



Awel y Môr Offshore Wind Farm

Proposed Substation Flood Consequences Assessment

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Awel Y Môr Offshore Wind Farm

Proposed Substation Flood
Consequences Assessment

October 2022

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Awel Y Môr Offshore Wind Farm

**Proposed Substation Flood Consequences
Assessment**

October 2022

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Executive summary

Mott MacDonald has been appointed by RWE Renewables (RWE) to provide engineering design services for a new onshore electrical substation, for the Awel y Môr (AyM) Offshore Wind Farm, buildings and associated infrastructure, near St Asaph, Denbighshire. Mott MacDonald has undertaken a Flood Consequence Assessment for the purpose of advising the DCO application for the development in relation to flooding consequences.

This has been completed in line with to Planning Policy Wales, 2004 Technical Advice Note 15: Development and Flood Risk (TAN15 (Welsh Assembly Government, 2004)). A revised version of TAN15 “Developing, flooding and coastal erosion” was published on 23 September 2021 alongside the new Flood Map for Planning (see Section 1.2), which includes climate change information to show how this will affect flood risk extents over the next century. It shows the potential extent of flooding assuming no defences are in place.

However, on 23 November 2021 the Minister for Climate Change made a statement suspending the coming into force of the new TAN 15, until 1 June 2023. This statement also confirmed that the existing TAN 15, published in 2004, and the Development Advice Map (DAM) will continue as the framework for assessing flood risk in the planning system until that time. The new TAN15 has now been removed from Welsh Government’s website.

This flood study has therefore been produced with reference to the 2004 version of TAN15 and associated DAM. With regards to the Flood Map for Planning, NRW’s website confirms “we may use the data as the ‘best available information’ on flood risk to inform our planning advice”. This flood study has therefore been produced with reference to NRW online Flood Map for Planning.

According to TAN 15 (Welsh Government, July 2004), the site is “Considered to be at little or no risk of fluvial or tidal/coastal flooding” as it is located within Zone A of the Development Advice Map (DAM) (Natural Resources Wales, 2022). Consequently, it is considered that the location of the proposed development within Zone A is justified. The DAM is primarily concerned with fluvial and tidal flood risk. The assessment has also considered the potential consequences of flooding from different sources of flood risk and the site is not considered to be at significant risk of fluvial or tidal flooding or flooding from groundwater, canals or reservoirs.

As required by National Grid standard TS 2.10.13, the attenuation for the permanent operational phase has been sized for no flooding in the 1 in 100 year event. The attenuation for the construction phase has been designed for no flooding in the 1 in 10 year event which is to be confirmed with the LLFA/SAB. If required there is space within the site to increase the size of temporary construction attenuation features for no flooding in the 1 in 100 year event. The upper end estimate of sensitivity for increases in peak rainfall intensity due to climate change has also been applied. This is 10% for the construction phase and 40% for the operational phase (Welsh Government, 2021).

Based on the information and recommendations outlined within this Flood Consequences Assessment, detailed surface water and foul drainage details will be provided to Denbighshire County Council for approval following detailed design (post consent). This will be controlled through a DCO Requirement. However, overall the perceived level of flood risk to and caused by the development is low.

TAN 15 and the associated DAM are expected to be updated in June 2023. Amendments to this FCA may be required for planning approval if the revised guidance has come into force prior to works commencing and further advice should be sought on the implications for the proposed development in terms of flood risk.

1 Introduction

RWE Renewables (RWE) are extending the Gwynt Y Môr Offshore Wind Farm in Liverpool Bay, off the North Wales Coast. The extension has been named Awel Y Môr Offshore Wind Farm (AyM). Mott MacDonald has been appointed by RWE Renewables (RWE) to provide engineering design services for a new onshore electrical substation, for the Awel y Môr Offshore Wind Farm with buildings and associated infrastructure near St Asaph, Denbighshire.

Mott MacDonald has undertaken an Flood Consequences Assessment (FCA) for the purpose of advising the DCO application for the development in relation to flooding consequences. This has been completed in line with to Planning Policy Wales, 2004 Technical Advice Note 15: Development and Flood Risk (TAN15 (Welsh Assembly Government, 2004)). A revised version of TAN15 “Developing, flooding and coastal erosion” was published on 23 September 2021 alongside the new Flood Map for Planning (see Section 1.2), which includes climate change information to show how this will affect flood risk extents over the next century. It shows the potential extent of flooding assuming no defences are in place.

However, on 23 November 2021 the Minister for Climate Change made a statement suspending the coming into force of the new TAN 15, until 1 June 2023. This statement also confirmed that the existing TAN 15, published in 2004, and the Development Advice Map (DAM) will continue as the framework for assessing flood risk in the planning system until that time. The new TAN15 has now been removed from Welsh Government’s website.

This flood study has therefore been produced with reference to the 2004 version of TAN15 and associated DAM. With regards to the Flood Map for Planning, NRW’s website confirms “*we may use the data as the ‘best available information’ on flood risk to inform our planning advice*”. This flood study has therefore been produced with reference to NRW online Flood Map for Planning.

This FCA has been produced for the consent stage.

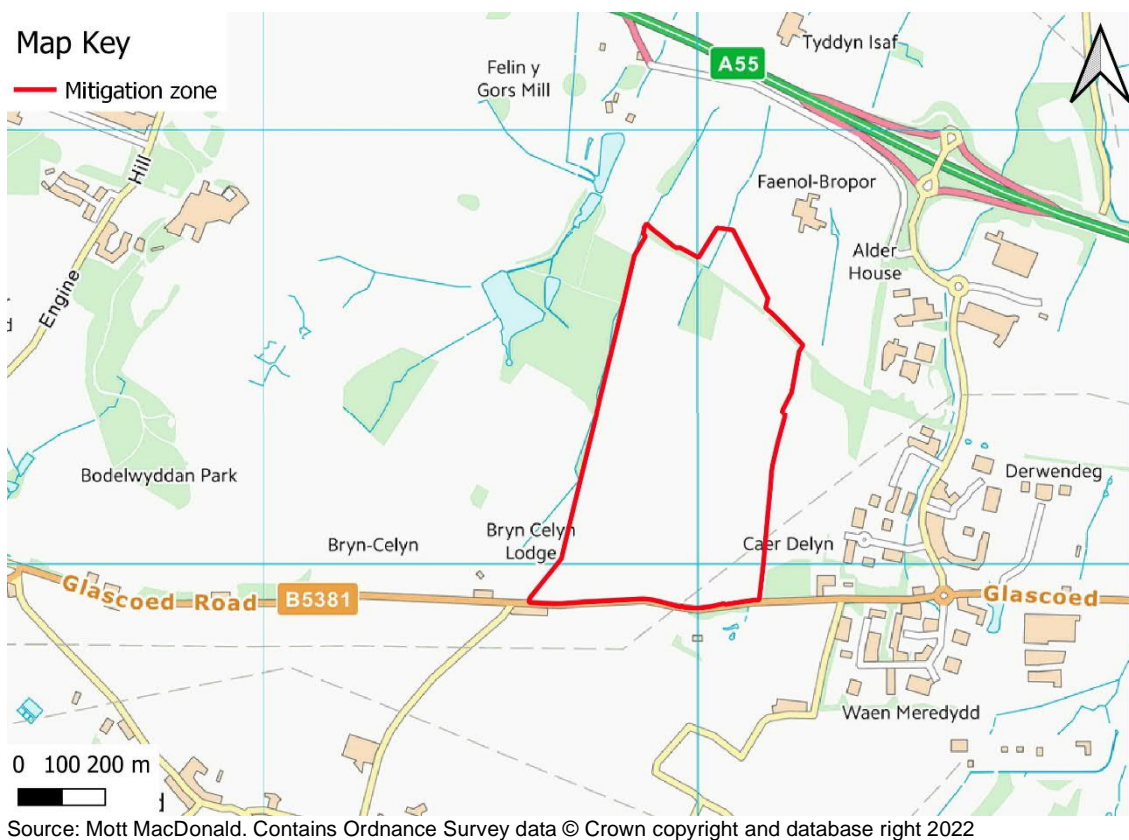
Following this, the detailed surface water and foul drainage details will be provided to Denbighshire County Council for approval following detailed design (post consent). This will be controlled through a DCO Requirement. Correspondence with the local authority will also clarify any further actions required (discussed further in Section 2.1.1). The approach adopted herein has been tailored such that it is proportionate to the scale and nature of the development.

The scope of the FCA reflects the stage of planning consideration and current level of detail available. Mott MacDonald has followed accepted procedure in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions. Mott MacDonald takes no liability for and gives no warranty against actual flooding of any property (client’s or third party) or the consequences of flooding in relation to the performance of the service. This report has been prepared for the purpose of advising the DCO application for the development in relation to flooding consequences. This document has been prepared for the titled project (Awel Y Môr Offshore Wind Farm) and Mott MacDonald accepts no responsibility or liability for this document to any other party other than by whom it was commissioned.

1.1 Site location and description

The development (hereafter referred to as “the site”) is centred at National Grid Reference SJ 00971 74274, in agricultural land west of St Asaph Business Park. It is bounded to the south by the B5381 Glascoed Road, with Bodelwyddan Park and a wooded area to the west and north. The land slopes at approximately 4% from south west to north east. Within the site are field drains and two ponds, and some field boundaries which contain un-named small watercourses which act as drainage ditches. The site will be accessed via a private access road. The mitigation zone is shown in Figure 1.1 below.

Figure 1.1: Site location with mitigation zone outlined in red



1.2 Proposed development

The site proposals comprise of a new onshore substation. The Construction Methodologies and Parameters Technical Note produced by Mott MacDonald (2020) states the site includes:

- Operational platform approximately 250m (length) x 200m (width), with an estimated area of 50,000m² (Air Insulated Substation);
- Construction compound approximately 250m (length) x 150m (width) with an estimated area of 37,500m²;

- Temporary construction access roads from existing highways to the compounds and between the operational and construction compound. The routes are to be confirmed at a later stage however will cover an approximate area of 4,100m²; and
- Permanent access road from the southern edge of site approximately 300m length with an estimated area of 2100m².

The exact dimensions and locations of the elements within the site are to be confirmed. For this Flood Consequence Assessment zones have been indicated to show approximate locations. Figure 1.2 shows the area covered by this assessment.

The construction compound will be temporary with construction lasting approximately 3 years. For the operational phase an indicative project lifetime of 25 has been used widely in project assessments, however an assessment period of 40 years has been used in this document to allow for increases in the proposed operational life of the substation.

Access roads will be constructed through the site to provide access during construction and once the site is operational. For the purpose of this assessment it is assumed that the access roads will be impermeable and that the full length of the roads will remain post construction. The combined impermeable area at the site in the worst case when the operational platform and construction compound are both in place.

Figure 1.2: Site location plan showing substation zone



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1.3 Sources of information

Mott MacDonald accessed the following sources of information in the preparation of this FCA:

- Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (Welsh Government, August 2022)
- Flood Consequence Assessments: Climate change allowances. (Welsh Government, 2021)
- Local Flood Risk Management Strategy (Denbighshire County Council, 2014)
- NRW Flood Maps for Planning (Natural Resources Wales, 2022)
- Development Advice Map (Natural Resources Wales, 2021)
- Open source LiDAR data, 1m DTM. (LiDAR Data, 2020)
- Planning application drawings:
 - Overall Site Layout – AIS (Drawing number AYM-MOT-V7-XX-DR-E-0003, revision 04)
 - Site Layout (Drawing number AYM-MMD-V7-XX-DR-C-0005, revision 03)
- Planning Policy Wales (PPW) (Welsh Government, 2021)
- Preliminary Flood Risk Assessment Flood Risk Regulations (2009) Preliminary Flood Risk Assessment Flood Risk Regulations (2009) (Denbighshire County Council, 2009)
- Technical Advice Note 15: Development, flooding and coastal erosion (Welsh Government, July 2004) (New issue to be implemented in June 2023)

2 Assessment of the suitability of the site for development proposed

The overarching aim of TAN15 (Welsh Assembly Government, 2004).is to ensure that new development is “directed away from Zone C and towards suitable land in Zone A, otherwise to Zone B, where river or coastal flooding will be less of an issue”.

2.1 Development Advice Zone

Figure 1 of TAN 15 defines three Development Advice Zones (A, B, and C), which are summarised in Table 2.1. Table 2.1 describes the composition and use of these zones to control and manage development.

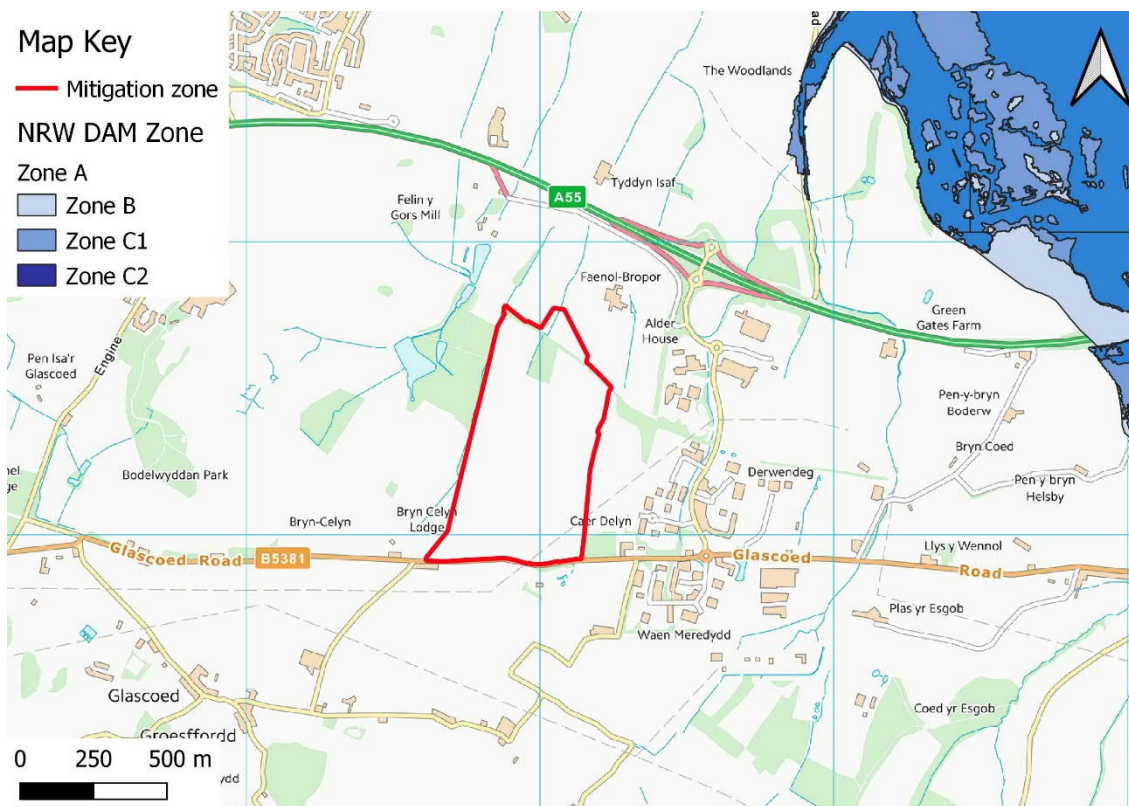
Table 2.1: Development Advice Zones

Zone	Sub-Zone	Description of Zone	Use within the precautionary framework
A		Considered to be at little or no risk of fluvial or tidal/coastal flooding	Used to indicate that justification test is not applicable and no need to consider [fluvial or tidal/coastal] flood risk further
B		Areas know to have been flooded in the past evidenced by sedimentary deposits	Used as part of precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further
C		Based on Environment Agency / NRW extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences
	C1	Areas of the floodplain which are developed and served by significant infrastructure, including flood defences	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences
	C2	Areas of the flood plain without significant flood defence infrastructure	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered

Source: Planning Policy Wales TAN 15 ((Welsh Assembly Government, 2004), last accessed January 2021

The Development Advice Map (DAM) indicates the extents of the Development Advice Zones in Wales. The site lies within Zone A (see Figure 2.1), therefore the justification test for the TAN15 acceptability criteria is not applicable. As the site is within Zone A, the local authority, Denbighshire County Council will be consulted to check if there are any further requirements of this FCA in support of the DCO application.

Figure 2.1: Development Advice Map



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2.1.1 Updated planning guidance

“TAN 15 is focussed on development and flood risk. The existing version was issued in 2004 and a review of its effectiveness was carried out in 2017. As result of the review, the Welsh Government has prepared an updated document which is now subject to public consultation.” (Welsh Government, 2021). The new guidance is expected to be implemented in June 2023. Any changes to the planning guidance will need to be reviewed later in the project.

It is expected that the changes to the planning guidance will not have a significant impact on how the project proceeds. However, correspondence with the local authority will be required to establish if amendments are required to this FCA to enable planning approval if the revised guidance has come into force prior to works commencing.

3 Assessment of flooding consequences

Appendix 1 of TAN 15 (Welsh Assembly Government, 2004) explains how the potential consequences of a flooding event should be assessed. The key objectives of the assessment relevant to the proposed development are to develop a sound appreciation of:

- The consequences of flooding on the development
- The consequences of the development on flood risk elsewhere within the catchment for a range of potential flooding scenarios up to that flood having a probability of 0.1%; and
- The assessment can be used to establish whether appropriate mitigation measures can be incorporated within the design of the development to ensure that development minimises risk to life, damage to property and disruption to people.

This section outlines an assessment of potential flooding consequences at the proposed site in line with TAN15.

3.2 Tidal and fluvial flooding

NRW's Flood Map for Planning (FMfP) shows 'Rivers and Sea Flood Zones', the zones are defined below (Natural Resources Wales, 2022). Flood Zone 3 displays the extent of flooding from:

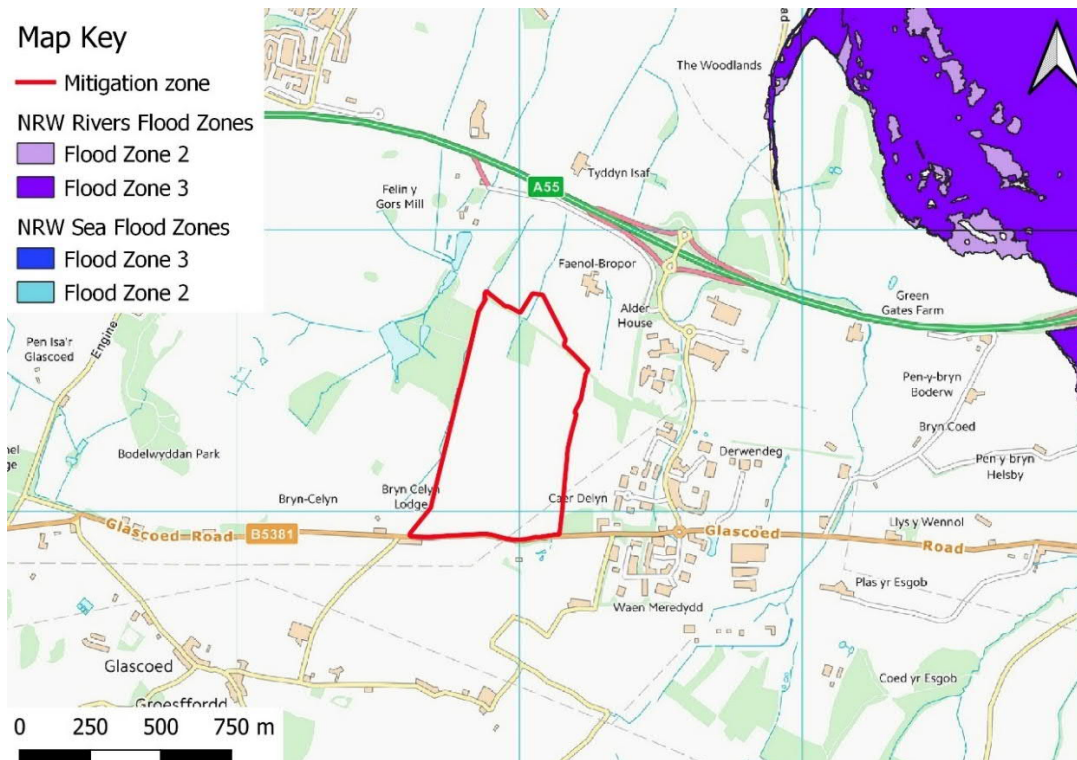
- rivers with a 1% (1 in 100) chance or greater of happening in any given year, including an allowance for climate change.
- the sea with a 0.5% (1 in 200) chance or greater of happening in any given year, including an allowance for climate change.

Flood Zone 2 displays the extent of flooding from:

- Rivers with less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance of happening in any given year, including an allowance for climate change.
- the Sea with less than 0.5% (1 in 200) but greater than or equal to 0.1% (1 in 1,000) chance of flooding in any given year, including an allowance for climate change.

The Rivers and Sea Flood Zone zones are shown in Figure 3.2. This indicates that the site of the proposed development is not in an area shown to be affected by tidal or fluvial flooding, and therefore it is reasonable to conclude that the site is at very low risk (less than 1 in 1000 annual probability including an allowance for climate change) from tidal or fluvial flooding.

Figure 3.2: NRW Flood risk from sea and rivers

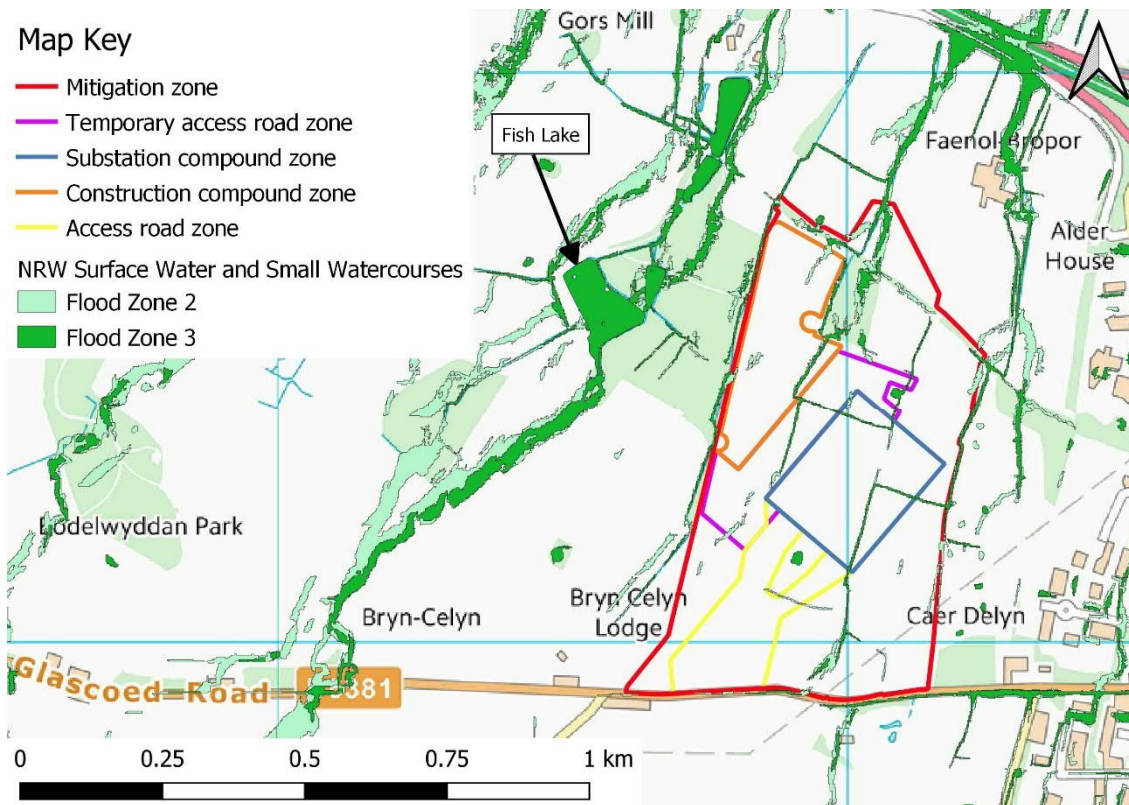


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3.3 Surface water flooding and small watercourses

NRW's Flood Map for Planning (FMfP) shows 'Flood Risk from Surface Water and Small Watercourses' Zones (Natural Resources Wales, 2022). Flood Zone 3 displays the extent of flooding from Surface water & small watercourses with a 1% (1 in 100) chance or greater of happening in any given year. Flood Zone 2 displays the extent of flooding from surface water & small watercourses with less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance of happening in any given year. Both Flood Zone extents include an allowance for climate change. Figure 3.3 shows the Surface Water and Small Watercourses Flood Zones.

Figure 3.3: NRW flood risk from surface water and small watercourses



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Overall, most of the mitigation zone is within Flood Zone 1 therefore the flood risk to the substation site due to surface water and small watercourses is predominantly very low (less than 1 in 1000 annual probability). Some areas of Flood Zone 2 and 3 (greater than 1 in 100 annual probability) cross the site, however this is predominately associated with water flow within the small watercourses/drainage ditches which is shown to be contained within their respective channels.

As shown in Figure 3.3 the construction of the substation and construction compound will likely disrupt most of the existing drainage ditches within the site. Therefore, it is expected that all ditches within the site extents will need to be diverted, either into existing adjacent ditches or into new land drainage diversions which will be constructed on site.

One option for diverting the ditches under the substation platform is to utilise the existing ditch on the eastern boundary of the site, further survey will be required to confirm which side of the red line boundary the ditch lies. If it sits outside of the red line boundary then the alternative option will be to construct a new ditch diversion which connects into an existing drainage ditch towards the north of the site.

As highlighted on Figure 3.3 there is a fish lake to the west of the site. As this is not a proposed outfall for site drainage and flow exceedance routes from the lake are unlikely to cross into the site, it has been omitted from this assessment

The proposed development will increase the impermeable area at the site in comparison with the undeveloped situation. Without mitigation this has the potential to increase surface water runoff from the site. This will be mitigated through the implementation of an appropriate sustainable drainage system. Further details are provided within Section 4. With these measures in place it is deemed that the development will pose a low risk to flooding elsewhere.

3.4 Groundwater flooding

The Pre-Desk Study Geotechnical Review produced by Mott MacDonald (2020) found that the BGS GeolIndex indicates the Clwyd Limestone Group bedrock to be a Principal Aquifer and the Warwickshire Group bedrock to be a Secondary A Aquifer. The overlying superficial Glacial Till is classified a Secondary Aquifer.

There are a number of drainage ditches and ponds shown on the OS mapping within or along the boundary of the site, which suggest the groundwater level at site may be high. There is no recorded history of significant groundwater flooding on the site (Denbighshire County Council, 2009).

3.5 Other sources of flooding

NRW's Flood Map for Planning (FMfP) shows 'Flood Risk from Reservoirs' (Natural Resources Wales, 2022) This map has been reviewed and of the proposed development is not in an area shown to be affected by reservoir flooding. Therefore, it is reasonable to conclude that it is not at significant risk from reservoir flooding.

There are no canals or sewers in the near vicinity of the site, and therefore it is reasonable to conclude that the site is at low risk from canal or sewer flooding.

3.6 Climate Change

The predicted effects of climate change indicate that peak rainfall intensities, river flows and tide levels will increase over the lifetime of the development. Due to the site's location any increase in river flows and tide levels are unlikely to impact the site however increases in rainfall intensity need to be considered in relation to increased risk of surface water flooding at and runoff from the site.

Table 3 of Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (Welsh Government, August 2022), and Table 2 of Flood Consequences Assessments: Climate change allowances (Welsh Government, 2021) both recommend a national precautionary sensitivity of between 20% (central estimate) and 40%

(upper end estimate) for peak rainfall intensity for the time horizon of the year 2070 to 2115 and between 5% (central estimate) and 10% (upper end estimate) for 2015 to 2039. These allowances are based on UK Climate Projections 2018 data (MET Office, 2018). It is recommended that peak rainfall intensities used in the assessment should be increased in line with this guidance for between 2015 and 2039 for the temporary works, and between 2070-2115 for the permanent works. Although an indicative operational project lifetime of 25 has been used widely in project assessments, an assessment period of 40 years has been used in this document to allow for increases in the proposed operational life of the substation, and therefore the 2070-2115 timescale has been used.

An increase in peak rainfall intensities because of the predicted effects of climate change would cause an increase in surface water flows at the site. Comparison of the surface water flood extents presented in Figure 3.3 indicates that any increase in flows is likely to result in only a small increase in flood extent. This suggests that the site is not significantly at risk from the effects of climate change.

3.7 Summary of flooding consequences

- Historically there are no recorded incidents of flooding at the site.
- The site is considered to be at low risk of fluvial or tidal flooding or flooding from groundwater, canals or reservoirs.
- The flood risk to the site due to surface water and small watercourses is predominantly very low however the proposed scheme will disrupt many of the existing drainage ditches across the site and increase the impermeable area at the site. Through implementation of an appropriate sustainable drainage system it is deemed that the risk of surface water flooding to the site will be low and the development will pose a low risk to flood consequence elsewhere.

4 Surface water management

Section 8 of TAN 15 (Welsh Assembly Government, 2004). defines the surface water requirements for new developments, as follows:

- Surface water run-off from new developments should be managed so that the development does not increase the risk of flooding elsewhere.
- Sustainable Drainage Systems (SuDS) should be implemented, wherever they will be effective, in all new development proposals, irrespective of the Development Advice Zone in which they are located.
- The aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce run-off where possible.

The drainage strategy will encompass sustainable drainage with natural runoff, pollution control and an attenuation feature. Details of the preliminary drainage strategy for the site can be found in the Awel Y Môr Offshore Wind Farm Preliminary Outline Drainage Strategy (Mott MacDonald, 2022).

The design of the site surface water drainage system will make allowance for existing watercourses/drains by retaining them where possible. However, it is likely that a number of the existing watercourses will need to be diverted to allow for construction of the operational, construction compounds and access roads. The diversions will not significantly change the characteristics of the existing site drainage network so should not negatively impact the existing drainage of the site or further downstream.

In the permanent case the proposed scheme will increase the impermeable area at the site by approximately 11,300m². Without mitigation this has the potential to increase surface water runoff from the site. Due to the low permeability of the underlying glacial till, infiltration is unlikely to be an effective drainage solution at the site. It is proposed that a new pond is constructed and utilised as a sustainable attenuation feature.

Initial sizing of the volume of attenuation required has been carried out. The permanent pond will be designed for 1 in 100-year event in accordance with standards. Future sensitivity analysis will be conducted on the performance of the drainage system using the 1 in 1,000 year rainfall event (as required by NG standard 2.10.13). It is approximated that 546m³ attenuation would be required during the 1 in 100 rainfall event with the upper climate change sensitivity of 40%. It is assumed that pond would discharge into an existing surface water drainage ditch with the outfall constrained to the greenfield run-off rate of the site.

During construction there will be further requirements for attenuation due to the impermeable areas of the construction compound and haul roads. It is approximated that the temporary attenuation required will be 1,500m² based on a 1 in 10 rainfall event with the upper climate change sensitivity of 10% (this is to be confirmed with Denbighshire CC (LLFA/SAB)). If required there is space within the site to increase the size of temporary construction attenuation features for no flooding in the 1 in 100 year event.

The access road will utilise swales for drainage where necessary, otherwise existing drainage will be implemented. Water treatment, pollution control and non-return valves will also be incorporated into the design of each channel and outfall during detailed design.

It is expected that the risk of surface water flooding to the development can be adequately managed using an appropriately designed and constructed surface water drainage system, in

conjunction with carefully considered ground levels. Some existing small watercourses will be diverted as part of the works, however this will not significantly change the characteristics of the existing site drainage network

The new drainage system will be owned, operated and maintained by RWE. Provided this drainage system is put in place, the post-development risk of surface water flooding to the proposed development and elsewhere, as a result of the development, should be acceptable in terms of planning policy.

5 Conclusion

RWE proposes the construction of a new onshore electrical substation, for Awel Y Môr Offshore Wind Farm, buildings and associated infrastructure Mott MacDonald has undertaken a Flood Consequences Assessment for the purpose of advising the DCO application for the development in relation to flooding consequences; namely Planning Policy Wales and Technical Advice Note 15 (TAN15 (Welsh Assembly Government, 2004)) Development and Flood Risk. TAN 15 and the associated DAM are expected to be updated in June 2023. Amendments to this FCA may be required for planning approval if the revised guidance has come into force prior to works commencing.

This report has demonstrated the site is not considered to be at risk of fluvial or tidal flooding, or flooding from canals or reservoirs. Small areas of the site are at risk of flooding from surface water and small watercourses, however this is localised to within the small watercourses/drains and two ponds. The proposed development should not increase the risk of flooding elsewhere. This risk of flooding from surface water is considered to be manageable through an appropriately designed and constructed sustainable drainage system.

In conclusion, based on the information and recommendations outlined within this Flood Consequences Assessment the perceived level of flood risk to and caused by the development is low.

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