Illaunbaun Wind Project, Co. Clare

Flood Risk assessment

March 2025

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This report describes work commissioned by Gavin & Doherty Geosolutions, by an instruction dated 06 December 2024. The Client's representative for the contract was Shubham Raj Barode of Gavin & Doherty Geosolutions. Justin Nangle of JBA Consulting carried out this work.

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Abbreviations

AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
CFRAM	Catchment Flood Risk Assessment and Management
DoHELG	Department of the Environment, Heritage and Local Government
DTM	Digital Terrain Model
FB	Freeboard
FFL	Finish Floor Levels
FRA	Flood Risk Assessment
FSR	Flood Studies Report
GSI	Geological Survey of Ireland
LiDAR	Light Detection and Ranging
NIFM	National Indicative Fluvial Mapping
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
RR	Rainfall-Runoff
RMS	Root Mean Square
SAC	Special Area of Conservation
SAAR	Standard Average Annual Rainfall (mm)
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SuDS	Sustainable Urban Drainage System
WL	Water Level

1 Introduction

1.1 Statement of Consistency

Under the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHLG & OPW, 2009), the Proposed Development must undergo a Flood Risk Assessment (FRA) to ensure sustainability and effective management of flood risk. This FRA is in compliance and consistent with the Guidelines.

1.2 Terms of Reference

JBA Consulting was appointed to prepare a Flood Risk Assessment (FRA) for a site located in Illaunbaun, Co. Clare. The report was prepared in response to a request by Gavin & Doherty Geosolutions to undertake an FRA for the site.

1.3 Flood Risk Assessment Aims and Objectives

This study is being completed to inform the future development of the site as it relates to flood risk. It aims to identify, quantify and communicate to Planning Authority officials and other stakeholders the risk of flooding to land, property and people and the measures that would be recommended to manage the risk.

The objectives of this FRA are to:

- Identify potential sources of flood risk;
- Confirm the level of flood risk and identify key hydraulic features;
- Assess the impact that the Proposed Development has on flood risk;
- Develop an appropriate flood risk mitigation and management measures which will allow for the long-term development of the site.

Recommendations for development have been provided in the context of the 2009 OPW / DECLG planning guidance, "The Planning System and Flood Risk Management". A review of the likely effects of climate change, and the long-term impacts this may have on any development has also been undertaken.

For general information on flooding, the definition of flood risk, flood zones and other terms see 'Understanding Flood Risk' in Appendix A.

1.4 Development proposal

The works cover a proposed wind farm located approximately 2.9km from the west coast of the Co. Clare coastline and is approximately 165.5ha in size. Refer to **Error! Reference source not found.**.

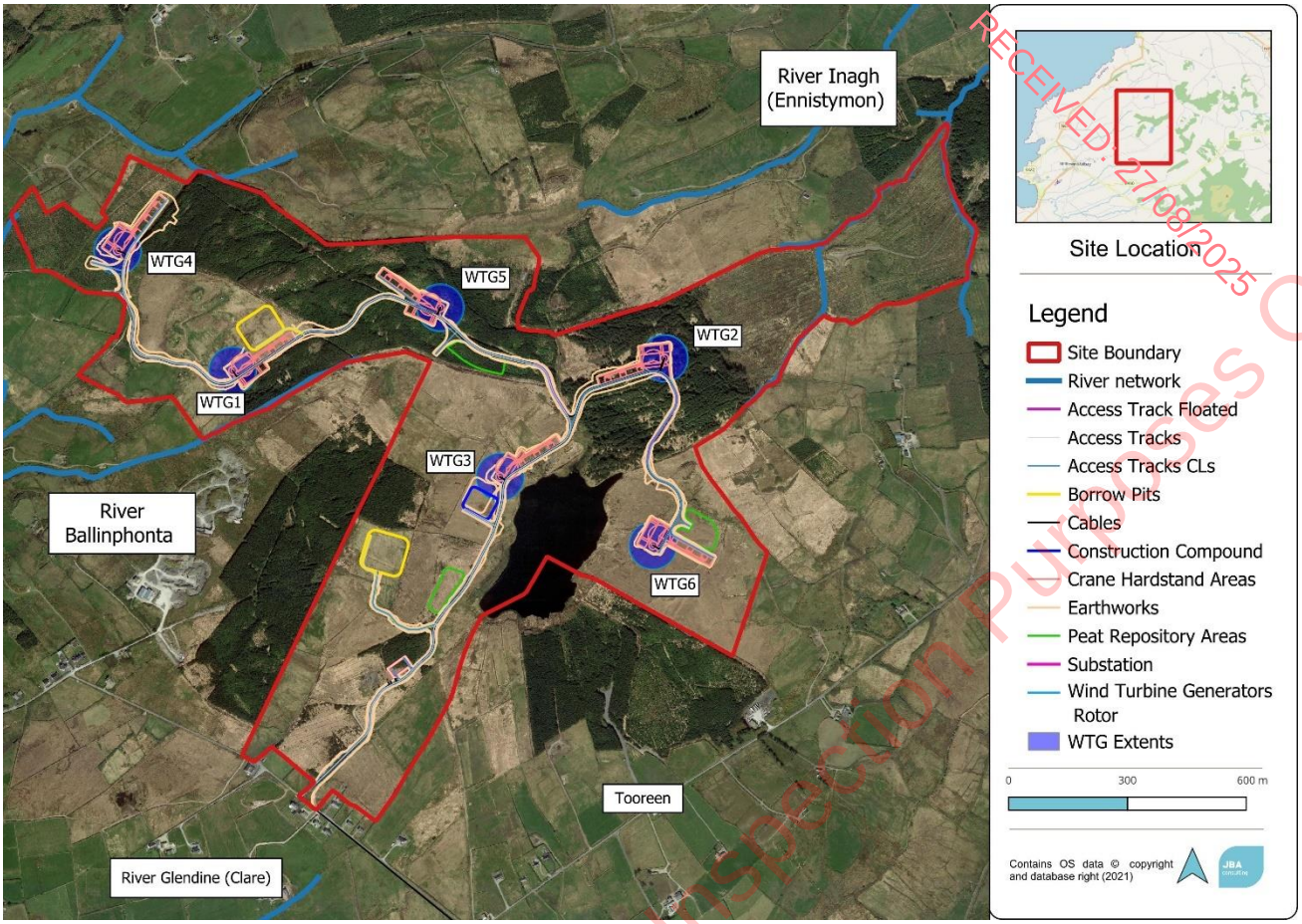


Figure 1–1: Development Layout

1.5 Report Overview

Section 0 of this report gives an overview of the study location and associated watercourses. Section 3 contains background information on flood risk. Section 4 provides initial assessment of flood risk and mitigation measures. Section 5 contains the report conclusions.

2 Site Background

This section describes the background information of the subject site in Illaunbaun, Co Clare, including adjacent drainage channels, watercourses and its wider geographical area.

2.1 Location

The site is located 4.2km from the town of Milltown Malbay and the town of Lahinch is located 5.2km to the northwest. The proposed planning boundary encompasses the townlands of Tooreen, Slievenalicka, Illaunbaun, Lackamore and Drumbaun, with the proposed access route from the northeast beginning on the border of Fahanlunaghta Beg townland. The site is approximately 165.5ha in size and there are three river systems in the vicinity, the following two of which lie within and adjacent to the development area. To the north-east is the River Inagh (Ennistymon) and to the west is the River Ballinphonta. Just outside of the development area is the River Glendine (Clare), and there are also several other river systems within 2km of the site. The location is shown below in Figure 2–1**Error! Reference source not found.**.

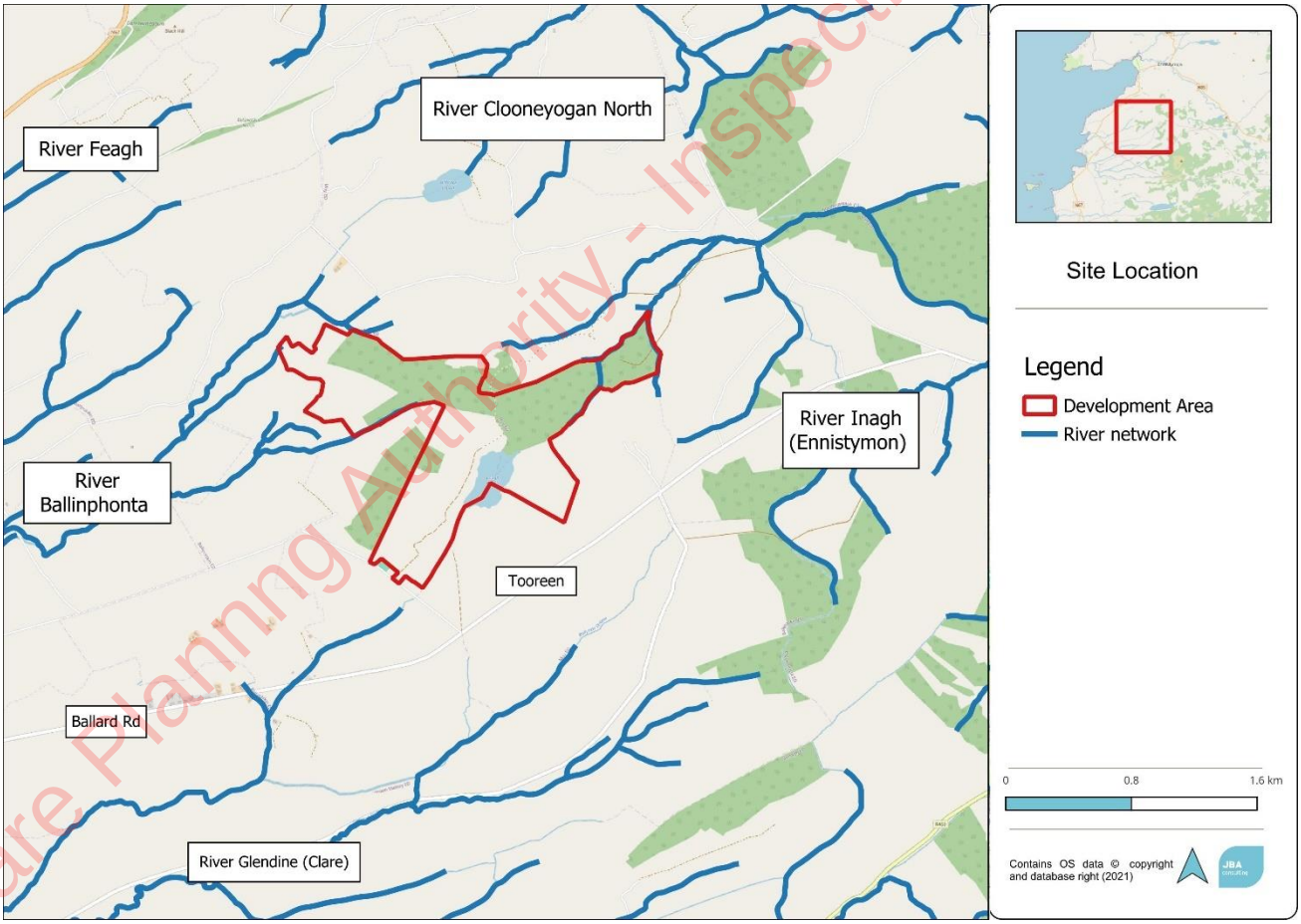


Figure 2–1: Site Location

2.2 Waterbodies

The River Ballinphonta in the west, River Inagh (Ennistymon) in the east, and Lough Keagh positioned in the south are the main hydrological features in the vicinity of the site. Tributaries of the River Ballinphonta form part of the western boundary, and tributaries of the River Inagh (Ennistymon) form part of the eastern boundary. Both rivers are part of the Mal Bay Catchment covering an area of 846.56km^2.

The River Ballinphonta flows west for approximately 6km entering the sea at Cleadh, Breaffy South Townland. The River Inagh (Ennistymon) flows west into Drumcullaun Lough and reaches the sea approximately 22km downstream at Liscannor Bay, Lahinch. **Error! Reference source not found.** below shows the hydrological features of the area.

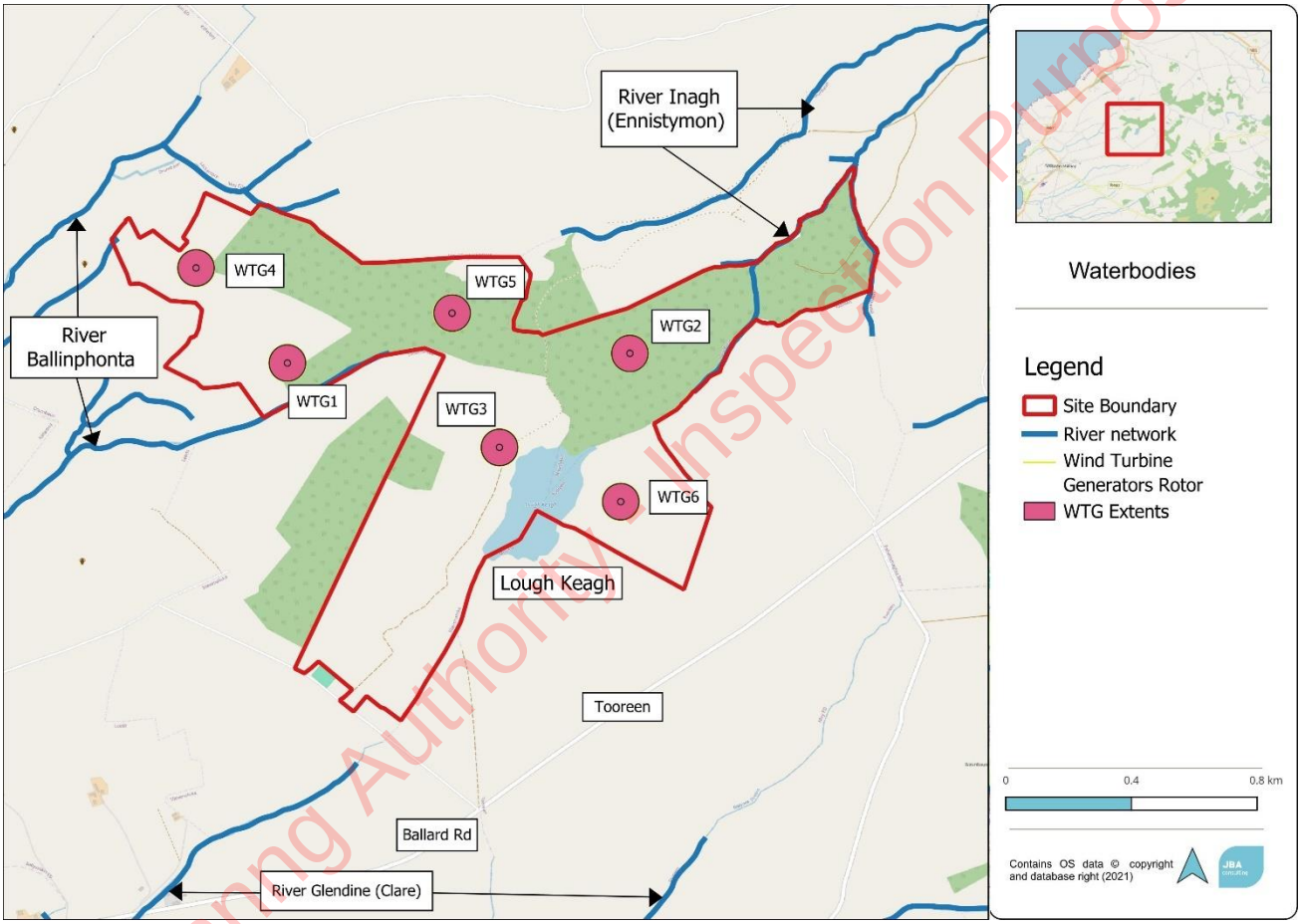


Figure 2–2: Waterbodies

Lough Abullaunduff is situated in a topographic basin in the northern section of the Proposed Development. The lough drains a small headwater of the River Inagh and is approximately 2.6ha in size, encompassing sections of Illaunbaun, Drumbaun and Lackamore townlands. Turbine 5 is located on the southwestern boundary of the former lake shoreline. The waterbody is represented on historical 6" and 25" OSi mapping but is not clearly identified in current mapping or the current EPA mapping (2023).

Field drain patterns in the area suggest the lake morphology has been altered in the past and satellite imagery shows vegetation changes at the lake boundary. The morphology of the lake waterbody may therefore change seasonally and/or during periods of higher precipitation. A site walkover conducted by Gavin & Doherty Geosolutions staff in July 2023 confirming the presence of Lough Abullaunduff, and ground conditions were noted to be marshy in nature. The lake water surface was obscured from view by rushes and other vegetation and a small headwater outflow to the River Inagh was confirmed to be flowing[1].

2.3 Geology

The groundwater and geological maps of the site, provided by the Geological Survey of Ireland (GSI), have been studied. The underlying soils at the site as per the EPA Subsoil types are predominantly blanket peat with sections of bedrock at the surface. Also present are shales and sandstones till (Namurian). There is water in the form of Lough Keagh in the south (refer to Figure 2–3).

The underlying bedrock is Central Clare group, described as Sandstone, siltstone and mudstone. There are no karst features located within the site or immediate surrounding area, with the closest karst feature is 15km to the east at the Tooreen East townland.

[1] Gavin and Doherty Geosolutions (2024) *Illaunbaun Wind Farm Environmental Impact assessment: Chapter 10 Hydrology and Flood Risk.* Dublin: Gavin and Doherty Geosolutions

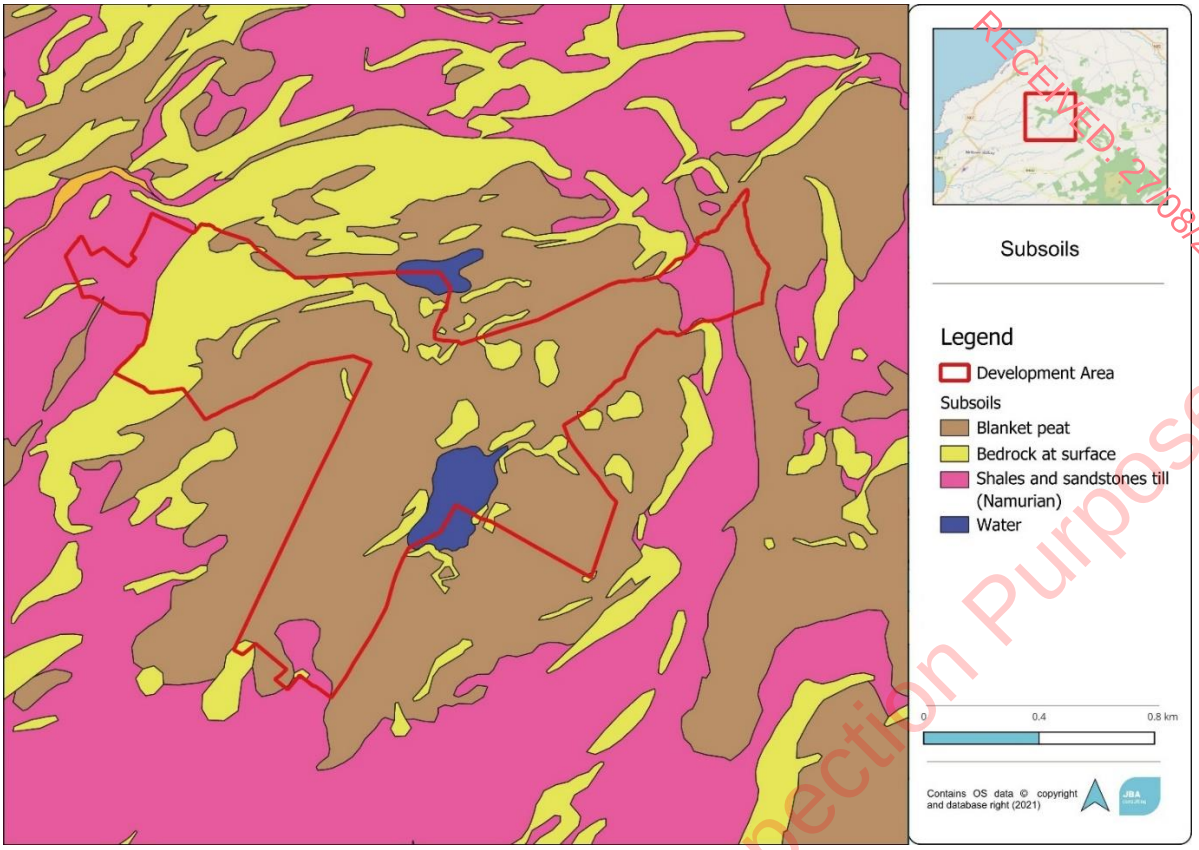


Figure 2–3: Geology and subsoils

2.4 Topography

A desktop study was undertaken to assess the topography of the site using data available from www.topographic-map.com The data shows the levels on site range from approximately 116mOD in the far east to 117mOD in the west, and 198mOD at the south at Slievenalicka. The general slope of the site is towards the north and west towards the River Inagh (Ennistymon) and River Ballinphonta respectively, the centre and south of the site are typically at a higher elevation (see Figure 2–4).

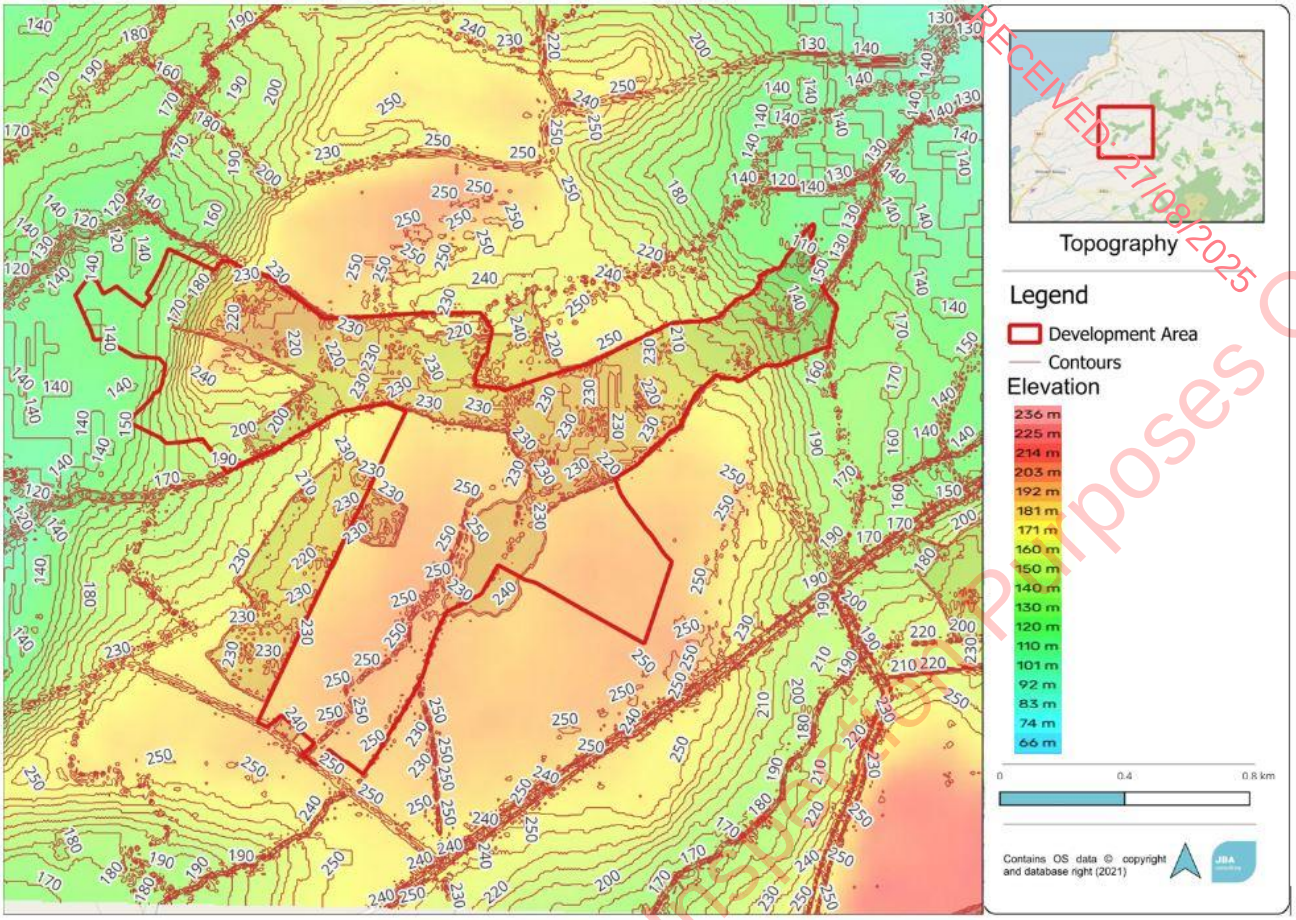


Figure 2–4: Topography[2]

[2] Topographic-map.com (2024) *Clare topographic map*. Available from: Clare topographic map, elevation, terrain [Accessed 04/03/2025]

3 Flood Risk Identification

An assessment of the potential for and scale of flood risk at the site is conducted using historical and predictive information. This identifies any sources of potential flood risk to the site and reviews historical flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections. Further detail on the Planning Guidelines and technical concepts are provided in Appendix 0.

3.1 Flood History

A number of sources of flood information have been reviewed to establish any recorded flood history at, or near the site. This includes the OPWs national flood information portal, www.floodinfo.ie, GSI database and general internet searches.

3.1.1 GSI Database Historical Data.

The Winter 2015/2016 Surface Water Flooding mapping, which shows fluvial and pluvial flood events from that period, was reviewed as part of the historic groundwater flood map and state review. An event was identified within the proposed site boundary; however, this corresponds to Lough Keagh, and turbine 3 extent is situated mainly outside of the surface water flooding area with the overlap coming from the turbine blade extent rather than the structure's foundations. The next flood location in the closest proximity is 1km north at Aillbrack Lough, located within Aillbrack Townland.

From the Historic Groundwater flooding mapping, the closest area of flooding is located 12.3km north-east, outside the village of Kilfenora to the west.

The Seasonal Flood Map 2020/2021 from the GSI database outlining peak flood extents from Autumn 2020 to Summer 2021 was also reviewed, and similarly the area surrounding Lough Keagh is affected within the site boundary with high and low events recorded. The proposed location for Turbine 3 extent is situated mainly outside of these extents, again with the overlap coming from the turbine blade extent rather than the structure's foundations. This is discussed further in Section 3.3.2. Similarly to the surface water flooding mapping, the next location in the closest proximity is 1km north, at Aillbrack Lough located within Aillbrack Townland. Refer to **Error! Reference source not found.**.

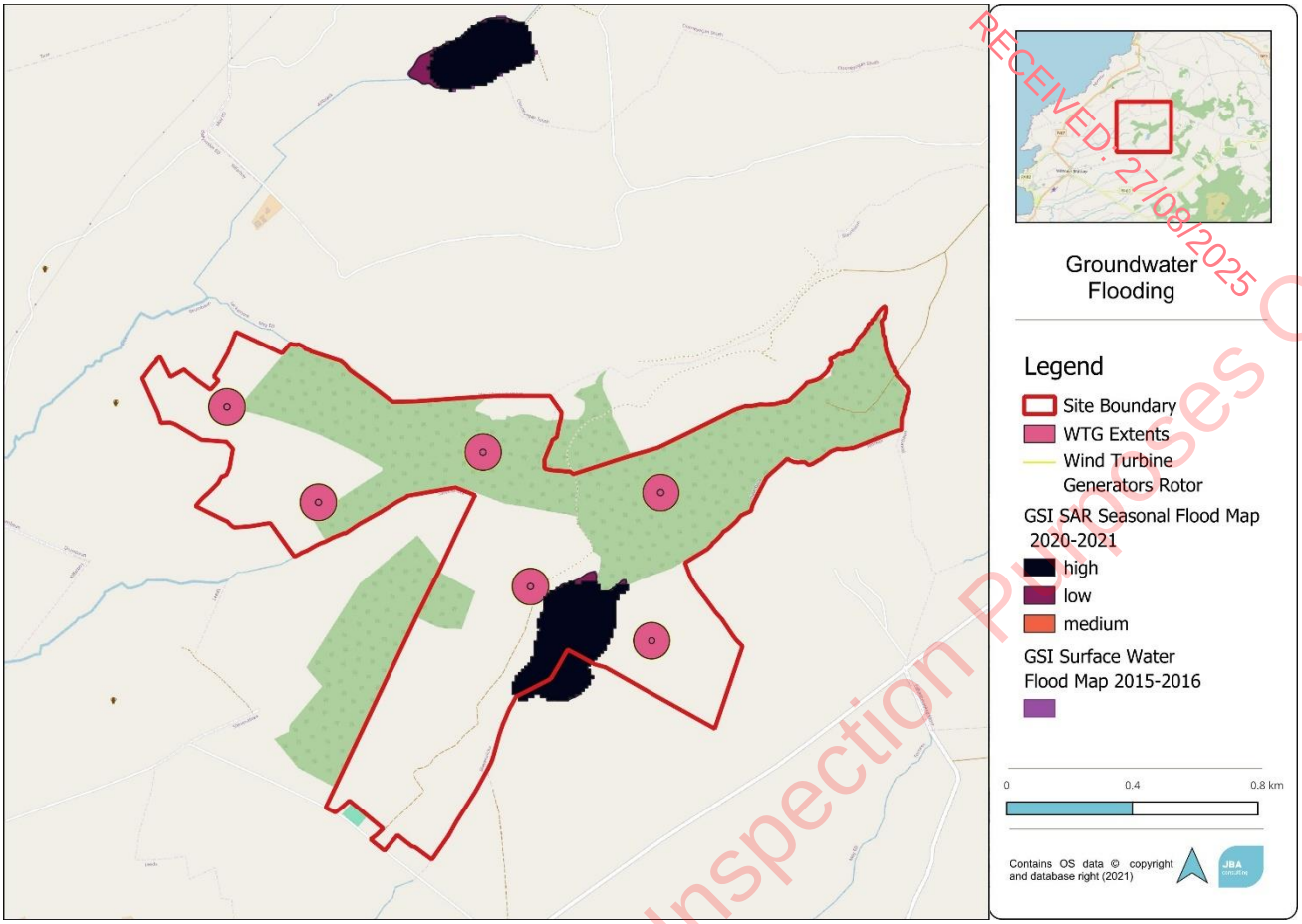


Figure 3–1: Groundwater Flooding

3.1.2 Floodinfo.ie

The OPW have established a National Flood Risk Hazard Mapping website, Floodinfo.ie, which highlights areas at flood risk through the collection of recorded data and observed flood events. Floodinfo.ie did not identify any historic flood events at the site, but there are 6 reports of historic flooding within 4km of the site. See Table 3-1 below and Figure 3–2 over page for historic flood events in the area. These are not deemed to be of any impact to the site.

Table 3-1: Flood Summary

Flood ID	Flood Summary	Distance From Site (km)
12600	Dated Flood - 11/09/2015, location: Church Road, Ennistymon Road, Miltown Malbay, Co. Clare. Irish Grid Co-ordinates: 105744 E 179408 N. The flooding event started on the 11th of September 2015 at approximately 5pm - 12.30am on the 12th of September. The peak flood occurred at approximately 9pm on the 11th of September.	3.8

Flood ID	Flood Summary	Distance From Site (km)
	The source of the flood waters was short duration heavy rainfall, caused by failure of large old stone culvert to accept volumes of water coming to it. Approximately 20 Residential properties affected, including a community centre, library and 5 commercial properties. Impacts to transport infrastructure include: approximately 1.5km of N67 affected and damage to Clonbony Bridge.	
3897 and 3933	Dated Flood - 07/01/2005, location: Milltown Malbay (Church Street, Church Car Park and Lahinch Road (N67). The source of the flood was runoff from the Clonbony Stream, Milltown Malbay. The N67 Lahinch Road and Car Park off of this road to right and Church Street flooded. Ther road was not impassable. 2/3 houses flooded badly. This problem has occurred 4/5 times in the past 10 years. Problem seems to have become worse in recent years. Cause is increased development in upstream areas has resulted in increased runoff to Clonbony stream and the problem is further exacerbated by lack of maintenance of Clonbony downstream of Miltown Malbay.	3.8
12560	Refer to the above flood ID - 12600, the description is the same and in the same area.	3.8

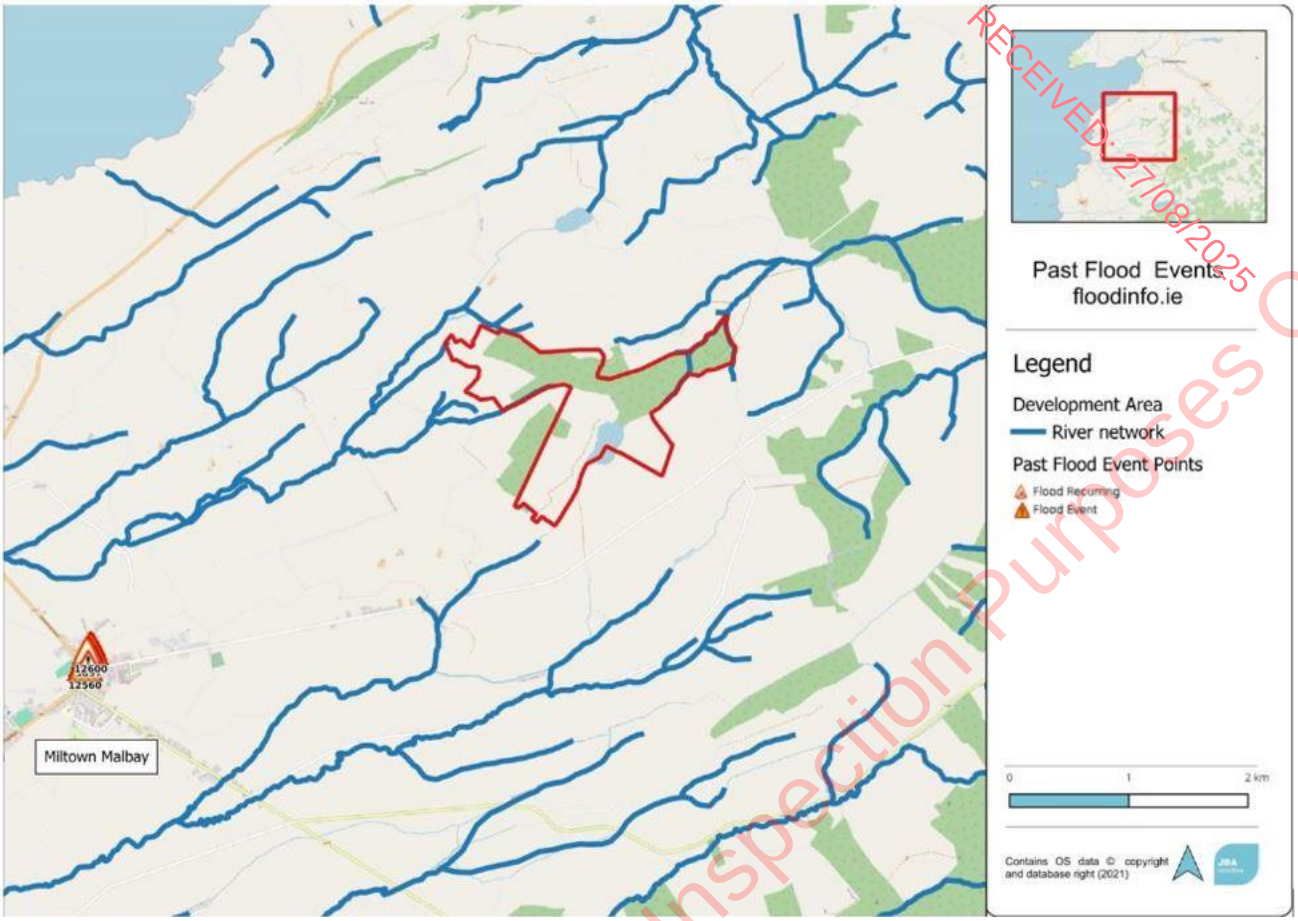


Figure 3–2: FloodInfo.ie Flood History

3.1.3 Internet Searches

An internet search was conducted to gather information about whether the site was affected by flooding previously and no flooding was reported at the site.

3.2 Predictive Flood Mapping

The wider area has been a subject to two predictive flood mapping or modelling studies.

- National Indicative Fluvial Mapping (NIFM).
- Clare County Development Plan 2023–2029 SFRA.

3.2.1 National Indicative Fluvial Mapping (NIFM)

The NIFM mapping was prepared, as required by the EU Floods Directive 2007/60/EC, for the purpose of an initial assessment to assist in the review of areas of potentially significant flood risk. They have been prepared for all watercourses in the country with a catchment greater than 5km^2 through the project, which was completed in 2020. The maps provide flood hazard information for areas not covered under the National CFRAM programme; however maps do not make use of channel survey data and do not take flood defences into account.

The NIFM mapping is present at the downstream sections of the following rivers:

- Approximately 1082m east of the Inagh (Ennistymon) River.
- Approximately 1849m southwest at the Glendine (Clare) River.
- Approximately 2503m west at the Ballinphonta River.

There is, however no NIFM mapping present for the site area. This mapping is outside of the site boundaries; however the sources for these rivers begin within the site boundary itself.

3.2.2 Clare County Development Plan 2023–2029 SFRA

A Strategic Flood Risk Assessment (SFRA) was commissioned by Clare County Council (CCC) as part of the preparation of the Clare County Development Plan 2023-2029. The new plan sets out the vision for how Clare should develop over the 6-year plan period in compliance with national and regional policies.

As stated in the Planning and Development (Strategic Environmental Assessment) Regulations 2004 (S.I. No. 436 of 2004), a Strategic Environmental Assessment (SEA) must be prepared as part of any county development plan to assess the likely significant effects of the plan's implementation on the environment.

The Planning System and Flood Risk Management Guidelines for Planning Authorities 2009 (the OPW Guidelines) recommend that an SFRA be prepared to support the SEA of a development plan to ensure that flood risk, where identified, is considered as one of the key environmental criteria against which the plan is assessed. The SFRA should ultimately inform policy and land use decisions in areas that have been assessed as being at risk of flooding.

The maps produced as part of the SFRA, commissioned by Clare County Council do not cover the site itself, and the site is not affected by fluvial flooding.

3.3 Sources of Flooding

The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. Following this initial phase of this Flood Risk Assessment, it is possible to summarise the level of potential risk posed by each source of flood sources are described below.

3.3.1 Fluvial

Tributaries of the River Ballinphonta form part of the western boundary, and tributaries of the River Inagh (Ennistymon) are within the site and form part of the eastern boundary. According to floodinfo.ie there is no history of flooding in the vicinity, with the closest source being 3.8km away at Milton Malbay (refer to Section 3.1.1).

3.3.2 Pluvial

Pluvial (or surface water) flooding is the result of rainfall-generated flows that arise before run-off can enter a watercourse or sewer. It is usually associated with high intensity rainfall. Flood risk from pluvial sources exists in all areas. The GSI Surface Water flood mapping from 2015/2016 was consulted, and the potential of surface water coming from the vicinity of Lough Keagh towards Turbine 3 is not considered to be a risk to structures on the site. This was based on the indicative nature of the GSI mapping coupled with the information that Turbine 3 is planned to have a base elevation of approximately 192.2mOD. There is a low point to the north of Lough Keagh at 183.8mOD, which 8.4m lower in elevation. During heavy rainfall, water will flow along lower ground levels and away from the turbine (see Figure 3–3).

The next closest pluvial extent is 928m north of the site at Aillbrack Lough see (**Error! Reference source not found.**). As shown in available site survey, Turbine 3 will have an elevation of approximately 192.3mOD. Being located on the slope of Slievenalicka, this is an increase in elevation of approximately 4.5m from the edge of Lough Keagh at approximately187mOD. The turbine rotor extent has been discounted when considering pluvial flood risk, and the mast location has been used as the reference point (see Figure 4–1). Considering this information, and the site survey displaying an increase in elevation of 4.5m from 187mOD at the edge of Lough Keagh to 192.3mOD at Turbine 3, pluvial flooding has been discounted as a risk to site.

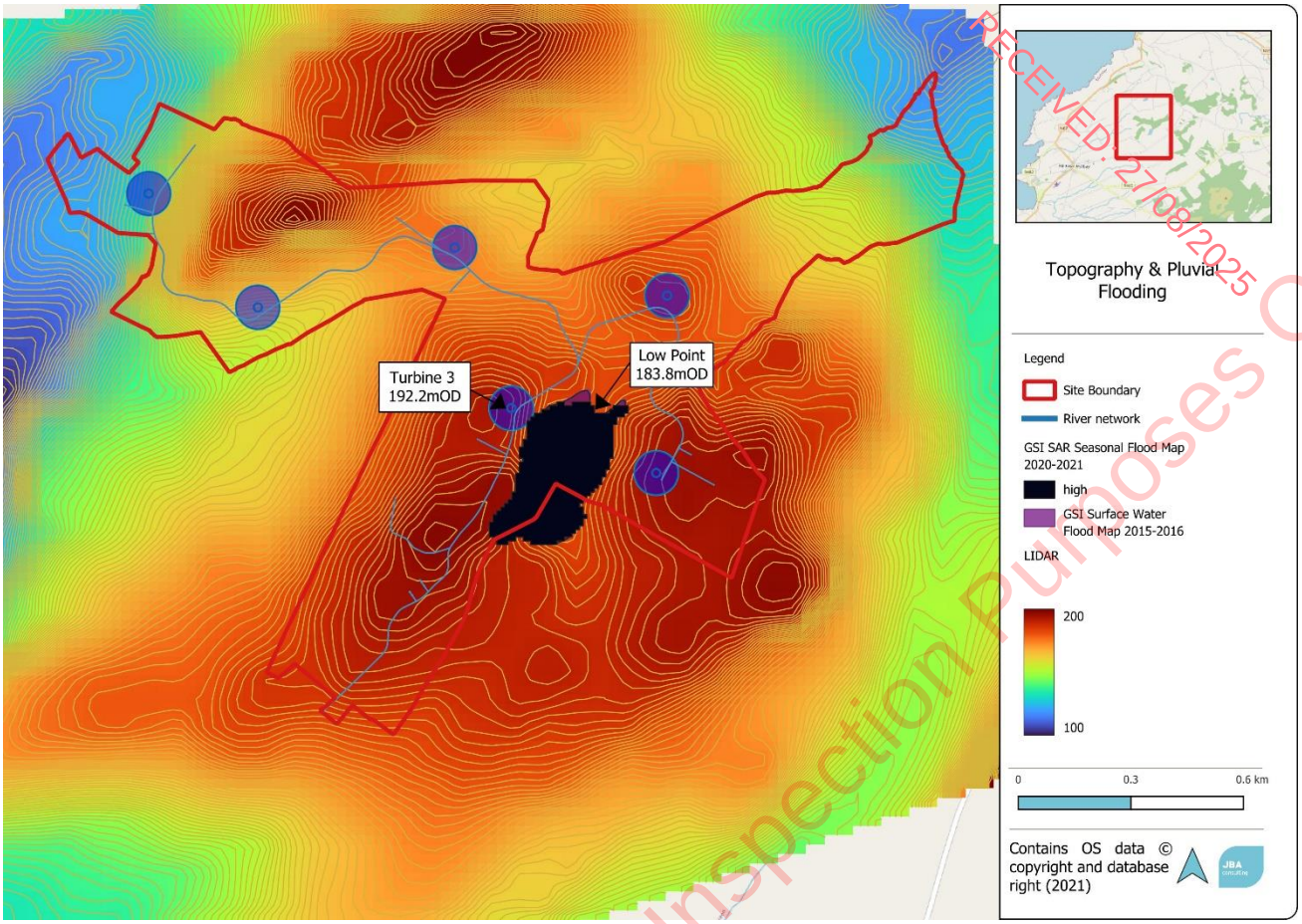


Figure 3–3: Pluvial Flooding - Topography

3.3.3 Groundwater

The GSI historic groundwater mapping was reviewed and does not indicate groundwater flooding at the site or surrounding area. The lake has been treated as a surface water feature rather than a groundwater-fed lake. The closest groundwater flood event is located approximately 15km to the west within the townland of Roxton, 3.1km south-west of Corofin. There are no karst features in the area which would indicate areas at risk of groundwater flooding. As previously stated, Turbine 3 has an elevation of approximately 192.3mOD and being located on the slope of Slievenalicka, this is an increase in elevation of approximately 4.5m from the edge of Lough Keagh (at approximately 187mOD). Due to the increase in elevation and distance of approximately 54m from Lough Keagh, the risk of groundwater flooding has been excluded from further consideration at this stage.

4 Flood Risk Assessment

4.1 Flood Risk

The surface water and seasonal flooding risk to Turbine 3 and other turbines on site has been reduced due to the indicative nature of the GSI mapping, which does not take into consideration the varying elevations on site. Turbine 3 has an elevation of approximately 192.3mOD and is located on the slope of Slievenalicka. This is an increase in elevation of approximately 4.5m from the edge of Lough Keagh, which lies at approximately 187mOD.

The WTG rotor extent has not been used when considering pluvial flood risk; the mast location has been used as the reference point. Considering this, and the site survey showing the increase in elevation from the edge of Lough Keagh to the mast of turbine 3, there is not considered to be a surface water risk to the turbine.

Additionally, the low point adjacent to Lough Keagh is 183.8mOD. During heavy rainfall water will flow along low ground levels away from the turbine. Refer to Figure 4–1.

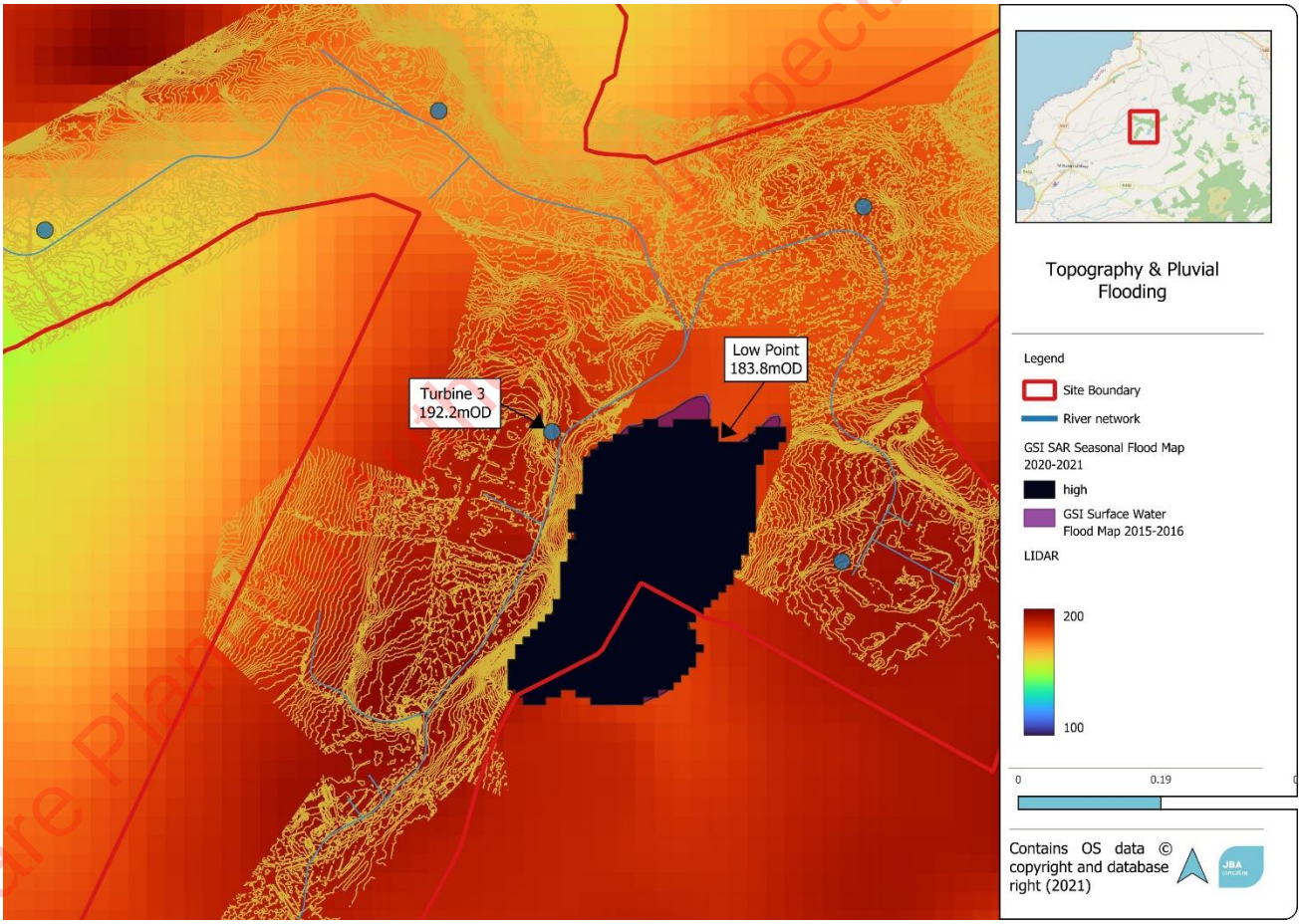


Figure 4–1: Site Survey Showing Proposed WTG3 Mast Location Minus Rotor Extent

4.1.1 Stormwater management plan for Wind Turbines

The wind turbines are positioned maintaining a minimum distance of a 50m buffer from surface watercourses. Wind turbines will be positioned outside of flow paths to ensure there is adequate distance between electrical equipment and water.

4.1.2 Access/Egress

Proposed access tracks should be strategically positioned to minimise the number of surface water flow paths crossing, therefore bypassing requirements for culverting/bridging in infrastructure design.

4.2 Residual Risk

There are no watercourses located within the site that are in the vicinity of the turbines, and the turbines are located on elevated ground. Therefore, no residual risk has been identified.

5 Conclusion

JBA Consulting has undertaken a Site-Specific Flood Risk Assessment for the proposed wind farm located partly within the townlands of Tooreen, Slievenalicka, Illaunbaun, Lackamore and Drumbaun County Clare. Multiple sources of available flood zone data in proximity to the site (including NIFM, GSI Winter 2015/2016 Surface Water Flooding mapping and Seasonal Flood Mapping 2020/2021) were considered suitable for the Stage 2 Flood Risk Assessment.

After review of the GSI Winter 2015/2016 Surface Water Flooding and Seasonal Flood Mapping 2020/2021, risk to the site has been managed through confirmation of the positioning of turbines a minimum distance of a 50m buffer from surface watercourses. Wind turbines will also be located outside of surface water flow paths to ensure there is adequate distance between electrical equipment and water. It was deemed that a more detailed hydrological and hydraulic analysis was not necessary in this instance.

As a result of the analysis undertaken of the available data, and of review of mitigation measures, it is concluded that the development is in compliance with the core principles of the Planning System and Flood Risk Management Guidelines and appropriately manages risk.

A Understanding Flood Risk

Flood risk is generally accepted to be a combination of the likelihood (or probability) of flooding and the potential consequences arising. Flood risk can be expressed in terms of the following relationship: Flood Risk = Probability of Flooding x Consequences of Flooding

A.1 Probability of Flooding

The likelihood or probability of a flood event (whether tidal or fluvial) is classified by its Annual Exceedance Probability (AEP) or return period (in years). A 1% AEP flood has a 1 in 100 chance of occurring in any given year.

In this report, flood frequency will primarily be expressed in terms of AEP, which is the inverse of the return period, as shown in the table below and explained above. This can be helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval and is the terminology which will be used throughout this report.

Table A-1: Conversion between return periods and annual exceedance probabilities

Return period (years)	Annual exceedance probability (%)
2	50
10	10
50	2
100	1
200	0.5
1000	0.1

A.2 Flood Zones

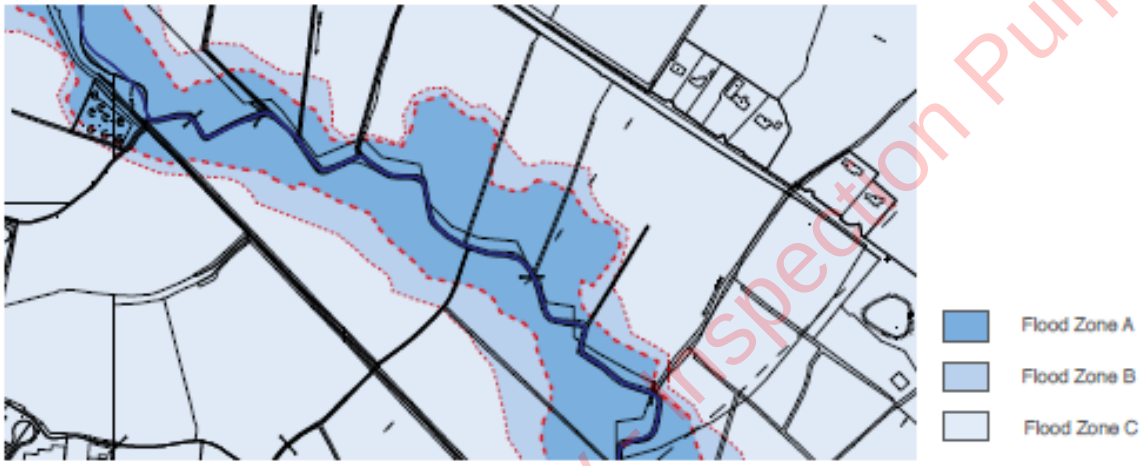
Flood Zones are geographical areas illustrating the probability of flooding. For the purposes of the Planning Guidelines, there are 3 types or levels of flood zones, A, B and C.

Table A-2: Flood Zones

Zone	Description
Flood Zone A	Where the probability of flooding is highest; greater than 1% (1 in 100) from river flooding or 0.5% (1 in 200) for coastal/tidal flooding.

Flood Zone B	Moderate probability of flooding; between 1% and 0.1% from rivers and between 0.5% and 0.1% from coastal/tidal.
Flood Zone C	Lowest probability of flooding; less than 0.1% from both rivers and coastal/tidal.

It is important to note that the definition of the flood zones is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the fact that there is a residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.



A.3 Consequence of Flooding

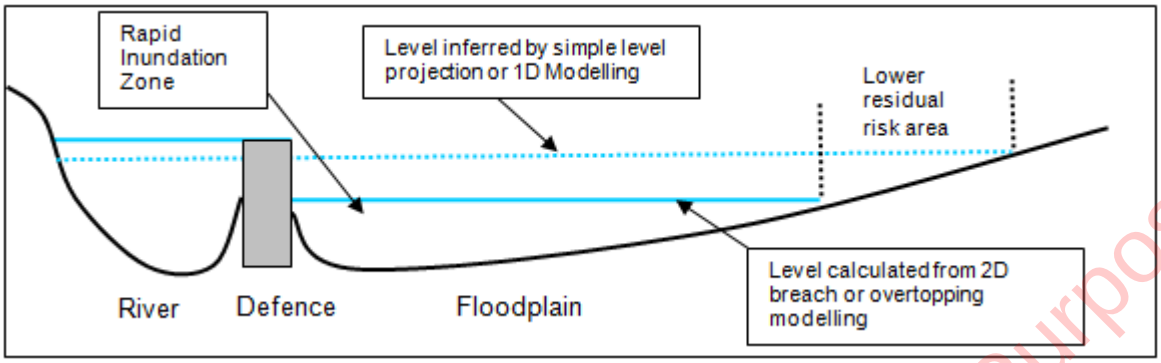
Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc.).

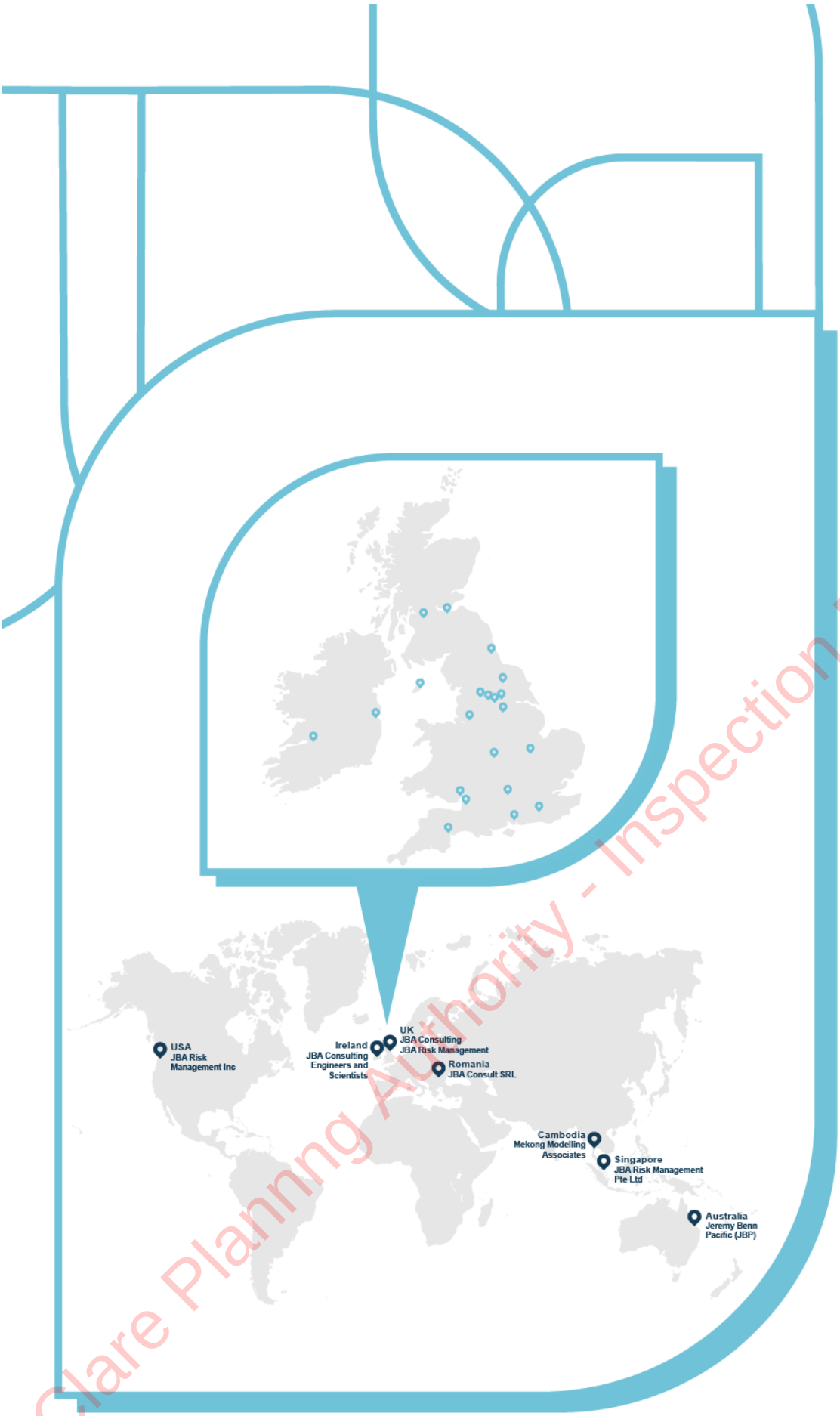
The 'Planning System and Flood Risk Management' provides three vulnerability categories, based on the type of development, which are detailed in Table 3.1 of the Guidelines, and are summarised as:

- Highly vulnerable, including residential properties, essential infrastructure and emergency service facilities;
- Less vulnerable, such as retail and commercial and local transport infrastructure;
- Water compatible, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.

A.4 Residual Risk

The presence of flood defences, by their very nature, hinder the movement of flood water across the floodplain and prevent flooding unless river levels rise above the defence crest level, or a breach occurs. This is known as residual risk.





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