Awel y Môr Offshore Wind Farm

Category 6: Environmental Statement

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ANNEX 5.7.1: ONSHORE ECC FLOOD CONSEQUENCE ASSESSMENT

Awel y Môr Offshore Wind Farm

Prepared for: Awel y Môr Offshore Wind Farm Limited

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1 Introduction

1.1 Terms of Reference

SLR Consulting Limited (SLR) was appointed by Awel y Môr Offshore Wind Farm Limited to prepare a Flood Consequences Assessment (FCA) for the proposed works to be used during the construction of the onshore infrastructure of the Awel y Môr Offshore Wind Farm (AyM OWF) development.

1.2 Site Location and Context

AyM OWF is a sister project of the operational Gwynt y Môr Offshore Wind Farm off the north east coast of Wales. The wind farm will require construction of onshore infrastructure for connection to the National Grid. The onshore ECC will be buried and will run from landfall at Ffrith beach, to the east of Rhyl, to a proposed onshore substation located to the west of St Asaph Business Park and on to the existing National Grid Bodelwyddan substation located to the south of St Asaph Business Park. `

A plan detailing the Order Limits (OL) for onshore works is included at Figure 1: Order LimitsFigure 1: Order Limits.

1.3 Development Description

Temporary works areas will be used during the construction phase of the onshore infrastructure for AyM . The onshore works, which are assessed in this FCA, include:

- landfall on the coast between Rhyl and Prestatyn, of the export cable from the offshore wind turbines;
- the onshore export cable corridor (ECC) between the landfall and proposed onshore substation, and between the proposed onshore substation and the existing National Grid connection to the south of St Asaph Business Park; and
- temporary construction compounds (TCC) and access arrangements;
- haul roads;
- Horizontal Directional Drilling (HDD) works (or other trenchless crossing technique) and access arrangements; and
- Transition Joint Bays (TJB) and joint bays along the onshore ECC.

Once constructed, all infrastructure relating to the onshore ECC will be below ground, other than elements of the landfall TJB and link boxes along the onshore ECC which will be set at ground level.

An indicative plan showing the location of onshore elements of AyM is included as Figure 1. The onshore substation is not located within Flood Zone C, however given the scale and permanent nature of this element of the onshore works and through consultation with NRW, a separate FCA for the proposed substation including a surface water drainage strategy has been prepared (Volume 5, Annex 7.2: Onshore Substation Flood Consequence Assessment). This element of onshore infrastructure is therefore not included within this reporting.

1.4 Background and Aims

The aim of the FCA is to advise the DCO application for AyM development in relation to flooding consequences and outline the potential for the onshore ECC to be impacted by flooding, the impacts of the works associated with establishing the onshore ECC on flooding, and the proposed measures which could be incorporated to mitigate any identified risk. The report has been produced in accordance with Planning Policy Wales (PPW)[1] and

1 Planning Policy Wales Edition 11, Welsh Government. February 2021

its associated Technical Advice Note 15 (TAN15)[2]. Reference has also been made to the Denbighshire County Council (DCC) Strategic Flood Consequence Assessment (SFCA)[3].

With reference to the indicative Development Advice Map[4] produced by Natural Resources Wales (NRW), some elements of the onshore ECC are noted to be within Zone C1, which is defined as areas of the floodplain which are developed and served by significant infrastructure, including flood defences. With reference to TAN15, a justification test is required to be met for proposed new development in areas considered to be at risk of flooding (Zone C) The Justification Test includes consideration of acceptability of consequences for the works in Zone C1, to indicate that the development can take place.

An extract of the Development Advice Map (DAM) is provided by Figure 2: NRW Development Advice Map Extract and the classification system is discussed at Section 2.1.

1.5 Sources of Information

This report has been produced in consultation with NRW and DCC and through reference to the following information sources:

- Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (Welsh Government, 2017);
- Flood Consequence Assessments: Climate change allowances. (Welsh Government, 2016);
- Local Flood Risk Management Strategy (DCC, 2014);
- NRW Development Advice Map and National Flood Hazard and Risk Maps (NRW, 2021);
- Open source LiDAR data, 1m DTM (NRW, 2021);
- AyM OWF Environmental Statement (ES) documentation;
    - Volume 3, Chapter 1: Onshore Project description;
    - Volume 3, Chapter 5: Onshore Biodiversity and Nature Conservation;
    - Volume 3, Chapter 6: Ground Conditions and Land Use;
    - Volume 3, Chapter 7: Hydrology and Flood Risk;
- Planning Policy Wales (PPW) (Welsh Government, 2021);
- Technical Advice Note 15 (TAN15): Development and Flood Risk (Welsh Assembly Government, 2004);
- Denbighshire Flood Consequence Assessment – Level 1 (JBA Consulting, 2018); and
- Technical Advice Note 15: Development, flooding and coastal erosion – consultation document (Welsh Government, October 2019)

2 Technical Advice Note 15: Development and Flood Risk to Planning Policy Wales, Welsh Assembly Government, 2004
3 Denbighshire Flood Consequence Assessment – Level 1, JBA Consulting, January 2018
4 Natural Resources Wales, Long Term Flood Risk Maps (accessed March 2021)

2 Site Suitability

The overarching aim of TAN15 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 Map

TAN15 defines three Development Advice Zones (A, B, and C), which are shown in Figure 1 of TAN15 and 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 known 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 floodplain 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 TAN15, accessed March 2021

The DAM indicates the extents of the Development Advice Zones in Wales. The onshore ECC crosses Zones A, B and C (see Figure 2) which are discussed below at Section 2.2.

2.1.1 Updated planning guidance

The existing version of TAN15 was issued in 2004 and a review of the original guidance was carried out in 2017. At the time of reporting, the new guidance is expected to be implemented in June 2023, which will follow the submission of the AyM application for development consent. Planning guidance with respect to these proposals

will remain under TAN15 in its current form. Following consultation with NRW, it is not expected that changes to the planning guidance will have a significant impact on how the project proceeds.

2.2 Flood Risk Classification

Works that are within Zone C1 of the DAM and which will require assessment are shown on Figure 2 and include the following cable route sections (and associated TCC and access arrangements):

- from landfall to the B5119 Dyserth Road crossing;
- from the A525 Rhuddlan Road crossing to the Clwyd Estuary crossing; and
- from the Clwyd Estuary crossing to the Sarn Lane crossing.

Remaining areas of the application boundary are within the DAM Zone A which is land considered to be at little or no risk of fluvial or coastal/ tidal flooding.

2.2.1 Areas of onshore ECC in Zone C1

2.2.1.1 Landfall to B5119 Dyserth Road

Works at landfall will include a below ground Transition Joint Bay (TJB) and Horizontal Directional Drilling (HDD) (or other trenchless crossing technique) pit with associated temporary compound (TCCs) and access routes. The TJB will be located within agricultural land to the south of the North Wales Main Line railway. Works will include a temporary working compound. A further TCC is also included, for the onshore ECC which is partially within Zone C1, to the north of Dyserth Road (B5119), with another TCC required for works on Ffrith beach located either near Fergusson Avenue or Garford Road (either TCC option would also be within Zone C1).

2.2.1.2 A525 Rhuddlan Road crossing to the Clwyd Estuary crossing

The cables will pass under the A525 Rhuddlan Road using HDD (or other trenchless crossing technique) which will include entry and exit pits and associated temporary compounds. The TCC and trenchless crossing works to the west of the A525 are partially within Zone C1 while other areas of the crossing are not shown to be at flood risk. The EEC from this point to the Clwyd Estuary is within Zone C1 and includes trenchless crossing works for crossing Glanffyddion Cut main river and trenchless crossing works to the east of the Afon Clwyd for the Clwyd Estuary crossing.

2.2.1.3 From the Clwyd Estuary crossing to the Sarn Lane crossing

The onshore ECC to the west of the Clwyd Estuary is within Zone C1 and includes a trenchless crossing exit/entry pit and associated works. South of the Clwyd Estuary crossing, the onshore ECC crosses the A547 Abergele Road which will include a TCC area to the north of the A547 carriageway. The onshore ECC passes out of Zone C1 immediately north of the Sarn Lane crossing which will have trenchless crossing works and a TCC area partially within land that is at risk of flooding.

2.2.2 Proposed temporary infrastructure

Each TCC area will be a maximum area of 22,500 m^2 and each trenchless crossing temporary compound a maximum area of 8,000 m^2. The made ground/ topsoil in these areas will be stripped and a capping layer of crushed stone introduced to provide an area of hardstanding. Buildings on the temporary works sites, if any, will be limited to small, temporary offices and welfare facilities. In addition, the sites will house construction plant and materials. These may have potential to cause some obstruction and diversion of floodwater during a flood event. A flood event on any of the work areas is considered to be unlikely. The potential scenarios in which work areas may experience flooding are:

- in the event of a breach of flood defences; or

- in an event which exceeds the level of protection afforded by the flood defences.

Given the limited size of the TCC's, the temporary nature of the works, the agricultural nature of the surrounding land the significance of any obstruction and subsequent diversion of flood flow routes is considered to be minor and short-term.

3 Site Description and Proposed Development

3.1 Topography

Detailed topographic survey of the onshore infrastructure works area has not yet been undertaken. Ground level data across the onshore ECC area has been obtained from 1m resolution aerial photogrammetry (LiDAR) data[5]. Analysis of the LiDAR data indicates that ground elevations to the south of landfall, east of Rhyl, are relatively flat with shallow gradients. The lowest elevations are noted around the Rhyl Cut watercourse at around 4.0 m above Ordnance Datum (aOD), rising to over 12 m aOD south of Dyserth Road. The agricultural land to the south east of Rhyl remains flat at about 12 m aOD before gently falling to the south of Rhyl as the onshore ECC passes into the Clwyd valley. Elevations within the onshore ECC adjacent to Glanffyddion Cut are at about 4.1 m aOD to the confluence with the Clwyd Estuary.

The agricultural land to the west of the Clwyd Estuary is flat and at similar elevations observed in the onshore ECC to the east of the estuary crossing point. Elevations remain at or around 4.1 m aOD within the onshore ECC further south, to the A547 Abergele Road crossing. South of Abergele Road the land begins to rise gradually to 10.0 m aOD or greater at Sarn Lane. South of Sarn Lane the onshore ECC crosses relatively flat agricultural land, with elevations between 9.0 and 11.0 m aOD before rising further south up to the A55 which is at an elevation of over 20.0 m aOD.

From the A55 ground levels continue to rise in the onshore ECC to the proposed substation which is at elevations ranging from 27.0 m aOD to the north of the zone to over 50.0 m aOD at the B5381 Glascoed Road. From the B5381 crossing the onshore ECC continues south and then east before connecting to the National Grid substation at Bodelwyddan. Ground levels south of the B5381 rise from around 52.0 m aOD to over 60.0 m aOD before falling again further east, to around 42.0 m aOD at the existing National Grid Bodelwyddan substation located to the south of St Asaph Business Park.

Figure 3: Plot of LiDAR Topographical Data details the LiDAR data for the proposed AyM OWF onshore works.

3.2 Hydrological Setting

The works area for the landfall site is located on the coastline between Rhyl and Prestatyn. The Irish Sea extends northwards from the coast.

The onshore ECC includes a number of catchments associated with NRW designated main rivers and ordinary watercourses. Definitions of these hydrological features are provided in detail in Volume 3, Chapter 7: Hydrology and Flood Risk of the ES. The main rivers are listed below:

- Rhyl Cut - The Rhyl Cut runs parallel to the coast from the outskirts of Prestatyn, flowing west across agricultural land to the south of the North Wales Main Line railway, through the centre of Rhyl before discharging to the Clwyd Estuary approximately 1.5 km upstream of the estuary mouth.
- Aberkinsey Drain - Aberkinsey Drain flows from south to north from a connection with Glanffyddion Stream, through the east of Rhyl where it passes to the Rhyl Cut (via Maes Gwilym Drain).
- Glanffyddion Cut - Glanffyddion Cut (Glanffyddion Stream) drains land to the east of Rhuddlan, including Dyserth and land to the north of Caerwys. The watercourse flows from east to west and discharges to the Clwyd Estuary to the north west of Rhuddlan, approximately 700 m downstream of the A525 crossing of the Clwyd Estuary.
- Afon Clwyd - The Afon Clwyd is the most significant watercourse within the study area, with a catchment draining large areas of north Denbighshire, including the settlements of St Asaph, Denbigh and Ruthin;

5 Lle Geo-Portal for Wales, Lle - Grid Products Available for Download on Lle (gov.wales), accessed March 2021

the Afon Elwy, a main river tributary which drains areas to the east of Conwy County; and the Afon Chwiler, a main river tributary which drains land to the west of Flintshire.

- Clwyd Embankment Drain North and South - Two further main rivers are crossed by the onshore ECC at the Clwyd Estuary. These are drainage channels to the north east and south west of the estuary channel and which operate as collector drains on the landward side of respective flood defences serving the Clwyd Estuary. The drains both flow north west, parallel to the Afon Clwyd, and ultimately discharge into the estuary downstream of the onshore ECC crossing point.
- Gypsey Lane Drain - Gypsey Lane Drain serves a small catchment which includes some highway drainage for the A547 Abergele Road and drainage of agricultural land to the north of the A457, adjacent to the Clwyd Estuary. The drain discharges to the Clwyd Embankment Drain South (above) and forms part of the Afon Gele catchment.
- Beeches Drain (into Pont Robin Cut) - Beeches Drain is a short section of main river which drains to the Clwyd Estuary via Pont Robin Cut. The head of this main river channel connects to Sarn Drain and a proportion of flow from the upstream Sarn Drain catchment drains through Beeches Drain.
- Tyddyn Isaf Drain - Tyddyn Isaf Drain is a main river tributary of Sarn Drain with a small upstream catchment of predominantly agricultural land.
- Sarn Drain - Sarn Drain is served by two main river tributaries, Sarn Drain East and Sarn Drain West which are parallel channels which flow north from the A55 before joining the main Sarn Drain channel. Downstream, Sarn Drain connects into Beeches Drain (above) and Sarn Cut which flows into the Afon Gele catchment.
- Pengwern Drain - Pengwern Drain flows from south to north, passing along the boundary of Princes Gorse woodland, north of the A55. Pengwern Drain flows into Clwyd Estuary via Pont Robin Cut.
- Non-main river watercourses - The study area includes a number of existing field drains, ditches and irrigation channels. The majority of the surface water channels crossed are non-main river and form tributaries to the watercourses detailed above. All non-main rivers are defined as ordinary watercourses.

3.3 Geological and Hydrogeological Features

The geological and hydrogeological setting of the ECC and ground conditions are described in detail within the ES at Volume 3, Chapter 6: Ground Conditions and Land Use.

Reference to the British Geological Survey online mapping[6] indicates potential for groundwater to be present beneath the ECC within Principal bedrock aquifers of the Clwyd Limestone group, underlying part of the onshore ECC between the substation and the National Grid Bodelwyddan substation; and within the Kinnerton Sandstone Formation, underlying the onshore ECC from landfall to immediately south of the A547 crossing. Secondary A bedrock aquifer is present within the mudstones of the Warwickshire Group which underlies the remaining onshore ECC.

Inland superficial deposits underlying the onshore ECC comprise mainly of Tidal Flat Deposits, Devensian Diamicton Till and Glaciofluvial Deposits. These deposits are generally classed as Secondary (undifferentiated or Secondary A) aquifers.

No groundwater Source Protection Zones are noted within the onshore ECC.

6 British Geological Survey Website [redacted]

3.4 Existing Drainage / Water Mains

Given the greenfield nature of the majority of land crossed by the onshore ECC, with the exception of agricultural land drains, there is no formal drainage infrastructure controlling runoff. During a rainfall event, surface water will infiltrate into the ground or, if the soil is saturated, flow over the surface, ponding in topographic lows or following the topographic slope into open drainage ditches/ streams or the main watercourse network.

A detailed review of local utilities has been undertaken to inform the onshore ECC route selection and it is noted that a number of water mains will be crossed by the onshore cabling. The crossings will be either trenched or use trenchless crossing techniques (for example HDD) and each crossing would require prior consent from Welsh Water.

4 Assessment of Flooding Consequences

TAN15 sets out how the potential consequences of a flooding event should be assessed and provides guidance on the technical requirements for undertaking such an assessment. The key objectives of the assessment relevant to the proposals are to develop a full 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 of the FCA outlines an assessment of potential flooding consequences of the onshore ECC in line with TAN15.

The NRW National Flood Hazard Maps have been used to assess the risk of flooding taking into account the effect of existing flood defences. Flood defences reduce, but do not completely remove the chance of flooding as they can be overtopped or fail.

4.1 Areas to be Assessed

As discussed at Section 2.2.1, works that have been identified to be within Zone C1 of the DAM and which will require assessment are:

- from landfall to the B5119 Dyserth Road crossing;
- from the A525 Rhuddlan Road crossing to the Clwyd Estuary crossing; and
- from the Clwyd Estuary crossing to the Sarn Lane crossing.

Remaining areas are within the DAM Zone A which is land considered to be at little or no risk of fluvial or coastal/ tidal flooding.

4.1.1 Landfall to B5119 Dyserth Road

The works area for the landfall site, including the TCC at either Garford Road or Ferguson Avenue for beach access and the trenchless crossing works compound and TCC area to the south of landfall, are located within an area shown to be potentially at risk of flooding from tidal flooding, and to a lesser extent, fluvial flooding. The tidal flood risk to this area is associated with tidal inundation from the Irish Sea. NRW has advised on extreme sea levels (0.5% AEP[7] or 1 in 200 chance, and 0.1% AEP or 1 in 1000 chance) for a section of coastline closest to landfall. The maximum lifetime of the works is envisaged to be approximately 18 months.

The SFCA and NRW flood defence data identifies that the sea wall defence along the coastal frontage between Prestatyn and the eastern end of Rhyl has an effective crest level of 7.23 m aOD. The ongoing East Rhyl Coastal Defence scheme will improve the standard of defence to provide protection for tidal events up to 0.5% AEP (1 in 200 chance) and will maintain this level of service over the short anticipated life of the proposed works and the operational life of AyM. The Shoreline Management Plan for the area[8] (Sub Cell 11a Gt Ormes Head to Formby Point10) suggests a “Hold the Line” policy for the coastal frontage at Rhyl Golf Links and along the wider frontage to the east and west, serving the Prestatyn and Rhyl settlements respectively. It is noted however that

7 Annual Exceedance Probability
8 SMP 22 Great Ormes Head to Scotland (North West England and North Wales), The Northwest Coastal Group, Shoreline Management Plans – North West Coastal Group (mycoastline.org.uk), accessed March 2021

the Central Prestatyn Coastal Defence Scheme which was submitted for planning permission in December 2021 (Planning Application 45/2021/1248) is for a new earth embankment that is set back from the front-line defences, following the boundary of the golf course along the A548 Rhyl Coast Road.

4.1.2 A525 Rhuddlan Road crossing to the Clwyd Estuary crossing

The works area for the onshore ECC to the east of the Clwyd Estuary, shown to be potentially at risk of flooding, will include cable trenching, trenchless crossing works, including temporary compounds and a small part of the TCC area to the west of the A525 crossing. The tidal flood risk to this area is associated with tidal inundation from the Clwyd Estuary. Fluvial flood risk is associated with the Clwyd Estuary, Glanffyddion Cut and other smaller tributaries. The maximum lifetime of the works in this area will be relatively short and is not expected to exceed 18 months.

The SFCA and NRW flood defence data identifies that the flood defences serving the eastern bank of the Clwyd Estuary are formed of a clay embankment with a cycle path along the top. The embankment has a crest level greater than 5.98 m aOD. This reach of the estuary is included within the Shoreline Management Plan and suggests a “Hold the Line” policy for the embankment up until 2030. Beyond 2030 there is potential for “Managed Realignment” subject to further studies. The defences are detailed as providing a current standard of protection that is greater than 0.5% AEP. This standard of protection will be maintained over the short-term anticipated duration of the proposed works.

4.1.3 From the Clwyd Estuary crossing to the Sarn Lane crossing

The works area for the onshore ECC to the west of the Clwyd Estuary shown to be potentially at risk of flooding will include cable trenching, trenchless crossing works for the Clwyd Estuary crossing, and TCC areas at road crossings. The tidal and fluvial flood risk to this area is associated with the Clwyd Estuary and associated tributaries including Pont Robin Cut and Gypsey Lane Drain. The maximum lifetime of the works in this area will be relatively short and is not expected to exceed 18 months.

The SFCA and NRW flood defence data identifies that the flood defences serving the eastern bank of the Clwyd Estuary are formed of a clay embankment with a crest level greater than 6.0 m aOD. This reach of the estuary is included within the Shoreline Management Plan and suggests a “Hold the Line” policy for the embankment up until 2030. Beyond 2030 there is potential for “Managed Realignment” subject to further studies. The defences are detailed as providing a current standard of protection that is to at least 0.5% AEP. This standard of protection will be maintained over the short-term anticipated duration of the proposed works.

4.2 Historical Flooding

Historical flooding extents are mapped on the NRW National Flood Hazard and Risk Maps which indicate that flooding has previously occurred in the following locations which are coincident with the onshore ECC route:

- agricultural land to the east of Rhyl, south of the North Wales Main Line railway;
- land to the north west of Rhuddlan, to the north of Glanffyddion Cut; and
- agricultural land to the west of the Clwyd Estuary, extending south across the A547 Abergele Road.

NRW also report that tidal flooding has occurred to properties in the vicinity of the landfall area around Garford Road, most notably in 2013.

4.3 Fluvial and Tidal Flooding

Agricultural land to the south of landfall, on the protected side of coastal defences, is generally at a *Low* risk of flooding from the sea. *Low* risk of tidal flooding is defined in TAN 15 as areas potentially at risk of flooding from the sea for events between 0.5% AEP and 0.1% AEP (1 in 200 chance and 1 in 1000 chance of flooding annually).

A small area of the golf course, to the west of the onshore ECC is shown to be at a *Medium* risk of flooding which is defined as areas potentially at risk of flooding from the sea for events between 3.3% AEP and 0.5% AEP (1 in 30 chance and 1 in 200 chance of flooding annually). Landfall areas on the seaward side of coastal defences are at a *High* risk of flooding from the sea which is defined as areas potentially at risk of flooding from the sea for events greater than 3.3% AEP (1 in 30 chance annually).

The risk of fluvial flooding to the south of landfall is limited to some lower lying land close to the Rhyl Cut. These areas are shown to be at a *Low* risk of fluvial flooding. *Low* risk of fluvial flooding is defined as areas potentially at risk of flooding from rivers for events between 1% AEP and 0.1% AEP (1 in 100 chance and 1 in 1000 chance of flooding annually).

For the land shown to be in Zone C1 to the east and west of the Clwyd Estuary, the potential extent of flooding from tidal or fluvial sources is very similar. Areas of potential flooding from the sea associated with the Clwyd Estuary are shown to be *Low* risk, whereas the same areas potentially at risk from fluvial flooding are shown to be *High* or *Medium* risk. *High* risk is defined as areas potentially at risk of flooding from rivers for events greater than 3.3% AEP. *Medium* risk is defined as areas potentially at risk of flooding from rivers for events between 3.3% AEP and 1% AEP.

4.3.1 Breach or failure of defences

There is a possibility that a breach could occur at a location within the coastal defences close to landfall or along the Clwyd Estuary defences. These defences are managed structures subject to regular inspection and are recorded as currently being in Good or Fair condition. Any failure or breach of these defences would be considered to be unlikely. The East Rhyl Coastal Defence scheme is intended to improve the standard of defence to provide protection for tidal events up to 0.5% AEP and it is assumed that these new defences, once complete will be in good condition.

The nature of the temporary works means that the site will not be permanently occupied; the number of people on the site at any one time will be controlled and limited; and the lifetime for construction is relatively short (less than18 months). The likelihood of a breach event occurring during the lifetime of the works and the risk to human life during such a flood event is therefore considered to be severely reduced as a consequence of the nature of the proposed development.

4.3.2 Proposed mitigation

The areas at flood risk are within Flood Warning areas:

- *Prestatyn and East Rhyl*, which covers extensive areas along the coast road from the eastern outskirts of Rhyl to Prestatyn Golf Course;
- *Clwyd Right Bank*, including land downstream of Rhuddlan, farmhouses and parts of west Rhyl; and
- *Clwyd Left Bank*, covering communities to the west of the Afon Clwyd including Kinmel Bay, Towyn, Belgrano and Pensarn.

Advance warning of a flood event potentially affecting the work area is likely to be available, enabling any users to avoid these areas during such an event. The manager of the works will be required to sign up to the flood warning service to receive a phone call or text message in the event of a potential flood threat to the area in which construction is active. This will be secured within the Construction Method Statement (CMS) which forms part of the outline Code of Construction Practice (CoCP). Any personnel due to work at the site could then be contacted and alerted to the potential for flooding. This procedure would be confirmed in the site specific working method statements.

For works to the north of existing coastal defences at landfall, all work schedules will be assessed against tide times at least two weeks in advanced and the operatives notified of the working times. Working times/ windows

will be briefed to all personnel prior to commencement of works allowing for weather conditions, tide height and tide times. It is anticipated that works will be continued until three hours before the anticipated high tide times dependant on which section of works is being undertaken at the time.

Site storage of fuel and chemicals shall be away from undefended areas potentially at risk of flooding. Refuelling of plant and equipment will only be permitted at designated refuelling areas and fuel shall be pumped into machines to minimise the risk of spillage. No refuelling shall take place on the beach area at any time. Small plant will be taken from the works face (when on the beach) and refuelled at a designated fuel area established above the mean high water level on land that is at low risk or is defended from flooding.

4.4 Surface Water Flooding

Flooding from surface water sources can occur during intense rainfall events, when water cannot soak into the ground or enter drainage systems. During such a rainfall event, any surface water overland flow migrating to construction work areas from off-site sources would flow over the surface in an uncontrolled manner following the topographic slopes.

The National Flood Hazard Map shows the *Flood Risk from Surface Water and Small Watercourses*. The flood risk to the onshore ECC route due to surface water is predominantly very low (less than 0.1% AEP). Some areas of high risk (greater than 3.3% AEP) do cross the route, however this is predominately associated with existing surface water drainage features/ drainage ditches and flows are generally contained within respective channels.

Some existing drainage ditches will need to be crossed or may need to be diverted temporarily or new drainage provided in order to facilitate construction infrastructure (TCC areas, trenchless crossing works, etc.). The proposed development will also temporarily increase impermeable areas in parts of the onshore ECC through the introduction of small construction buildings or bunded storage areas. Without mitigation this has the potential to increase surface water runoff from the onshore ECC.

4.4.1 Proposed mitigation

This will be mitigated through the implementation of appropriate temporary drainage and a drainage strategy in line with principles set out in a CoCP. Any drainage channels crossed or disrupted due to construction activities will be reinstated at the completion of works. With these measures in place, it is considered that the construction activities will pose a low risk to flooding elsewhere.

Other than where crossings are required, all working areas, refuelling and storage areas will be set back from water features by at least 10 m where practicable.

4.5 Groundwater Flooding

Groundwater flooding can occur when groundwater levels rise above surface levels, or within underground structures. The SFRA does not highlight any significant areas of risk on the lower lying ground from the landfall, around Rhyl and immediately west of the proposed Clwyd crossing. Some areas of potential risk are shown where land rises up to the A55 and south of the A55 to the east of the substation zone.

Whilst there is some limited potential for shallow groundwater beneath some areas of the onshore ECC, proposed buildings within the works, if any, will be limited to small, temporary offices and welfare facilities, with no basement structures. The risk posed by ground water flooding is considered to be very limited and not significant.

4.5.1.1 Proposed mitigation

None considered necessary.

4.6 Flooding from Sewers

Sewer flooding can occur during periods of heavy rainfall when a sewer becomes blocked or is of inadequate capacity. Given the greenfield nature of the majority of the onshore ECC, there is unlikely to be formal drainage infrastructure controlling runoff from any areas. A small number of Welsh Water sewers have been identified which pass under the onshore ECC route and which will require consent to be crossed.

Any surcharge of sewers at or in close proximity to the onshore ECC would be likely to form shallow overland flow, following local gradients and passing to local surface water drainage features. Flooding from this source is therefore considered to be very limited and the risk is assessed to be not significant.

4.6.1.1 Proposed mitigation

None considered necessary.

4.7 Other Sources of Flooding

The National Flood Hazard Map shows the Flood Risk from Reservoirs dataset. Some of the land to the south west of the Clwyd Estuary is shown on this mapping to be potentially susceptible to flooding in the event of a failure of a reservoir. This risk is detailed as being associated with Llyn Aled and Llyn Aled Isaf reservoirs, both of which drain into the Afon Elwy catchment, over 30 km upstream of the Clwyd Estuary.

The reservoirs are formally maintained structures that are required to be regularly inspected. The likelihood of failure of these structures and the remote location upstream of any construction working areas mean that the risk of flooding from this source is assessed to be not significant.

There are no canals in the near vicinity of the onshore ECC.

Given the limited size of the temporary infrastructure and the temporary nature of the works, the agricultural nature of the surrounding land, and the residual nature of the flood risk, the likelihood of flooding and the magnitude and significance of any obstruction and subsequent diversion of flood flow routes is considered to be minor and short-term.

4.7.1.1 Proposed mitigation

None considered necessary.

4.8 Event Exceedence and Residual Risk

The mitigation measures proposed as part of the construction phase works will be set out in a CoCP which will include a Construction Method statement (CMS) and drainage strategy. An outline version of the CoCP is provided with the application for development consent (application ref 8.13) and are considered appropriate to mitigate against any residual risks or event exceedence scenarios.

4.9 Summary of Sources of Flooding

A summary of the overall risk of flooding from the respective potential sources assessed is presented in Table 4-1.

Table 4-1: Potential Sources of Flooding

Potential Source of Flooding	Flood Risk at the onshore ECC
Sea or Tidal Flooding	Low
Rivers or Fluvial Flooding	High
Surface Water and Overland Flow	Low
Groundwater	Not significant
Sewers	Not significant
Reservoirs, Canals and other Artificial Sources	Not significant

5 SURFACE WATER MANAGEMENT

There will potentially be an increase in hardstanding associated with works within the onshore ECC. Within the TCC work areas and trenchless crossing works compounds, the made ground or topsoil will be stripped and a capping layer of crushed stone introduced to provide an area of hardstanding. Some areas may have small temporary building or welfare facilities and storage areas may include impermeable bunding.

There will therefore be a small potential increase in the rate and volume of surface water runoff generated at the TCC work areas and trenchless crossing works compounds. Given the size and lifetime of the works areas, any increase in surface water run-off associated with their instalment is considered to be relatively minimal and short-term. The immediate surrounding land is greenfield, on which no buildings or development are located, therefore the consequence of relatively small increases in overland flow onto these areas is considered to be minimal.

All work areas will be required to control surface water within the application boundary and this control will be likely to include attenuation and settlement areas to manage and treat surface water runoff. Discharges to the water environment will be at controlled rates and will be either to infiltration or through discharge of clean water to local surface water features.

All work areas will be fully reinstated following completion of construction activities.

Principles for control of surface water in all work areas will be defined within the CoCP.

The lifetime of the works is envisaged to be approximately 18 months. It is not considered necessary therefore to consider the effect of climate change on rainfall intensity, or sea levels, for the purpose of this assessment.

6 JUSTIFICATION TEST

Under TAN15 there is a requirement for any proposed work within Zone C1 to be subject to the justification test, including acceptability of consequences. Criteria that must be demonstrated in order to justify development within flood Zone C, are as follows:

i) Its location in Zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or,

ii) Its location in Zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

and,

iii) It concurs with the aims of PPW and meets the definition of previously developed land; and,

iv) The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in TAN15 found to be acceptable.

With regard to part i) of the Justification Test, it is considered that the works areas within Zone C1 are justified as they are critical elements within the construction phase of AyM, which is classified as a Nationally Significant Infrastructure Project (NSIP). This is a project which provides the opportunity to contribute towards meeting the UK Government's targets for generating energy from a renewable source, i.e. wind and will generate employment during construction and operation of the OWF . Further detail on the policy need for the project is summarised in the site selection chapter of the Environmental Statement (application ref 6.1.4: Site Selection and Alternatives) and the Planning Statement (application ref: 8.1).

With regard to part iii) of the Justification Test, the works within Zone C1 are related to the installation of the onshore cables and will be temporary in nature. No permanent above ground structures will be developed as part of the works. The works are not within previously developed land however following the works there will be no change to existing land use.

With regard to part iv) of the justification Test, this FCA has assessed the potential consequences of a flooding event for the works areas. The acceptability criteria for proposed developments within flood Zone C1 are set out in Appendix 1, Part C of TAN15 and are reproduced in Table 6-1- below. An extra column has been added to demonstrate how the proposed development meets the criteria.

Table 6-1: Acceptability criteria for proposed developments within Zone C1

Acceptable consequences for nature of use	Evidence to demonstrate how the proposed development meets the criteria
Flood defences adequate	The coastal tidal flood defences serving the landfall area provide protection up to at least the 0.5% AEP tidal flood level. The flood defences serving the Clwyd Estuary have a design standard of 0.5% AEP.
Agreement for construction and maintenance costs secured	Not applicable.
Occupiers aware of flood risk	Through signing up to the Flood Warning Service, site users will be made aware of the potential flood risk.

Escape/evacuation routes present; Effective flood warning provided; Flood emergency plans and procedures	The manager of the construction works would sign up to the flood warning service to receive a phone call or text message in the event of a potential flood threat to the working areas. Any personnel due to work at the site could then be contacted and alerted to the flood risk.
Flood resistant design	Buildings on the work areas, if any, will be limited to small, temporary offices and welfare facilities. Given the nature of the buildings, the temporary nature of their lifetime, and the residual nature of the flood risk, flood resistant design is not considered appropriate.
No increase in flooding elsewhere	Given the small size of the temporary buildings, the temporary nature of the works area, the agricultural nature of the surrounding land, and the residual nature of the fluvial flood risk, the likelihood of a flood event and magnitude and significance of any obstruction and subsequent diversion of flood flow routes or displacement of fluvial floodplain is considered to be minor and short-term. Given the size and lifetime of the works sites, any increase in surface water run-off associated with their instalment is considered to be relatively minimal and short-term. The immediate surrounding land is greenfield, on which no buildings are located, therefore the impact of the potential relatively small increase in overland flow onto these areas is considered to be minimal. The minor increased rate and volume of run-off from the sites will be managed through control principles set out in an outline CoCP that will be revised and submitted to DCC for approval in consultation with NRW prior to the commencement of works.

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7 Summary and Conclusions

The aim of this Flood Consequence Assessment is to outline:

- the potential for the AyM onshore ECC route to be impacted by flooding;
- the potential impacts of the construction works on flooding both onsite and in the vicinity, and
- the proposed measures which can be incorporated to mitigate the identified risks.

The report has been produced in accordance with the guidance detailed in TAN15 and following consultation with NRW.

Parts of the ECC are located within Zone C1 of the DAM and as such are subject to the Justification Test. AyM is considered to meet the policy requirements of the test and the potential consequences of a flooding event have been considered within this report. In terms of the criteria contained in TAN15, the development proposals are considered to meet the requirements of the Justification Test and are therefore found to be acceptable.

Some areas of the onshore ECC route are located within the defended tidal and fluvial floodplain. The nature of the works means that the land will not be permanently occupied; the number of people working on the onshore ECC at any time will be controlled and limited; and the lifetime of the proposed works is relatively short. The likelihood of the defences being overtopped or a breach event occurring during the lifetime of the works and the risk to human life during such a flood event is therefore considered to be severely reduced as a consequence of the nature of AyM.

The manager of the construction works will be required to sign up to the flood warning service. Any personnel due to work at the site could be contacted and alerted to the flood risk. All work schedules for activity on Ffrith Beach will be assessed against tide times and the operatives notified of the working times. Assessment will allow for weather conditions, tide height and tide times. Site storage of fuel and chemicals shall be away from undefended areas potentially at risk of flooding. Refuelling of plant and equipment will only be permitted at designated refuelling areas, set back from water features by at least 10 m where practicable. No refuelling shall take place on the beach area at any time.

There will be a potential increase in the rate and volume of surface water runoff generated within temporary compounds and trenchless crossing works areas associated with the onshore ECC. Given the size and lifetime of the works areas, any increase in surface water runoff associated with the works is considered to be minimal and short-term. The immediate surrounding land is greenfield, on which no buildings are located, therefore the impact of the potential relatively small increase in overland flow onto these areas is considered to be minimal.

All work areas will be required to control surface water within the application boundary and this control will include attenuation settlement areas to safeguard water quality. Discharges to the water environment will be at controlled rates and will be either to infiltration or through discharge of clean water to local surface water features. Principles for control of surface water in all work areas have been set out within an outline CoCP that will be revised and submitted to DCC for approval in consultation with NRW prior to the commencement of works.

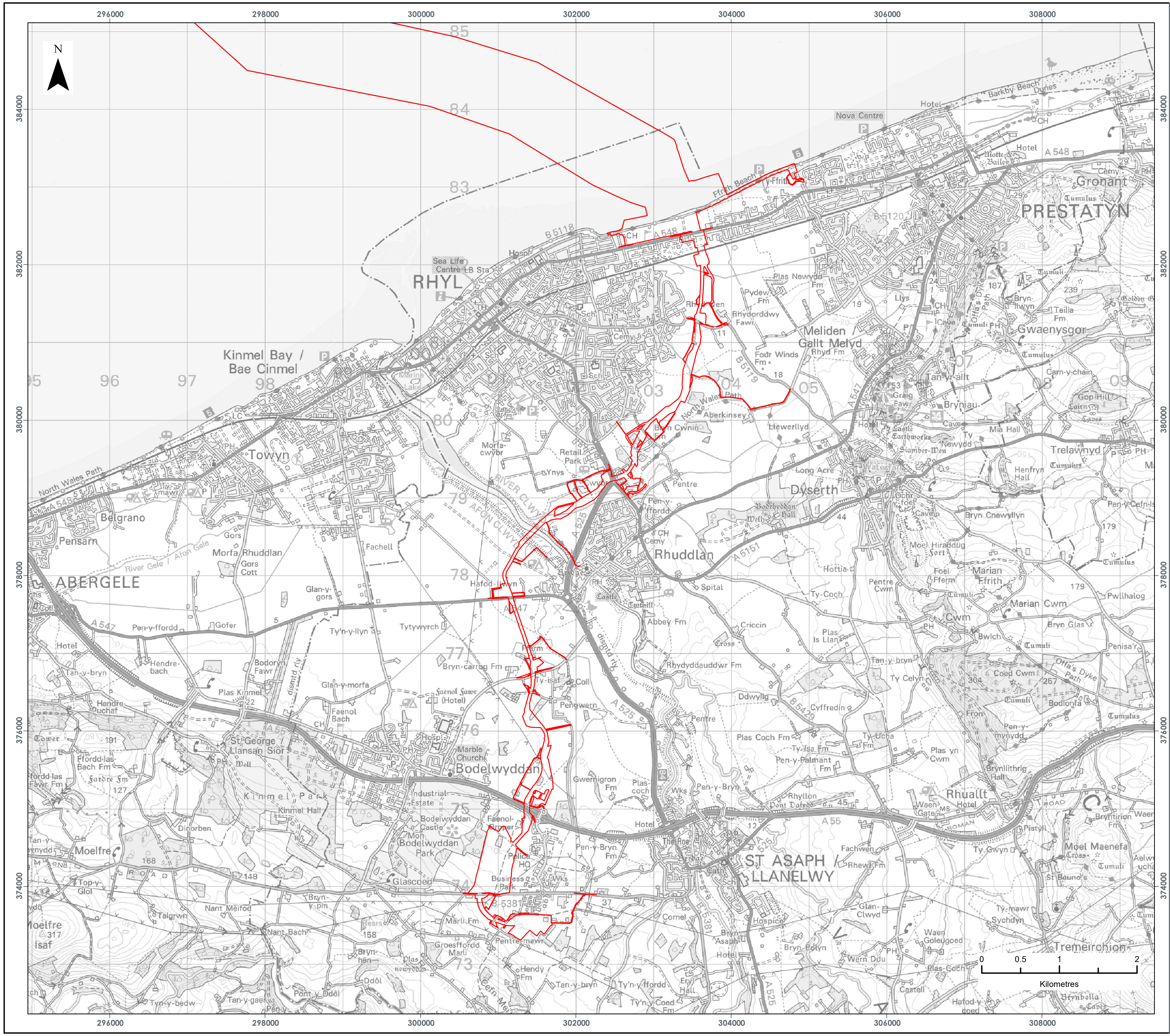
In conclusion, based on the information outlined within this initial Flood Consequences Assessment, the perceived level of flood risk to and caused by the development is low and the development would be safe, without significantly increasing flood risk elsewhere.

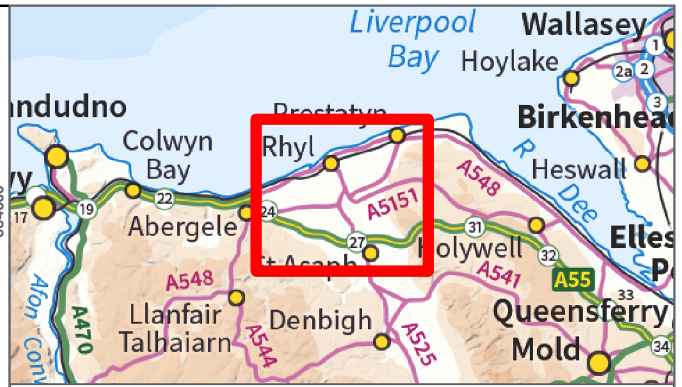
DRAWINGS

Figure 1: Order Limits

Figure 2: NRW Development Advice Map Extract

Figure 3: Plot of LiDAR Topographical Data





LEGEND

Order Limits

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Order Limits

VER	DATE	REMARKS	Drawn	Checked
1	31/03/2022	ES Issue	JRS	MF

FIGURE NUMBER:

FIGURE 1

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:50,000	A3	ODN	British National Grid

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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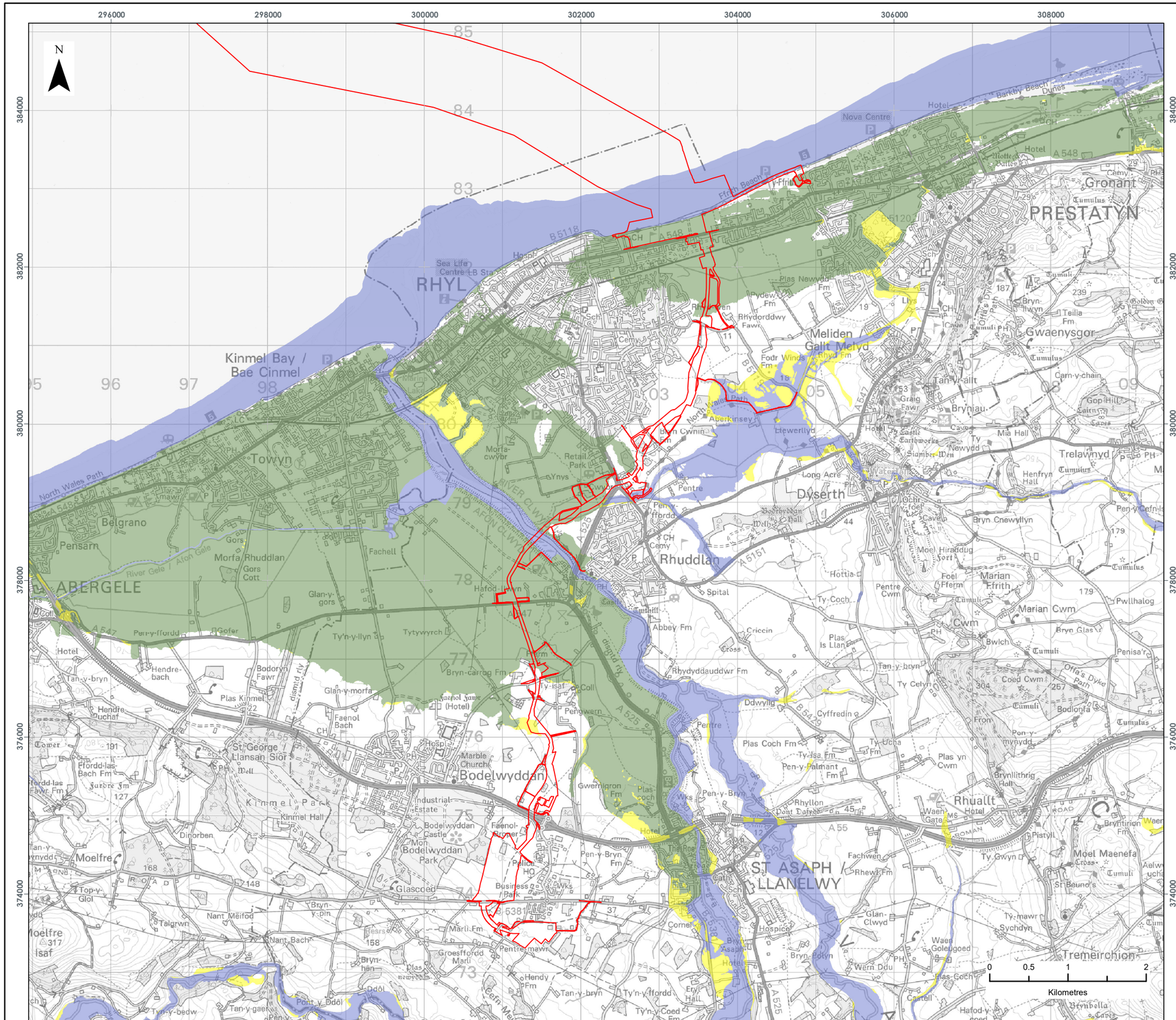

LEGEND

- Order Limits

NRW Development Advice Map

- Zone C1
- Zone C2
- Zone B

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

NRW DEVELOPMENT ADVICE MAP EXTRACT

VER	DATE	REMARKS	Drawn	Checked
1	31/03/2022	ES Issue	JRS	MF

FIGURE NUMBER:

FIGURE 2

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:50,000	A3	ODN	British National Grid

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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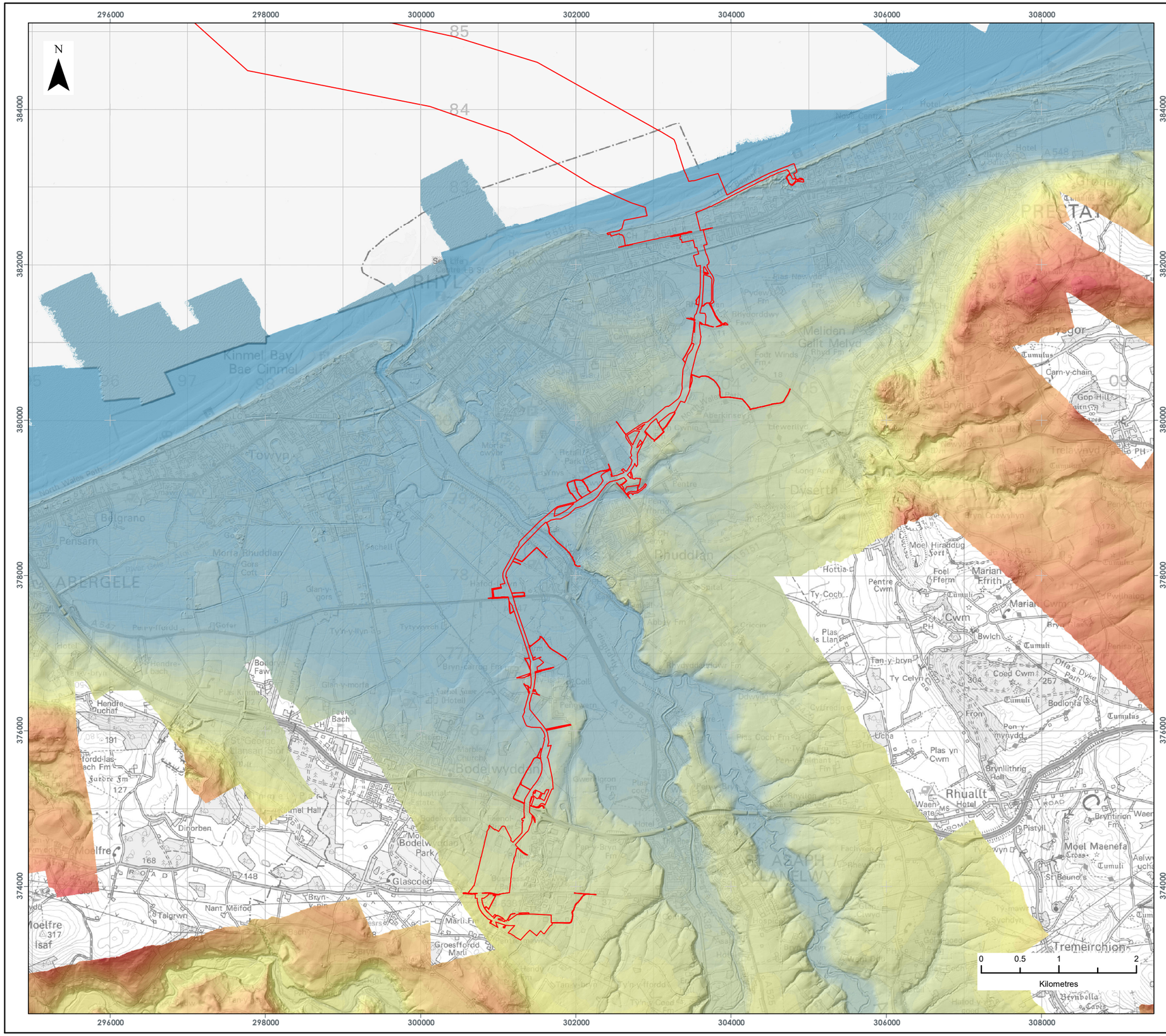

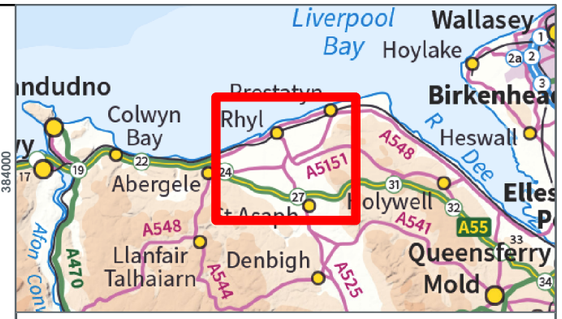

LEGEND

Order Limits

Ground Elevation (m AOD)

High : 240 m

Low : 0 m

Data Source:
© Crown copyright [and database rights] (2022) OS OpenData.
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PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

PLOT OF LIDAR TOPOGRAPHICAL DATA

VER	DATE	REMARKS	Drawn	Checked
1	31/03/2022	ES Issue	JRS	MF

FIGURE NUMBER:

FIGURE 3

SCALE:	PLOT SIZE:	DATUM:	COORDINATE SYSTEM:
1:50,000	A3	ODN	British National Grid

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

\\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00009 Awel y Mor\Tech\GIS\Dwgs\Wking\202201 Environmental Statement\Onshore ECC Flood Consequence Assessment\05356.00009.0321.0 Plot of LiDAR Topographical Data.mxd

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