

TOBIN

**Ballincor Wind Farm
RWE Renewables,
Co. Offaly
Flood Risk Assessment**

RWE

BUILT ON KNOWLEDGE

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1. INTRODUCTION

TOBIN were appointed by RWE Renewables Ireland Ltd. to undertake a Flood Risk Assessment (FRA) for a proposed wind farm at Ballincor, on the border between County Offaly and County Tipperary.

The subject site is located approximately 5km south of Birr and 13km east of Borrisokane (see Figure 1-1) and the proposed development includes the construction of 11 wind turbines, substation, BESS, Met Mast and their access tracks.

The Planning System and Flood Risk Management (PSFRM) Guidelines categorise types of development into three vulnerability classes based on their sensitivity to flooding. As per Table 2.1 for the classification of vulnerability of different types of development in the PSFRM Guidelines, electricity generating power stations are classified as “essential infrastructure”. And as such are considered appropriate in Flood Zone C (Low probability of flooding i.e., 0.1% AEP).

The subject site is bounded to the northwest by the L1071 Road and to the southeast by the R492 Road. The north, south, and west of the subject site are bounded by agricultural land. The east of the site is bounded by bogland. There are staggered houses in all directions from the subject site

The hydraulic features of particular interest to the subject site are the Little Brosna River and its tributaries. The Little Brosna River Flows along the majority of the eastern boundary of the subject site, with three of its tributaries flowing through the northern portion of the subject site (The Holy Well Clohaskin, Rath Beg, and Pallas 25 Rivers). The Little Brosna River originates in its headwaters 5km south of the subject site, where the Kilcomin and Keeloge Streams join. The river then flows 5.5km east before flowing north along the eastern boundary of the wind farm site and eventually draining into the River Shannon approximately 20km northwest of the subject site.

The purpose of this Stage 2 FRA report is to identify, quantify, and communicate the risks of flooding, if any, to the proposed development.



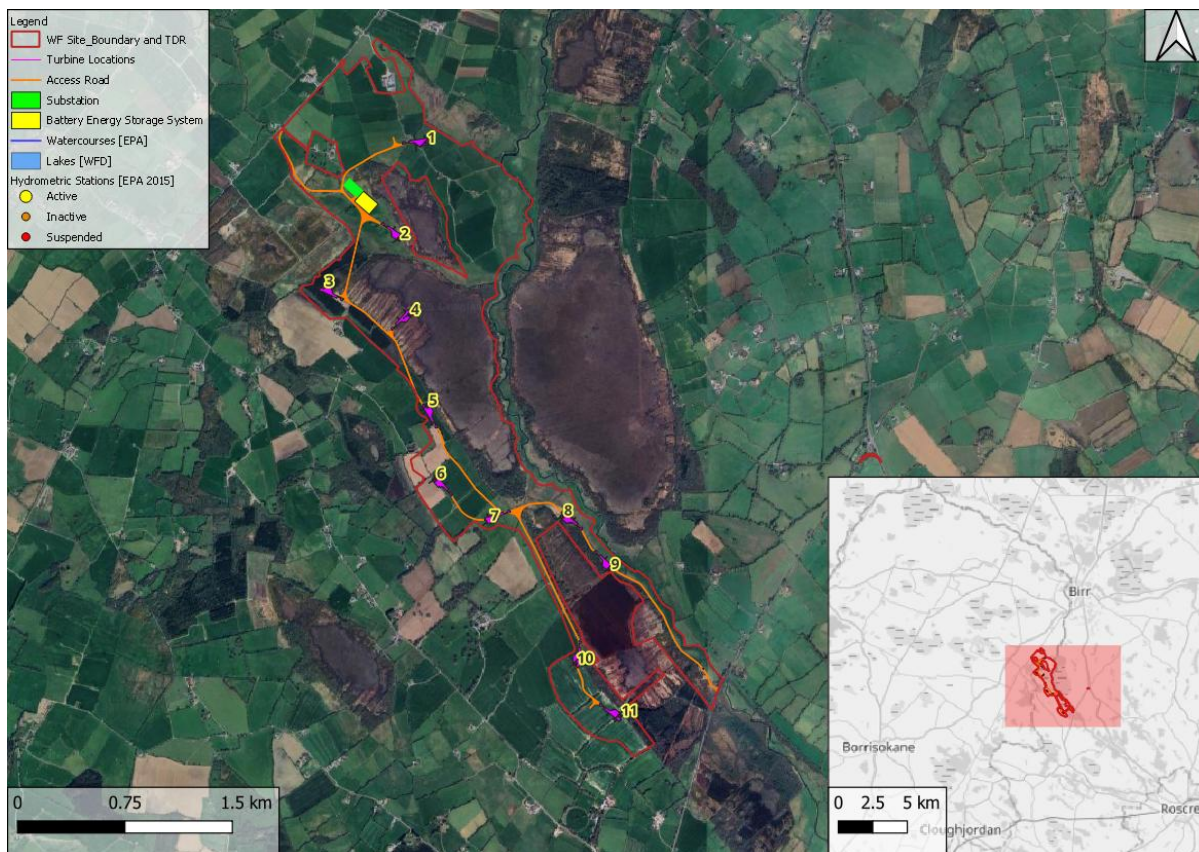


Figure 1-1 Site Location



2. FLOOD RISK MANAGEMENT GUIDANCE

This Stage 2 Flood Risk Assessment was carried out in accordance with the following flood risk management guidance documents:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities
- Flood Risk Management Climate Change Sectoral Adaptation Plan
- Offaly County Development Plan (2021 – 2027)
- Tipperary County Development Plan (2022 – 2028)

2.1 THE PLANNING SYSTEM AND FLOOD RISK MANAGEMENT GUIDELINES

The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM Guidelines) were published in 2009 by the Office of Public Works (OPW) and Department of the Environment, Heritage, and Local Government (DoEHLG). Their aim is to ensure that flood risk is considered in development proposals and the assessment of planning applications.

2.1.1 Flood Zones and Vulnerability Classes

The PSFRM Guidelines discuss flood risk in terms of three flood zones (A, B, and C), which correspond to areas of high, medium, or low probability of flooding, respectively. The extents of each flood zone are based on the Annual Exceedance Probability (AEP) of various flood events.

The PSFRM Guidelines also categorise different types of development into three vulnerability classes based on their sensitivity to flooding. The PSFRM guidelines state that the proposed wind farm is classified as “essential infrastructure”. The proposed development is therefore appropriate in Flood Zone C (low probability of flooding i.e., less frequently than 0.1% AEP event).

Table 2.1 shows a decision matrix that indicates which types of development are appropriate in each flood zone and when the Justification Test (see Section 2.1.2) must be satisfied. The annual exceedance probabilities used to define each flood zone are also provided.

Table 2.1: Decision Matrix for Determining the Appropriateness of a Development

Flood Zone: (Probability)	Annual Exceedance Probability (AEP)	Highly Vulnerable	Less Vulnerable	Water Compatible
A (High)	<u>Coastal Flooding</u> More frequent than 0.5% AEP	Justification Test Required	Justification Test Required	Appropriate
	<u>Fluvial & Pluvial Flooding</u> More frequent than 1% AEP			
B (Medium)	<u>Coastal Flooding</u> 0.1% to 0.5% to AEP	Justification Test Required	Appropriate	Appropriate
	<u>Fluvial & Pluvial Flooding</u> 0.1% to 1% AEP			
C (Low)	<u>Fluvial, Pluvial & Coastal Flooding</u> Less frequent than 0.1% AEP	Appropriate	Appropriate	Appropriate



2.1.2 Justification Test

Any proposed development being considered in an inappropriate flood zone (as determined by Table 2.1) must satisfy the criteria of the Justification Test outlined in Figure 2-1 (taken from the PSFRM Guidelines).

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 also 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.

Figure 2-1: Criteria of the Justification Test

2.2 THE FLOOD RISK MANAGEMENT CLIMATE ADAPTION PLAN

The Flood Risk Management Climate Change Sectoral Adaptation Plan was published in 2019 and updated in 2025 under the National Adaptation Framework and Climate Action Plan. This plan outlines the OPW’s approach to climate change adaptation in terms of flood risk management.

This approach is based on a current understanding of the potential impacts of climate change on flooding and flood risk. Research has shown that climate change is likely to worsen flooding through more extreme rainfall patterns, more severe river flows, and rising mean sea levels.

To account for these changes, the Adaptation Plan presents two future flood risk scenarios to consider when assessing flood risk:

- Mid-Range Future Scenario (MRFS)
- High-End Future Scenario (HEFS)

Table 2.2 indicates the allowances that should be added to estimates of extreme rainfall depths, peak flood flows, and mean sea levels for the future scenarios.

Table 2.2: Climate Change Adaptation Allowances for Future Flood Risk Scenarios

Parameter	Mid-Range Future Scenario (MRFS)	High-End Future Scenario (HEFS)
Extreme Rainfall Depths	+ 20%	+ 30%
Peak River Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 0.5 m	+ 1 m

For the purpose of this flood risk assessment, the proposed development has been assessed against the Mid-Range Future Scenario as it represents a likely future scenario.

2.3 OFFALY COUNTY DEVELOPMENT PLAN (2021 – 2027)

The current Offaly County Development Plan 2021-2027 was adopted on 10th September 2021 and came into effect 20th October 2021, providing a strategic framework for planning and sustainable development in county Offaly. Chapter 3 outlines Offaly County Council’s strategy for Climate Action and Energy, with Section 3.5 outlining County policies for Flood Risk Management, referencing the Strategic Flood Risk Assessment (SFRA) prepared to consider flood risk within the Plan boundary.

In accordance with The Planning System and Flood Risk Management, Guidelines for Planning Authorities, a Strategic Flood Risk Assessment (SFRA) was prepared to assess flood risk within the Plan area, and it formed part of the Offaly County Development Plan as a separate document.

A number of approaches to managing flood risk in the county have been employed in helping to make the Plan and are recommended particularly for dealing with planning applications. These include:



1. Areas at risk of flooding have been identified and there is a greater understanding of why flooding occurs in the general area.
2. A precautionary approach has largely been employed to landuse zoning to avoid directing development towards areas at risk of flooding. Under the Plan, no highly or less vulnerable land uses are being proposed on undeveloped lands in Flood Zone A (high flood risk) and no highly vulnerable land uses are being proposed on undeveloped lands in Flood Zone B (moderate flood risk). This is because a Constrained Land Uses designation (see Section 12.6.1 and the SFRA that accompanies the Plan) is being applied through the Plan across all lands within Flood Zones A and B.
3. A site-specific flood risk assessment will be required to accompany development proposals for areas at risk of flooding (fluvial, pluvial or groundwater), even for developments deemed appropriate in principle to the particular Flood Zone and mitigation measures for site and building works will be required to be integrated.
4. Policies and objectives have been devised in the SFRA for incorporation into this plan’.

2.4 TIPPERARY COUNTY DEVELOPMENT (PLAN 2022-2028)

The current Tipperary County Development Plan provides a strategic framework for land use planning in county Tipperary for 2022 to 2028. This Plan, through its supporting Environmental Reports (SEA Environmental Report, Natura Impact Statement and Strategic Flood Risk Assessment) as set out in Volume 5, focuses on the way that the natural environment works as a system. Environmental protection is a core objective, and the Council will seek, at all times, to integrate sustainable economic and social development with the protection and enhancement of our natural environment, and the natural services on which we depend.

Section 11.9 outlines the policies of Tipperary County Council to Surface Water and Flooding, incorporating the PSFRM Guidelines.

The associated policies are as follows:

- 11-9 Assess all new developments (both within and without designated Flood Risk Zones) in line with the ‘Staged Approach’ and pre-cautionary principle set out in the Planning System and Flood Risk Management Guidelines for Planning Authorities, (DEHLG, 2009) and any amendment thereof, and the following:
- (a) Require the submission of site-specific Flood Risk Assessments for developments undertaken within Flood Zones A & B and on lands subject to the mid-range future scenario floods extents, as published by the OPW. These Flood Risk Assessments shall consider climate change impacts and adaptation measures including details of structural and non-structural flood risk management measures, such as those relating to floor levels, internal layout, flood-resistant construction, flood-resilient construction, emergency response planning and access and egress during flood events.
 - (b) SFRA’s and site-specific flood risk assessments shall provide information on the implications of climate change with regard to flood risk in relevant locations. The 2009



OPW Draft Guidance on Assessment of Potential Future Scenarios for Flood Risk Management (or any superseding document) shall be consulted with to this effect.

(c) Ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the OPW Climate Change Sectoral Adaptation Plan for Flood Risk Management applicable at the time.

(d) Applications for development on land identified as ‘benefitting land’ may be prone to flooding, and as such site-specific flood risk assessments may be required in these areas.

(e) Require applications for new development, or for an extension to an existing development on land zoned for ‘Social and Public’ or ‘Amenity’ use and where a potential flood risk is identified, and where the proposed use might be vulnerable, to be subject to site-specific flood risk assessment to the satisfaction of the Council.

11-10 (a) Flood risk assessments shall incorporate consideration of climate change impacts and adaptation measures with regard to flood risk, and,

(b) Flood risk management planning shall determine actions to embed and provide for effective climate change adaptation as set out in the OPW ‘Climate Change Sectoral Adaptation Plan for Flood Risk Management’ applicable at the time.

11-11 (a) Ensure that new developments proposed in ‘Arterial Drainage Schemes’ and ‘Drainage Districts’ do not result in a significant negative impact on the integrity, function and management of these areas.

(b) Consult with the OPW in relation to proposed developments in the vicinity of Flood Relief Schemes and drainage channels and rivers for which the OPW are responsible, and to retain a strip on either side of such channels, where required, to facilitate maintenance access thereto.

(c) Protect the integrity of any formal flood risk management infrastructure (see key flood risk infrastructure identified in Section 2.2 “Drainage, Key Flood Risk Infrastructure and Early Warning Systems” of the SFRA), thereby ensuring that any new development does not negatively impact any existing defence infrastructure or compromise any proposed new defence infrastructure

11-F (a) To support and facilitate the CFRAM Programme, and to support the OPW in the development and implementation of sustainable flood risk management plans and actions.

(b) To consider, as appropriate any new and/or emerging data, including, when available, any relevant information contained in the CFRAM Programme Flood Risk Management Plans.



3. INITIAL FLOOD RISK ASSESSMENT

3.1 PAST FLOOD EVENTS

The OPW's National Flood Information Portal¹ provides past flood event mapping with records of flooding reports, meeting minutes, photos, and/or hydrometric data. Based on the flood map shown in Figure 3-1, there are no historical flood events recorded in the vicinity of the subject site. The closest past flood event to the subject site is located approximately 1.8km east of the subject site. These events are not hydraulically linked to the subject site, as they are not located on a river or stream that flows to the site.

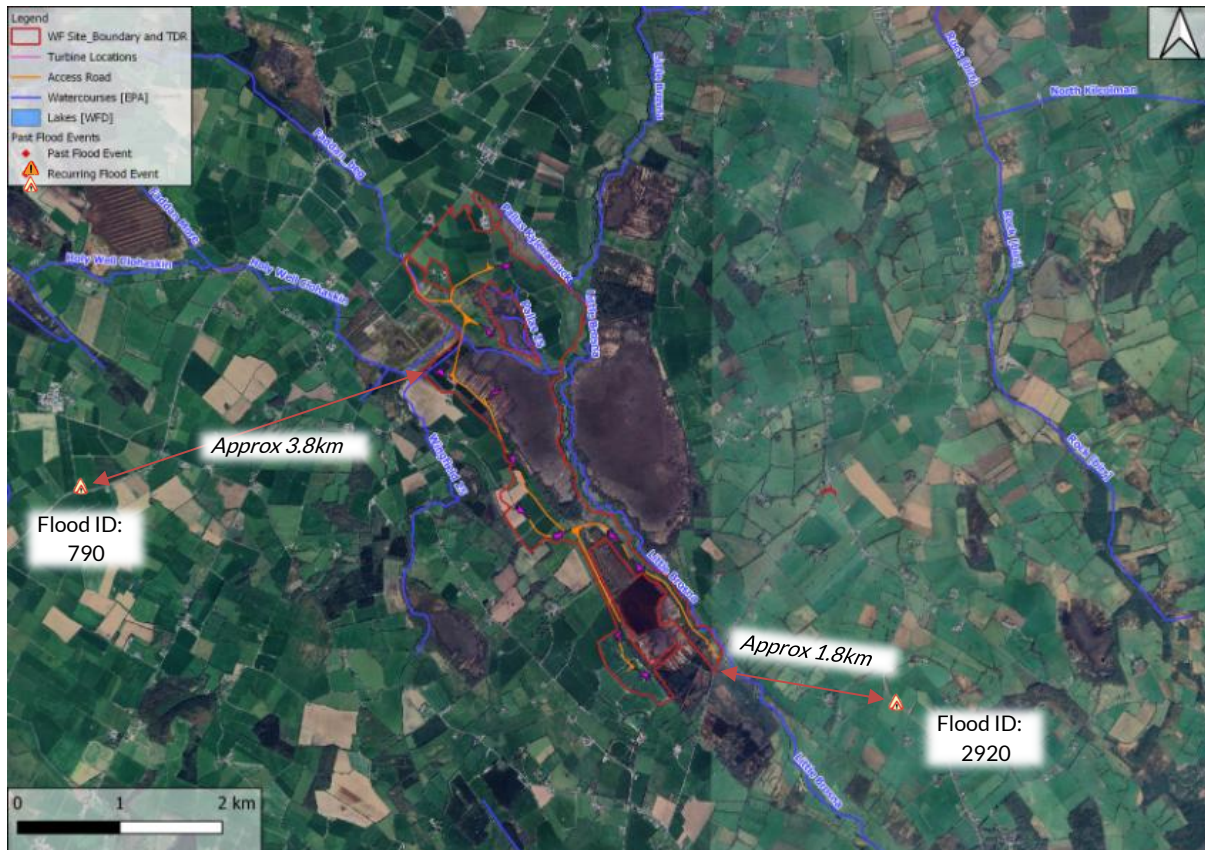


Figure 3-1: Past Flood Events

¹ floodinfo.ie



3.2 OPW PRELIMINARY FLOOD RISK ASSESSMENT (PFRA) STUDY

In 2009, the OPW produced a series of maps to assist in the development of a broad-scale FRA throughout Ireland. These maps were produced from several sources.

The OPW’s National Preliminary Flood Risk Assessment (PFRA) Overview Report from March 2012 noted that *“the flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location”*.

Figure 3-2 provides an overview of the fluvial, coastal, pluviial, and groundwater indicative flood extents in the vicinity of the subject site.

As per Figure 3-2, the subject site is not predicted to be liable to coastal or groundwater flooding during extreme events.

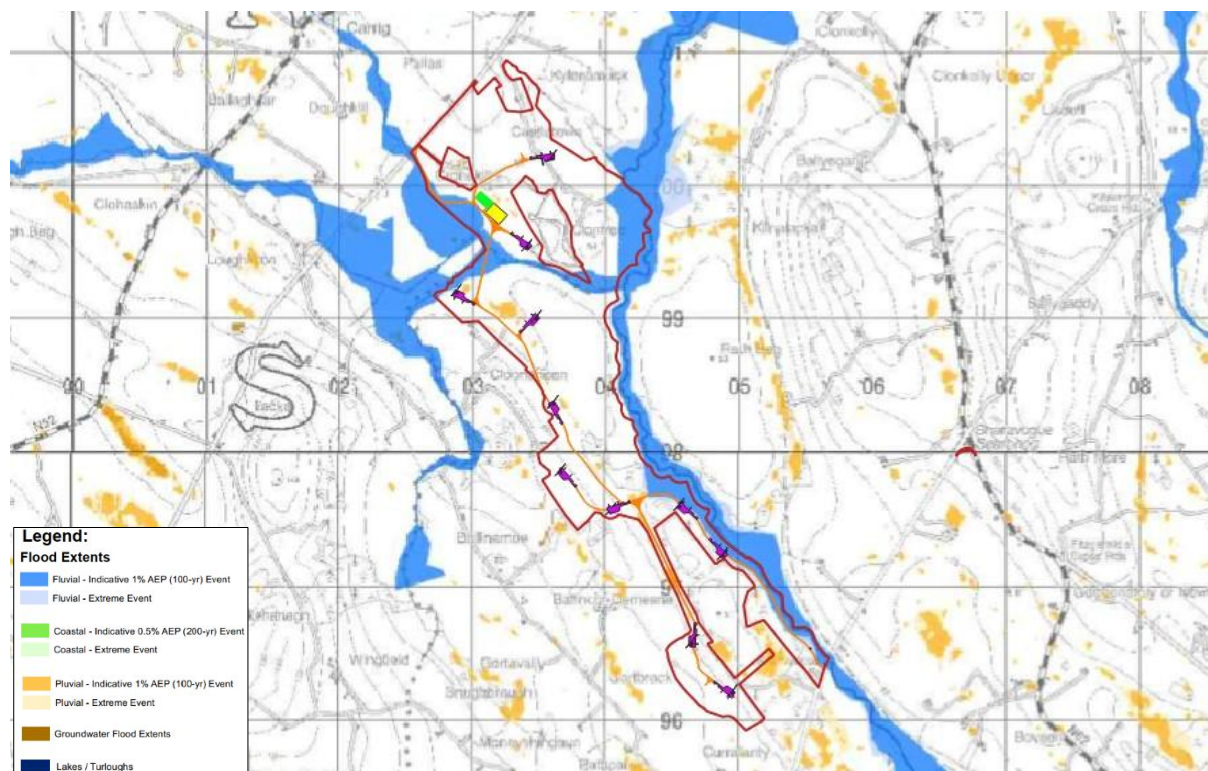


Figure 3-2: Indicative Flood Mapping [extract from PFRA Map 180 & 197]

Figure 3-3 provides mapping of the 1 in 100-year and 1 in 1000-year (1% and 0.1% AEP) PFRA fluvial flood extents.



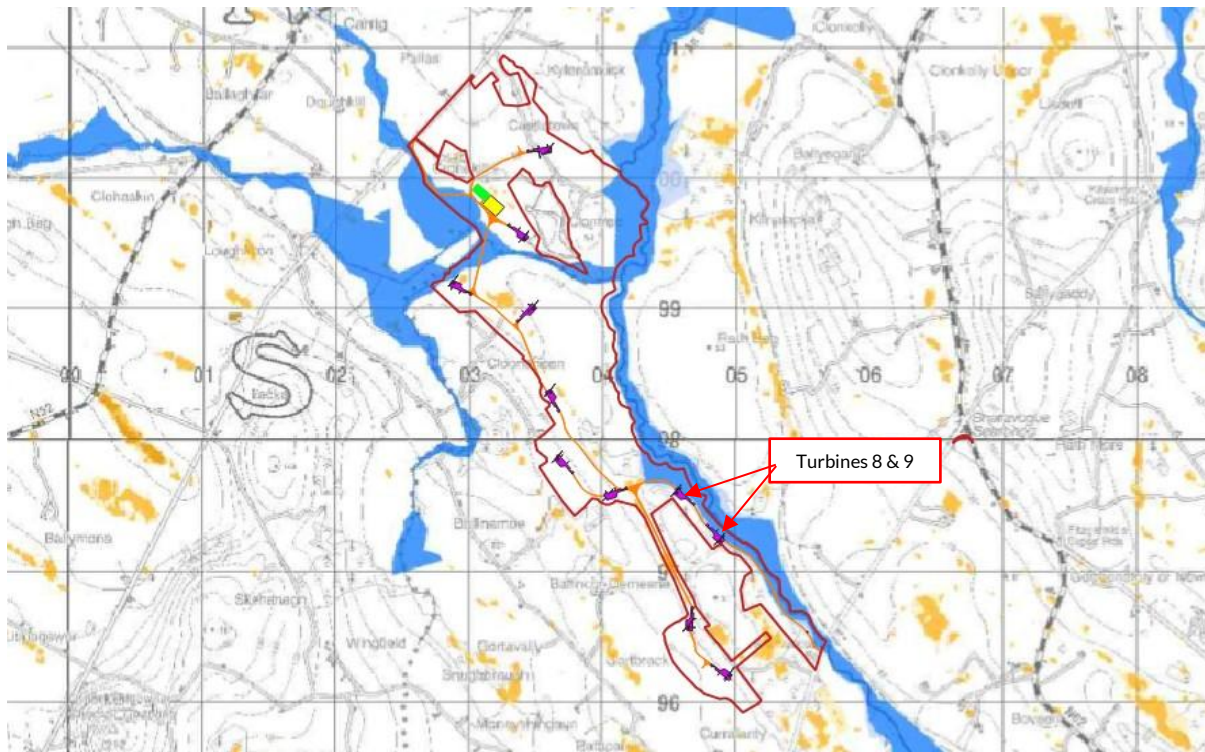


Figure 3-3: PFRA Flood Extents

The PFRA mapping indicates multiple areas of pluvial flooding within the subject site. The pluvial flooding is not expected to affect any of the turbines or access roads. Fluvial flooding as part of the PFRA mapping indicates flooding to turbines 8 and 9, as well as areas on the access roads to the north of the subject site.

It is important to acknowledge the limitations associated with the Preliminary Flood Risk Assessment (PFRA) maps to understand the context and reliability of the flood risk information presented. Key limitations include:

- Assumed channel capacity (due to absence of channel survey information)
- Absence of flood defences and other drainage improvements and channel structures (bridges, weirs, culverts)
- Local errors in the national Digital Terrain Model (DTM)

Improved hydraulic modelling was carried out through the Catchment Flood Risk Assessment and Management Study (CFRAM) in 2015 (discussed in Section 3.3) and is considered more accurate than the PFRA study as it utilised surveyed river geometry and was subject to greater model calibration.



3.3 CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

In 2015, the OPW produced flood maps as part of the Catchment Flood Risk Assessment and Management (CFRAM) Study. The flood extents in these maps are based on detailed modelling of Areas for Further Assessment identified by the National Preliminary Flood Risk Assessment.²

3.3.1 Fluvial Flood Risk (CFRAM)

The River Shannon and many of its tributaries in the vicinity of the subject site are modelled as part of the CFRAM study. CFRAM mapping of the existing 1 in 100-year (1% AEP) and 1 in 1000-year (0.1% AEP) predicted fluvial flood extents, is presented in Figure 3-4. The predicted flood mapping produced as part of the CFRAM Study indicates that the subject site is liable to fluvial flooding in a 1 in 100-year (1% AEP) and 1 in 1000-year (0.1% AEP) event. Turbines 1, 2, 8, and 9 and two of the sites access roads are liable to fluvial flooding in a current event (See Figure 3-5 & Figure 3-6).

- Turbine 1's hardstand base is approximately 25% inundated in a 1 in 100-year (1% AEP) event, with approximately 35% of the area at risk of flooding in a 1 in 1000-year (0.1% AEP) event.
- Turbine 2's hardstand base is approximately 5% inundated in a 1 in 100-year (1% AEP) event, with approximately 25% of the area at risk of flooding in a 1 in 1000-year (0.1% AEP) event.
- Turbine 8's hardstand base is approximately 5% inundated in a 1 in 100-year (1% AEP) event, with a slightly larger area at risk of flooding in a 1 in 1000-year (0.1% AEP) event
- Turbine 9's hardstand base is approximately 50% inundated in a 1 in 100-year (1% AEP) event, with a slightly larger area at risk of flooding in a 1 in 1000-year (0.1% AEP) event

As per the PSFRM guidelines wind farms are required to be located in Flood Zone C (less than 0.1% AEP). As outlined above, there are four turbine locations where portions of the locations are located in Flood Zone A/B, therefore, the Justification Test is required. Access roads are appropriate in Flood Zone B (between 1% and 0.1% AEP), and therefore need to be justified for areas where the roads are not appropriately located.

It should be noted that the substation and the Battery Energy Storage System (BESS) are not within any flood extents and are appropriately located in Flood Zone C.

The tributaries of the Little Brosna River were not modelled as part of the CFRAM Study as they were not considered as Areas for further Assessment (AFA).

² https://www.floodinfo.ie/about_frm/



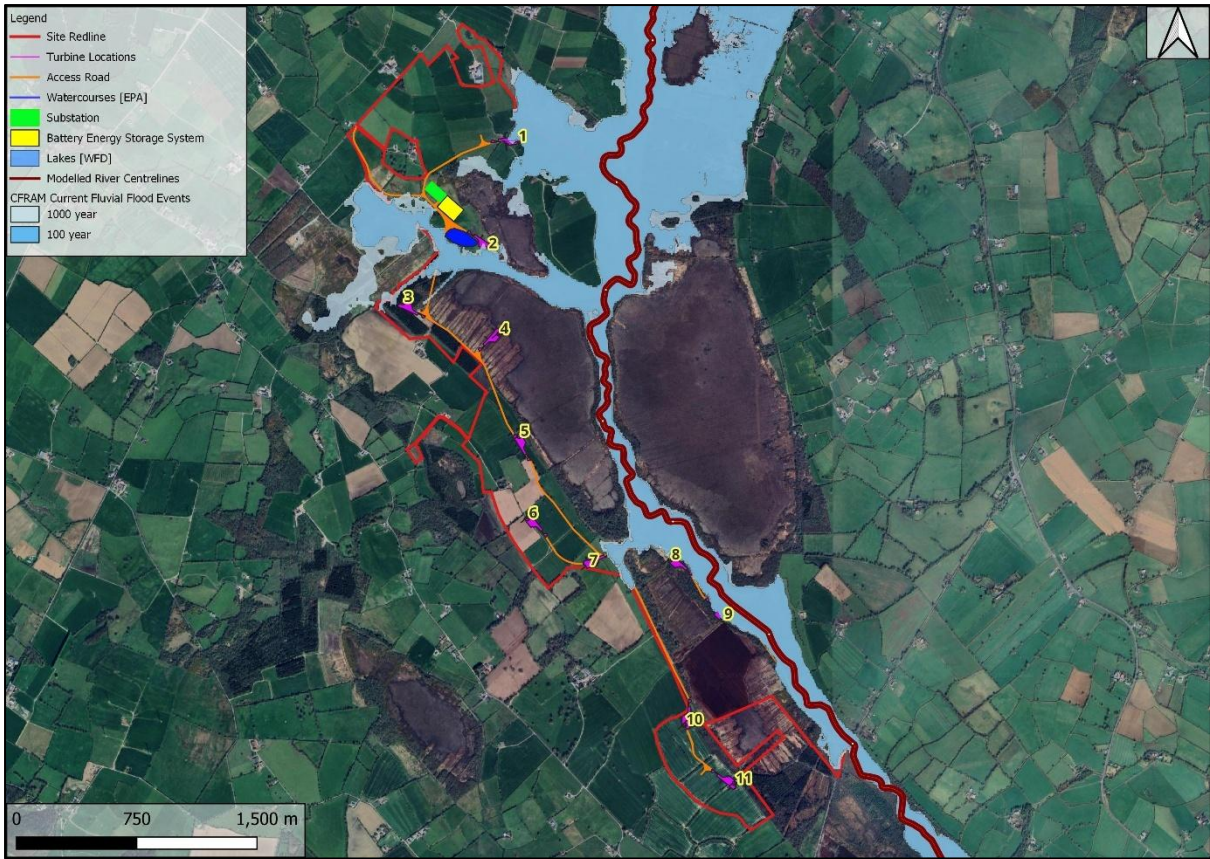
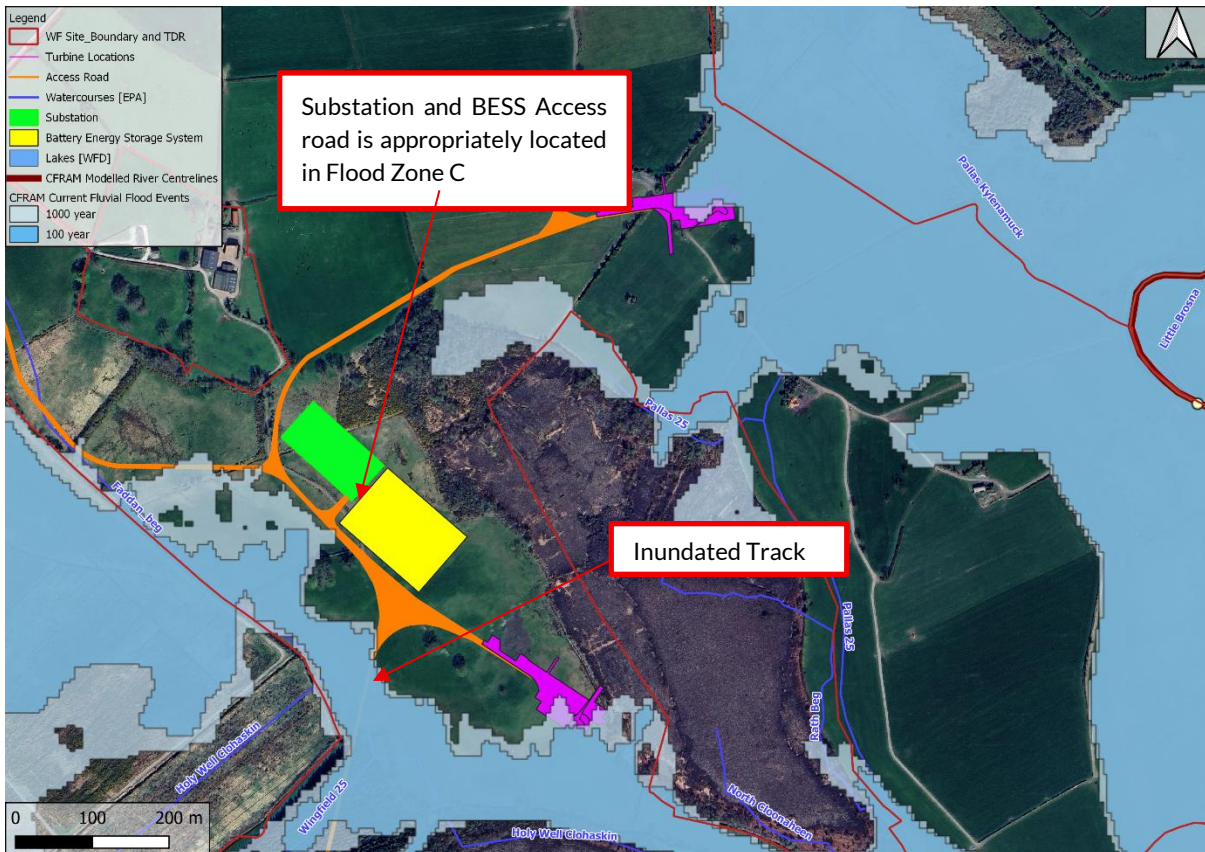


Figure 3-4: CFRAM Existing Fluvial Flood Extents

Figure 3-5: CFRAM Existing Fluvial Flood Extents – Turbines 1 & 2



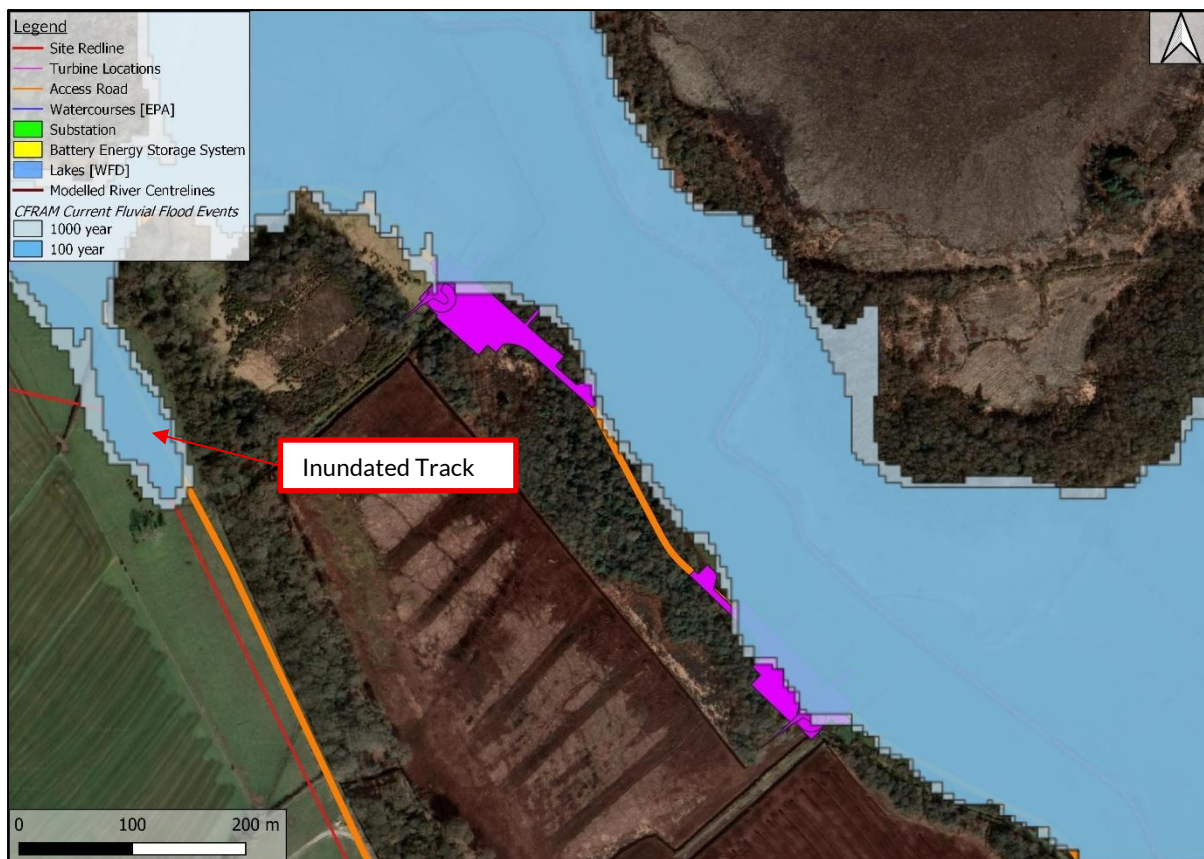


Figure 3-6: CFRAM Existing Fluvial Flood Extents – Turbines 8 & 9

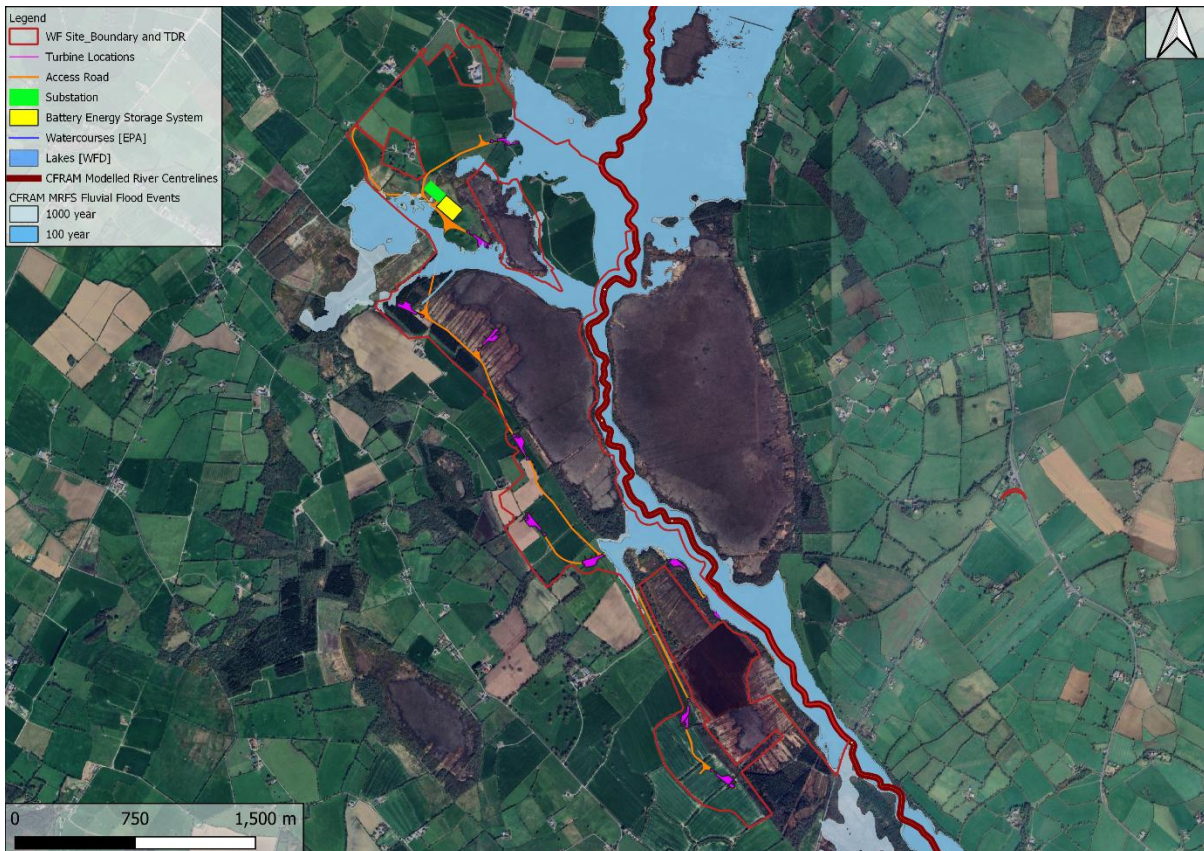


Figure 3-7 indicates the MRFS fluvial flood extents produced as part of the CFRAM Study during the 1 in 100-year (1% AEP) and 1 in 1000-year (0.1% AEP) flood event. Again, turbines 1, 2, 8, and 9 and access roads are all liable to fluvial flooding (Figure 3-8 and Figure 3-9). The further flood extents with the MRFS do not inundate any of the other turbines or access roads.

- Turbine 1's hardstand base is approximately 40% inundated in a 1 in 100-year (1% AEP) event, with a slightly larger area at risk of flooding in a 1 in 1000-year (0.1% AEP) event.
- Turbine 2's hardstand base is approximately 25% inundated in a 1 in 100-year (1% AEP) event, with a slightly larger area at risk of flooding in a 1 in 1000-year (0.1% AEP) event.
- Turbine 8's hardstand base is approximately 15% inundated in a 1 in 100-year (1% AEP) event, with a slightly larger area at risk of flooding in a 1 in 1000-year (0.1% AEP) event.
- Turbine 9's hardstand base is approximately 75% inundated in a 1 in 100-year (1% AEP) event, with a slightly larger area at risk of flooding in a 1 in 1000-year (0.1% AEP) event.



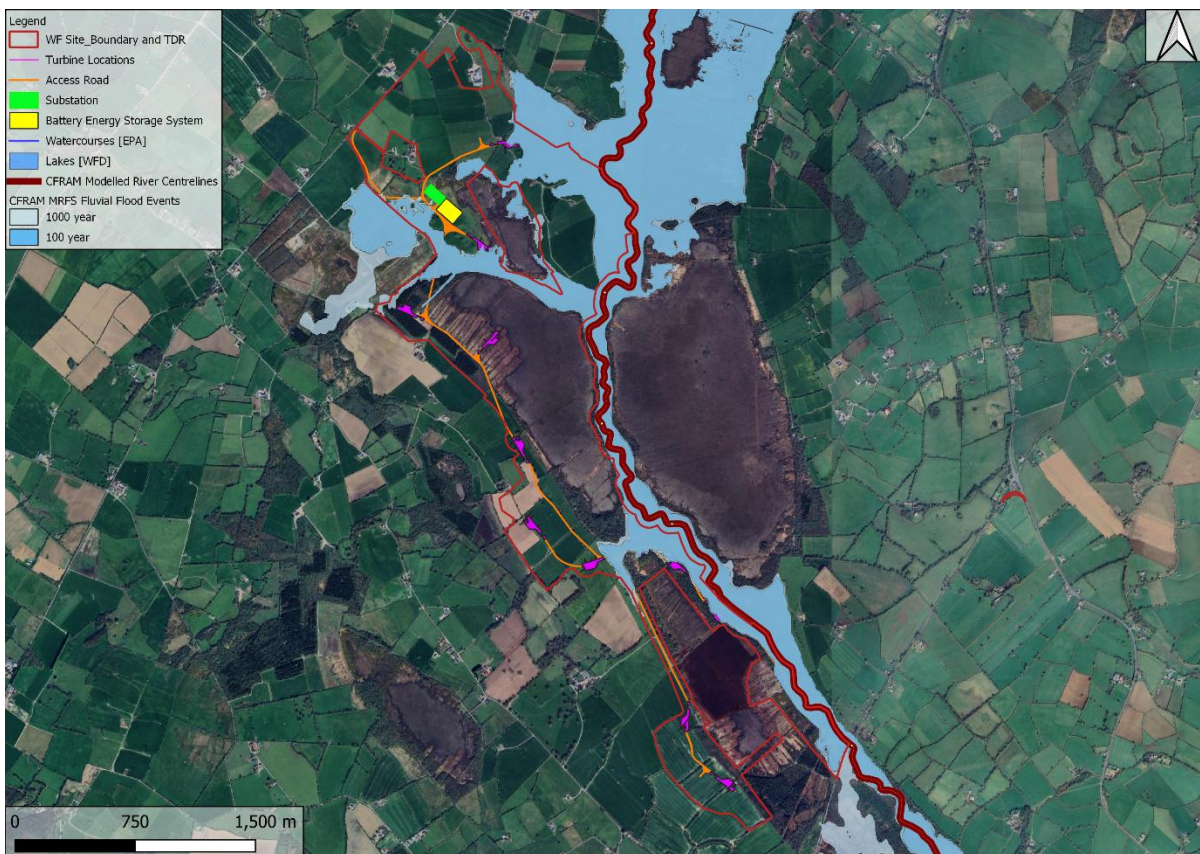


Figure 3-7: CFRAM MRFS Fluvial Flood Extents

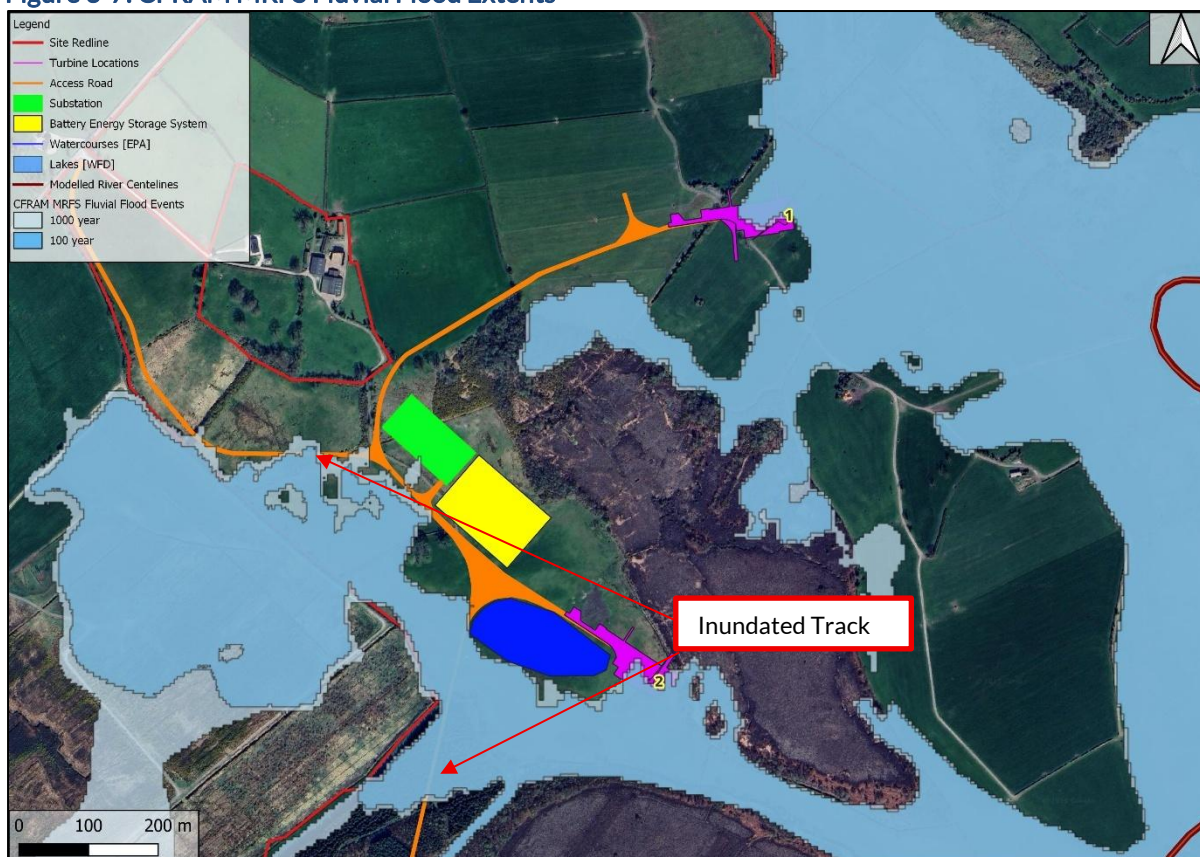


Figure 3-8: CFRAM MRFS Fluvial Flood Extents - Turbines 1 & 2



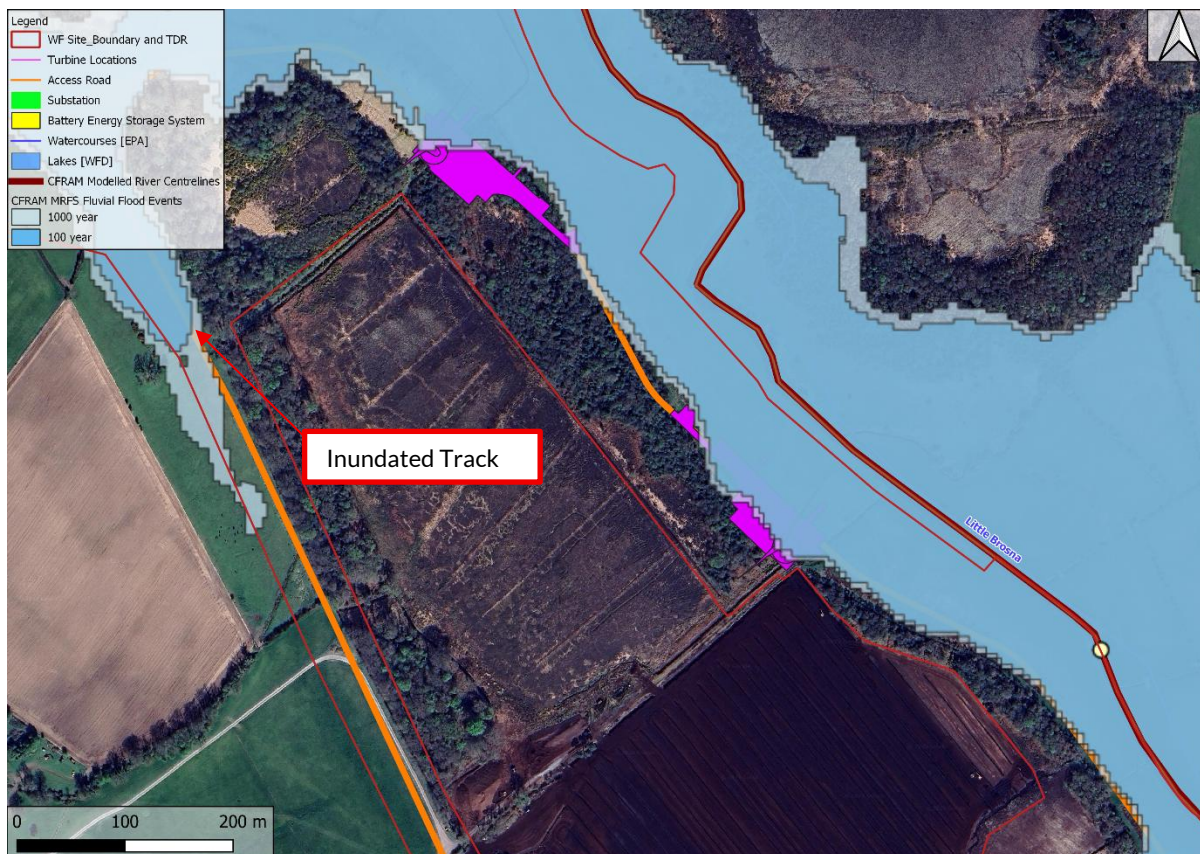


Figure 3-9: CFRAM MRFS Fluvial Flood Extents - Turbines 8 & 9

3.3.2 Coastal flood Risk (CFRAM)

The subject site is more than 75km inland. Therefore, there is no risk of coastal flooding to the subject site.



3.4 OPW DRAINAGE DISTRICTS AND ARTERIAL DRAINAGE SCHEMES

The OPW Drainage Districts were carried out by the commissioners of Public Works under a number of drainage and navigation acts from 1842 to the 1930s to improve land for agriculture and to mitigate flooding.³ The local authorities are charged with the responsibility to maintain Drainage Districts.

Benefited lands are areas that were previously subject to poor drainage and/or flooding but that have benefited from the implementation of Arterial Drainage Schemes carried out under the Arterial Drainage Act 1945.

The subject site has benefited from an arterial drainage scheme. The Little Brosna River is a land commission watercourse and it, along with many of its tributaries are seen to benefit from the scheme.

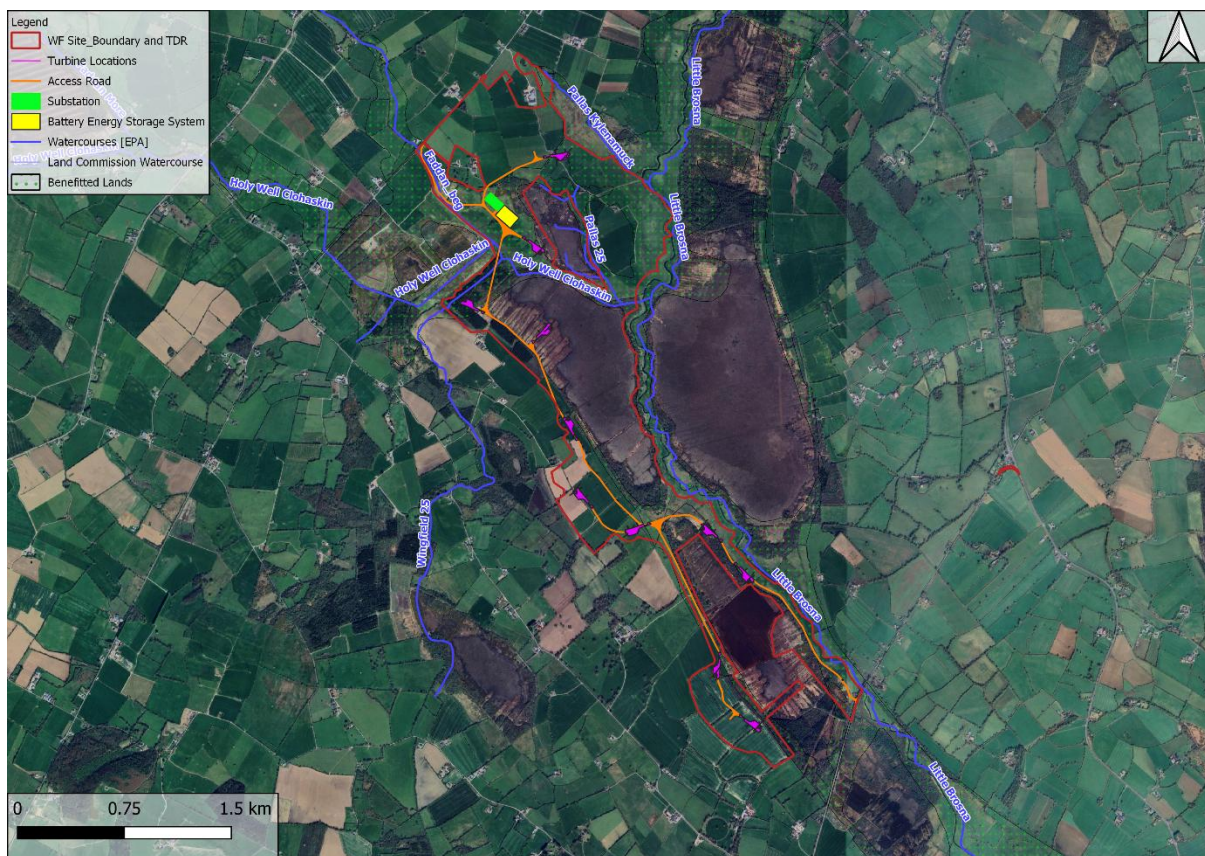


Figure 3-10: Arterial Drainage

³ www.floodinfo.ie



3.5 GEOLOGICAL SURVEY IRELAND MAPPING

Based on a review of the OPW’s Preliminary Flood Risk Assessment (PFRA) mapping (see Figure 3-2) there is no noted risk of groundwater flooding to the subject site.

GSI Groundwater Flooding Probability Maps⁴ for the subject site were reviewed. There are no GSI historic groundwater flood extents in the vicinity of the subject site. The closest groundwater extent is approximately 2.3km east of the subject site. There are surface water flood extents noted within the site boundary. These extents are expected to be as a result of the Little Brosna River and its tributaries. The SAR Seasonal mapping from 2015 to 2021 shows a further increase in the surface water flood extents, again assumed to be as a result of the Little Brosna River and its tributaries.



Figure 3-11: GSI Mapping of Groundwater Flooding

Geological Survey Ireland (GSI) subsurface mapping of karst features⁵ in the area show that there is no karst features located in the vicinity of the subject site (see Figure 3-12). The closest karst features to the subject site are two springs located 2.4km northeast of the site.

⁴FloodInfo.ie | National Flood Information Portal, Available at: <https://www.floodinfo.ie/map/floodmaps/>

⁵GSI Groundwater Data Viewer, Available at: <https://dcnr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef>



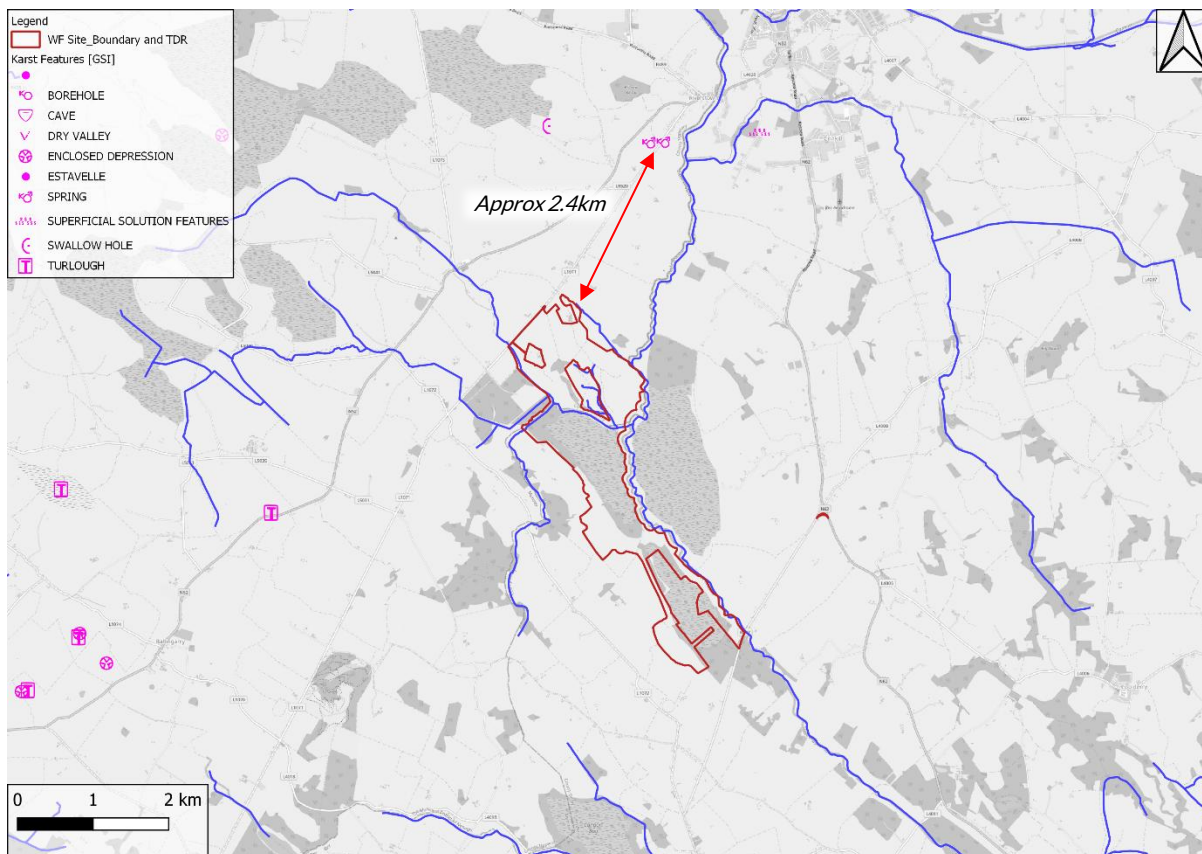


Figure 3-12: GSI Mapping of Karst Features



4. DETAILED FLOOD RISK ASSESSMENT

With reference to the PSFRM guidelines, the proposed development is comprised of 'highly vulnerable' (wind farm and access roads) and 'water compatible' (open space) elements.

Therefore, wind farm is considered appropriate in Flood Zone C (Low probability of flooding i.e., 0.1% AEP), Access roads are appropriate in Flood Zone B (between 1% and 0.1% AEP) and open spaces are appropriate in any flood zone

4.1 FLUVIAL FLOODING

The hydraulic features of consideration to the subject site are the Little Brosna River and many of its tributaries (Pallas Kyleneamuck stream, Pallas 25 stream, Rathbeg stream, and the Holy Well Clohaskin stream). CFRAM mapping indicates that the subject site is liable to fluvial

Based on fluvial extent mapping from the CFRAM study, four turbines and two sections of the access road are identified as being at risk of flooding during both 1 in 100-year (1% AEP) and 1 in 1000-year (0.1% AEP) fluvial flood events. Approximately 25% of Turbine 1 hardstand base inundated in a 1% AEP event, increasing to around 35% in a 0.1% AEP event. Turbine 2 and Turbine 8 each experience about 5% inundation in a 1% AEP event, with Turbine 2's flood extent rising to 25% in a 0.1% AEP event, while Turbine 8 sees a slight increase. Turbine 9 is most impacted, with around 50% of its base inundated in a 1% AEP event and a marginally larger area affected in a 0.1% AEP event. All these turbine locations show increased flood extents under the Mid-Range Future Scenario (MRFS), indicating a potential escalation in flood risk over time.

LiDAR data was used to estimate the water level in the 1 in 1000-year (0.1% AEP) MRFS event. The estimated max water level in a 1 in 1000-year (0.1% AEP) event was 46.2mOD. Adding an additional 300mm to account for freeboard gave a **minimum level of 46.5mOD**. It is recommended that all critical infrastructure is constructed to this level.

Some areas of the flood plain in the vicinity of the subject site are removed due to the construction of the turbine hardstanding areas and roads, to compensate for the removed flood plain compensatory storage is proposed. The compensation storage has an area of approximately 14000m² and is located to the south of access road to Turbine 2. In order to compensate for the approximate 3,000m³ of flood plain removed, the compensation storage should have a depth of approximately 1m. The location of the compensation storage is shown in Figure 4-1.



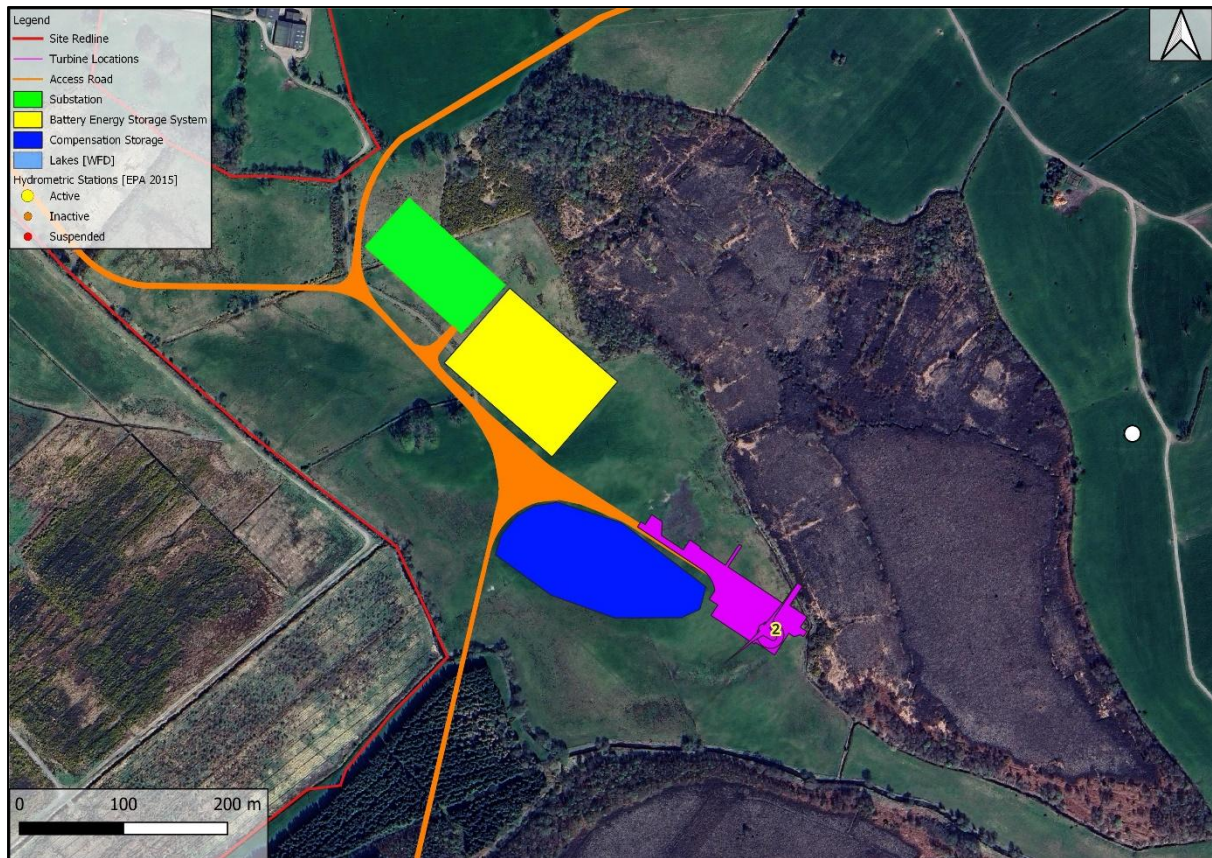


Figure 4-1: Compensation Storage

Therefore, provided that the minimum level of 46.5mOD is adhered to for the four vulnerable turbine locations, it is estimated that risk of fluvial flooding associated with the proposed development is minimal. The areas of the access tracks which are liable to fluvial flooding in the 1 in 100-year (1% AEP) events will be justified in Section 4.5

It should be noted that any areas where the proposed access road is required to go over one of the existing watercourses, a section 50 application for the bridge/culvert must be submitted.

4.2 COASTAL FLOODING

The subject site is located approximately 75km inland from the sea and therefore it is estimated that the risk of coastal flooding associated with the development is minimal.

4.3 PLUVIAL FLOODING

The PFRA indicative mapping indicates that there are multiple areas of the subject site liable to pluvial flooding. The extents do not inundate any of the turbines or access roads. The hardstanding areas of the turbines will be raised and ensure that the turbines are not located in any localised depressions, therefore reducing the pluvial flood risk to the at risk areas.

Surface water arising on the proposed wind farm will be managed by a dedicated stormwater drainage system in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.



The landscaping and topography of the developed site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Therefore, it is estimated that risk of pluvial flooding associated with the proposed development is minimal.

4.4 GROUNDWATER FLOODING

Based on a review of Geological Survey Ireland (GSI) subsurface mapping of karst features (Figure 3-12), predicted groundwater flooding in the area (Figure 3-11), and the PFRA study (Figure 3-2), there is no evidence to suggest liability to groundwater flooding at the proposed development site. The SAR Seasonal map however shows some small areas of the hardstanding areas and access road as liable to surface water flooding. It is expected that the developed side, with raised lands to accommodate the road and hardstanding will remove this groundwater flood risk

4.5 THE JUSTIFICATION TEST

With reference to the PSFRM Guidelines, aspects of the proposed development are considered “highly vulnerable” in terms of its sensitivity to flooding, appropriate for construction in Flood Zone C, where the probability of flooding is less than 1 in 1000-year (0.1% AEP). Access roads are considered “less vulnerable”, and therefore appropriate in Flood Zone B, where the probability of flooding is less than 1 in 100-year (1% AEP).

Based on the findings of this Flood Risk Assessment, as outlined in Section 3.3, some of the “highly vulnerable” developments are located within fluvial Flood Zone A and B, and some of the “less vulnerable” developments are located within fluvial Flood Zone A.

1. The site has not been zoned as part of the Offaly or Tipperary County Development Plans (2021 – 2027 and 2022-2028 respectively), however a comprehensive site selection process considering land ownership and environmental limitations identified this area as the most suitable location for the wind farm.
2. The proposed development has been subject to this Flood Risk Assessment.
 - (i) It is predicted that the development will not increase the risk of fluvial flooding elsewhere as it will not sever any existing flow paths. The river crossing proposed between turbines 2 and 3 will be designed to the requirements of a Section 50 Application. The total area of flood plain expected to be removed as a result of raising the hardstanding areas is approximately 0.011km², whereas the estimated total floodplain in the vicinity of the subject site is approximately 3.085km². The total loss of floodplain is therefore negligible in relation to the whole floodplain. An additional 14,000m³ (0.014km²) of compensation storage will be provided to replace the floodplain which is removed by the hardstanding areas.



The surface water arising within the hardstanding areas of the proposed development will also be managed by a dedicated stormwater drainage system in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

- (ii) All critical infrastructure will be constructed at least 300mm above the 1 in 1000-year (0.1% AEP) MRFS fluvial flood level, to a **minimum level of 46.5mOD**. The turbines and substation and BESS will be largely unmanned, only accessed in times where maintenance is required. Maintenance can be rescheduled to another date when there are large amounts of rainfall recorded in the previous days. Access roads are only used to provide maintenance to the turbines and are therefore not to be used after any heavy rainfall. The access road which provides access to the substation is located in Flood Zone C and therefore, access can be remained during extreme storm events in case of emergencies.
- (iii) Residual risks to the site and to the proposed development during an extreme flood event can be managed to an acceptable level through the measures mentioned above, a dedicated storm water drainage system and effective landscaping and topography. An emergency management plan will be prepared to ensure the development is empty during a flood event. The development involves raising the vulnerable elements (Turbines 1, 2, 8 and 9) above the 1 in 1000-year (0.1% AEP) MRFS flood level.
- (iv) The proposed development is compatible with the wider planning objectives of the area, which promotes sustainable growth and development.

The proposed development, therefore, satisfies the PSFRM criteria for the Justification Test.



5. CONCLUSIONS

TOBIN were appointed by RWE Renewables Ireland Ltd. to undertake a Flood Risk Assessment (FRA) for lands and proposed wind farm at Ballincor, on the border between County Offaly and County Tipperary.

With reference to the PSFRM guidelines, the proposed development is comprised of “highly vulnerable” (essential infrastructure) elements.

Fluvial Flooding

Based on a review of available information, it was estimated that four of the turbines are at risk of fluvial flooding (Turbines 1, 2, 8, and 9). The amount of inundation varies at each turbine, with Turbine 8’s hardstand being the least inundated and Turbine 9’s hardstand being the most. All of the four mentioned Turbines hardstands are liable to fluvial flooding in both 1 in 100-year and 1 in 1000-year (1% & 0.1% AEP) Current and MRFS events.

In order to ensure the turbines are not at risk of fluvial flooding it is proposed that their critical infrastructure are raised above that of the 1 in 1000-year (0.1% AEP) MRFS event, with additional freeboard added. It is proposed that all critical infrastructure will have a **minimum level of 46.5mOD**.

Approximately 14,000m³ of compensation storage is proposed adjacent to Turbine 2, to account for the flood plain lost due to the construction of the hardstanding areas of the turbines.

On this basis, it is estimated that the risk of fluvial flooding to all the critical infrastructure will be minimal. The risk of flooding to the access roads is justified appropriately in Section 4.5.

Coastal Flooding

The subject site is not at risk of coastal flooding due to its distance inland from coastal waters.

Pluvial Flooding

Pluvial flood extents do not inundate any of the turbines or access roads.

Surface water arising on the proposed mixed-use development will be managed by a dedicated stormwater drainage system in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

The landscaping and topography of the developed site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Groundwater Flooding

There is no evidence to suggest groundwater as a potential source of flood risk to the proposed subject site, the raised lands to accommodate the hardstanding area and access road will remove the surface water flood risk to the development.



Based on the results of this flood risk assessment, it is estimated that the risk of flooding to the proposed development will be minimal, and that the development will not increase the risk of flooding elsewhere.





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