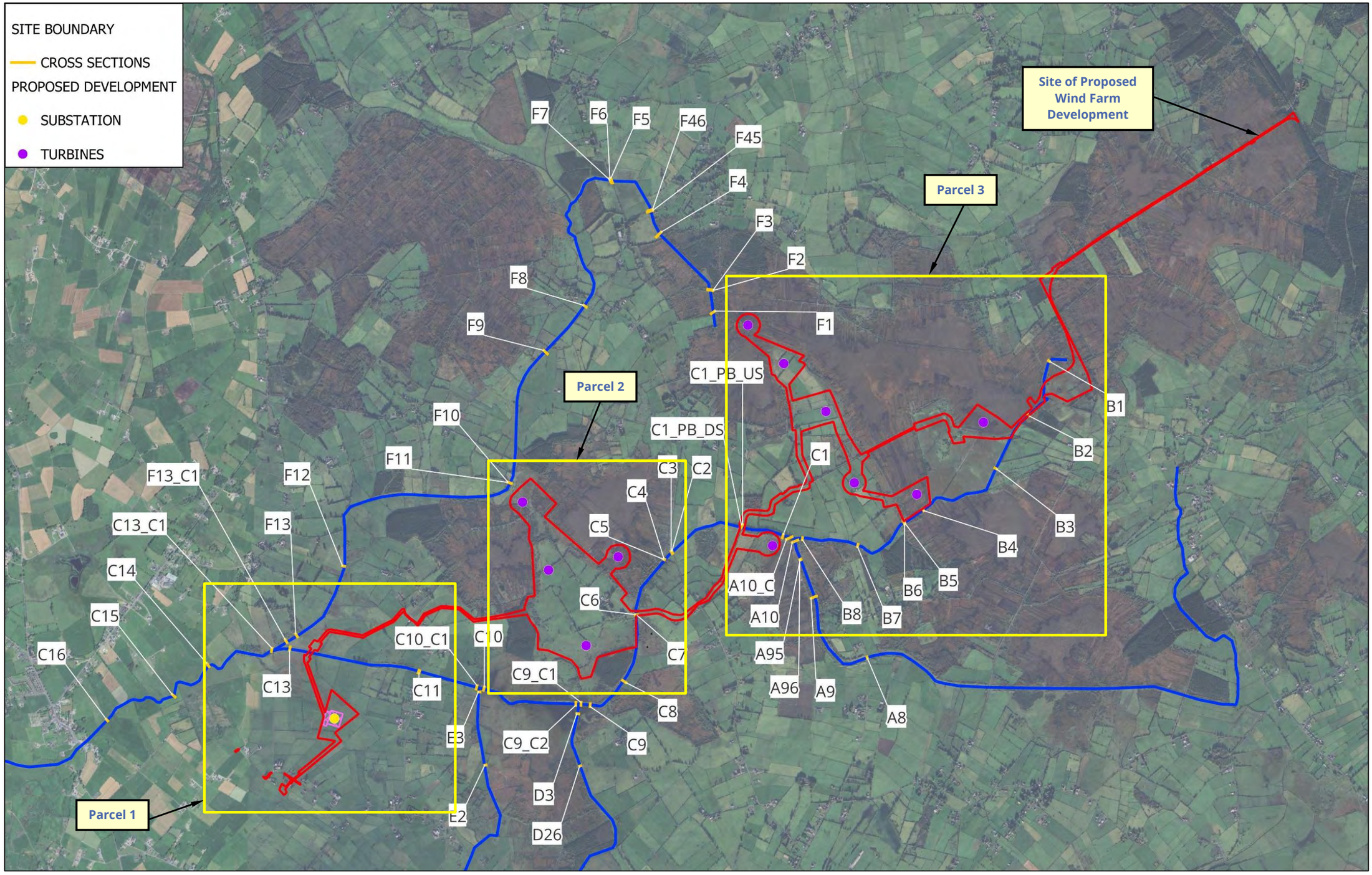


Figure 14 - Cross Section Locations

8.1. Parcel 1

Parcel 1 is located in the western portion of the overall site.

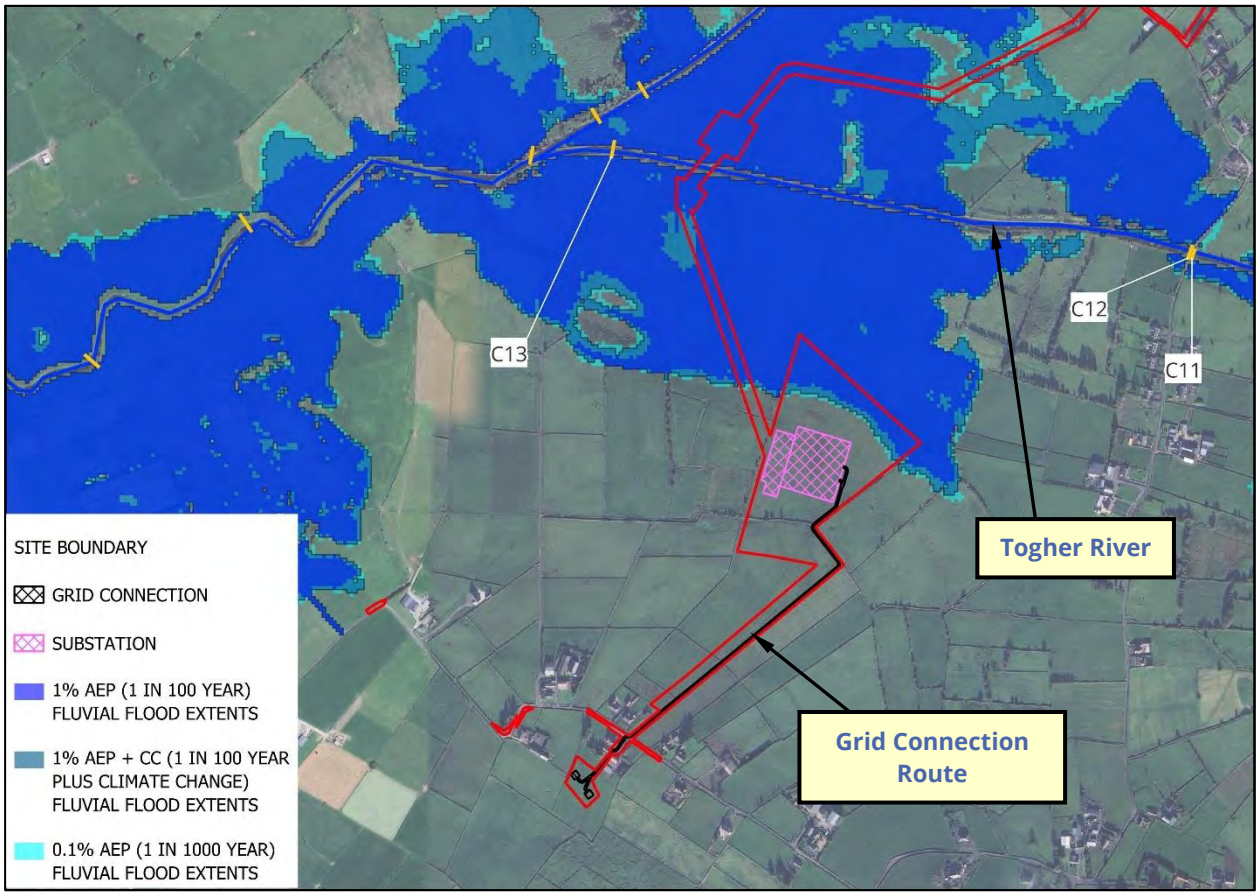


Figure 15 - Parcel 1

As illustrated in *Figure 15* above, both the substation and the grid connection route do not fall within the delineated predictive 1% AEP (1 in 100 Year), 1% AEP + CC (1 in 100 Year Plus Climate Change), and 0.1% AEP (1 in 1000 Year) fluvial flood extents. The two cross sections most relevant to Parcel 1, C12 and C13, are located on the Togher River 345m north of the proposed substation.

Table 7 below summarises the predictive current scenario 1% AEP (1 in 100 year), 1% AEP + CC (1 in 100 Year Plus Climate Change, and the current scenario 0.1% AEP (1 in 1000 year) fluvial flood levels at cross section locations C12 and C13.

Node Label	1% AEP Peak Flood Level (m OD)	1% AEP + CC Peak Flood Level (m OD)	0.1% AEP Peak Flood Level (m OD)
C12	26.61	26.84	26.94
C13	26.55	26.78	26.88

Table 7 - Predictive 1% AEP, 1% AEP + CC, & 0.1% AEP Flood Levels in Togher River – Parcel 1

As illustrated in *Figure 15* above, the proposed substation and the proposed grid connection within Parcel 1 do not fall within a predictive fluvial flood zone.

However, to ensure a robust and sustainable development, the finished floor level of the proposed substation will be constructed to a minimum level of 0.5m above the predictive peak 0.1% AEP flood level at cross sectional location C13 – i.e. 26.94m OD + 0.5m = **27.44m OD**.

The assessment and analysis presented above demonstrates that the development as proposed within Parcel 1 is not predicted to result in an adverse impact to the existing hydrological regime of the area or increase fluvial flood risk elsewhere.

8.2. Parcel 2

Parcel 2 is located in the centre portion of the overall site and is illustrated below in *Figure 16.*

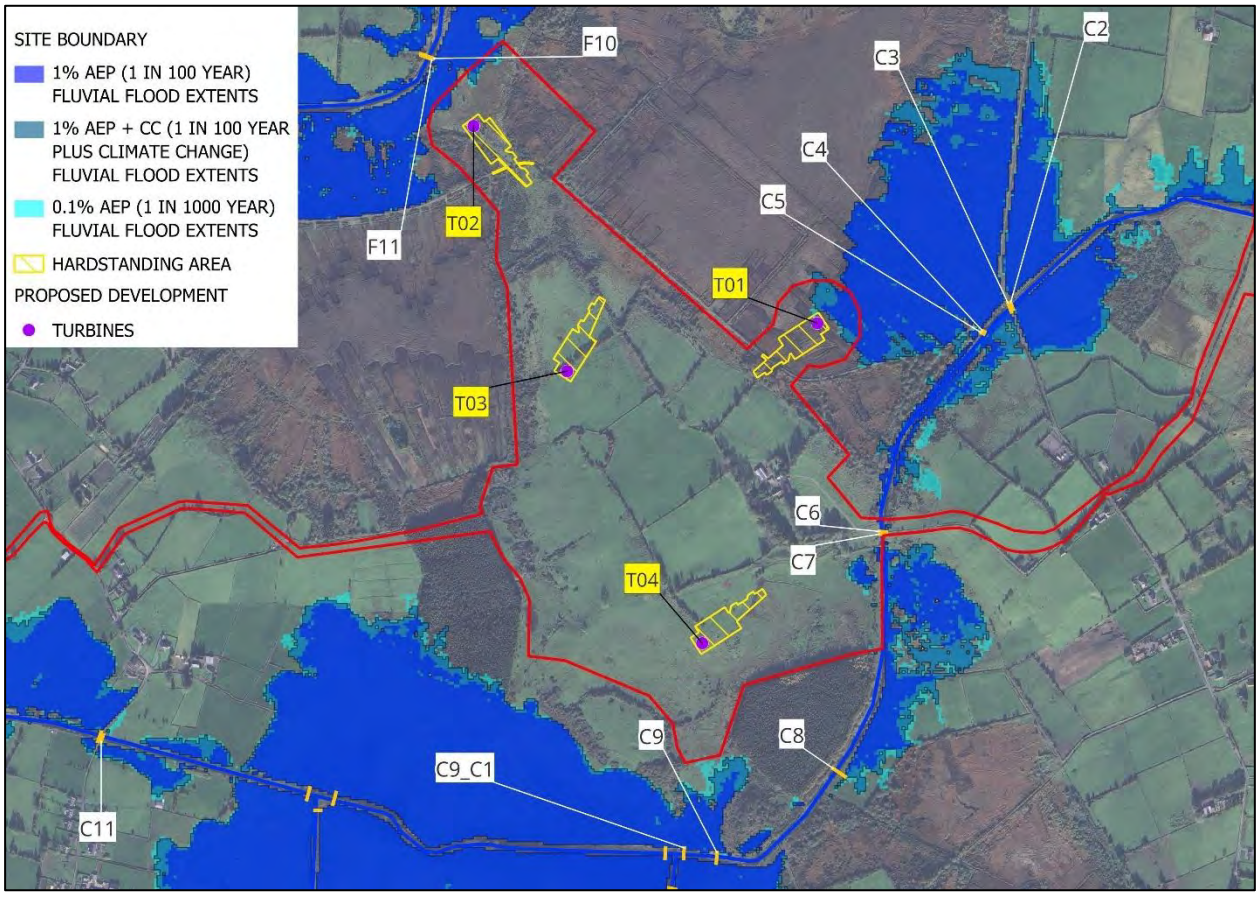


Figure 16 - Parcel 2

As illustrated above in *Figure 16* four proposed turbines (T01, T02, T03, and T04) are located within Parcel 2.

The proposed turbines within Parcel 2 do not fall within a predictive 1% AEP (1 in 100 Year), 1% AEP + CC (1 in 100 Year Plus Climate Change), or 0.1% AEP (1 in 1000 Year) fluvial flood zone.

Proposed turbines T02, T03 and T04 are located sufficiently beyond any delineated fluvial flood zone extents, and therefore are deemed not to require any explicit minimum design levels above predictive 0.1% AEP (1 in 1000 year) fluvial flood level.

Any vulnerable elements of the proposed turbines shall be constructed a minimum of 0.3m above existing ground levels as a precautionary measure.

Proposed Turbine T01 is located approximately 280m north west from its closest point to the Togher River. Cross sections C5 to C6 are located closest to proposed turbine T01. *Table 8* below summarises the predictive current scenario 1% AEP (1 in 100 year), 1% AEP + CC (1 in 100 Year Plus Climate Change, and the current scenario 0.1% AEP (1 in 1000 year) fluvial flood levels at cross section locations C5 and C6.

Node Label	1% AEP Peak Flood Level (m OD)	1% AEP + CC Peak Flood Level (m OD)	0.1% AEP Peak Flood Level (m OD)
C5	27.80	28.07	28.15
C6	27.02	27.22	27.30

Table 8 - Predictive 1% AEP, 1% AEP + CC, & 0.1% AEP Flood Levels in Togher River – Parcel 2

As illustrated above in *Figure 16* proposed turbines (T01,T02,T03, and T04) do not fall within a predictive fluvial flood zone.

However, to ensure a robust and sustainable development, any vulnerable elements of the proposed turbines (T02, T03, and T04) should be constructed a minimum of 0.3m above existing ground levels as a precautionary measure. Any vulnerable elements of Proposed Turbine T01 should be constructed to a minimum level of 0.3m above the peak 0.1% AEP (1 in 1000 year) flood level at cross section C5 - i.e. 28.15m OD + 0.3m = 28.45m OD.

The assessment and analysis presented above demonstrates that the development proposed within Parcel 2 is not predicted to result in an adverse impact to the existing hydrological regime of the area or increase fluvial flood risk elsewhere.

8.3. Parcel 3

Parcel 3 is located in the eastern portion of the overall site and is illustrated below in *Figure 17.*

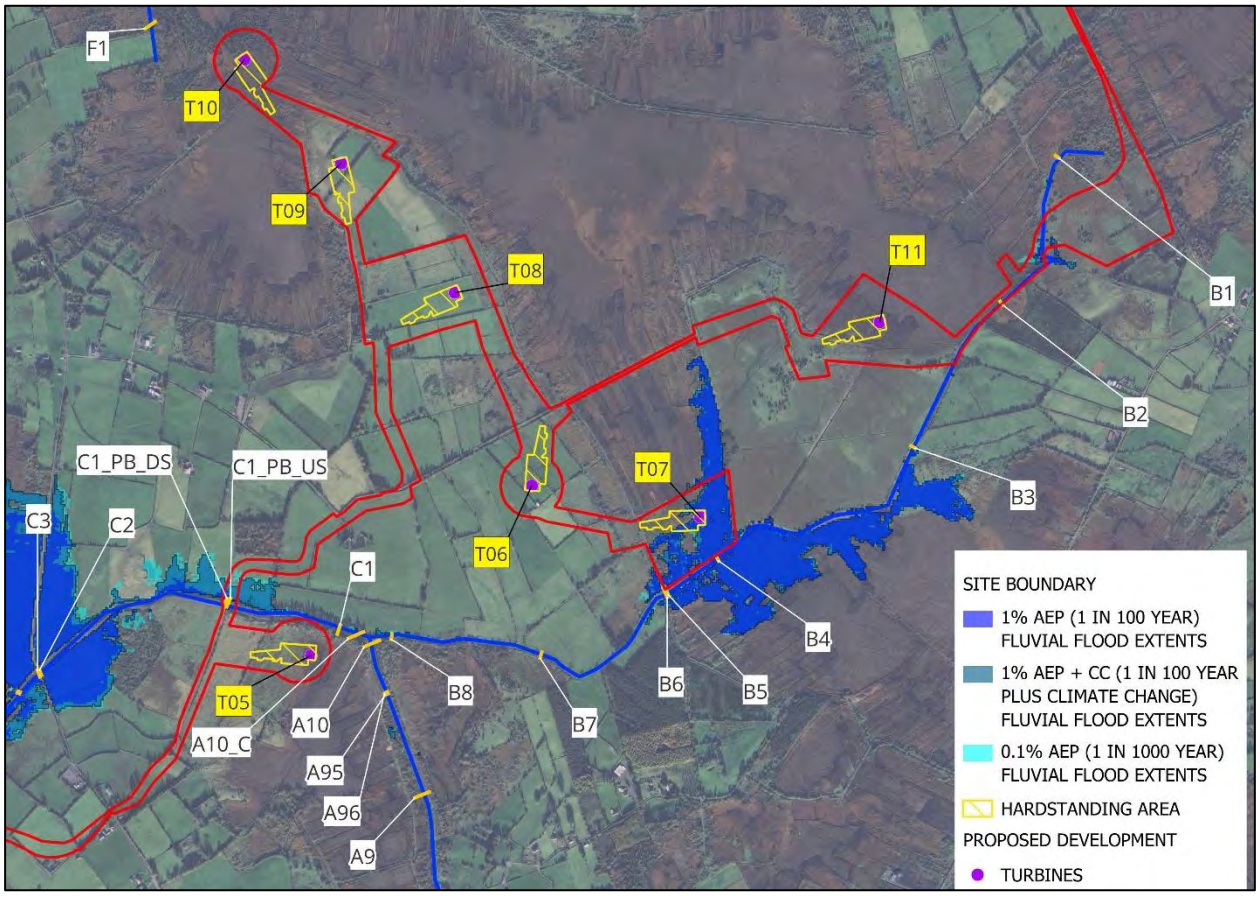


Figure 17 - Parcel 3

As illustrated above in *Figure 17* seven proposed turbines (T05, T06, T07, T08, T09, T10, T11) are located within Parcel 3.

Proposed Turbine T07 falls within a delineated 1% AEP (1 in 100 Year), 1% AEP + CC (1 in 100 Year Plus Climate Change), and 0.1% AEP (1 in 1000 Year) fluvial flood zone.

Six of the seven proposed turbines (T05, T06 , T08, T09, T10 and T11) within Parcel 3 do not fall within a predictive fluvial flood zone. Proposed turbines T06, T08, T09, T10 and T11 are located sufficiently beyond any delineated fluvial flood zone extents, and therefore are deemed not to require any explicit minimum design levels above predictive 0.1% AEP (1 in 1000 year) fluvial flood level.

Any vulnerable elements of the proposed turbines should be a minimum of 0.3m above existing ground levels as a precautionary measure.

Proposed Turbine T05 is located approximately 100m south from its closest point to the Togher River. Cross sections C1 to C1_PB_US are located closest to proposed turbine T05. *Table 8* below summarises the predictive current scenario 1% AEP (1 in 100 year), 1% AEP + CC (1 in 100 Year Plus Climate Change), and the current scenario 0.1% AEP (1 in 1000 year) fluvial flood levels at cross section locations C1 to C1_PB_US.

Node Label	1% AEP Peak Flood Level (m OD)	1% AEP + CC Peak Flood Level (m OD)	0.1% AEP Peak Flood Level (m OD)
C1	28.07	28.41	28.55
C1_PB_US	28.04	28.38	28.51

Table 9 - Predictive 1% AEP, 1% AEP + CC, & 0.1% AEP Flood Levels in Togher River – Parcel 3

As illustrated in *Figure 17* above, proposed turbine T05 does not fall within a predictive fluvial flood zone. However, to ensure a robust and sustainable development, any vulnerable elements of Proposed Turbine T05 should be constructed to a minimum level of 0.3m above the peak 0.1% AEP (1 in 1000 year) flood level at cross section C1 - i.e. 28.55m OD + 0.3m = 28.85m OD.

Proposed Turbine T07 is located 130m north west from its closest point to the Cloonbar River. Cross sections B4 to B5 are located closest to proposed turbine T07. *Table 8* below summarises the predictive current scenario 1% AEP (1 in 100 year), 1% AEP + CC (1 in 100 Year Plus Climate Change), and the current scenario 0.1% AEP (1 in 1000 year) fluvial flood levels at cross section locations B4 to B5.

Node Label	1% AEP Peak Flood Level (m OD)	1% AEP + CC Peak Flood Level (m OD)	0.1% AEP Peak Flood Level (m OD)
B4	30.89	30.97	31.00
B5	30.82	30.91	30.94

Table 10 - Predictive 1% AEP, 1% AEP + CC, & 0.1% AEP Flood Levels in Cloonbar River – Parcel 3

As illustrated above *Figure 17* above and *Figure 18* below, at the location of proposed turbine T07, a portion of the hardstanding area associated with this turbine falls within a delineated 1% AEP (1 in 100 Year), 1% AEP + CC (1 in 100 Year Plus Climate Change), and 0.1% AEP (1 in 1000 Year) fluvial flood zone.

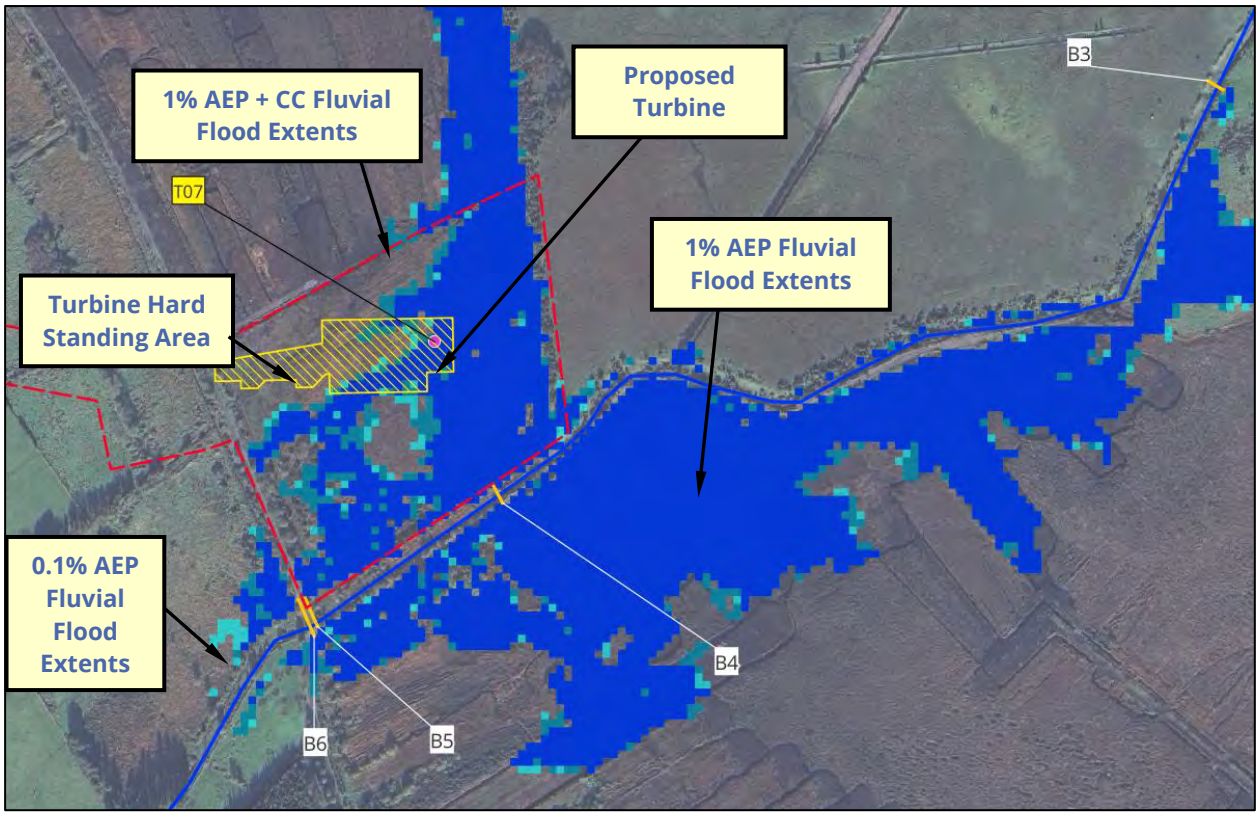


Figure 18 - Fluvial Flood Extents Within the Vicinity of Turbine T07

At the specific location of proposed turbine T07, the predictive 1% AEP (1 in 100 Year), 1% AEP + CC (1 in 1000 Year Plus Climate Change) and 0.1% AEP (1 in 1000 Year) fluvial flood depths are 1.67m, 1.74m and 1.77m respectively.

The hardstanding area associated with proposed turbine T07 will be built at or close to existing ground levels, and will therefore not result in an adverse impact to the existing flood regime at this location. Only the base footprint area of proposed turbine T07, and its associated supporting structure, falls within the delineated flood zones illustrated in *Figure 18* above. which will take up space in the fluvial flood extent is the footprint of the turbine structure itself.

The base of the proposed turbine will be sealed to prevent water ingress. No vulnerable components of the turbine will be located at ground level and will be constructed to a minimum level of 31.3m OD, which is 0.3m above the 0.1% AEP (1 in 1000 Year) fluvial flood level at this location (31.0m OD + 0.3m = 31.3m OD).

In order to assess the potential impact of the proposal to construct turbine T07 within a delineated flood zone on the existing hydrological regime of the area, additional hydraulic modelling was undertaken, and which incorporated the total platform footprint area of the wind turbine base structure and main turbine shaft cross-sectional area into the hydraulic model (i.e. proposed development scenario).

The hydraulic model was re-run in consideration of the proposed developed scenario and the results were processed and evaluated.

The results of the updated and additional hydraulic model analysis in consideration of the proposed development scenario are illustrated below in *Figure 19*.

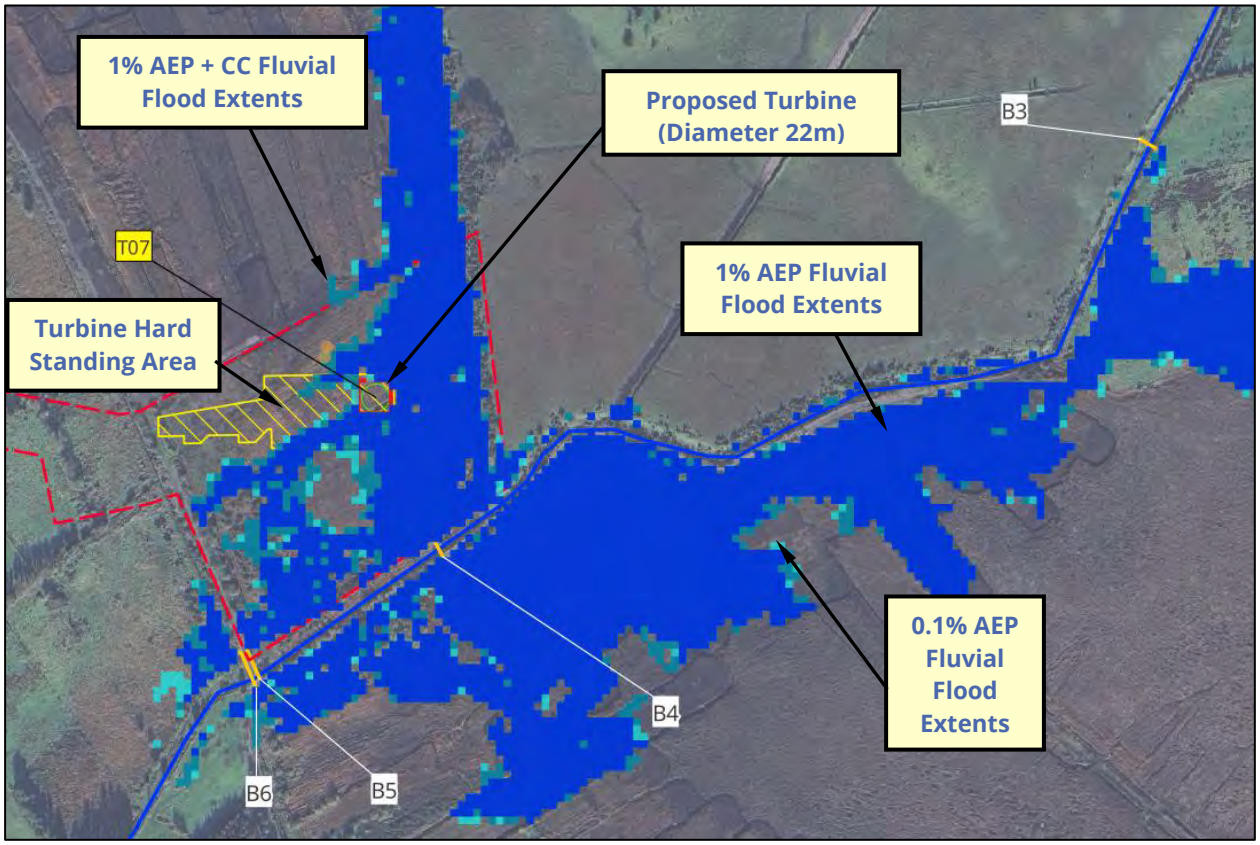


Figure 19 - Fluvial Flood Extents Within the Vicinity of Turbine T07 – Proposed Turbine Footprint Blocked

As illustrated in *Figure 19* above, during the occurrence of the 1% AEP (1 in 100 year), 1% AEP + CC (1% AEP + CC (1 in 100 Year Plus Climate Change) and 0.1% AEP (1 in 1000 year) fluvial flood events, the predictive flood extents are identical to the baseline scenario as illustrated above in *Figure 18*.

The footprint area of proposed turbine (T07) will therefore not result in any adverse impact on the existing fluvial flood extents, depths, or flow paths when compared to the existing undeveloped baseline scenario (*Figure 18* above).

The peak flood water levels in the Cloonbar River at this location, and in consideration of the proposed development scenario, are listed in *Table 11* below.

Node Label	1% AEP Peak Flood Level (m OD)	1% AEP + CC Peak Flood Level (m OD)	0.1% AEP Peak Flood Level (m OD)
B4	30.89	30.97	31.00
B5	30.82	30.91	30.94

Table 11 - - Predictive 1% AEP, 1% AEP + CC, & 0.1% AEP Flood Levels in Cloonbar River – Parcel 3 – Proposed Development Scenario

Comparing the predictive flood levels listed in *Table 10* and *Table 11* above, indicates that there is no predictive increase in extreme fluvial flood levels due to the proposal to construct turbine 07 within the predictive fluvial flood zones.

The assessment and analysis presented above demonstrates that the development proposed within Parcel 3 is not predicted to result in an adverse impact to the existing hydrological regime of the area or increase fluvial flood risk elsewhere.

8.4. Auxiliary Works Within Site of the Proposed Wind Farm Development

The turbines and substation within the site of the proposed wind farm development will be inter-connected via 33 kV medium voltage electrical and communication cabling which will be installed below ground. As this inter-connected cable is below ground it will not result in any adverse impact to the existing hydrological regime of the area.

Internal access tracks are also been proposed as part of the overall wind farm development. These access tracks will either be built at or close to existing ground levels or will be built as an engineered "floating road" over the peat. This is in order to ensure that there is no impact on the existing hydrological regime of the area.

2 No. hydraulic structures are proposed as part of the overall wind farm development, the locations of which are illustrated in *Figure 20* below. A dual circular culvert is proposed on the Cloonbar River, while a single bridge is proposed on the Togher River (Reference WC01).

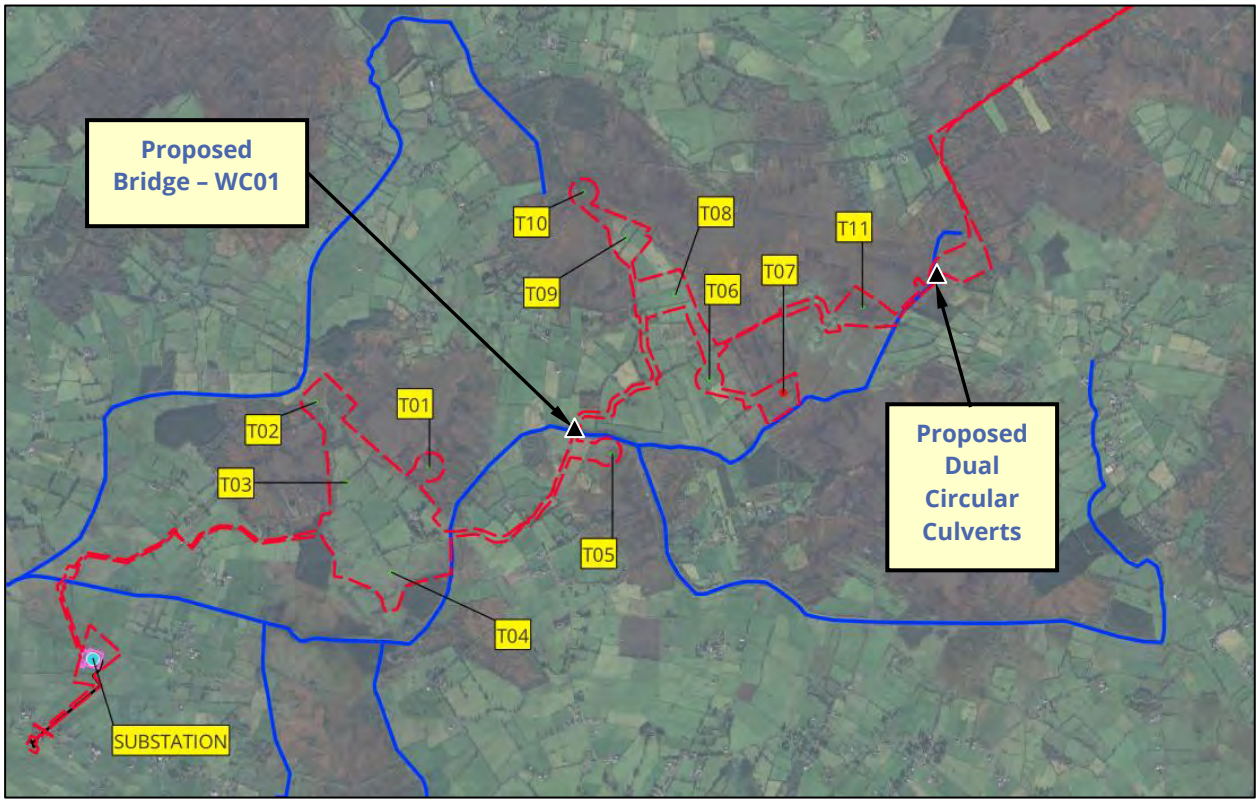


Figure 20 - Proposed Hydraulic Structures Locations

13 culverts are also proposed on various field drains within the site of the proposed wind farm development. As these field drains do not appear on 6 inch map, they are not deemed to require a Section 50 consent, however they will be designed to Section 50 guidelines where suitable. The location of the culverts located on the field drains is illustrated below in *Figure 21*.

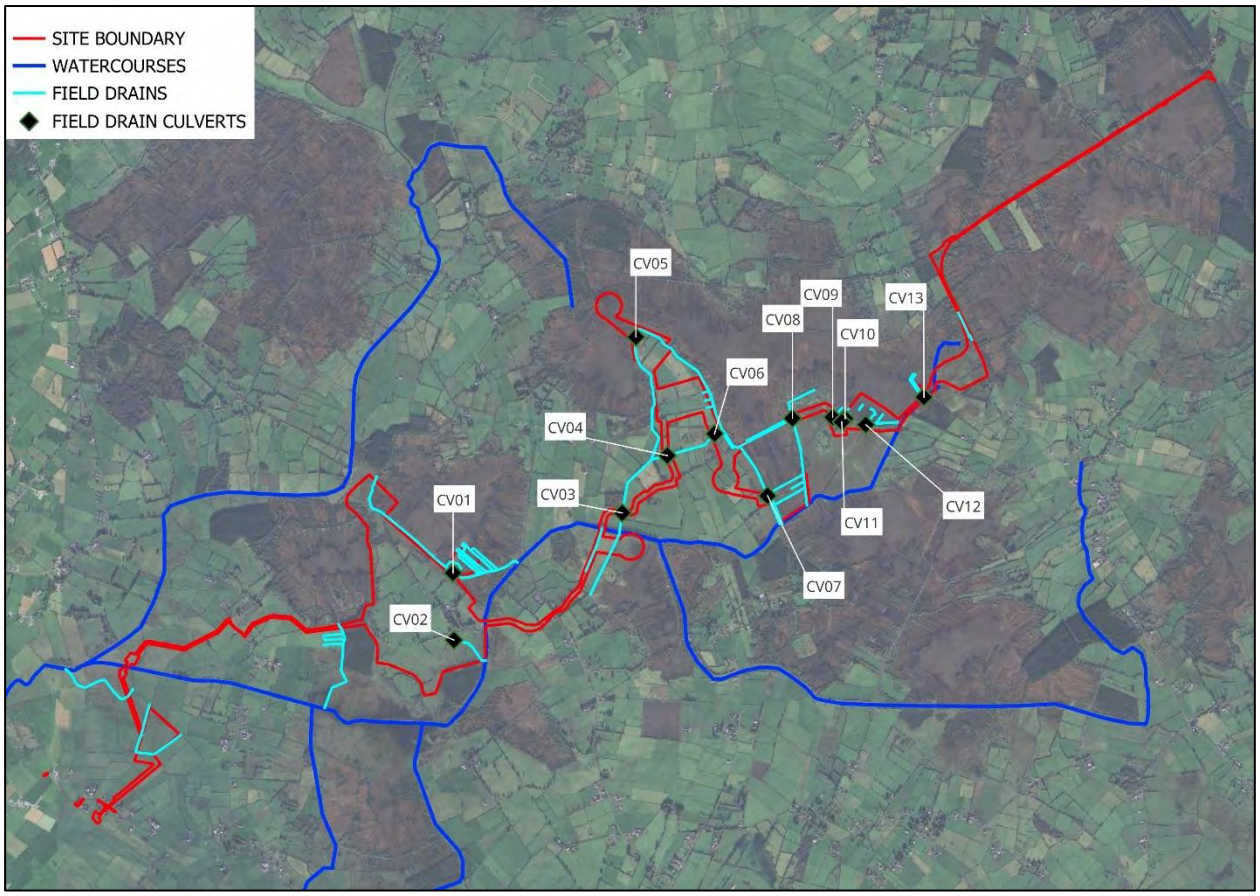


Figure 21 - Location of Field Drain Culverts

9. Development in the Context of the Guidelines

In the context of the 'Planning System and Flood Risk Management Guidelines, DOEHLG, 2009' three flood zones are designated in consideration of flood risk to a particular development site.

Flood Zone 'A' – where the probability of flooding from rivers and watercourses is the highest (greater than 1% or 1 in 100 year for river and watercourse flooding and 0.5% or 1 on 200 for coastal or tidal flooding).

Flood Zone 'B' – where the probability of flooding from rivers and watercourses is moderate (between 0.1% or 1 in 1000 year for river and watercourse flooding and 0.5% or 1 on 200 for coastal or tidal flooding).

Flood Zone 'C' – where the probability of flooding from rivers and watercourses is low or negligible (less than 0.1% or 1 in 1000 year for both river and watercourse and coastal flooding). Flood Zone 'C' covers all areas that are not in Zones 'A' or 'B'.

The 'Planning System and Flood Risk Management Guidelines' list the planning implications for each flood zone, as summarised below:

Zone A – High Probability of Flooding. Most types of development would not be considered in this zone. Development in this zone should be only be considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the 'Planning System and Flood Risk Management Guidelines' justification test has been applied. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space and outdoor sports and reaction would be considered appropriate in this zone.

Zone B – Moderate Probability of Flooding. Highly vulnerable development such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses, strategic transport and essential utilities infrastructure would generally be considered inappropriate in this zone, unless the requirements of the justification test can be met. Less vulnerable development such as retail, commercial and industrial uses and recreational facilities might be considered appropriate in this zone. In general however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone 'C' and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to the development can be adequately managed and that development in this zone will not adversely affect adjacent lands and properties.

Zone C – Low to Negligible Probability of Flooding. Development in this zone is appropriate from a flood risk perspective. Developments in this zone are generally not considered at risk of fluvial flooding and would not adversely affect adjacent lands and properties from a flood risk perspective.

In the context of the 'Planning System and Flood Risk Management Guidelines, DOEHLG, 2009' the assessment and analysis undertaken as part of this Site-Specific Flood Risk Assessment has determined the following:-

- The location of the proposed substation and the grid connection route do not fall within a delineated predictive fluvial Flood Zone 'A' or Flood Zone 'B'. The location of the proposed sub-station and grid connection route therefore fall within Flood Zone 'C'.
- The location of proposed turbines T01, T02, T03, T04, T05, T06, T08, T09, T10 and T11 do not fall within a delineated predictive fluvial Flood Zone 'A' or Flood Zone 'B'. The location of these proposed turbines therefore fall within Flood Zone 'C'.
- The location of proposed turbine T07 falls within a delineated predictive fluvial Flood Zone 'A' and Flood Zone 'B'.

The development as proposed at the location of proposed turbine 07 may be subject to the requirements of the Justification Test.

10. Justification Test for Development Management

In the context of the 'Planning System and Flood Risk Management Guidelines, DOEHLG, 2009' and in consideration of the scenario that the development as proposed is undefended, the assessment and analysis undertaken as part of this Site Specific Flood Risk Assessment indicates that the development as proposed at the location of proposed Turbine T07 falls within a delineated predictive Flood Zone 'A' and Flood Zone 'B'.

The other elements of the overall wind-farm development (Turbines T01, T02, T03, T04, T05, T06, T08, T09, T10, T11, the substation and grid connection) fall within Flood Zone 'C'.

Table 3.1 of the guidelines lists the vulnerability class of various types of development. The development as proposed (Wind Turbine) is therefore classified as 'Less Vulnerable Development'.

Table 3.2 of the guidelines (duplicated below) provides a matrix of different vulnerability classes of development in relation to Flood Zones A, B and C, and lists if development is appropriate in each Zone and where the Justification Test should be applied.

	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

Table 3.2: Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test

With reference to the table above, the type and form of development proposed is 'Less Vulnerable Development' and the location of proposed Turbine T07 falls within a delineated Flood Zone 'A' and Flood Zone 'B', therefore the development as proposed at the location of proposed Turbine T07 is subject to the requirements of the 'Justification Test'.

Where 'Less Vulnerable Development' is proposed within a delineated 'Flood Zone A' the planning authority must be satisfied that the development as proposed satisfies the criteria of the Justification Test as described in Box 5.1 of the guidelines (*duplicated below*):-

Box 5.1 Justification Test for development management (to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

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.

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;

   (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;

   (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

   (iv) The development proposed addresses the above in a manner that is compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Each of the criteria listed in Box 5.1 above is considered as follows:-

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.

Answer – The subject lands in which T7 is proposed is zoned Wind Development Potential designation as 'Open to Consideration' as per the Galway County Development Plan.

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 practical will reduce overall flood risk;

Answer – The development proposal has been subject to a detailed Site Specific Flood Risk Assessment in accordance with the guidelines. The assessment, analysis and hydraulic modelling undertaken as part of this Site Specific Flood Risk Assessment indicates that the proposed wind farm development is not predicted to result in an adverse impact to the hydrological regime of the area or increase fluvial flood risk elsewhere

(ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;

Answer – The proposed wind farm will not introduce a significant amount of additional personnel to the area. The site is located in a rural setting and is not surrounded by existing high density development. Flood risk to or from the proposed development is not expected to have any adverse impact to the economy in the area.

(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 or any future flood risk management measures and provisions for emergency services access;

Answer – The proposed turbine is not expected to result in a residual flood risk. The development as proposed will not require any flood protection or flood risk management measures to be implemented.

The development as proposed does not depend on any existing flood protection measures or on the design, implementation and funding of any future flood risk management measures. Access for any emergency services would not be impeded or restricted due to the proposed turbine.

(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;

Answer – Not applicable to this development proposal

11. Summary Conclusions

In consideration of the findings of this preliminary Stage 1 Site Specific Flood Risk Assessment and analysis the following conclusions and recommendations are made in respect of the site of the proposed wind farm development:

- A Site Specific Flood Risk (SSFRA) assessment, appropriate to the type and scale of development proposed, and in accordance with 'The Planning System and Flood Risk Management Guidelines – DoEHLG-2009' has been undertaken.
- The proposed site of the proposed wind farm development has been screened, scoped, and assessed for flood risk in accordance with the above guidelines.
- The primary flood risk to the proposed site can be attributed to a fluvial flood event in the Togher River, the Cloonbar River, the Beagh Beg River, the Shancloon River, and/or the Black River.
- The screening assessment undertaken as part of this SSFRA indicates that the site is not at risk of pluvial or groundwater flooding.
- A detailed Digital Terrain Model (DTM) has been developed for the area of the site.
- The 1% AEP (1 in 100 year – Flood Zone 'A'), 1% AEP + CC (1 in 100 year Plus Climate Change), and 0.1% AEP (1 in 1000 year – Flood Zone 'B') fluvial flood event peak flows have been derived for this assessment.
- A linked 1D-2D hydraulic model has been developed for watercourses at and in the vicinity of the proposed wind farm development utilising the Flood Modeller Pro software. The model has been developed utilising surveyed watercourse cross sectional data and LiDAR data for the area.
- A Digital Terrain Model (DTM) has been developed for the area using the LiDAR data. Utilising the DTM, the predictive 1% AEP (1 in 100 year), 1% AEP + CC (1 in 100 year Plus Climate Change) and 0.1% AEP (1 in 1000 year) flood extents have been delineated and thematically mapped over the full extent of the DTM.
- The hydraulic model developed for this project is considered to provide an accurate and site specific delineation of the predicted existing scenario flood extents at the location of the site of the proposed wind farm development.

- The assessment and analysis undertaken as part of this Site Specific Flood Risk Assessment (SSFRA) has determined that the location of the proposed substation and the grid connection route do not fall within a delineated predictive fluvial Flood Zone 'A' or Flood Zone 'B'. The location of the proposed sub-station and grid connection route therefore fall within Flood Zone 'C'.
- The location of proposed turbines T01, T02, T03, T04, T05, T06, T08, T09, T10 and T11 do not fall within a delineated predictive fluvial Flood Zone 'A' or Flood Zone 'B'. The location of these proposed turbines therefore fall within Flood Zone 'C'.
- The location of proposed turbine T07 falls within a delineated predictive fluvial Flood Zone 'A' and Flood Zone 'B'.
- To ensure a robust and sustainable development, the finished floor level of the proposed substation will be constructed to a minimum level of 0.5m above the predictive peak 0.1% AEP flood level at cross sectional location C13 – i.e. 26.94m OD + 0.5m = **27.44m OD**.
- Any vulnerable elements of Proposed Turbine T01 shall be constructed to a minimum level of 0.3m above the peak 0.1% AEP (1 in 1000 year) flood level at cross section C5 - i.e. 28.15m OD + 0.3m = 28.45m OD.
- To ensure a robust and sustainable development, any vulnerable elements of Proposed Turbine T05 shall be constructed to a minimum level of 0.3m above the peak 0.1% AEP (1 in 1000 year) flood level at cross section C1 - i.e. 28.55m OD + 0.3m = 28.85m OD.
- The base of proposed turbine T07 will be sealed to prevent water ingress. No vulnerable components of the turbine will be located at ground level and will be constructed to a minimum level of 31.3m OD, which is 0.3m above the 0.1% AEP (1 in 1000 Year) fluvial flood level at this location (31.0m OD + 0.3m = 31.3m OD).
- Proposed Turbines T02, T03, T04, T06, T08, T09, T10 and T11 are located sufficiently beyond any delineated fluvial flood zone extents, and therefore are deemed not to require any explicit minimum design levels above predictive 0.1% AEP (1 in 1000 year) fluvial flood level.
- In consideration of findings and output of this SSFRA, and the implementation of the recommendations listed above, the flood risk to and from the development as proposed is considered to be LOW. The wind farm development as proposed is not predicted to result in an adverse impact to the existing hydrological regime of the area or increase flood risk elsewhere and is therefore considered to be appropriate from a flood risk perspective.

Appendices

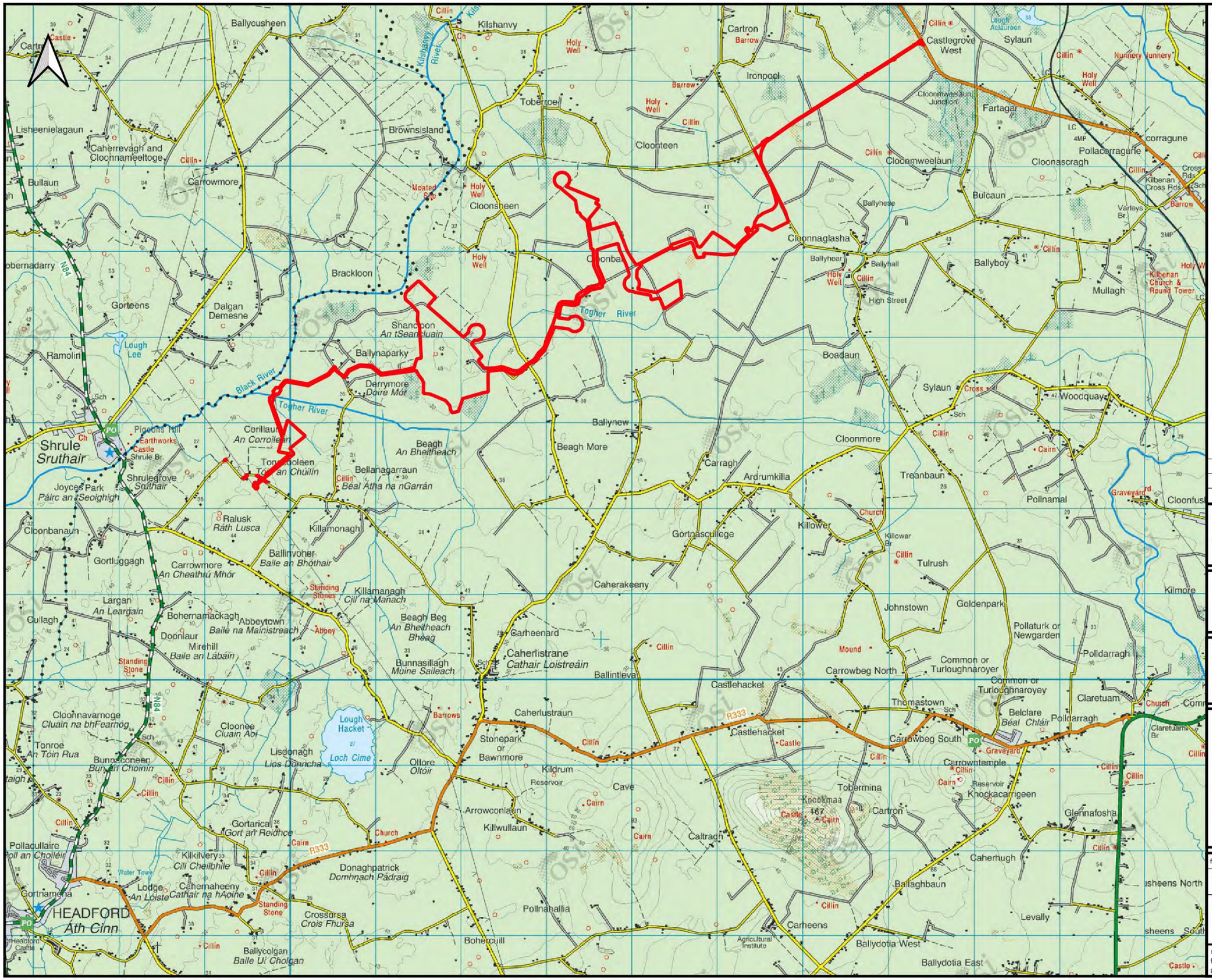
Appendix A. Drawings

IE2611-001-A Site Location Map

IE2611-100-A Catchment Areas

IE2611-002-A 1% AEP (1 in 100 Year) & 0.1% AEP (1 in 1000 Year) Fluvial Flood Extents

IE2611-003-A 1% AEP + CC (1 in 100 Year Plus Climate Change) Fluvial Flood Extents



LEGEND

SITE BOUNDARY

rev.	date	amendment	drn	ckd
B	28.05.25	ISSUE	MOF	PMS
A	28.11.24	ISSUE	MOF	PMS

PROPOSED WINDFARM DEVELOPMENT & ASSOCIATED INFRASTRUCTURE WORKS AT SHANCLOON, CO. GALWAY

SITE SPECIFIC FLOOD RISK ASSESSMENT

LOCATION MAP

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

CARLOW OFFICE:
INNOVATION CENTRE
GREEN ROAD
CARLOW R95 W248

NEWRY OFFICE:
1 RDC HOUSE
WIN BUSINESS PARK
NEWRY BT35 6PH

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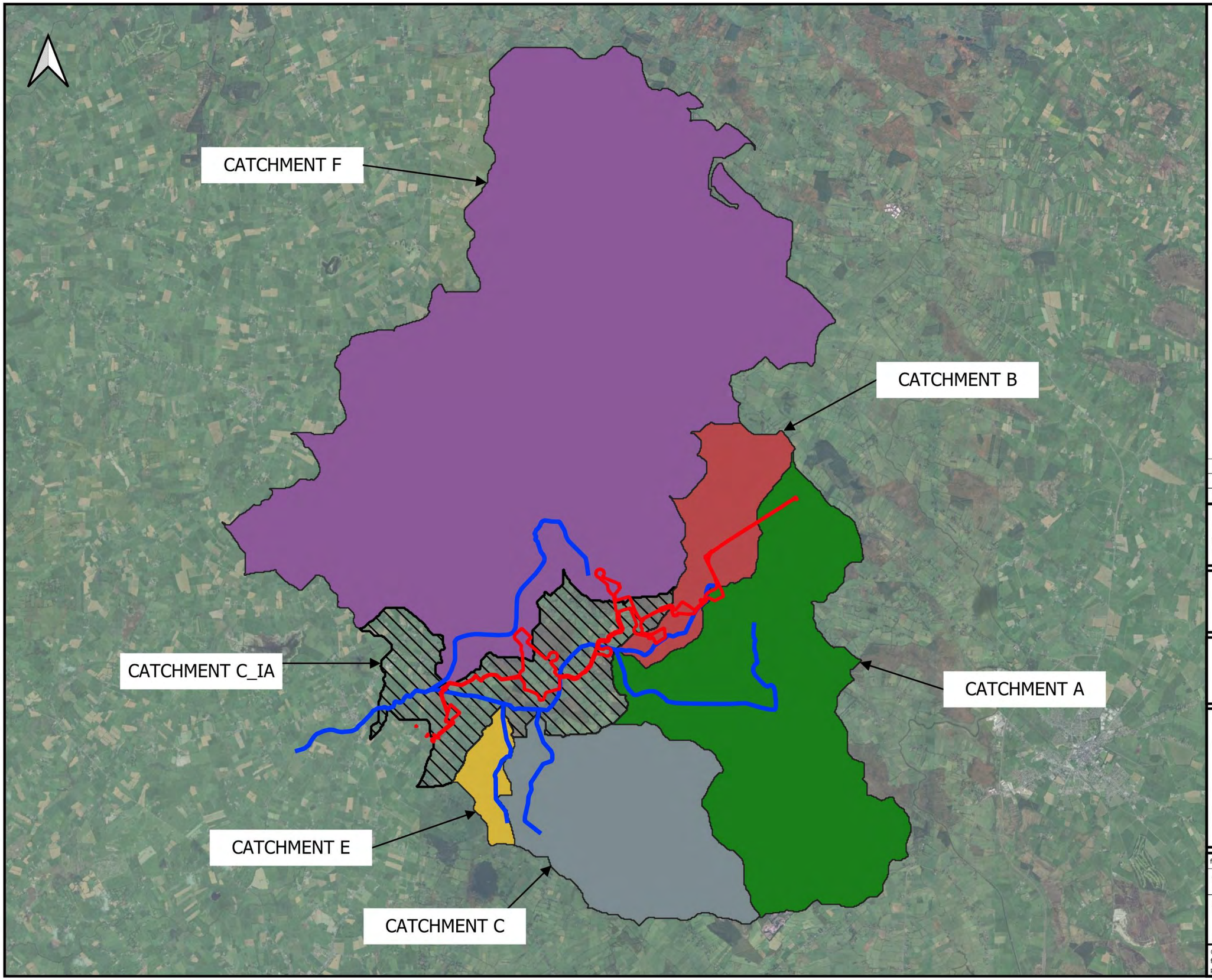

LEGEND

SITE BOUNDARY

WATERCOURSES

- Stream A - Togher River
- Stream B - Cloonbar River
- Stream C_IA - Intervening Area
- Stream D - Beagh Beg River
- Stream E - Shancloon River
- Stream F - Black River

rev.	date	amendment	drn	ckd
B	28.05.25	ISSUE	MOF	PMS
A	28.11.24	ISSUE	MOF	PMS

PROPOSED WINDFARM DEVELOPMENT & ASSOCIATED INFRASTRUCTURE WORKS AT SHANCLOON, CO. GALWAY

SITE SPECIFIC FLOOD RISK ASSESSMENT

CATCHMENT AREAS

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

CARLOW OFFICE:
INNOVATION CENTRE
GREEN ROAD
CARLOW R95 W248

NEWRY OFFICE:
1 RDC HOUSE
WIN BUSINESS PARK
NEWRY BT35 6PH

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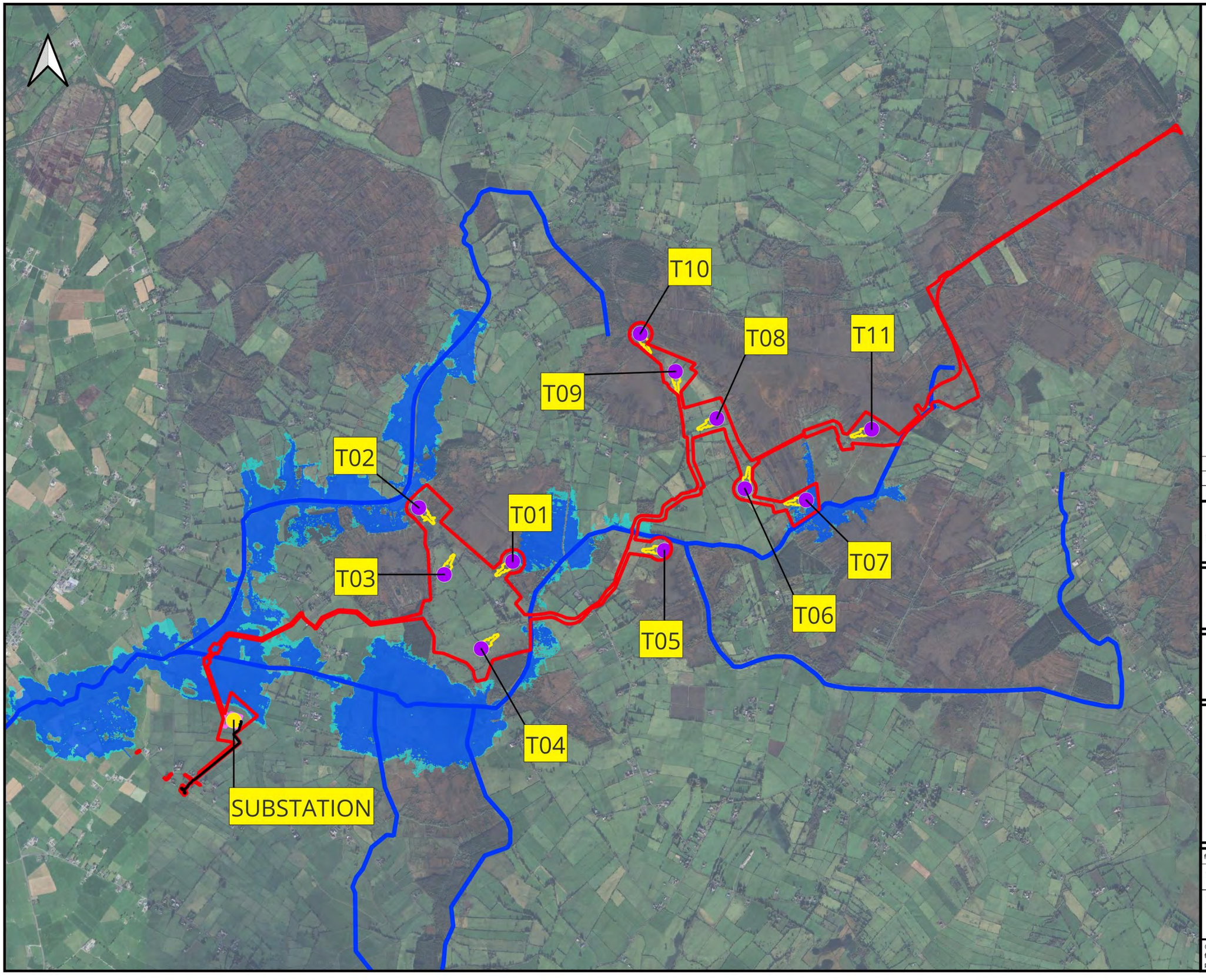

LEGEND

- SITE BOUNDARY
- WATERCOURSES
- 1% AEP (1 IN 100 YEAR) FLUVIAL FLOOD EXTENTS
- 0.1% AEP (1 IN 1000 YEAR) FLUVIAL FLOOD EXTENTS

PROPOSED DEVELOPMENT

- SUBSTATION
- TURBINES
- GRID CONNECTION
- HARDSTANDING AREA

rev.	date	amendment	drn	ckd
B	28.05.25	ISSUE	MOF	PMS
A	28.11.24	ISSUE	MOF	PMS

PROPOSED WINDFARM DEVELOPMENT & ASSOCIATED INFRASTRUCTURE WORKS AT SHANCLOON, CO. GALWAY

SITE SPECIFIC FLOOD RISK ASSESSMENT

1% AEP (1 IN 100 YEAR) & 0.1% AEP (1 IN 1000 YEAR) FLUVIAL FLOOD EXTENTS

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

CARLOW OFFICE:
INNOVATION CENTRE
GREEN ROAD
CARLOW R95 W248

NEWRY OFFICE:
1 RDC HOUSE
WIN BUSINESS PARK
NEWRY BT35 6PH

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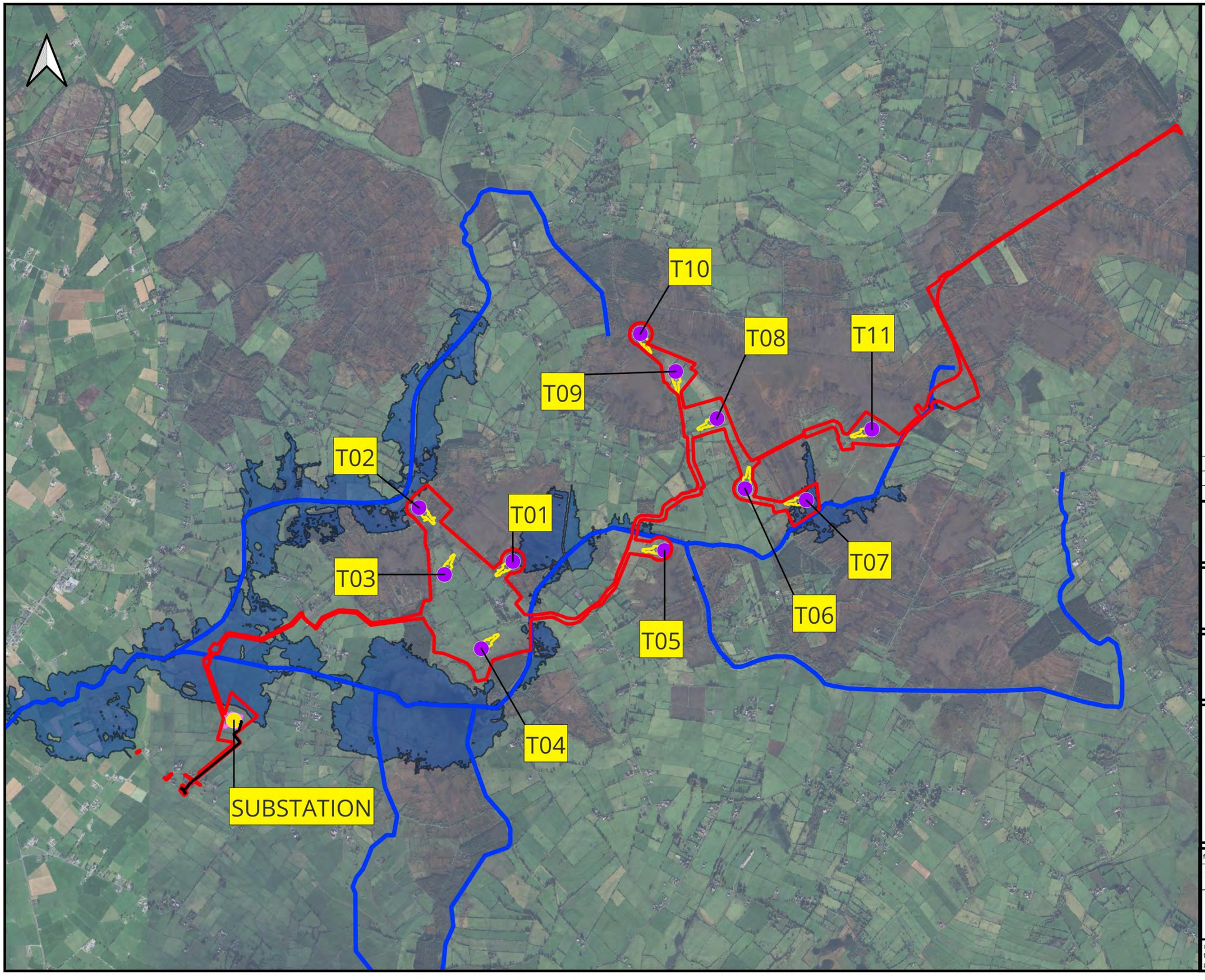

LEGEND

- SITE BOUNDARY
- WATERCOURSES
- 1% AEP + CC (1 IN 100 YEAR PLUS CLIMATE CHANGE) FLUVIAL FLOOD EXTENTS

PROPOSED DEVELOPMENT

- SUBSTATION
- TURBINES
- GRID CONNECTION
- HARDSTANDING AREA

rev.	date	amendment	drn	ckd
B	28.05.25	ISSUE	MOF	PMS
A	28.11.24	ISSUE	MOF	PMS

PROPOSED WINDFARM DEVELOPMENT & ASSOCIATED INFRASTRUCTURE WORKS AT SHANCLOON, CO. GALWAY

SITE SPECIFIC FLOOD RISK ASSESSMENT

1% AEP + CC (1 IN 100 YEAR PLUS CLIMATE CHANGE) FLUVIAL FLOOD EXTENTS

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WATER-ENVIRONMENTAL-CIVIL

CARLOW OFFICE:
INNOVATION CENTRE
GREEN ROAD
CARLOW R95 W248

NEWRY OFFICE:
1 RDC HOUSE
WIN BUSINESS PARK
NEWRY BT35 6PH

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		approved: PMS
		date: 28/05/2025

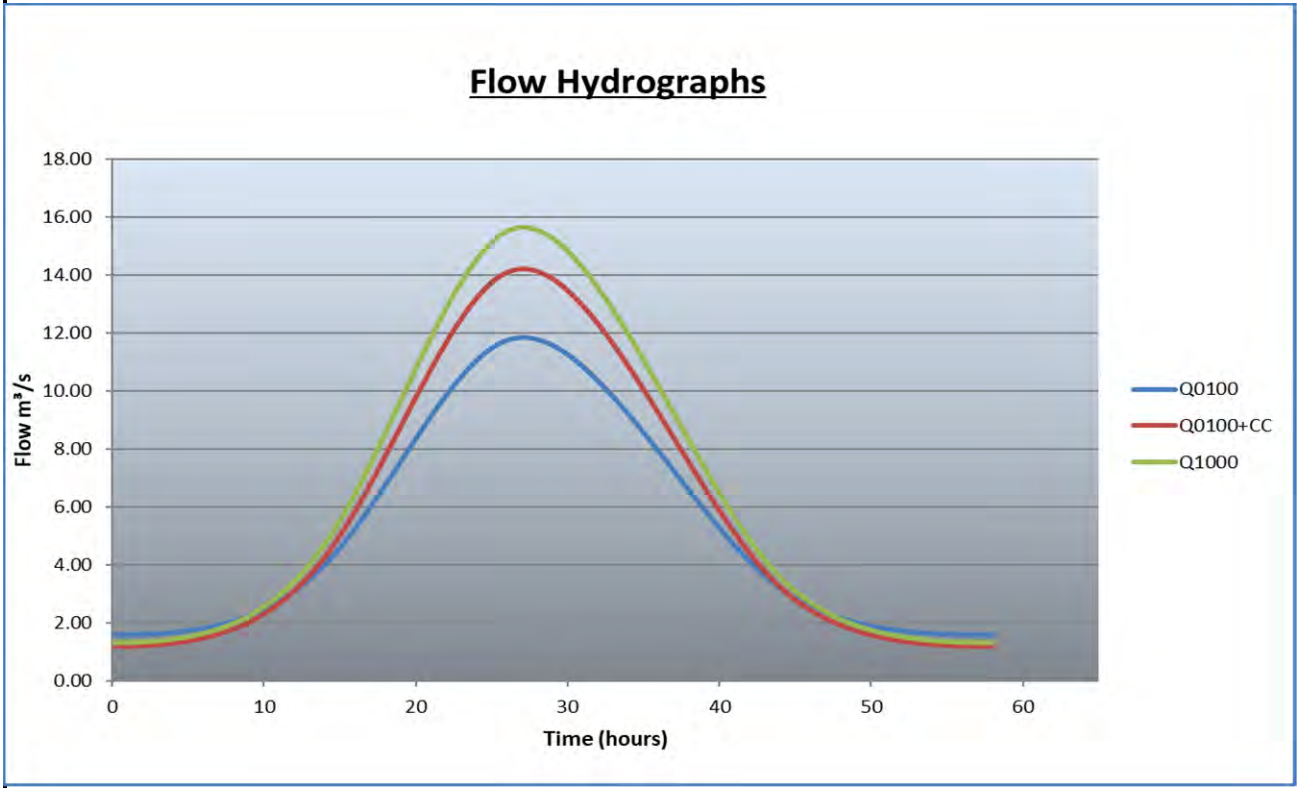
Appendix B. Hydrological Calculations

Project Code	IE2611
Project Name	Proposed Wind Farm, Shancloon, Co. Galway
Date	20/01/2023
Produced By	Micheal O Flatharta
Checked By	Paul McShane
Watercourse Name	Stream A
FSU Node Reference	30_2383_10
Flow Estimation Method	7 parameter
Growth Factor Method	National Growth Factors
Hydrograph Method	FSSR

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

* Flows used in project are highlighted in RED and UNDERLINED

Peak Flood Flows (m3/s)							
Flood Return Period (Years)	2	5	10	20	50	100	1000
Growth Curve Factor (QT/QBAR)	0.95	1.2	1.37	1.54	1.77	1.96	2.59
QT	5.742					11.85	15.66
MRFS						14.22	
HEFS							



Catchment Descriptors			
Catchment Area	AREA, km²	29.112	FSU
Standard Average Annual Rainfall	SAAR, mm	1106.3	FSU
Res. Soil Moisture Deficit (This value is Calculated)	RSMD, mm	42.5	= (2.48*(SQRT(SAAR)))-40
Baseflow Index Measure of a catchments responsiveness	BFIHOST	0.569473236	FSU
Flood Attenuation by Reservoirs and Lakes (FARL) index	FARL	1	FSU
Drainage Density	DRAIND	0.449	FSU
Mainstream Slope	S1085	0.86903	FSU
Percentage of the catchment river network that is included in the drainage schemes	ARTDRAIN2	0.8557	FSU

Flood Studies Update 7 Term Equation *				
QMED - FSU Seven Parameter Equation Assuming no suitable Pivotal gauges available	$=0.00001237(AREA^{0.937} BFIsoils^{-0.922} SAAR^{1.306} FARL^{2.217} DRAIND^{0.341} S1085^{0.185})(1+ARTDRAIN2)^{0.408}$			
Unadjusted Rural QMED	=	4.412	m^3/s	
Adjusted QMED	=	4.412	m^3/s	
Apply Factorial Standard Error	=	1.370		Standard FSE = 1.37, but can be changed if justified
Factoral Standard Error Adjusted QMED	=	**6.045**	**m^3/s**	

Q_{MED} = 6.04 m^3/s

Project Code	IE2611
Project Name	Proposed Wind Farm, Shancloon, Co. Galway
Date	20/01/2023
Produced By	Micheal O Flatharta
Checked By	Paul McShane
Watercourse Name	Stream B
FSU Node Reference	30_3579_7
Flow Estimation Method	7 parameter
Growth Factor Method	National Growth Factors
Hydrograph Method	FSSR

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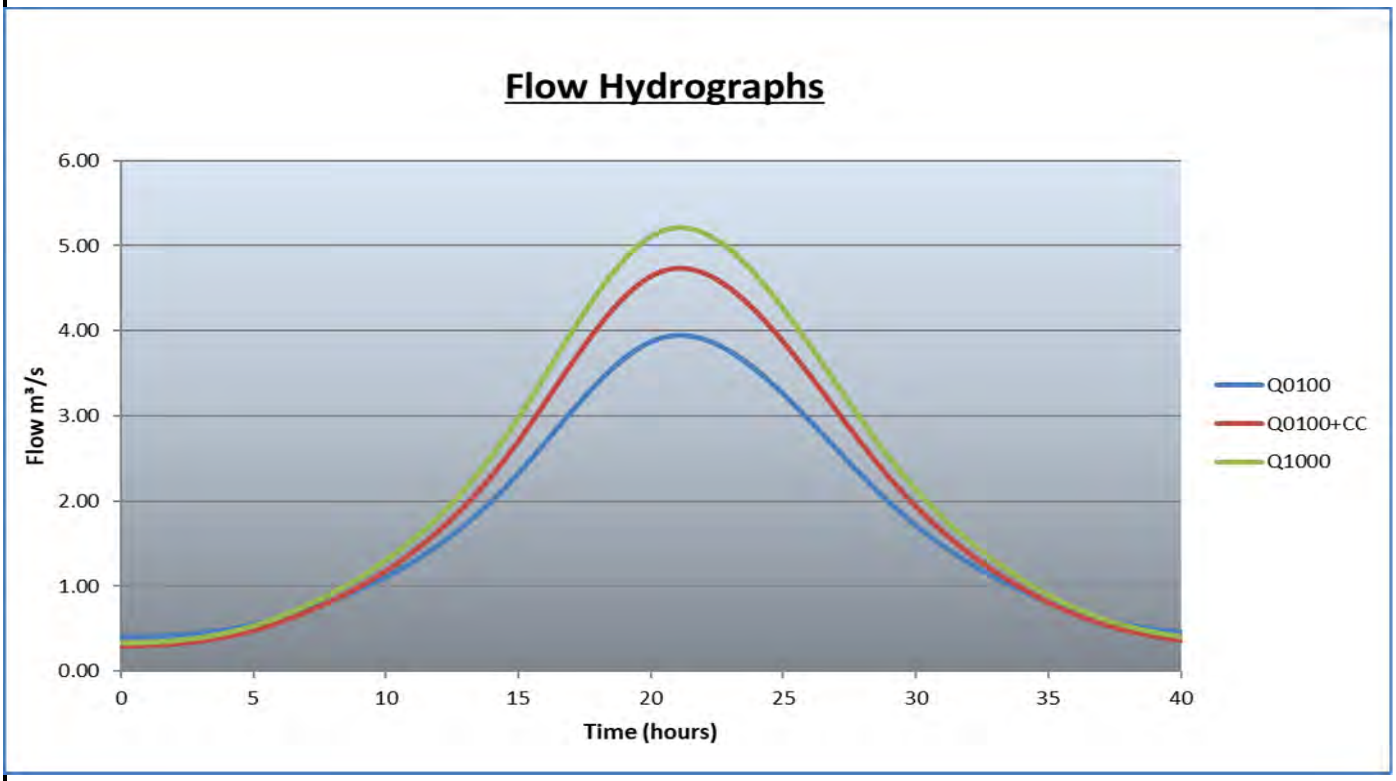
* Flows used in project should be highlighted in RED and UNDERLINED

Peak Flood Flows (m3/s)							
Flood Return Period (Years)	2	5	10	20	50	100	1000
Growth Curve Factor (QT/QBAR)	0.95	1.2	1.37	1.54	1.77	1.96	2.59
QT	1.91					3.95	5.21
MRFS						4.74	
HEFS							



Catchment Descriptors			
Catchment Area	**AREA, km²**	7.279	FSU
Standard Average Annual Rainfall	**SAAR, mm**	1116.41	FSU
Res. Soil Moisture Deficit (This value is Calculated)	**RSMD, mm**	**42.9**	= (2.48*(SQRT(SAAR)))-40
Baseflow Index Measure of a catchments responsiveness	**BFIHOST**	0.553326566	FSU
Flood Attenuation by Reservoirs and Lakes (FARL) index	**FARL**	1	FSU
Drainage Density	**DRAIND**	0.411	FSU
Mainstream Slope	**S1085**	2.88255	FSU
Percentage of the catchment river network that is included in the drainage schemes	**ARTDRAIN2**	0.7217	FSU

Flood Studies Update 7 Term Equation *				
QMED - FSU Seven Parameter Equation Assuming no suitable Piviotal gauges available	$=0.00001237(AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185})(1+ARTDRAIN2)^{0.408}$			
Unadjusted Rural QMED	=	1.470	m^3/s	
Adjusted QMED	=	1.470	m^3/s	
Apply Factorial Standard Error	=	1.370		Standard FSE = 1.37, but can be changed if justified
Factoral Standard Error Adjusted QMED	=	**2.013**	**m^3/s**	

QMED = **2.013** m^3/s

Project Code	IE2611
Project Name	Proposed Wind Farm, Shancloon, Co. Galway
Date	20/01/2023
Produced By	Micheal O Flatharta
Checked By	Paul McShane
Watercourse Name	Stream C Intervening Area
FSU Node Reference	-
Flow Estimation Method	7 parameter
Growth Factor Method	National Growth Factors
Hydrograph Method	FSSR

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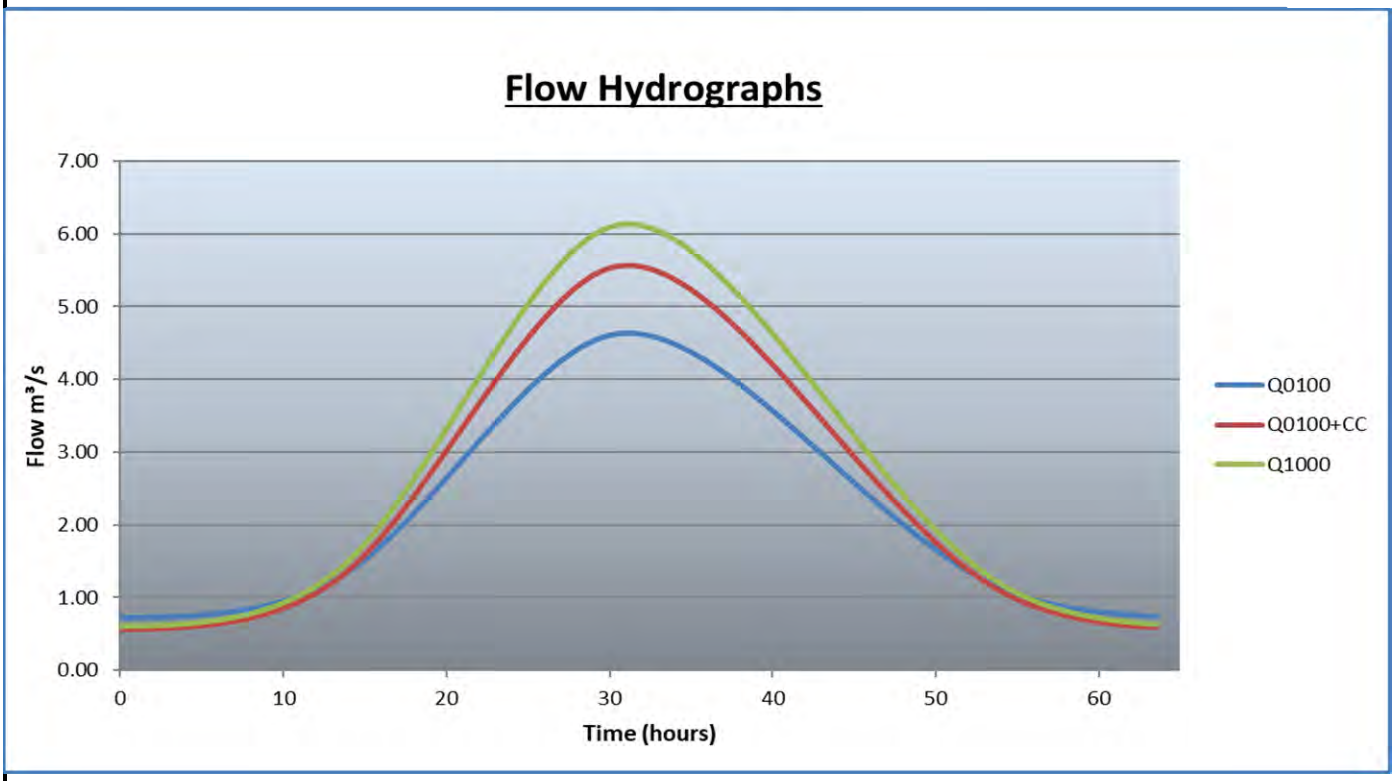
WATER-ENVIRONMENTAL-CIVIL

* Flows used in project should be highlighted in RED and UNDERLINED

Peak Flood Flows (m3/s)							
Flood Return Period (Years)	2	5	10	20	50	100	1000
Growth Curve Factor (QT/QBAR)	0.95	1.2	1.37	1.54	1.77	1.96	2.59
QT	2.25					4.64	6.13
MRFS						5.57	
HEFS							



Catchment Descriptors			
Catchment Area	**AREA, km²**	12.513	FSU
Standard Average Annual Rainfall	**SAAR, mm**	1133.46	FSU
Res. Soil Moisture Deficit (This value is Calculated)	**RSMD, mm**	**43.5**	= (2.48*(SQRT(SAAR)))-40
Baseflow Index Measure of a catchments responsiveness	**BFIHOST**	0.561868511	FSU
Flood Attenuation by Reservoirs and Lakes (FARL) index	**FARL**	1	FSU
Drainage Density	**DRAIND**	0.509869735	FSU
Mainstream Slope	**S1085**	0.2529	FSU
Percentage of the catchment river network that is included in the drainage schemes	**ARTDRAIN2**	0.83166144	FSU

Flood Studies Update 7 Term Equation *				
QMED - FSU Seven Parameter Equation Assuming no suitable Piviotal gauges available	$=0.00001237(AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185}\ )(1+ARTDRAIN2)^{0.408}$			
Unadjusted Rural QMED	=	1.728	m^3/s	
Adjusted QMED	=	1.728	m^3/s	
Apply Factorial Standard Error	=	1.370		Standard FSE = 1.37, but can be changed if justified
Factoral Standard Error Adjusted QMED	=	**2.367**	**m^3/s**	

QMED = **2.367** m^3/s

Project Code	IE2611
Project Name	Proposed Wind Farm, Shancloon, Co. Galway
Date	20/01/2023
Produced By	Micheal O Flatharta
Checked By	Paul McShane
Watercourse Name	Stream D
FSU Node Reference	30_2364_6
Flow Estimation Method	7 parameter
Growth Factor Method	National Growth Factors
Hydrograph Method	FSSR

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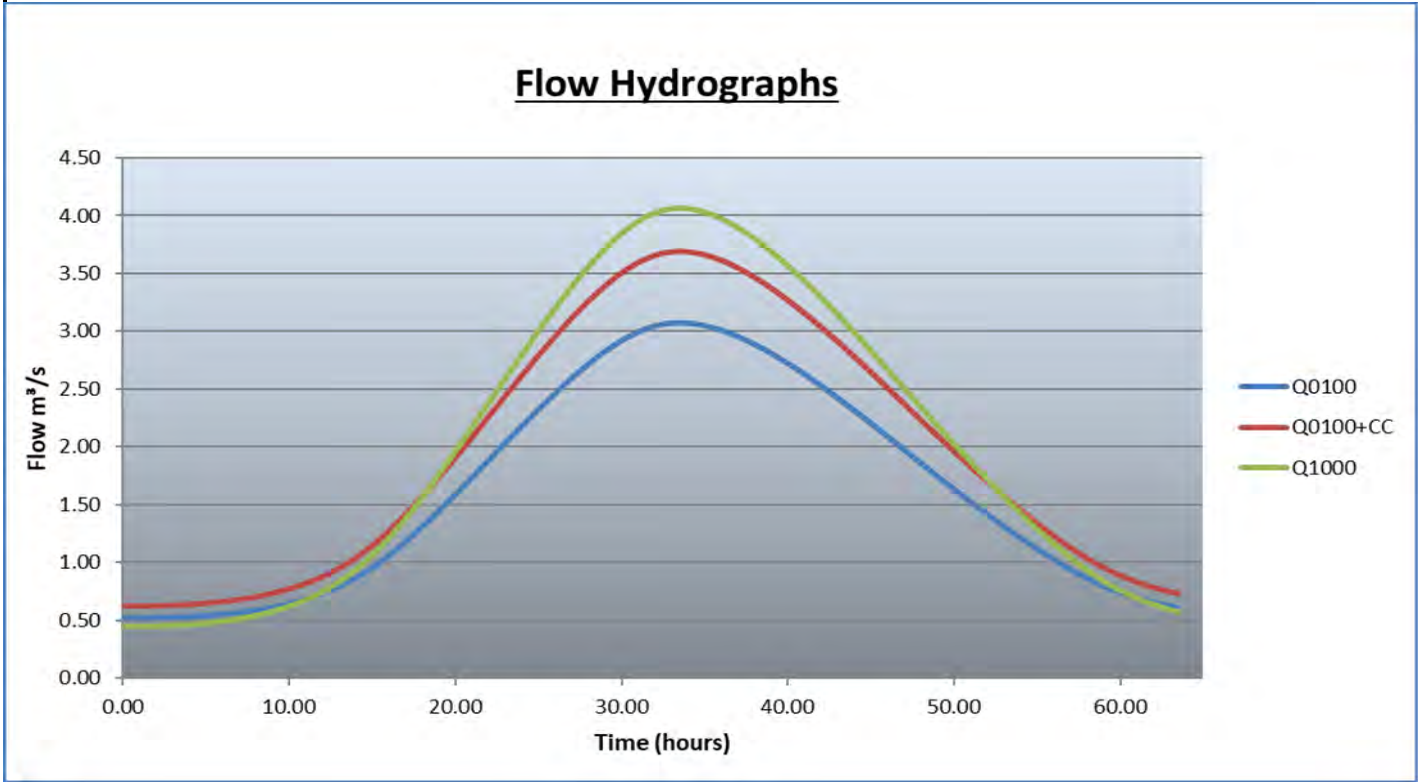
WATER-ENVIRONMENTAL-CIVIL

* Flows used in project should be highlighted in RED and UNDERLINED

Peak Flood Flows (m3/s)							
Flood Return Period (Years)	2	5	10	20	50	100	1000
Growth Curve Factor (QT/QBAR)	0.95	1.2	1.37	1.54	1.77	1.96	2.59
QT	1.49					3.07	4.06
MRFS						3.69	
HEFS							



Catchment Descriptors			
Catchment Area	**AREA, km²**	16.557	FSU
Standard Average Annual Rainfall	**SAAR, mm**	1128.49	FSU
Res. Soil Moisture Deficit (This value is Calculated)	**RSMD, mm**	**43.3**	= (2.48*(SQRT(SAAR)))-40
Baseflow Index Measure of a catchments responsiveness	**BFIHOST**	0.685921573	FSU
Flood Attenuation by Reservoirs and Lakes (FARL) index	**FARL**	1	FSU
Drainage Density	**DRAIND**	0.189	FSU
Mainstream Slope	**S1085**	0.1	FSU
Percentage of the catchment river network that is included in the drainage schemes	**ARTDRAIN2**	0.9509	FSU

Flood Studies Update 7 Term Equation *				
QMED - FSU Seven Parameter Equation Assuming no suitable Piviotal gauges available	$=0.00001237(AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185}\ )(1+ARTDRAIN2)^{0.408}$			
Unadjusted Rural QMED	=	1.145	m^3/s	
Adjusted QMED	=	1.145	m^3/s	
Apply Factorial Standard Error	=	1.370		Standard FSE = 1.37, but can be changed if justified
Factoral Standard Error Adjusted QMED	=	**1.568**	**m^3/s**	

QMED = **1.568** m^3/s

Project Code	IE2611
Project Name	Proposed Wind Farm, Shancloon, Co. Galway
Date	20/01/2023
Produced By	Micheal O Flatharta
Checked By	Paul McShane
Watercourse Name	Stream E
FSU Node Reference	30_581_4
Flow Estimation Method	7 Parameter
Growth Factor Method	National Growth Factors
Hydrograph Method	FSSR

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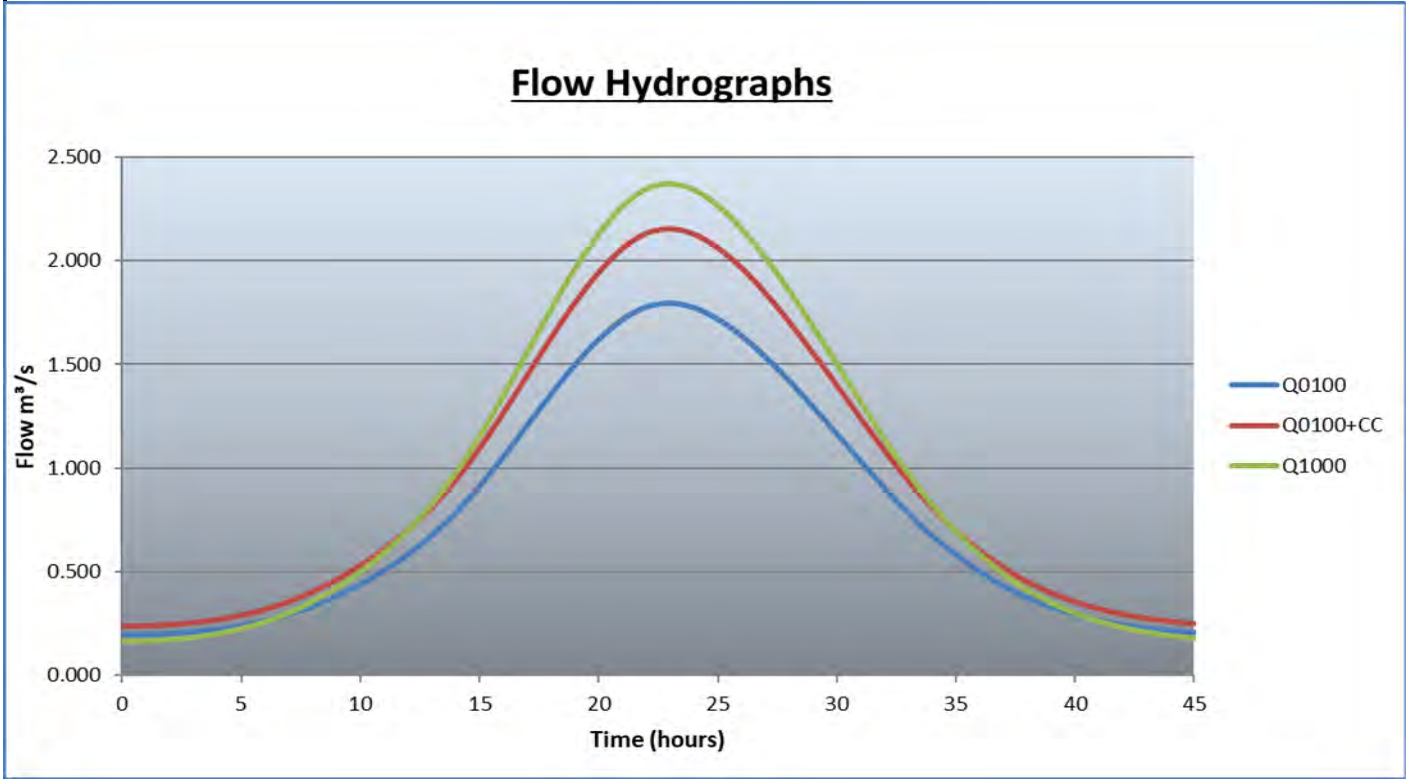
WATER-ENVIRONMENTAL-CIVIL

* Flows used in project should be highlighted in RED and UNDERLINED

Peak Flood Flows (m3/s)							
Flood Return Period (Years)	2	5	10	20	50	100	1000
Growth Curve Factor (QT/QBAR)	0.95	1.2	1.37	1.54	1.77	1.96	2.59
QT	0.87					1.79	2.37
MRFS						2.15	
HEFS							



Catchment Descriptors			
Catchment Area	**AREA, km²**	2.057	FSU
Standard Average Annual Rainfall	**SAAR, mm**	1147.73	FSU
Res. Soil Moisture Deficit (This value is Calculated)	**RSMD, mm**	**44.0**	= (2.48*(SQRT(SAAR)))-40
Baseflow Index Measure of a catchments responsiveness	**BFIHOST**	0.603593535	FSU
Flood Attenuation by Reservoirs and Lakes (FARL) index	**FARL**	1	FSU
Drainage Density	**DRAIND**	2.318	FSU
Mainstream Slope	**S1085**	1.34365	FSU
Percentage of the catchment river network that is included in the drainage schemes	**ARTDRAIN2**	0.6854	FSU

Flood Studies Update 7 Term Equation *				
QMED - FSU Seven Parameter Equation Assuming no suitable Piviotal gauges available	$=0.00001237(AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185}\ )(1+ARTDRAIN2)^{0.408}$			
Unadjusted Rural QMED	=	0.668	m^3/s	
Adjusted QMED	=	0.668	m^3/s	
Apply Factorial Standard Error	=	1.370		Standard FSE = 1.37, but can be changed if justified
Factoral Standard Error Adjusted QMED	=	**0.915**	**m^3/s**	

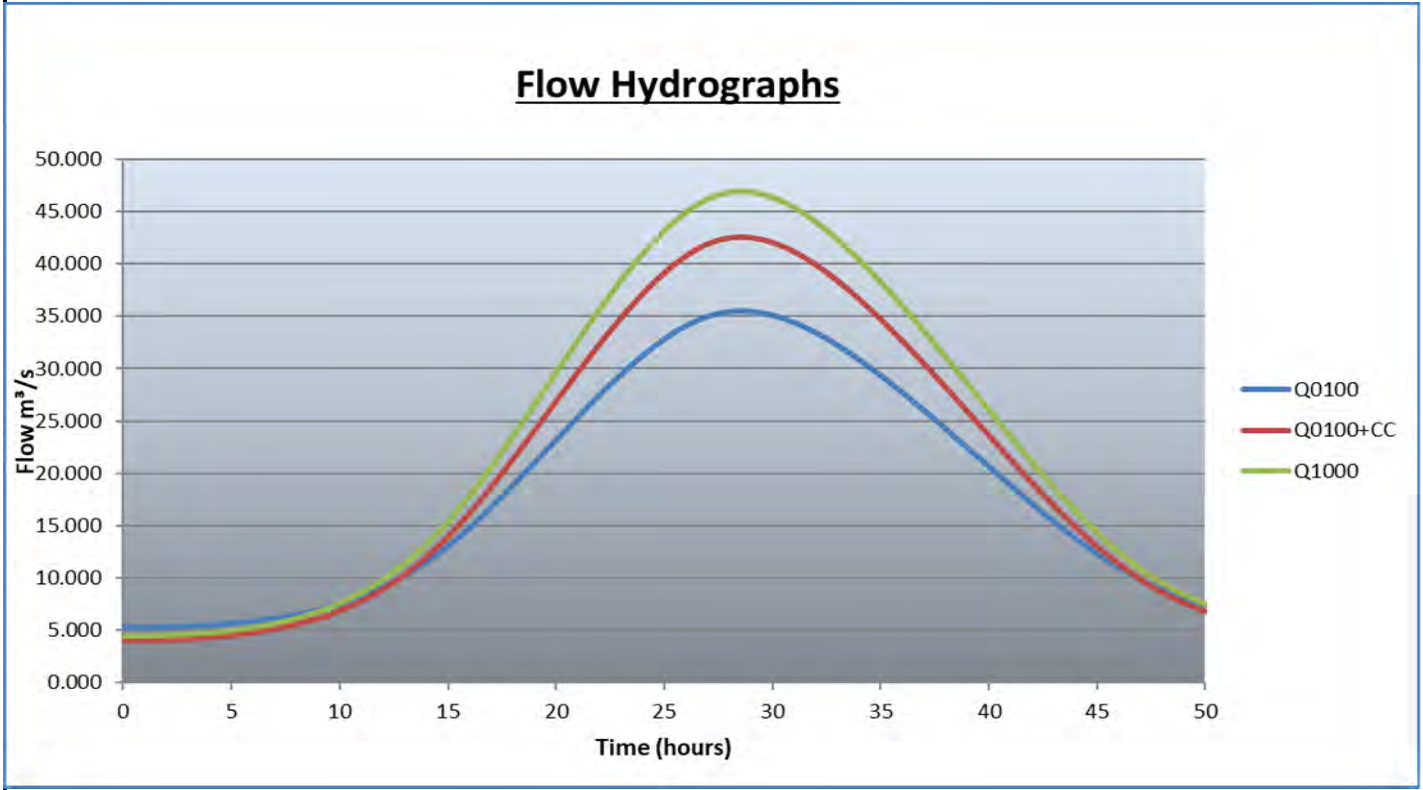
QMED = **0.915** m^3/s

Project Code	IE2611
Project Name	Proposed Wind Farm, Shancloon, Co. Galway
Date	20/01/2023
Produced By	Micheal O Flatharta
Checked By	Paul McShane
Watercourse Name	Stream F
FSU Node Reference	30_2928_3
Flow Estimation Method	7 parameter
Growth Factor Method	National Growth Factors
Hydrograph Method	FSSR

IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

* Flows used in project should be highlighted in RED and UNDERLINED

Peak Flood Flows (m3/s)							
Flood Return Period (Years)	2	5	10	20	50	100	1000
Growth Curve Factor (QT/QBAR)	0.95	1.2	1.37	1.54	1.77	1.96	2.59
QT	17.199					35.485	46.891
MRFS						42.58	
HEFS							



Catchment Descriptors			
Catchment Area	**AREA, km²**	89.646	FSU
Standard Average Annual Rainfall	**SAAR, mm**	1143.1	FSU
Res. Soil Moisture Deficit (This value is Calculated)	**RSMD, mm**	**43.8**	= (2.48*(SQRT(SAAR)))-40
Baseflow Index Measure of a catchments responsiveness	**BFIHOST**	0.561043424	FSU
Flood Attenuation by Reservoirs and Lakes (FARL) index	**FARL**	0.994	FSU
Drainage Density	**DRAIND**	0.475	FSU
Mainstream Slope	**S1085**	0.82719	FSU
Percentage of the catchment river network that is included in the drainage schemes	**ARTDRAIN2**	0.8105	FSU

Flood Studies Update 7 Term Equation *				
QMED - FSU Seven Parameter Equation Assuming no suitable Piviotal gauges available	$=0.00001237(AREA^{0.937}\ BFIsoils^{-0.922}\ SAAR^{1.306}\ FARL^{2.217}\ DRAIND^{0.341}\ S1085^{0.185})(1+ARTDRAIN2)^{0.408}$			
Unadjusted Rural QMED	=	13.215	m^3/s	
Adjusted QMED	=	13.215	m^3/s	
Apply Factorial Standard Error	=	1.370		Standard FSE = 1.37, but can be changed if justified
Factoral Standard Error Adjusted QMED	=	**18.105**	**m^3/s**	

QMED = **18.105** m^3/s