Foel Fach Wind Farm Limited.

Foel Fach Wind Farm - Environmental Statement Volume III

Appendix 7.1: Flood Consequences Assessment

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CONTENTS

TABLES

EXECUTIVE SUMMARY

A Flood Consequences Assessment has been prepared for the Proposed Development to assess the flood risk within the Application Site and in areas downstream. The assessment provides an outline strategy for water and drainage management during all phases of the Proposed Development. The Site is largely in areas with no risk of flooding from any source, with no risk of groundwater flooding and a few small areas at risk of localised surface water and small watercourse flooding. Areas downstream of the Site have a higher risk of flooding, including along the Nant Gau and Llyn Maen Bras. The proposed drainage promotes maintenance of natural runoff characteristics where possible, or drainage infrastructure to mimic these characteristics, where required. Runoff attenuation and treatment proposals are designed to prevent any detrimental effects on the water quality or quantity of water features at the Site or downstream.

1 INTRODUCTION

1.1 Introduction

1.1.1 This report provides a Flood Consequences Assessment for Foel Fach Wind Farm and associated infrastructure, hereafter referred to as the 'Proposed Development'.

1.1.2 The report forms a Technical Appendix to Volume II of the Environmental Statement (ES) for the Proposed Development and should be read in conjunction with **ES Volume II, Chapter 7 Land, Soils, and Water** and associated figures in **Volume IV**. It has been produced to address the potential for changes to flood risk in areas downstream of the Proposed Development and to set out principles by which this would be prevented. The assessment includes details of proposed water management and water treatment infrastructure including sustainable drainage options.

1.1.3 For the purposes of this report, the study area is considered to include the application boundary plus an area up to 2 kilometres (km) from the application boundary. In terms of flood risk, downstream effects are considered for greater distances as impacts can be transmitted downstream for considerable distance without appropriate control.

1.2 Site Location

1.2.1 The Application Site ('Site') is located within the administrative boundary of Gwynedd Council, North Wales, approximately 3.1 km north east of Bala. Eryri National Park is situated to the west of the Site, with the nearest turbine (T01) located approximately 1.9 km east of the national park boundary. The Site elevation varies from approximately 225 metres (m) above Ordnance Datum (AOD) to approximately 550 m AOD. The majority of the Site is located on an area of grazing moorland with two parcels of registered common land. Two registered common land parcels are located in the eastern area of the Site. The majority of the land within the Site is Countryside and Rights of Way Open Access land, with areas of agricultural land. A number of Public Rights of Way (PRoW) are present within and adjacent to the Site, although none are nationally designated trails. Small wooded areas are present within the Site. Ancient woodland and larger areas of forestry are present outside the application boundary, to the south.

1.3 Development Proposals

1.3.1 The Proposed Development would include:

- 10 no. three bladed horizontal axis wind turbines, up to 200 or 220 metres in height to the blade tip (where specified)

- wind turbine foundations and hardstanding areas which will include crane pad hardstanding areas and laydown/storage areas
- an onsite substation
- a battery energy storage system (BESS)
- permanent wind monitoring equipment (LiDAR)
- site access improvements, through the upgrading of the existing junction off the B4501
- onsite access tracks (new roads and upgraded existing roads/tracks), passing places and vehicle turning heads
- underground power cables linking the wind turbines and the substation
- watercourse crossings and associated infrastructure
- drainage systems
- micrositing up to 50 m
- onsite signage, and
- biodiversity enhancements proposals.

1.3.2 Full details of the Proposed Development design are provided in **ES Volume II, Chapter 2: Description of the Proposed Development**.

1.4 Aims

1.4.1 In accordance with TAN15, this report aims to undertake a review of the current hydrological setting of the Site, including available information concerning flood risk within the Site and in areas downstream, to provide an outline strategy for water and drainage management during all phases of the Proposed Development process. Recommendations will be made for water management and mitigation that would be implemented to minimise the risk of increasing downstream flood risk because of the Proposed Development works. The outline strategy provided should be used to underpin relevant sections of the detailed design and to fulfil the requirements for a SuDS Approval Body (SAB) application post-consent.

1.5 Assessment Method

1.5.1 This assessment has involved the following stages:

- desk study
- site reconnaissance
- consideration of flooding risk, and
- assessment of drainage characteristics and downstream flood risk.

2 SITE DRAINAGE CHARACTERISTICS

2.1 Introduction

2.1.1 This section outlines the existing drainage characteristics of the Site to determine a baseline against which to assess changes to the drainage regime. Natural drainage characteristics are determined by the Site topography, existing drainage features and natural catchment areas, Site rainfall characteristics, current land use and any existing drainage infrastructure.

2.2 Site Topography

2.2.1 The Site is located on relatively high ground, with elevations ranging from 250 m to 569 m AOD. The highest point within the Site is the peak of Garnedd Fawr in the north which lies at 569 m AOD. The topography of the Site slopes downward from north-east to south.

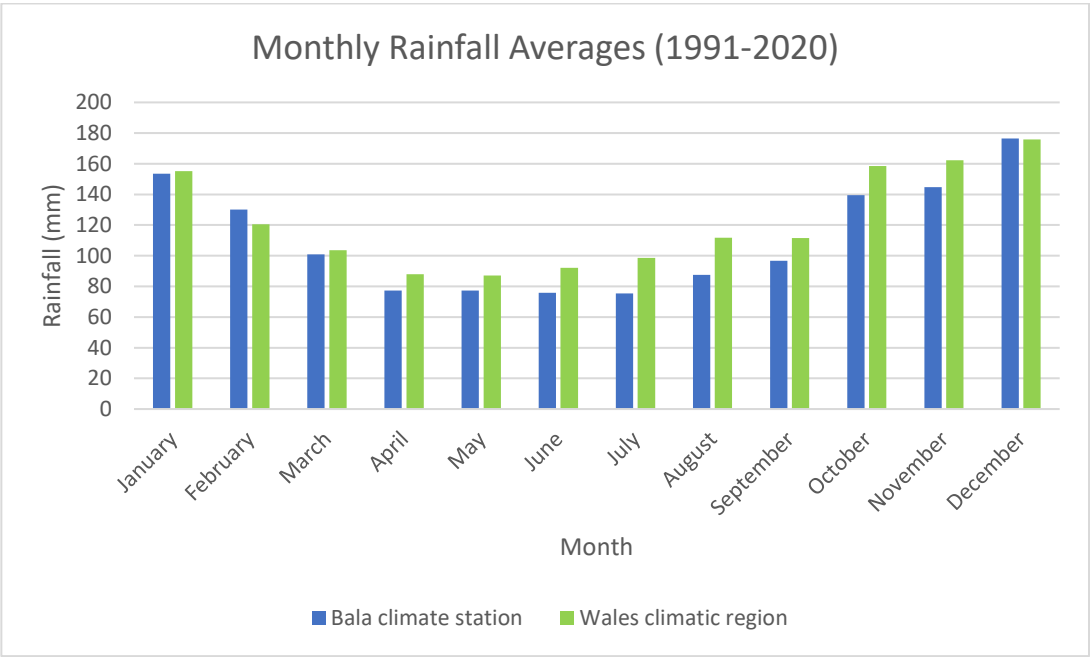
2.2.2 The Site is surrounded by four prominent hills: Cerrig y Gordref (497 m AOD) to the north, Foel Goch (611 m AOD) to the north-east, Moel Darren (509m AOD) to the east at the edge of the application boundary and Garw Fynydd (490 m AOD) to the south. Craig y Garn (461 m AOD) is located at a greater distance to the west, across the Afon Mynach valley.

2.2.3 The southern part of the Site slopes smoothly down from the peaks of Moel Emoel (549 m AOD) and Eglwys-Anne Warren Ffridd (463 m AOD) towards Llyn Maen Bras at approximately 355 m AOD.

2.3 Rainfall

2.3.1 Rainfall in Wales varies widely, with the highest average annual totals recorded in the central upland spine between Bannau Brycheiniog and Eryri (Met Office, 2016). Bala monitoring station is the nearest monitoring station to the Site, situated approximately 4 km south (Met Office, 2025). Rainfall data from this station is thus likely to provide a good representation of the Site and the surrounding area. **Graph 7.1.1** compares the average monthly rainfall distribution for the Bala climate monitoring station with that of the Wales climatic region.

2.3.2 Most of the rainfall occurs during the autumn and winter months (October to January), with December experiencing the highest recorded monthly rainfall totals (up to 177 millimetres (mm)). From January to July, rainfall declines to a low of 75 mm. From July, rainfall slowly increases towards the end of the year. Rainfall recorded at the Bala climate station is slightly lower than the Wales climatic region; however, seasonal fluctuations are consistent with the rest of the region.



Graph 7.1.1 Monthly rainfall averages for both the Bala climate station and Wales climatic region. Averages cover the period of 1991-2020 (Met Office, 2025).

2.4 Existing Drainage and Natural Catchments

2.4.1 Catchment data obtained from the Flood Estimation Handbook (FEH) Web Service (FEH, 2025), shows that the Proposed Development lies within five catchment areas: Medrad to the north, Meloch to the east, Dee-Alwen to Llyn Tegid to the south, Tryweryn-Dee to Mynach to the south-west, and Mynach to the north-west. Catchment areas and key watercourses are shown in **ES Volume IV, Figure 7.6: Hydrological Catchments and Watercourses**. An overview of the watercourse catchments, their areas and the infrastructure proposed within them is provided in **Table 7.1.1.**

Afon Medrad

2.4.2 The Afon Medrad catchment, covering a small area at the northern edge of the Site, has a total area of 15.2 km^2 and drains 0.03% of the Site.

2.4.3 Drainage for the catchment is provided by the Afon Medrad and its tributaries.

2.4.4 Within the Site, the Medrad catchment is described by Natural Resource Wales' (NRW) Environmental Information Portal (NRW, 2025) as an area of unimproved acid grassland with areas of wet modified bog, acid flush and bracken.

Afon Meloch

2.4.5 The Afon Meloch catchment, covering the eastern part of the Site, has a total area of 16.1 km^2 and drains 39.42% of the land within the Site.

2.4.6 Drainage is provided by the Nant Cefn Coch, which is a minor tributary of the Afon Meloch, and the Afon Meloch itself.

2.4.7 The Afon Meloch catchment has been described by NRW (NRW, 2025) as an area of unimproved acid grassland on Moel Darren, including large areas of wet modified bog, acid flush and bracken.

River Dee-Alwen to Llyn Tegid

2.4.8 The River Dee-Alwen to Llyn Tegid catchment, covering the central southern part of the Site, has a total area of 6.2 km^2 and drains 26.70% of the land within the Site.

2.4.9 Drainage is provided by unnamed minor watercourses feeding Llyn Maen Bras, and by the Nant Hafhesp and its tributaries downstream of Llyn Maen Bras.

2.4.10 The River Dee-Alwen to Llyn Tegid catchment is described by NRW (NRW, 2025) an area of unimproved acid grassland with large areas of wet modified bog, acid flush and bracken.

Afon Tryweryn-Dee to Mynach

2.4.11 The Afon Tryweryn-Dee to Mynach catchment, covering the south-western corner of the Site, has a total area of 20 km^2 and drains 0.12% of the land within the Site.

2.4.12 Drainage is provided by unnamed minor watercourses feeding into the Afon Tryweryn.

2.4.13 The Afon Tryweryn-Dee to Mynach catchment is described by NRW (NRW, 2025) as a mixture of enclosed improved grassland, improved and marshy grasslands with small areas of woodland, and an area of unimproved acid grassland with wet, modified bog.

Afon Mynach

2.4.14 The Afon Mynach catchment, covering the north-western part of the Site, has a total area of 17.1 km^2 and drains 33.72% of the land within the Site.

2.4.15 Drainage is provided by the Afon Mynach and its tributaries.

2.4.16 Within the Site, the eastern part of the Afon Mynach catchment is described by NRW (NRW, 2025) as an area of unimproved acid grassland with large areas of wet modified bog, acid flush and bracken. Conversely, the western part towards the application boundary is described as semi-improved neutral grassland.

Table 7.1.1 Overview of Watercourse Catchment Areas and Infrastructure

Catch-ment	Total area (km^2)	% of site within catchment	% of catchment within site	Infrastructure within Catchment
Afon Mynach	17.1 km^2	33.72%	12.90%	Main site access track Entrance construction compound Borrow pit Watercourse crossing WC01 Part of wind turbine T02.
Afon Meloch	16.1 km^2	39.42%	16.02%	Wind turbines T02, T03, T04, T05, T06, T07, T08, T09, and T10 Access track Watercourse crossing WC02 and WC03 Part of substation Batching compound Bridge temporary working area LiDAR compound.
River Dee - Alwen to Llyn Tegid	6.2 km^2	26.70%	28.12%	Wind turbine T01 Part of substation Section of access track.
Afon Tryweryn - Dee to Mynach	20 km^2	0.12%	0.041%	None
Afon Medrad	15.2 km^2	0.03%	0.013%	None

Rainfall Characteristics

2.4.17 A review of the watercourse catchment and rainfall characteristics has been undertaken using data from the FEH Web Service (CEH, 2025). Catchment statistics have been provided for the five catchments in the Proposed Development.

2.4.18 Standard average annual rainfall (SAAR) for the three main catchment areas are as follows:

- Afon Mynach: 1,635 mm
- Afon Meloch: 1,422 mm
- River Dee-Alwen to Llyn Tegid: 1,425 mm

2.4.19 The average SAAR for the catchment areas is 1,487.5 mm which is comparable with records collected from Bala climate monitoring station. This value has been used for calculations in **Section 3** below.

Catchment Land Use

2.4.20 Land at the Proposed Development is primarily used for agricultural purposes as pasture and rough grazing. Two parcels of registered common land are present in the north-east of the Site. The majority of the land falls under Countryside and Rights of Way Open Access land.

2.4.21 Terrestrial habitats within the Site are relatively dry, although there are some boggy areas. The western and south-western sections are characterised by fields used for pasture and improved grazing with hedgerows providing field boundaries. The rest of the Site is open moorland with rough grazing on hill summits and valley slopes. A small area of deciduous trees is present in the western section of the Site.

2.4.22 There are two residential properties and farms in proximity to the Site, both are located towards the western section of the Site.

Existing Drainage Infrastructure

Wastewater

2.4.23 There is no existing wastewater infrastructure for foul drainage within the Site. Most of the nearby properties are on private water supply (PWS) and are anticipated to have private wastewater disposal via septic tanks or similar.

Surface Water

2.4.24 Surface drainage within the Site is variable. Parts of the Site drain via infiltration and overland flow to existing natural watercourse channels and groundwater with limited or no artificial drainage or modification to natural channels. Some of the Site is seasonally boggy, and indistinct overland flow paths merge to form more distinct drainage channels. One waterbody, Llyn Maen Bras, is present within the southern part of the application boundary.

2.4.25 In other parts of the Site, the natural drainage has been significantly modified to improve drainage for agricultural purposes. This is most notable in the areas of improved pasture, but extensive drainage ditches are apparent in some moorland areas.

2.4.26 All watercourse systems, whether natural or artificial, ultimately drain into Afon Dyfrdwy (River Dee) via associated tributaries.

2.4.27 The photographs in **Table 7.1.2** below provide examples of key hydrological features within the Site.

Table 7.1.2 Key Hydrological Features Within the Site

Photograph 7.1.1: View of wetland area west of T03. National Grid Reference (NGR) SH 93490 41030.

Photograph 7.1.2: Boggy area in the headwaters of a tributary to Llyn Maen Bras. NGR SH 93450 40710.

Photograph 7.1.3: Small vegetated watercourses in a headwater tributary of Llyn Maen Bras south of T01. NGR SH 93184 40726.

Photograph 7.1.4: Artificial drainage into an unnamed tributary of Afon Mynach. Manhole in the foreground is a disused well. NGR SH 91096 40898.

Photograph 7.1.5: Vegetated drainage ditch in poor condition. NGR SH 91841 40884.

Photograph 7.1.6: Outlet of a culvert diverting a small watercourse under a track. NGR SH 92145 40933.

Photograph 7.1.7: Pooled surface water and culvert outlet feeding an unnamed watercourse. NGR SH 92166 41022.

Photograph 7.1.8: Boggy area in the headwaters of a tributary to the Nant Cefn-coch. NGR SH 93758 40870.

Photograph 7.1.9: The Nant Cefn-coch, in the form of a narrow channel east of T09. NGR SH 94705 41420.

Photograph 7.1.10: Boggy area and Surface water pooling on track. NGR SH 93722 41906

Private Water Supplies

2.4.28 The Private Water Supply (PWS) records of Gwynedd Council and Conwy County Borough Council have been consulted to determine the presence of PWS within the Site and within 5 km of the Site. Two PWS sources are located in proximity to the Site, with a further 101 locations within the 5 km buffer zone. Nine supplies have been found to have a potential linkage to the Site.

2.4.29 Details of the risk assessment process are provided in **ES Volume II, Chapter 7: Land, Soils and Water** and **ES Volume III, Appendix 7.8: Private Water Supplies Risk Assessment**.

2.5 Flood Risk

Planning Policy Requirements

2.5.1 Planning Policy Wales 12th edition (PPW12), Policy 6.6 seeks to ensure that adequate flood management measures are considered and included in development proposals. It requires planning authorities and developers to ensure that development proposals do not increase the risk of surface and groundwater flooding. The policy also requires Sustainable Drainage Systems (SuDS) to be integrated into development proposal designs, with their adoption, design and long-term maintenance agreed with the relevant SuDS Approval Body (SAB). SAB consent must be obtained prior to commencing construction. For further guidance, developers are directed to the Welsh Government's Technical Advice Note 15: Development, Flooding and Coastal Erosion (TAN15) (Welsh Government 2025a).

2.5.2 TAN15 provides the framework within Wales for assessing flood risk from surface water, rivers, the sea and the risk of coastal erosion. It provides measures that developers can take to ensure that flood risks arising from their proposed schemes are adequately managed. TAN15 also requires an FCA for any development proposal located fully or partly in Surface Water and Small Watercourses Flood Zones 2 and 3. The FCA is required to assess the risks and consequences of flooding on the proposed development and the impacts of the proposed development on flood risk elsewhere.

2.5.3 TAN15 sets out categories for development vulnerability to flooding. The categories are as follows:

- Highly vulnerable developments – developments where the ability of occupants to decide on whether they wish to accept the risks to life and property associated with flooding, or be able to manage the consequences of such a risk, is limited.
- Less vulnerable developments – developments where the ability of occupants to decide if risks and consequences are acceptable is greater than that in the highly vulnerable category.

- Water-compatible developments – developments which are required to be located near water by virtue of their nature, and developments which are resilient to the effects of occasional flooding.

2.5.4 The Anglesey and Gwynedd Joint Local Development Plan 2011-2026 (adopted 2017) requires that development proposals should incorporate water conservation measures, including SuDS. It also mandates all developments to implement flood minimisation or mitigation measures where possible, to reduce surface water run-off and minimise its contribution to flood risk elsewhere. It further requires compliance with the requirements of TAN15, particularly in relation to flood risk management and the integration of SuDS into the development proposal.

Flood Risk within the Site

2.5.5 NRW's online Flood Map for Planning (NRW, 2025) shows that the Site is largely in areas with no risk of flooding from any source. A map showing the flood risk within the Site with all watercourse crossing locations, as required in TAN15, is provided in **Figure 7.1.1.**

2.5.6 The minor watercourses and drainage channels within the Site and its immediate surroundings are indicated to be within Flood Zones 2 and 3 for surface water and small watercourse flooding. The areas include the headwater channels of tributaries to Llyn Maen Bras and the lake itself, the headwater channels and mainstem of the Nant Cefn-coch, the headwater channels and mainstem of the Nant Gau and the unnamed watercourse and minor tributaries located south of Llaithgwm draining west into the Afon Mynach.

2.5.7 A very small section of the Nant Cefn-coch mainstem inside the eastern Site boundary is indicated to be within fluvial Flood Zones 2 and 3. There is a further area of fluvial Flood Zones 2 and 3 a short distance outside the Site boundary along the western margin, associated with the Afon Mynach.

2.5.8 Some small areas of proposed infrastructure coincide with surface water and small watercourse flood areas, mainly in areas where crossing of watercourse or drainage channels is required. Infrastructure that may be affected by surface water flooding along unmapped drainage channels includes parts of the crane hardstanding areas for turbines T01 and T09 and the temporary working area associated with the watercourse crossing between turbines T08 and T09 to allow a bridge crossing (WC03) to be installed. Flood risk can be managed for the lifetime of the Proposed Development by provision of suitable Sustainable Drainage Systems including water retention areas such as ponds or swales.

2.5.9 Flood Zone 2 represents the extent of flooding from surface water, small watercourses and rivers with less than 1% (1-in-100) but greater than or equal to 0.1% (1-in-1000) chance of happening in any given year, including an allowance for climate change.

2.5.10 Flood Zone 3 indicates the extent of flooding from surface water, small watercourses and rivers with a 1% (1-in-100) or greater chance of happening in any given year, including an allowance for climate change.

2.5.11 The Site is not at risk of groundwater flooding as the Proposed Development is mainly located on high ground.

2.5.12 The Proposed Development is categorised as a less vulnerable development. Less vulnerable new developments can only be permitted in exceptional circumstances in areas of Flood Zone 3. Although parts of the Site lie within Flood Zone 3, TAN15 permits developments that address energy security needs, such as the Proposed Development, as an exceptional circumstance.

2.5.13 Watercourse crossing structures which may influence local hydraulics are assessed in **ES Volume III, Appendix 7.2: Watercourse Crossing Schedule.** A map showing the flood risk within the Site with all watercourse crossing locations, as required in TAN15, is provided in **Figure 7.1.1.**

Flood Risk Downstream of the Site

2.5.14 Areas downstream of the Site have a higher risk of flooding. NRW's Flood Map for Planning (NRW, 2025) indicates that the River Dee/Afon Dyfrdwy valley includes a broad area within Flood Zones 2 and 3 for river flooding that extends across most of the town of Bala. Sections of the Afon Mynach and Afon Tryweryn valleys also show some localised flood risk.

2.5.15 Although there is no flood defence infrastructure within the Site, Bala community is categorised within the TAN15 Defended Zones described as areas that benefit from Risk Management Authority flood defences (Welsh Government, 2025).

2.5.16 The Nant Cefn-coch channel is also indicated to have areas of river Flood Zones 2 and 3 before it reaches the River Dee/Afon Dyfrdwy.

2.5.17 Parts of the Nant Gau channel are indicated to have broader areas of small watercourse Flood Zones 2 and 3 upstream of its confluence with the Afon Mynach.

2.5.18 Two locations with active impoundment licences were identified through the Scoping Direction. One is located along the Nant Gau at NGR SH 91790 42006 and the other location is at the outfall of Llyn Maen Bras near Glan-yr-Afon at NGR SH 92900 39500. Both locations are downstream from the Proposed Development and are located within areas at risk of surface water or small watercourse flooding.

2.5.19 It is important to ensure that downstream flood risk is not exacerbated in any way by the Proposed Development. **Section 3** of this report considers drainage requirements and provides an outline drainage strategy that would require implementation to manage surface water from the Site.

Recorded Flood Events

2.5.20 NRW's online Flood Map for Planning (NRW, 2025) does not show any recorded flood events within the Site. However, within 5 km of the application boundary, two flood events are recorded at Llangollen to Bala (3.4 km south) and at Afon Ceirw near Llangwm (4.4 km north). Both flood events are recorded to have started and ended in January 1964.

Watercourse Crossing Infrastructure

2.5.21 All proposed watercourse crossing structures would be designed to permit conveyance of a 1-in-100 year storm event of 6 hours duration (the 'Design Storm') plus climate change allowance, to prevent flooding upstream of structures. Sizing of structures would be undertaken as part of the detailed design process.

3 OUTLINE DRAINAGE STRATEGY

3.1 Introduction

3.1.1 This section provides a summary of the outline drainage strategy for the Site as detailed in **ES Volume III, Appendix 7.10: Outline Drainage Strategy**. The proposal is to maintain Site runoff within the natural catchment areas, and to maintain drainage to the Site watercourses following treatment and attenuation in order to mimic natural flow patterns as closely as possible.

3.2 Wastewater Drainage

3.2.1 It is anticipated that wastewater drainage for construction and operation would be provided by a suitably sized containment tank, which would be emptied by tanker and all wastewater would be removed for disposal at a suitably licensed treatment facility. No discharge to ground or to a watercourse is proposed.

3.3 Surface Water Drainage

3.3.1 The surface water drainage network for the Site would be designed considering the requirements of the Flood and Water Management Act 2010 (Schedule 3) and current best practice guidance from the Welsh Government (2018) and the Construction Industry Research and Information Association Publication C753 – the SuDS Manual (CIRCA, 2015).

3.3.2 The following sections describe the requirements that lead to determination of the proposed drainage strategy, and which informs the Sustainable Drainage Systems (SuDS) provision recommendations.

3.3.3 The Welsh Government's document 'Statutory National Standards for Sustainable Drainage Systems' (2018) sets out a hierarchy of surface water runoff designations that must be followed. The Levels are as follows:

- Priority Level 1: Surface water runoff is collected for use
- Priority Level 2: Surface water runoff is infiltrated to ground
- Priority Level 3: Surface water runoff is discharged to a surface water body
- Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain or another drainage system, and
- Priority Level 5: Surface water runoff is discharged to a combined sewer.

3.3.4 Priority Levels 4 and 5 should only be used in exceptional circumstances. Priority Level 1 is the preferred option.

Detailed Design

3.3.5 Site-specific details and design proposals would be provided as part of the detailed design. This would include infiltration testing as required at suitable locations within the Site.

SuDS Components

3.3.6 Several SuDS features have been considered for inclusion within certain sections of the Proposed Development's drainage network to control, manage and treat surface water runoff during construction, operation, and decommissioning of the Proposed Development. These include swales and filter strips, filter drains, check dams, silt fences, settlement ponds, detention basins and sumps.

Site Conditions for SuDS

3.3.7 It is anticipated that settlement ponds would be used at each turbine location, the substation, construction compound and the borrow pit to provide water storage, attenuation and treatment to remove suspended sediment from surface water runoff. The ponds would be established during construction to provide water management for the construction phase works. It is anticipated that most of the ponds would be fully reinstated at the end of the construction period. Settlement ponds and silt fencing may also be required at locations for temporary storage of soil, peat soil and aggregate.

3.3.8 Swales and filter strips would provide attenuation, storage and treatment for access tracks and turbine hardstandings, with swales forming the preferred option. During construction, small sumps with silt fencing would be established periodically along track routes to manage entrained sediment within the surface water. The sumps and silt fencing would be removed at the end of the construction phase once vegetation on the filter strips and swales has become established.

3.3.9 Temporary cut-off drains and bunds would be required around excavation areas for the turbine bases and hardstanding areas, to capture clean runoff and divert it around construction areas. These may be converted into swales at the end of the construction phase if long-term drainage is required.

3.3.10 Should detailed design calculations determine the requirement for long-term temporary stormwater storage or treatment, one or more of the settlement ponds would be retained as a detention basin or SuDS pond through the operational phase of the Proposed Development, with appropriate fencing in place. This would be set out in the detailed drainage strategy, which would be prepared following further site investigation and secured by condition prior to the commencement of construction works.

3.4 Surface Water Runoff Hydraulic Control

3.4.1 The Welsh Government's document 'Statutory National Standards for Sustainable Drainage Systems' (2018) (Welsh Government, 2018) sets out several expectations for surface water systems in relation to runoff hydraulic controls, as follows:

- Surface water should be managed to prevent, so far as possible, any possible discharge from the Site for most rainfall events of less than 5 mm. The surface water runoff rate for the 1-in-1 year return period event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the Proposed Development runoff on the morphology and associated ecology of the receiving water bodies.
- The surface water runoff for events up to the 1% (1-in-100 year) return period event (or agreed equivalent) should be controlled to help mitigate negative impacts of the Proposed Development on flood risk in the receiving water body.
- The surface water runoff for events up to the 1% (1-in-100 year) return period (or agreed equivalent) should be managed to protect people and property on and adjacent to the Site from flooding from the drainage system.
- The risks (both on and offsite) associated with the surface water runoff for events greater than the 1% (1-in-100 year) return period should be considered. Where the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.
- Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage) and the associated flood risks managed where possible.

Site Results

3.4.2 HR Wallingford's greenfield runoff rate estimation tool for sites (HR Wallingford, 2025) allows estimation of runoff rates for greenfield sites. The tool makes use of site-specific data including the total Proposed Site area, SAAR and standard percentage runoff (SPR). SAAR and SPR are both provided by the FEH Web Service data sheets (CEH, 2025). A copy of the tool's output report is provided in **Annex A**.

3.4.3 In addition, it is possible to calculate the long-term storage volume required to maintain discharge from the Site at the pre-development greenfield rates. Calculations make use of the design storm, defined as a 1-in-100 year storm event of 6 hours duration. The figures used in the calculation are derived from the FEH Web Service. A copy of the calculation is provided in **Annex A**.

3.4.4 For the Proposed Development, the details used in the calculations are provided in **Table 7.1.3**.

Table 7.1.3 Input Parameters Used for Greenfield Runoff Rate and Long-term Storage Volume Calculations

Parameter	Value	Notes
Total site area	53.3 ha	Release land area
SAAR	1487.5 mm	From FEH
SPR	0.476	From FEH
Design Storm rainfall	64.14 mm	From FEH, 1-in-100 year return period storm for 6 hours duration
Total impermeable surface	49.3%	Percentage release land required for long-term infrastructure

3.4.5 Results from the calculations are provided in **Table 7.1.4**.

Table 7.1.4 Results from the Greenfield Runoff Rate and Long-term Storage Calculations.

Parameter	Value	Notes
Q_{BAR} runoff rate	634 l/s	Results from greenfield runoff rate estimation for sites tool (HR Wallingford, 2023)
1 in 1 year runoff rate	557.9 l/s	
1 in 30 year runoff rate	1,128.5 l/s	
1 in 100 year runoff rate	1,382.1 l/s	
Long-Term Storage Volume	5,455.23 m^3	See **Annex A** for calculation details
Long-Term Storage Volume plus climate change allowance	6,600.83 m^3	Includes climate change uplift of 21%

3.4.6 Details of proposed temporary (construction phase) and long-term (operational phase) water storage locations, storage capacity and discharge locations would be provided as part of the drainage infrastructure detailed design.

4 CONCLUSIONS

4.1.1 This report provides an assessment of flood risk and drainage in relation to the Proposed Development. Flood risk within the Site is minimal and confined to drainage channels and existing watercourses and waterbodies.

4.1.2 Management of downstream flood risk is addressed by way of the outline drainage strategy, which is summarised in the report. More details are provided in **ES Volume III, Appendix 7.10: Outline Drainage Strategy,** which sets out the methods to be used for the detailed design of the drainage system, in line with the requirements of the Welsh Government and taking current best practice guidance into account.

4.1.3 The Site currently drains via overland flow and drainage ditches to the existing natural and artificial watercourses in and around the Site. The proposed drainage development promotes maintenance of natural runoff characteristics where possible, and drainage infrastructure to mimic these characteristics where required. Runoff attenuation and treatment proposals are designed to prevent any detrimental effects to the water quality or quantity of existing waterbodies. The proposed strategy makes use of SuDS features within the detailed engineering design to mimic the existing runoff characteristics.

4.1.4 All necessary water environment authorisations and SAB approval would be put in place prior to any site works taking place.

4.1.5 Following the assessment of flood consequences of the Proposed Development and the drainage strategy, this report has demonstrated that the Proposed Development will neither increase flood risk within the Site nor flood risk downstream of the Site. In addition, the drainage infrastructure and measures, including SuDS, proposed will ensure that surface water runoff does not exceed the greenfield runoff rates, and will enable storm water from any future flood events to be managed appropriately on-site, including increases in water volume arising from climate change. Therefore, the Proposed Development complies with the requirements of TAN15.

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ANNEX A – GREENFIELD RUNOFF RATE ESTIMATION TOOL

Greenfield runoff rate estimation tool

hrwallingford www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

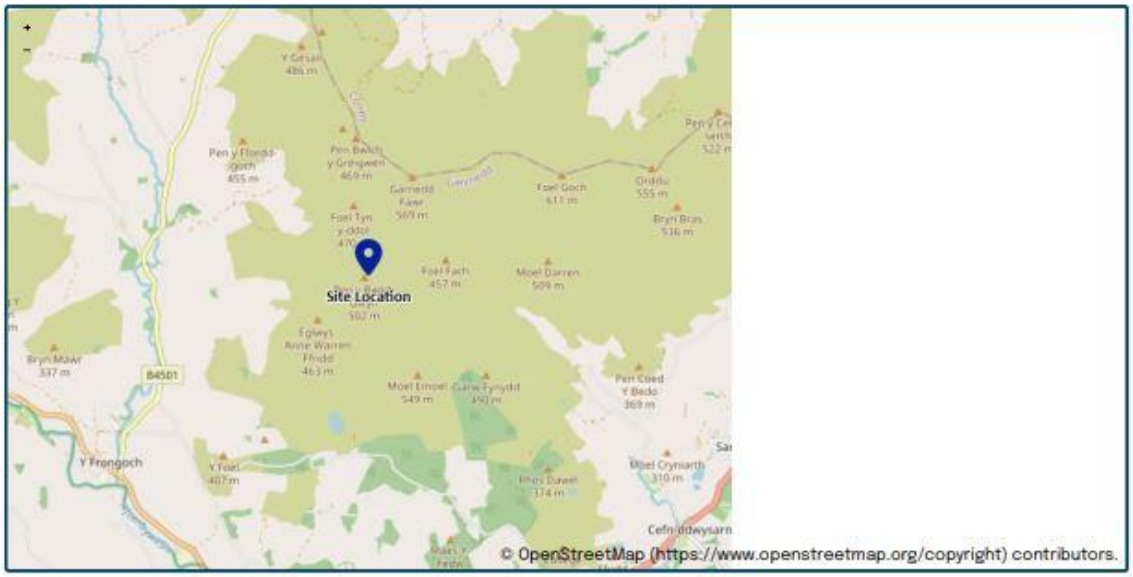
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	17/06/2025
Calculated by	Etisang Abraham
Reference	Foel Fach Wind Farm
Model version	2.0.1

Location

Site name	
Site location	



Site easting	293296
Site northing	341100

Site details

Total site area (ha)	53.28 ha

Greenfield runoff

Method

Method	IH124

IH124

	My value		Map value
SAAR (mm)	1487 mm		1483
How should SPR be derived?	Estimate using BFI		
BFIHOST	0.367		
SPR	0.476		
QBar (IH124) (l/s)	634 l/s		

Growth curve factors

	My value		Map value
Hydrological region	9		9
1 year growth factor	0.88		
2 year growth factor	0.93		
10 year growth factor	1.42		
30 year growth factor	1.78		
100 year growth factor	2.18		
200 year growth factor	2.46		

Results

Method	IH124
Flow rate 1 year (l/s)	557.9 l/s
Flow rate 2 year (l/s)	589.8 l/s
Flow rate 10 years (l/s)	900.3 l/s
Flow rate 30 years (l/s)	1128.5 l/s
Flow rate 100 years (l/s)	1382.1 l/s
Flow rate 200 years (l/s)	1559.6 l/s

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.0.1) developed by HR Wallingford and available at uksuds.com (https://www.uksuds.com/). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (https://www.uksuds.com/terms-conditions). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Long-term Storage Volume Calculations

$$VOLxs = RD\ x\ A\ x\ 10\left[\frac{PIMP}{100}(\alpha\ 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta\ SPR) - SPR\right]$$

Equation 24.10 from CIRIA Report C753 The SUDS Manual.

Parameter	Units	Value used	Notes
VOLxs	m^3	5455	Extra runoff volume of development runoff over greenfield runoff
RD	mm	64.14	Design storm rainfall, for 1-in-100 year return period storm of 6 hour duration
A	ha	53.28	Actively drained area
PIMP		49.3%	Impermeable area as a percentage of the total area
α		1	Proportion of paved area draining to the network, with 80% assumed runoff. Taken as 1 for the calculation.
β		1	Proportion of the pervious area draining to the network or directly to the river. Taken as 1 for the calculation.
SPR		0.476	Standard percentage runoff (from FEH Web Service)

FIGURES

290500E 291200E 291900E 292600E 293300E 294000E 294700E 295400E

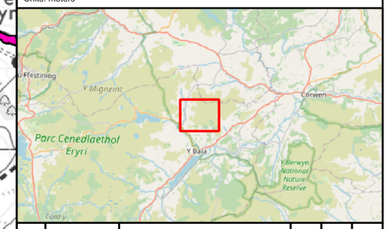
342300N 341600N 340900N 340200N 339500N 338800N

Flood Map Rivers and Sea
- Flood Zone 2
- Flood Zone 3

Flood Map Surface Water
- Flood Zone 2
- Flood Zone 3

LEGEND:
- Turbine
- Site Boundary
- Hardstands
- Tracks
- Verges
- Substation
- Batching Compound
- Construction Compound
- Bridge Temporary Working Area
- Batching Earthworks Cut
- Batching Earthworks Fill
- LiDAR Compound
- Borrow Pit
- Cut
- Compound Earthworks Cut
- Compound Earthworks Fill
- LiDAR Earthworks Cut
- Substation Earthworks Cut
- Substation Earthworks Fill
- Watercourse Crossings

CRS: EPSG:27700
Projection: Transverse Mercator
Ellipsoid: EPSG:7001
Units: meters



Rev	Date	Description	Drn	Chk	App
1.1	05/11/2025	Second Draft	CP	GE	CI
00	24/06/2025	First Draft	CP	EA	CI

Foel Fach Wind Farm

TITLE: Figure 7.1.1 Flood Risk and Watercourse Crossing Locations

ID:P664094_Figure7.1.1 Flood Risk & Watercourse Crossings

0 0.3 0.6 km
Kilometers
Scale: 1:15000 @A3

REV 1.1

Path: C:\Users\chris.palmer\OneDrive - HBK Group\Documents\00 Projects\P664094 Foel Fach\GIS\1 EIA & TA figures