Partners in UK offshore wind

MONA OFFSHORE WIND PROJECT

Environmental Statement

Volume 7, Annex 2.1 Flood Consequences Assessment

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F01

Image of an offshore wind farm

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Prepared by:

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Prepared for:

Mona Offshore Wind Ltd.

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Glossary

Term	Meaning
Annual Exceedance Probability	The chance that a storm event of a particular size is experienced or exceeded during any year.
Catchments	An area that serves a watercourse with rainwater. Every part of land where the rainfall drains to a single watercourse is in the same catchment.
Climate Change	A long term change in weather patterns, in the context of flood risk, climate change will produce more frequent severe rainfall.
Discharge Consents	Consent granted by Natural Resources Wales (NRW) to discharge into watercourses, subject to conditions.
Field drainage	Limiting the effect of flooding by maintaining surface water and land drainage systems.
Flood consequence assessment (FCA)	A Flood Consequence Assessment is an assessment of the risk of flooding from all flood mechanisms, including the identification of flood mitigation measures, in order to satisfy the requirements of the planning policy Wales and the technical advice note 15.
Flood defences	A structure that is used to reduce the probability of floodwater affecting a particular area.
Flood Risk Activity Permit (FRAP)	A FRAP required for activities in or near a (designated) main river and associated flood defences and/or within a flood plain of a main river from NRW.
Flood Zone 1	Low Probability Land having a less than 1 in 1,000 annual probability of river or sea flooding.
Flood Zone 2	Medium Probability Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Flood Zone 3	High Probability Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Fluvial flooding	Fluvial flooding occurs when rivers burst their banks as a result of sustained or intense rainfall.
Geology	The scientific study of the origin, history and structure of the earth.
Greenfield runoff rate	Rates of surface water runoff from a site that is undeveloped (greenfield).
Ground conditions	The chemical and physical characteristics of the soil at a particular location and how it has been affected by historical land uses.
Groundwater	All water which is below the surface of the ground in the saturated zone and in direct contact with the ground or subsoil.
Lead Local Flood Authority	Lead Local Flood Authorities (LLFA) are responsible for managing flood risk from surface water, groundwater and ordinary watercourses Lead Local Flood Authorities have responsibility for developing a Local Flood Risk Management Strategy for their area identifying local sources of flooding. The local strategy produced must be consistent with the national strategy. It will set out the local organisations with responsibility for flood risk in the area, partnership arrangements to ensure co-ordination between these organisations, an assessment of the flood risk, and plans and actions for managing the risk.
Main rivers	The term used to describe a water course in respect of which the NRW has permissive powers in relation to its management.
Ordinary watercourses	The term used to describe a water course owned and operated by a local Drainage Board, a Lead Local Flood Authority or a private land owner.

Term	Meaning
Ordinary watercourse consent	Consents required for works in an ordinary watercourse from the relevant LLFA.
Planning Policy Wales Edition 11	Planning Policy Wales Edition 11 sets out the land use planning policies of the Welsh Government. The objective is to ensure the planning system contributes towards sustainable development and improves the social, economic, environmental land cultural well-being of Wales.
QBAR	The mean annual flood. Within the context of the greenfield runoff rate, the QBAR value is the estimation of the mean annual maximum flow rate.
River Basin Management Plan	River Basin Management Plans describe the current state of the water environment in the river basin district. It sets out what improvements are possible by 2015 and how the actions will make a difference to the local environment - the catchments, estuaries, the coast and groundwater.
Shoreline Management Plan	A Shoreline Management Plan is a large-scale assessment of the risks associated with coastal processes and sets out a policy framework to address these risks to people and the developed, historic and natural environments. Coastal processes include tidal patterns, wave height, wave direction and the movement of beach and seabed materials.
Strategic Flood Risk Assessment	A Strategic Flood Risk Assessment provides information on areas at risk from all sources of flooding.
Surface water runoff	Surface water runoff is flow of water that occurs when excess stormwater, meltwater, or other sources of water flows over a surface.
Sustainable Drainage Systems	A sequence of management practices and control measures designed to mimic natural drainage processes by allowing rainfall to infiltrate, and by attenuating and conveying surface water runoff slowly at peak times.
SuDS Approving Body	A service delivered by the Local Authority (Conwy County Borough Council and Denbighshire County Council) to ensure that drainage proposals for all new developments over 100m² of construction area are fit for purpose, designed and built in accordance with the National Standards for Sustainable Drainage published by Welsh Ministers.
Technical advice note 15 (2004)	Technical Advice Note (TAN)15 provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding. It advises on development and flood risk as this relates to sustainability principles, and provides a framework within which risks arising from both river and coastal flooding, and from additional run-off from development in any location, can be assessed.
Tidal (Coastal) flooding	Tidal flooding is caused by extreme tidal conditions including high tides and storm surges, overtopping local flood defences or coastal features.
Treated Effluent	Water that has received primary, secondary or advanced treatment to reduce its pollution or health hazards and is subsequently released from a wastewater facility after treatment.
UK Climate Projections 2009	Climate projections expressed in terms of absolute values. A projection of the response of the climate system to emission scenarios of greenhouse gases and aerosols, or radiative forcing scenarios based upon climate model simulations and past observations.
Undefended Flood Zone	NRW mapped river and sea flood water extents which do not take into account the presence of flood defences.
Water Quality	The physical, chemical and biological characteristics of water.
Welsh Water	Welsh Water is a water company which supplies drinking water, drainage and sewerage services for the majority of Wales via a network of pipe and pump infrastructure.

Acronyms

Acronym	Description
AOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
CCBC	Conwy County Borough Council
DAM	Development Advice Maps
DCC	Denbighshire County Council
DCO	Development Consent Order
FCA	Flood Consequence Assessment
LDP	Local Development Plan
NRW	Natural Resources Wales
PPW	Planning Policy Wales
SPA	Special Protection Area
SSSI	Site off Special Scientific Interest
SuDS	Sustainable Drainage System
TAN 15	Technical Advice Note 15

Units

Unit	Description
ha	Hectare
km	Kilometre
kV	Kilovolt
l/s	Litres per second
m	Meters
m^2	Meters squared
mm	Millimetres
%	Percentage
km^2	Square kilometres

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1 FLOOD CONSEQUENCES ASSESSMENT

1.1 Introduction

1.1.1.1 This Flood Consequences Assessment (FCA) has been used to inform the assessment of Mona Offshore Wind Project as reported in Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement. A site-specific FCA has been prepared for the Mona Onshore Development Area.

1.1.1.2 The FCA supports the Development Consent Order (DCO) application for the Mona Offshore Wind Project in accordance with the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009.

1.1.1.3 Developments that are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works.

1.1.1.1. The key objectives of the FCA are:

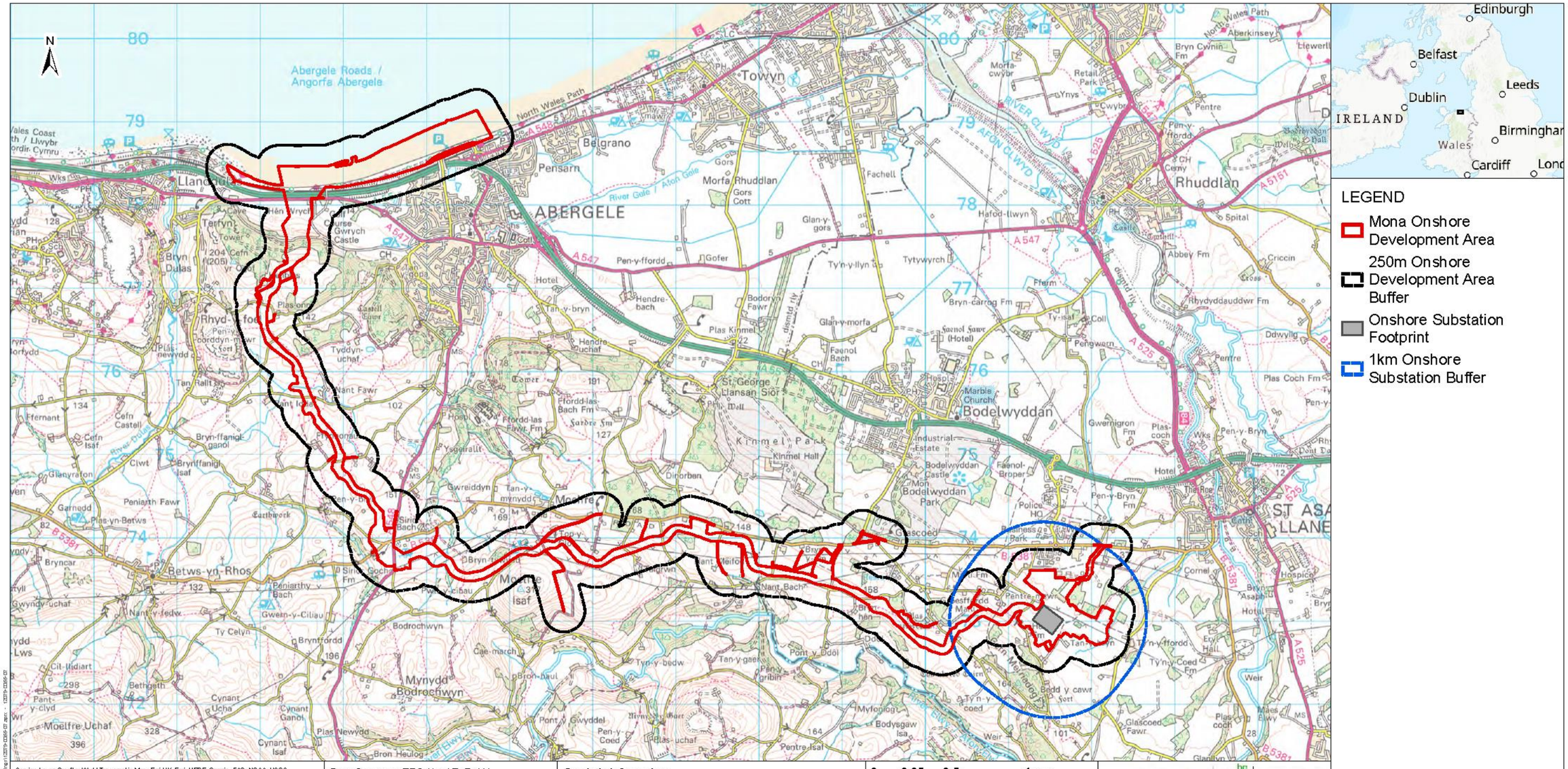
- To assess the flood risk to the Mona Offshore Wind Project and to demonstrate the feasibility of appropriate design such that any residual flood risk to the Project and users would be acceptable
- To assess the potential impact of the Mona Offshore Wind Project on flood risk elsewhere and to demonstrate the feasibility of appropriate design, such that the Project would not increase flood risk elsewhere
- To satisfy the requirements of the legislative planning guidance set out in section 2 which require FCAs to be submitted in support of DCO applications.

1.2 Study area

1.2.1.1 The hydrology and flood risk study area used for the assessment focuses on areas landward of Mean High Water Springs (MHWS). The elements of the hydrology and flood risk study area relevant to this technical report are described below and shown on Figure 1.1:

- The area of land to be temporarily or permanently occupied during the construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project (hereafter referred to as the Mona Onshore Development Area)
- Flood risk receptors located within 1 km of the Onshore Substation. The 1 km buffer was chosen primarily to identify any existing receptors, assets or infrastructure that have the potential to be affected by flood risk as a result of the permanent infrastructure associated with the Mona Offshore Wind Project.

1.2.1.2 With regards to permanent infrastructure, the technical report focuses on the Onshore Substation platform.



Service Layer Credits: World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS / bp / EnBW

Geodetic Information:
Datum: OSGB 1936. Projection: British National Grid.
Scale@ 271.5mm x 154mm: 1:50,163

0 0.25 0.5 1 nm
0 0.5 1 2 km

Project Name:	Drawing Title:	Drawing Number:
MONA OFFSHORE WIND PROJECT	HYDROLOGY AND FLOOD RISK STUDY AREA	12079-0355-07

VER	DATE	DETAILS	BY	CHECK
01	20/10/23	FINAL	JM	CR

Figure 1.1: Hydrology and flood risk study area.

1.2.1.3 This technical report should be read in conjunction with Volume 7, Annex 2.2: Surface watercourses and Natural Resources Wales (NRW) flood zones of the Environmental Statement and the Outline Operational Drainage Strategy (Document reference J28).

1.3 Methodology

1.3.1 Overview

1.3.1.1 The FCA has been produced in accordance with the Overarching National Policy Statement (NPS) for Energy EN-1, Planning Policy Wales (PPW) Edition 11, current (2004) and draft (2021) Technical Advice Note 15: Development and Flood Risk (TAN 15).The FCA makes reference to local flood risk documents and includes a summary of the relevant local planning policies in addition to potential flood risk and hydrological constraints to the Mona Onshore Development Area, including the Onshore Substation. The policies cover the requirements in respect to Nationally Significant Infrastructure Projects.

1.3.1.2 In order to achieve the key objectives above, a staged approach was adopted in preparing the FCA in accordance with NPS (EN-1), PPW 11 and TAN 15. Initially, screening studies have been undertaken utilising publicly available information within the hydrology and flood risk study area which may warrant further consideration. Identified potential flooding issues are then assessed further within a specific flood risk section. The outputs of this assessment are:

- A review of all available information and a qualitative analysis of the flood risk to the Onshore Substation platform and Mona Onshore Development Area
- Identification of any impact of the Mona onshore infrastructure has on flood risk elsewhere.

1.3.1.3 The FCA covers both temporary and permanent infrastructure proposed within the Mona Onshore Development Area. As the vast majority of permanent infrastructure associated with the Mona Offshore Wind Project is to be located within the Onshore Substation, the FCA for the Onshore Substation platform has been presented first, followed by the Onshore Cable Route which predominantly consists of temporary development.

1.3.2 Information sources

1.3.2.1 The information used in the preparation of this report is set out in Table 1.1.

Table 1.1: Information sources consulted during preparation of the FCA

Title	Source	Year	Author
Ordnance Survey (OS) mapping 1:25 000	http://bing.com/maps	2023	OS
Interactive map viewer	https://naturalresources.wales/evidence-and-data/maps/browse-map-of-data-about-the-natural-environment/?lang=en	2023	NRW
Geoindex Onshore Mapping	https://www.bgs.ac.uk/map-viewers/geoindex-onshore/	2023	British Geological Survey (BGS)
Soilscapes viewer	http://www.landis.org.uk/soilscapes/	2023	The National Soils Research Institute
Groundsure Enviro+Geo insights report	reference GSIP-2022-12806-10820_A – E and GSIP-2022-12806-10819	2022	Groundsure
Flood Estimation Handbook (FEH) Web Service	https://fehweb.ceh.ac.uk/GB/map	2023	FEH
Flood Map for Planning (FMfP)	https://flood-map-for-planning.naturalresources.wales/	2023	NRW
Development Advice Mapping (DAM)	https://naturalresources.wales/flooding/flood-map-for-planning-development-advice-map/?lang=en	2023	NRW
Flood Risk Assessment Wales Map	https://naturalresources.wales/flooding/flood-map-for-planning-development-advice-map/?lang=en	2023	NRW
National Flood Hazard and Risk Maps	https://naturalresources.wales/flooding/flood-map-for-planning-development-advice-map/?lang=en	2023	NRW
DataMapWales	https://datamap.gov.wales/	2023	Welsh Government
Flood Consequences Assessments: Climate Change Allowances	https://www.gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf	2021	Welsh Government

1.3.2.2 Table 1.2 below lists the reports consulted during preparation of the FCA.

Table 1.2: Reports consulted during preparation of the FCA

Title	Source	Year	Author
Local Development Plan (2007 – 2022) Adopted 2013	https://www.conwy.gov.uk/en/Resident/Planning-Building-Control-and-Conservation/Strategic-Planning-Policy/Adopted-Local-Development-Plan-LDP/Assets-written-proposals-maps/Conwy-Local-Development-Plan-2007-2022.pdf	2013	Conwy County Borough Council (CBCC)
Local Flood Risk Management Strategy (LFRMS)	https://www.conwy.gov.uk/en/Resident/Crime-and-emergencies/Preparing-for-Emergencies/Flooding/documents/Conwy-Local-Flood-Risk-Management.pdf	2013	CBCC
Preliminary Flood Risk Assessment	https://www.conwy.gov.uk/en/Resident/Crime-and-emergencies/Preparing-for-Emergencies/Flooding/documents/Conwy-Preliminary-Flood-Risk-Assessment.pdf	2011	CBCC
Strategic Flood Consequences Assessment	https://www.conwy.gov.uk/en/Resident/Planning-Building-Control-and-Conservation/Strategic-Planning-Policy/Adopted-Local-Development-Plan-LDP/Evidence-Base/Natural-Environment/BP17-Conwy-Strategic-Flood-Consequences-Assessment.pdf	2012	CBCC
Local Development Plan (2006 – 2021)	https://www.denbighshire.gov.uk/en/planning-and-building-regulations/local-development-plan/adopted-local-development-plan.aspx	2006	Denbighshire County Council (DCC)
Local Flood Risk Management Strategy	https://www.denbighshire.gov.uk/en/your-council/strategies-plans-and-policies/strategies/local-flood-risk-management-strategy.aspx	2014	DCC
Preliminary Flood Risk Assessment and Addendum	https://www.denbighshire.gov.uk/en/your-council/strategies-plans-and-policies/strategies/local-flood-risk-management-strategy.aspx	2009	DCC
Strategic Flood Consequences Assessment	https://www.denbighshire.gov.uk/en/documents/planning-and-building-regulations/ldp/evidence-monitoring-and-information/strategic-flood-consequence-assessment-final-report-january-2018.pdf	2018	DCC

2 POLICY AND GUIDANCE

2.1 National policy

2.1.1 National Policy Statements

2.1.1.1 Planning policy for Nationally Significant Infrastructure Projects, specifically in relation to hydrology and flood risk is contained in NPS EN-1 (2024). It sets out the aims of planning policy on development and flood risk to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process. Guidance on what needs to be considered in the application is set out in Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement. In terms of mitigation and the management of flood risk, NPS (EN-1) paragraphs 5.8.26 and 5.8.27 state:

- "*Site layout and surface water drainage systems should cope with events that exceed the design capacity of the system, so that excess water can be safely stored on or conveyed from the site without adverse impacts*"
- "*The surface water drainage arrangements for any project should, accounting for the predicted impacts of climate change throughout the development's lifetime, be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, unless specific off-site arrangements are made and result in the same net effect*".

2.1.2 Planning Policy Wales Edition 11

2.1.2.1 PPW Edition 11 (2021) sets out the land use planning policies of the Welsh Government. The objective is to ensure the planning system contributes towards sustainable development and improves the social, economic, environmental land cultural well-being of Wales.

2.1.2.2 Chapter 13 'Minimising and Managing Environmental Risk and Pollution' outlines the Welsh Government's objectives in terms of addressing flood risk.

2.1.2.3 Section 13.4 of PPW 11 states:

'*Development proposals in areas designed as being of high flood hazard should only be considered where:*

- New development can be justified in that location, even though it is likely to be at risk from flooding
- The development proposal would not result in the intensification of existing development which may itself be at risk
- New development would not increase the potential adverse impacts of a flood event.'

2.1.2.4 PPW is supplemented by a series of Technical Advice Notes (TAN). TAN 15 provides technical guidance on development and flood risk.

2.1.3 Technical Advice Note (TAN) 15: Development and Flood Risk

2.1.3.1 TAN 15 (2004) and the draft version of TAN 15 (2021) provides technical guidance to supplement the policy set out within PPW in relation to development and flooding. The guidance relates to sustainability principles and provides a framework to allow risks

arising from river flooding, coastal flooding and additional run off from developments to be assessed.

2.1.3.2 In relation to flood risk, TAN 15 indicates that the Welsh Government has a duty to ensure that development is sustainable and does not create problems for future generations. Managing flooding has an important role to ensure sustainable development by guiding developments to locations with little or no risk from river, tidal or coastal flooding, managing consequences of flooding where developments can be justified and making provision for climate change.

2.1.3.3 TAN 15 confirms that each planning authority in Wales must prepare a development plan for its area. The development plans provide locational guidance for development, detailed site-specific policies and identification of proposals for development. Catchment Flood Management Plans aim to take a holistic approach to flood management at a catchment scale and can provide guidance on managing risk to future developments. The information provided in local development plans and catchment flood management plans will aid with the application of the justification test. This FCA is in line with the guidance of the 2004 and 2021 editions of TAN 15.

Development Advice Maps

2.1.3.4 The Welsh Government produces DAM to accompany TAN 15 (2004). These maps show the degree of flood risk which is to be applied to a site for the planning process and thus establish the suitability of a site for development. These maps are based upon the Natural Resource Wales (NRW) flood maps and similarly they can be modified through the presentation of data (i.e. hydraulic modelling) to illustrate that a Site is within a different flood zone. The DAM zones are listed below, alongside their attributed planning actions:

- **Zone A:** Areas considered to be at little or no risk of fluvial or tidal/coastal flooding. Flood risk within this zone does not need to be considered further
- **Zone B:** Areas known to have been flooded in the past evidenced by sedimentary deposits. Areas within this zone are further checked against the 0.1% flood level
- **Zone C1:** Based on the NRW 0.1% flood outline and are areas of the floodplain developed served by significant flood defence infrastructure
- **Zone C2:** Based on the NRW 0.1% flood outline and areas of the floodplain without significant flood defence infrastructure.

Flood Map for Planning

2.1.3.5 Whilst the revised edition of TAN 15 has been paused, when implemented it will be supported by the new FMfP to demonstrate how flood risk will be affected by climate change in the next century. Whilst the FMfP has no official status for planning purposes until the new TAN 15 comes into effect, NRW may use the FMfP as ‘best available information’ on flood risk to inform planning guidance.

2.1.3.6 The NRW Flood Zones refer to the probability of flooding from rivers and sea in a given year, assuming no defences are in place and including an uplift to account for climate change. Flood zone definitions are set out as the following:

- **Flood Zone 1:** land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)

- **Flood Zone 2:** land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year, including an allowance for climate change
- **Flood Zone 3**: land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year, including an allowance for climate change.

Requirements of TAN 15

2.1.3.7 An FCA to support a development application, should be proportionate to the risk and appropriate to the scale, nature and location of the development. The following will need to be considered:

- The consequences of flooding on the development, the consequences of the development on flood risk elsewhere and if appropriate mitigation measures to be incorporated into the design
- Mechanisms of flooding, including sources of floodwater, how floodwater enters and flows across a site, height and speed of floodwaters
- Uncertainties in estimating flood events including use of historical records and forecasting
- Security of proposed developments over their lifetime and ensuring those using the development have an awareness of the potential risks from flooding
- Description of consequences under a range of extreme events including: mechanisms, sources, depths, speed, rate of rise, overland flood routes, velocity, access and egress, impacts on natural heritage and impact on flood risk in surrounding areas
- Structural adequacy of defences to contain flows and withstand overtopping and if required the suitability of implementing a buffer zone adjacent to defences
- Measures required to ensure flooding is managed to acceptable levels and ensure that the impact upon flood risk elsewhere in the flood plain is managed.

2.2 Local planning policy

2.2.1 Conwy Local Development Plan 2007 to 2022

2.2.1.1 The Local Development Plan (LDP) provides a framework for sustainable development within CBCC up to 2022. The LDP was formally adopted in October 2013 and is used for consistent and rational decision-making during the plan period to ensure the most efficient use of land and other limited resources, whilst at the same time promoting the regeneration and stimulation of the local economy for the benefit of the present and future population.

2.2.1.2 The LDP expired in December 2021 and a replacement LDP is currently being developed; the 2013 LDP is considered to be still relevant until the new LDP is issued. It is unknown whether the LPA will save any of the expired LDP policies.

2.2.1.3 The CCBC LDP does not contain any specific policies regarding flood risk; however, the most relevant policies are outlined below.

Strategic Policy DP/1 Sustainable Development Principles

2.2.1.4 Development will only be permitted where it is demonstrated that it is consistent with the principles of sustainable development. All developments are required to take account of and address the risk of flooding and pollution in the form of noise, lighting, vibration, odour, emissions or dust.

Policy DP/3 Promoting Design and Reducing Crime

2.2.1.5 All new development will be of high quality, sustainable design which provides usable, safe, durable and adaptable places and protects local character and distinctiveness of the Plan Area's built historic and natural environment. CBCC will require development to provide sustainable urban drainage systems to limit waste water and water pollution and reduce flood risk in line with national guidance and Policy NTE/8 – 'Sustainable Drainage Systems'(SuDS).

Policy NTE/6 Energy Efficiency and Renewable Technologies in New Development

2.2.1.6 The efficient use and conservation of natural resources are essential to the overall quality of life within the Plan Area and to support wider social and economic sustainability objectives. The Council will ensure that all new developments incorporate the principles of sustainable design such as: appropriate layout, massing, orientation, use of materials, rainwater harvesting, energy efficiency, sustainable drainage and waste recycling areas/storage in line with the Development Principle Policies and NTE/8 – 'Sustainable Drainage Systems'.

Policy NTE/8 Sustainable Drainage Systems

2.2.1.7 The use of Sustainable Drainage Systems will be required wherever reasonably practicable with preference for onsite disposal and where satisfactory arrangements can be put in place for the long-term maintenance of those systems. Where this is not proposed a developer will need to justify that discharge is necessary and is adequately controlled.

2.2.1.8 Subsequent preference for surface water drainage will be for:

1. Drainage to a surface water body (river, lake etc.) subject to appropriate treatment and attenuation
2. Drainage to surface water sewer
3. Drainage to combined sewer.

2.2.1.9 The developer must demonstrate that higher preference drainage options are unfeasible before proposing less sustainable options.

2.2.2 Denbighshire Local Development Plan 2006 to 2021

2.2.2.1 The LDP provides a framework for sustainable development within DCC up to 2021. The LDP was formally adopted on 04 June 2013 and is used for consistent and rational decision-making during the Plan period to ensure the most efficient use of land and other limited resources, whilst at the same time promoting the regeneration and stimulation of the local economy for the benefit of the present and future population.

2.2.2.2 Whilst the LDP expired in December 2021, a replacement LDP is currently being developed. However, the Denbighshire Local Development Plan 2018 to 2033: Revised Delivery Agreement December 2022 confirms that the current adopted LDP will remain the statutory development plan until it is replaced by a revised version of the LDP and as such the existing LDP policies remain the basis for determining planning applications.

2.2.2.3 DCC LDP does not contain any specific policies regarding flood risk; however, the most relevant policies are outlined below.

Policy RD 1 Sustainable Development and Good Standard Design

2.2.2.4 Development proposals will be supported within development boundaries provided that all the following criteria are met:

- Satisfies physical or natural environmental considerations relating to land stability, drainage and liability to flooding, water supply and water abstraction from natural watercourses.

Policy VOE 6 Water Management

2.2.2.5 All development will be required to eliminate or reduce surface water run-off from the site, where practicable. The run-off rates from the site should maintain or reduce pre-development rates.

2.3 Climate change

2.3.1.1 TAN 15 states that when considering new development proposals, it is necessary to take account of the potential impact of climate change over the lifetime of development. To ensure future development can provide a safe and secure living and/or working environment throughout its lifetime, national planning policy requires proposals in areas of high flood risk to be accompanied by an assessment of flooding consequences to and from the development, taking into account the impacts of climate change.

2.3.1.2 In line with TAN 15 and NRW Climate Change Allowances guidance (September 2021), the climate change allowances have been informed by latest available information on climate change projections and different scenarios of carbon dioxide (CO_2) emissions to the atmosphere. Allowances are provided for different epochs (periods) of time over the next century.

Both the central and upper end allowances should be assessed to understand the range of impact. As a minimum, proposals should be assessed against the central allowance to inform design levels. It is recommended that the 2080s changes are used when considering any time beyond 2115. Table 2.1 below presents the anticipated increase in peak river flows for the Western Wales River Basin and

2.3.1.3 Table 2.2 presents the expected change to Extreme Rainfall Intensity. The climate change allowances are based on UKCP09 and emerging UKCP18 research data.

Table 2.1: Peak river flow allowances by River Basin District (use 1961 to 1990 baseline)

River Basin District	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Western Wales	Upper Estimate	25%	40%	75%
	Central Estimate	15%	25%	30%

Table 2.2: Change to extreme rainfall Intensity compared to a 1961-90 baseline

Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper Estimate	10%	20%	40%
Central Estimate	5%	10%	20%

2.3.1.4 The NRW Climate Change Allowances Guidance (September 2021) recommends that the central estimate, or change factor, for the 2080s for the relevant river basin district should be used to assess the potential impact of climate change as part of a flood consequence assessment.

2.3.1.5 The allowances are consistent with the A1B (medium) emissions scenario derived from UKCP09 and emerging UKCP18 research data and converted into regionalised data of climate change on flood flows for the 2020s, 2050s and 2080s time-horizon and for the B1 (low) and A1F1 (high) emissions scenarios for the 2080s time-horizon.

2.3.1.6 Runoff and attenuation calculation for any development design would have to take into account the above change in climate change policy.

3 ONSHORE SUBSTATION PLATFORM FLOOD CONSEQUENCES ASSESSMENT

3.1 Site setting

3.1.1 Location

3.1.1.1 The proposed location of the Onshore Substation platform is centred on National Grid Reference SJ 01486 73017, approximately 2.8 km to the southwest of St Asaph village. The site is bound by pastural agricultural fields and currently access is gained via the B5381, a public highway. The location of the Onshore Substation is shown on Figure 1.1.

3.1.2 Topography

3.1.2.1 The boundary associated with the Mona Onshore Substation falls from 65 m AOD within the southwest of the site to approximately 55 m AOD within the northeast of the site. The lst toocal topography within the 1 km buffer of the Onshore Substation generally falls towards the northeast.

3.1.3 Existing use

3.1.3.1 The site of the proposed Onshore Substation platform currently comprises pastural agricultural fields, with field margins delineated by mature trees and hedgerows. An ordinary watercourse is present immediately to the east of the Onshore Substation platform. OS mapping also identifies a watercourse which issues on the central west boundary of the platform and flows north and a watercourse (possibly a drainage ditch) extending into the south boundary of the Onshore Substation platform.

3.1.3.2 The 1 km hydrology and flood risk study area associated with the Onshore Substation platform comprises predominantly of agricultural land use in addition to areas of woodland and a sparse density of residential dwellings. Towards the north of the buffer zone is located National Grid Bodelwyddan substation, the B5381 and St Asaph Business Park beyond.

3.1.4 Proposed use

3.1.4.1 The proposed Onshore Substation platform will have a footprint of up to 65,000 m^2 and a maximum earthworks footprint of 75,000 m^2 within which up to 42,000 m^2 will be impermeable and will comprise up to four buildings. The temporary working area of the Onshore Substation platform is 150,000 m^2. The Onshore Substation is expected to have an operational life of 35 years and indicative layouts are presented within Volume 1, Chapter 3, Project description of the Environmental Statement.

3.1.4.2 A permanent access road will be provided to the Onshore Substation: the road will extend up to 800 m in length and up to 15 m wide. This will include services and drainage. Assessment of this access road is not included within this assessment, with assessment limited to the Onshore Substation Platform only.

3.1.5 Hydrological overview

3.1.5.1 A 1 km buffer was selected for the Onshore Substation platform to identify any potential receptors that might be affected by the Onshore Substation.

3.1.5.2 The Onshore Substation platform is located within the catchment of the River Elwy, a Main River which conveys flows to the east some 1.5 km to the south of the substation platform (see Volume 7, Annex 2.2: Surface watercourses and NRW flood zones of the Environmental Statement). The river converges with the River Clwyd some 3.9 km to the northeast of the Onshore Substation platform and discharges to the Irish Sea approximately 7.8 km to the north of the Onshore Substation platform at Rhyl.

3.1.5.3 OS mapping shows the ordinary watercourse located in the east of the Onshore Substation platform rises from a well and conveys flow to the north, eventually discharging to Pengwern Drain, a NRW designated Main River. And eventually discharges to the River Clwyd.

3.1.5.4 There are several additional ordinary watercourses present within the 1 km buffer zone which eventually drain to the River Elwy/River Clwyd. A number of pond features are also present within the buffer zone.

3.1.6 Hydrogeological overview

Geological setting

3.1.6.1 The BGS Geology of Britain mapping (1:50,000 scale) indicates the entirety of the proposed Onshore Substation platform is underlain by glacial till (diamicton) superficial deposits. The 1 km buffer zone is also predominantly underlain by glacial till (diamicton).

3.1.6.2 The far west extent of the Onshore Substation platform is underlain by Clwyd Limestone Group (limestone) while the remainder of the site is underlain by Warwickshire Group (mudstone, siltstone and sandstone).

3.1.6.3 The 1 km buffer zone is predominantly underlain by Clwyd Limestone Group (limestone) with Warwickshire Group (mudstone, siltstone and sandstone) present within the east extent.

Groundwater

3.1.6.4 Published borehole logs from BGS undertaken as part of the construction of Glascoed Water Works 1.7 km to the west of the site extend to maximum depths of 9.45 m below ground level (bgl). Boreholes logs recorded glacial till to approximately 9 m bgl before encountering limestone. No groundwater strikes were recorded within the borehole logs.

Aquifer designation

3.1.6.5 Bedrock Geology Aquifer Designation Wales mapping indicates Clwyd Limestone Group (limestone) to be a Principal Aquifer; permeable layers capable of supporting water supplies at a local scale and in some cases forming an important source of base flow to rivers. Warwickshire Group (mudstone, siltstone and sandstone) is classified as a Secondary A Aquifer; i.e. permeable layers capable of supporting water supplies at a local scale and in some cases forming an important source of base flow to rivers.

3.1.6.6 Superficial Deposits Aquifer Designation Wales mapping indicates glacial till deposits are categorised as a Secondary (undifferentiated) aquifer; this is rock considered to have variable and insignificant contributions to water resources and river base flows.

Source Protection Zones

3.1.6.7 There are no Source Protection Zones (SPZ) within the Onshore Substation platform and the associated 1 km buffer area.

Soils classification

3.1.6.8 The National Soils Research Institute Soilscapes viewer classifies soils underlying the proposed Onshore Substation platform as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

3.1.6.9 Soils within the 1 km buffer zone are classified as mainly slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils, with an area of freely draining soils within the southwest of the buffer.

3.1.7 Flood risk assessment

Fluvial and tidal flooding

Flood Map for Planning

3.1.7.1 The NRW FMfP indicates the Onshore Substation platform and associated 1 km buffer zone is located wholly within fluvial and tidal Flood Zone 1.

Development Advice Maps

3.1.7.2 The DAM indicates the Onshore Substation platform and associated 1 km buffer zone is wholly located within the DAM Zone A.

Denbighshire County Council data

3.1.7.3 The DCC Preliminary Flood Risk Assessment, Strategic Flood Consequences Assessment and Local Flood Risk Management Strategy documents do not hold any records of historic flood event having taken place within the Onshore Substation platform or within its 1 km buffer zone.

Summary

3.1.7.4 The Onshore Substation platform and surrounding 1 km buffer zone are assessed to have a low risk of fluvial flooding. Due to the distance inland from sea, the site and associated buffer zone is also assessed to have a low risk of tidal flooding.

Surface water flooding

3.1.7.5 Surface water flooding occurs when the amount of rainfall exceeds the drainage or infiltration capacity of the surface it falls upon. Surface water runoff can coalesce into surface water flow pathways as it flows towards a drainage system or watercourse. Surface water can also pond within areas of inadequate drainage. Flooding from watercourses not classified as Main Rivers is also included within this category.

Flood Map for Planning

3.1.7.6 The NRW FMfP indicates the majority of the Onshore Substation Platform is located within surface water and small watercourses. There are two surface water flow

pathways within the Onshore Substation that are classified as Flood Zone 2 and 3 and are discussed in further detail below.

National Flood Hazard Maps

3.1.7.7 The NRW Flood Risk from Surface Water and Small Watercourse mapping indicates the Onshore Substation platform is predominantly located outside the mapped extent at risk of surface water flooding. There is a 'low to high' risk of flooding associated with surface water pathways flowing towards two ordinary watercourses present within the site. With the implementation of mitigation and the Outline Operational Drainage Management Strategy (Document reference J28), the risk will be reduced to 'low'.

3.1.7.8 Flooding associated with the 30-year event is isolated to the northwest extent of the Onshore Substation platform with flood depths less than 150 mm.

3.1.7.9 Flow pathways become established by the 1,000-year event and convey flow towards ordinary watercourses that flow to the north of the Onshore Substation platform. While flood depths are predominantly less than 150 mm, isolated areas of flooding are up to 900mm. The majority of flooding is thought to be constrained within watercourse channels. Flood velocities associated with the 1,000-year event are less than 1m/s . Flood hazard posed by both flood pathways are largely categorised as 'low' with very limited areas of 'danger for most'.

3.1.7.10 Within the 1 km buffer zone there is a 'low to high' risk of flooding from additional small watercourses and from isolated areas of surface water ponding.

3.1.7.11 A buffer or easement will be provided between the banks of the diverted watercourse and the proposed Onshore Substation platform: the width of the easement will be no greater than 8 m and will be agreed with the LLFA. Final proposed ground levels will be shaped to ensure the flow pathway regime is maintained to ensure surface water can be conveyed towards the watercourses and offsite. The risk of flooding from this source is therefore classified as low.

Flooding from rising/high groundwater

3.1.7.12 Groundwater flood risk mapping included within the Groundsure Enviro and Geo Insight report (2022) shows the Onshore Substation platform has a 'low' risk of groundwater flooding. The majority of the 1 km buffer zone is also shown to have a 'low' risk of flooding with limited areas with a 'negligible' risk of flooding.

3.1.7.13 Any ingress of groundwater during the earthworks will be managed appropriately using dewatering. The approach will be confirmed in the Construction Surface Water and Drainage Management Plan post consent (see Outline Construction Surface Water Drainage Management Plan Document Reference J26.6). With the mitigation, the overall risk of flooding from groundwater has been assessed to be very low.

Reservoir failure assessment

3.1.7.14 The NRW FMfP includes flood risk from reservoirs mapping which shows the entirety of the Onshore Substation platform is located outside the extents of flooding from this source.

3.1.7.15 The overall risk of flooding from reservoir failure has been assessed to be negligible.

Sewer/water main failure assessment

3.1.7.16 Flooding from sewerage failure occurs when a rainfall event exceeds the maximum capacity of the surrounding network. The most common causes of flooding from sewers are inadequate flow capacity, blockages, pumping station failures, burst water mains, water inflow from rivers or the sea, tide locking, siltation, fats/greases and sewer collapse. Should any of these events occur there is a risk of flooding within the vicinity of the sewer by surcharge where the flood is in excess of the sewer capacity (usually 1 in 30-year event or greater).

3.1.7.17 The site is currently in agricultural use and is therefore, unlikely to have sewer assets within the site. Mitigation measures, as identified in Table 2.17 of Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement, limit the potential impact on the surrounding sewer networks from any residual risk from this source. Flood risk from this source is therefore assessed to be very low.

Flood defence measures

3.1.7.18 The NRW FMfP shows there are no flood defences present within the Onshore Substation platform or the 1 km buffer zone.

Historic flooding

3.1.7.19 The NRW FMfP includes recorded flood extents mapping which shows the entirety of the Onshore Substation platform is located outside the mapped extent of historical flooding.

Current flood risk

3.1.7.20 The Onshore Substation platform is located within Flood Zone 1/Zone A and is considered at low risk from fluvial and tidal sources.

3.1.7.21 It has been determined that the main risk of flooding to the Onshore Substation platform is surface water flooding from ordinary watercourses.

3.2 Flood risk management

3.2.1 Site vulnerability

3.2.1.1 In accordance with the Development Vulnerability Categories in Figure 2 of TAN 15, substation developments are classified as ‘Less Vulnerable’.

3.2.1.2 The Onshore Substation platform, its access/egress and associated 1 km buffer zone are located in Zone A/Flood Zone 1.

3.2.1.3 All types of development are considered acceptable within this Zone A and B and therefore the justification test is not applicable to the Onshore Substation platform.

3.2.2 Mitigation measures

3.2.2.1 The Mona Onshore Development Area is located wholly within Flood Zone 1/Zone A and as such no fluvial/tidal mitigation measures are proposed.

3.2.2.2 The ordinary watercourse within the Onshore Substation platform falls within the proposed location of the platform and therefore, a diversion will be required. The diversion will be appropriately sized to ensure conveyance of existing flows without

increasing fluvial flood risk upstream of the site via the constriction of flows. An easement will be provided between the banks of the diverted watercourse and the proposed Onshore Substation platform; the width of the easement will be no greater than 8 m and will be agreed in consultation with the LLFA.

3.2.2.3 Surface water run-off trending towards the site due to the local topographical gradients shall be redirected from the Onshore Substation platform by installing cut-off drains/ditches at the platform perimeter. These cut-off drains will divert overland flows around the Onshore Substation, discharging flows into the watercourse to the north. Cut off drains/ditches will be designed at detailed design stage to ensure surface water flows can be adequately conveyed.

3.2.2.4 Flood risk arising from construction activities during the construction phase is to be mitigated via the implementation of the Construction Surface Water and Drainage Management Plan (Document ReferenceJ26.4) which appends the Code of Construction Practice (CoCP) (Document reference J26).

3.3 Drainage strategy

3.3.1 Surface water drainage

3.3.1.1 The sustainable management of surface water is an essential element of reducing future flood risk to the site and its surroundings.

3.3.1.2 Undeveloped sites generally rely on natural drainage to convey or absorb rainfall, with water infiltrating into the ground or coalescing across the surface towards watercourses. As the Onshore Substation platform is currently in agricultural use, field drains will be present. The location of field drains will be confirmed with landowners as part of the field drainage strategy that will be undertaken prior to construction (see the Outline CoCP (Document Reference J26). Any field drainage intercepted during the construction of the Onshore Substation platform will be either be reinstated or re-aligned around the perimeter of the Onshore Substation. Any works undertaken will be in agreement with DCC, the LLFA.

3.3.1.3 The effect of development is generally to reduce the permeability of at least part of the site, which markedly changes its response to rainfall. Without specific measures to manage surface water the volume of water and peak flow rate are likely to increase. Inadequate surface water drainage arrangements can threaten the development itself and increase the risk of flooding to others.

3.3.1.4 Surface water arising from a developed site is to be managed in a sustainable manner (as far as practicable) to mimic the natural hydrology of the site, whilst reducing the risk of flooding on the site and elsewhere, taking climate change into account. For further information, refer to the Outline Operational Drainage Management Strategy that has been prepared for the Onshore Substation and is presented within Document reference J28 of the DCO application.

3.3.2 Sustainable drainage options

3.3.2.1 NPS EN-1, PPW Edition 11, associated TAN 15 technical guidance, SuDS Manual (CIRIA, 2015) and the DCC LDP promote sustainable water management through the use of SuDS. A hierarchy of techniques is identified:

- Prevention
- Source control

- Site control
- Regional control.

3.3.2.2 An Outline Operational Drainage Management Strategy has been prepared for the Onshore Substation and is presented within Document reference J28 of the DCO application.

3.3.2.3 The Outline Operational Drainage Management Strategy has selected a combination of source control and site control for the Onshore Substation, to be reviewed at detailed design stage.

3.3.3 Runoff rate calculations

3.3.3.1 The proposed land use comprises a substation and associated permanent infrastructure. It has been assumed that 60% of the substation area will be hardstanding. The discharge rate from the surface water attenuation will be restricted to the 1 in 1 year greenfield runoff rate.

3.3.3.2 The site is currently agricultural and as such, the IH124, FEH and ICP SuDS methods for calculating the greenfield runoff rate have been used for the site. The lowest (worse case) runoff rate was selected; the ICP SuDS rate which is presented within Table 3.1.

Table 3.1: Existing surface water run-off rates for site

Return period (years)	Runoff rate (l/s)
1 in 1	6.8
QBAR	7.2
1 in 30	13.6
1 in 100	16.8

3.3.4 Attenuation requirements

3.3.4.1 The attenuation volume required to restrict surface water runoff from impermeable areas of the site prior to discharge have been determined using the industry standard MicroDrainage software suite. Calculations are presented within the Outline Operational Drainage Management Strategy (Document reference J28).

3.3.4.2 Surface water flows from the 1 in 100-year + 40% climate change event are to be attenuated within a SuDS detention basin, details of which are presented within the Outline Operational Drainage Management Strategy (Document reference J28).

3.3.4.3 Sensitivity checks have been undertaken within MicroDrainage confirm there is sufficient freeboard within the SuDS (detention) basin to cater for a 1 in 10-year (+40% climate change) event within 24 hours of the design event (1 in 100-year +40% CC). The detention basin is also capable of catering for the 1 in 1,000 year + 40% climate change event.

3.3.5 Discharge hierarchy

3.3.5.1 The SuDS discharge hierarchy describes the priority for selecting a method of surface water discharge and is based on the following sequence:

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

3.3.5.2 The Outline Operational Drainage Management Strategy (Document reference J28) details that due to the nature of the project, there is only limited opportunity to employ surface water re-use within the site.

3.3.5.3 Based on geology underlying the site, it is assumed surface water discharge via infiltration is unlikely to be suitable, however this option will be reviewed under the detailed design stage.

3.3.5.4 An ordinary watercourse is present within the site and has currently been identified as the primary point of discharge for the discharge of surface water from the Onshore Substation.

3.4 Summary and conclusions

3.4.1 Summary

3.4.1.1 A site-specific FCA in accordance with section 5.7 of the NPS EN-1, PPW and TAN 15 has been undertaken for the Onshore Substation platform located 2.8 km to the southwest of St Asaph village.

3.4.2 Flood risk

3.4.2.1 The Onshore Substation platform is located within Flood Zone 1/Zone A and is considered at low risk from fluvial and tidal sources.

3.4.2.2 The site is assessed to have a low risk of surface water flooding from ordinary watercourses and a very low and negligible risk of flooding from all other sources. An appropriate easement between the diverted ordinary watercourse and the Onshore Substation platform is proposed is to be agreed in consultation with the LLFA.

3.4.2.3 There are no historical records of flooding within the site held by either the NRW or DCC.

3.4.2.4 In accordance with the Development Vulnerability Categories in Figure 2 of TAN 15, substation developments are classified as ‘Less Vulnerable’.

3.4.2.5 All types of development are considered acceptable within this zone and the justification test is not applicable to the Onshore Substation.

3.4.3 Surface water drainage

3.4.3.1 The Onshore Substation platform is assumed to have 60% impermeable area. The site is currently agricultural and as such, the proposed discharge rate will be set to the

ICP SuDS 1 in 1-year greenfield runoff rate. Surface water flows from the 1 in 100-year + 40% climate change event will be attenuated within a SuDS detention basin prior to discharge to watercourse as described in the Outline Operational Drainage Management Strategy (Document Reference J28). All proposals are to be reviewed and refined at detailed design stage.

3.4.4 Conclusion

3.4.4.1 The FCA and supporting documentation demonstrates the Onshore Substation platform meets the requirements of the NPS EN-1, PPW and TAN 15.

4 MONA ONSHORE DEVELOPMENT AREA FLOOD CONSEQUENCE ASSESSMENT

4.1 Site setting

4.1.1 Location

4.1.1.1 The Mona Onshore Development Area extends approximately 15 km from the landfall location to the west of Abergele to the Onshore Substation located to the southwest of St Asaph and a further 1 km to the National Grid Substation at Bodelwyddan. The location of the Mona Onshore Development Area is shown on Figure 2.1 of Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement.

4.1.2 Existing use

4.1.2.1 The Mona Onshore Development Area runs predominantly through agricultural land uses and woodland. Residential settlements are sparse; with development mainly limited to farmhouses peppered within the landscape. Limestone hills are present along the coastline and hinterland, with land steeply rising inland from the heavily modified coastline. Inland areas of the Mona Onshore Development Area generally consist of rolling hills and valleys.

4.1.2.2 The Mona Onshore Development Area traverses across Llanddulas Limestone and Gwrych Castle Wood, classified as Site of Special Scientific Interest (SSSI) and also borders Coed y Gopa SSSI. Liverpool Bay/Bae Lerpwl is also classified as a Special Protection Area (SPA).

4.1.2.3 It is noted the Mona Onshore Development Area includes Traeth Pensarn SSSI however, the drill profile of the trenchless technique will avoid the designated site.

4.1.3 Proposed use

4.1.3.1 For the purpose of this FCA, the maximum design scenarios are identified within Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement and are summarised below:

- Onshore Cable Corridor (approximately 74 m wide (including temporary area) and 15 km in length; once installed the cables will occupy a permanent corridor of approximately 30 m wide)
    - Up to four cable trenches will be located within the Onshore Cable Corridor, each trench up to 2.5 m wide at ground level
- 400kV Grid Connection Cable Corridor (approximately 48 m wide (including temporary area) and 1 km in length; once installed the cables will occupy a permanent corridor of approximately 16m wide)
    - Up to two cable trenches within the 400kV grid connection cable corridor, each trench up to 2.5 m wide at ground level
- Up to 45 trenchless crossing locations. Dimensions of trenchless crossing launch pits and reception pits for river and road crossings are 10 m x 10 m. Trenchless crossing operations will require a temporary works area of 50 m x 50 m
- Up to one primary compound measuring 150 m x 150 m and up to four secondary compounds each measuring 150 m x 100 m

- Temporary 6 m wide haul road constructed using imported engineering granular fill with geotextile layers and a nominal thickness of 400 mm and maximum thickness of up to 1000 mm.

4.1.4 Hydrological overview

4.1.4.1 A 250 m search area buffer was selected for the Mona Onshore Development Area to identify any potential receptors that might be affected by the cable corridor. The 250 m buffer is considered an appropriate buffer to identify changes in flood risk in the surrounding area.

4.1.4.2 The Mona Onshore Development Area is predominantly located within upland catchments of the Welsh Western Rivers Basin District and crosses a number of hydrological catchments associated with ordinary watercourses which form tributaries to the River Elwy and River Gele. Numerous pond features are also located within the Mona Onshore Development Area.

Main rivers

4.1.4.3 There are no Main Rivers located within the Mona Onshore Development Area.

Ordinary watercourses

4.1.4.4 The Mona Onshore Development Area is shown to cross several ordinary watercourses (see Volume 7, Annex 2.2: Surface watercourses and NRW flood zones of the Environmental Statement):

- Two tributaries of the River Gele
- Nant y Bryniau
- Nant y Cregiau
- Nant Luke
- A tributary of the River Clywd
- A tributary of the River Elwy.

Sea

Shoreline management plan

4.1.4.5 The Landfall area falls under the Shoreline Management Plan 2: 22 - Great Ormes Head to Scotland sub cell 11a PU2.3 which has a Hold the Line policy. The 20, 50 and 100-year Shoreline Management Policies are Hold the Line. Groynes are present along the coastline of the west extent of the Landfall area.

WFD classification

4.1.4.6 Coastal areas to the north of Landfall are located within the Wales GB641011650000 WFD coastal waterbody, which is classified as Moderately exposed, Macrotidal, heavily modified coastal. Overall classification and overall objective classifications are both good.

Flood defences

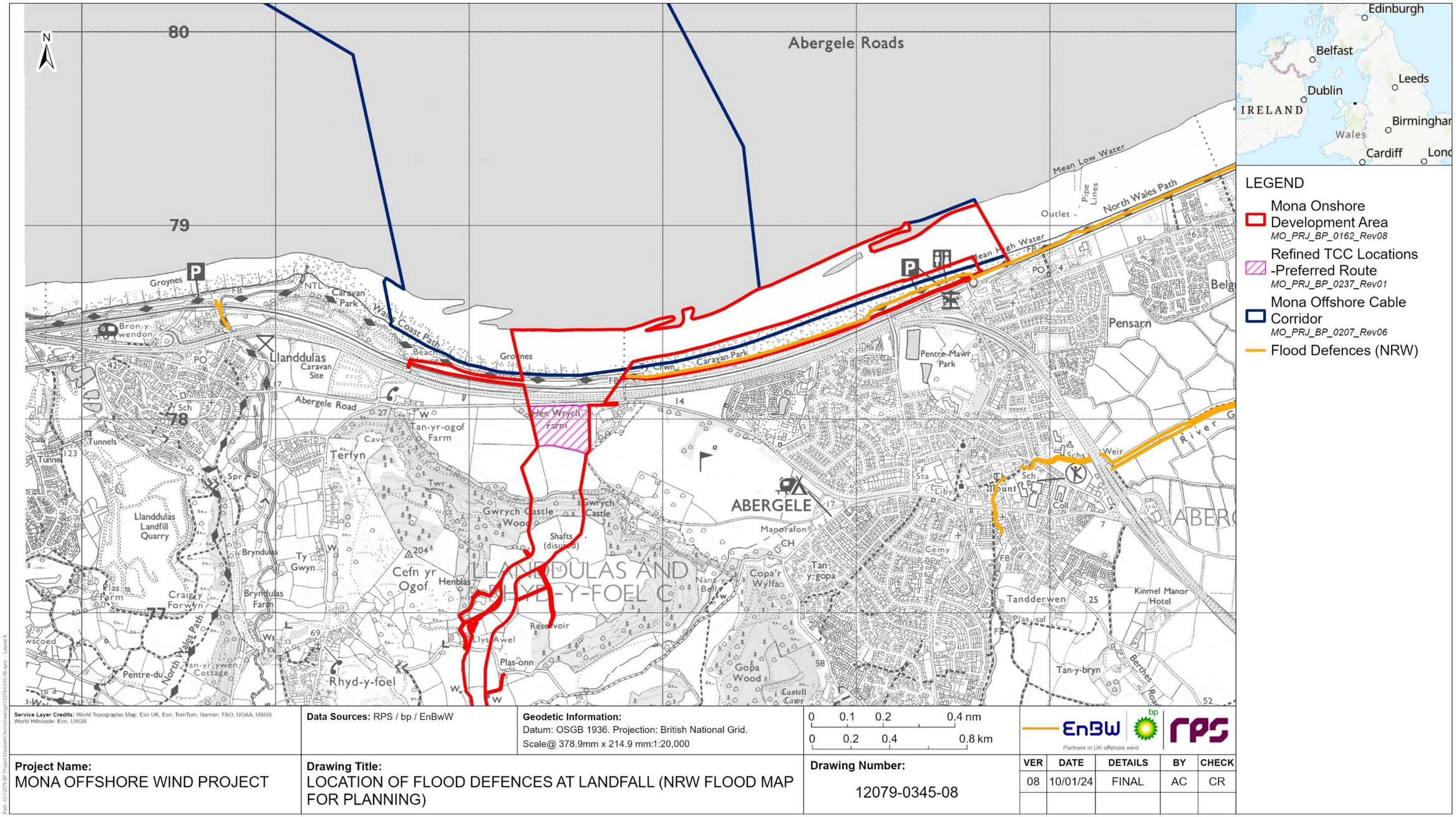
4.1.4.7 The NRW FMfP shows a coastal flood defence wall is present along the onshore margin of the intertidal zone within the east extent of the Landfall (see Figure 4.1). The structure provides a 200-year standard of protection and is maintained by CCBC.

4.1.4.8 No additional flood defence structures are shown on NRW mapping to be present within the Mona Onshore Development Area.

Flood alert and flood warnings

4.1.4.9 Abergele Sea Road Flood Warning reference 101FWTWN415. incorporates the far east extent of the landfall area.

4.1.4.10 The North Wales coast Flood Alert area reference 101WATNE10 incorporates the far west extent of the landfall area as well as a similar footprint to the Abergele Sea Road Flood Warning Area.



Service Layer Credits: World Topographic Map: Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS / bp / EnBwW

Geodetic Information:
Datum: OSGB 1936. Projection: British National Grid.
Scale@ 378.9mm x 214.9 mm:1:20,000

0 0.1 0.2 0.4 nm
0 0.2 0.4 0.8 km

EnBW bp RPS
Partners in UK offshore wind

Project Name:
MONA OFFSHORE WIND PROJECT

Drawing Title:
LOCATION OF FLOOD DEFENCES AT LANDFALL (NRW FLOOD MAP FOR PLANNING)

Drawing Number:
12079-0345-08

VER	DATE	DETAILS	BY	CHECK
08	10/01/24	FINAL	AC	CR

Path: O:\12079 BP Project Elizabeth Bond\Drawings\12079-0345-08.aprx - Layout A

Figure 4.1: Location of flood defences at Landfall (NRW Flood Map for Planning)

4.1.5 Hydrogeological overview

Superficial deposits

4.1.5.1 BGS Geology of Britain mapping (1:50,000 scale) indicates the majority of the lower elevations within the Mona Onshore Development Area is underlain predominantly by glacial till (diamicton) superficial deposits, with limited isolated areas of glaciofluvial (sand and gravel) and alluvium (clay,silt sand and gravel) superficial deposits near pond features. The intertidal area is underlain by storm beach deposits (gravel) (refer to Volume 3, Chapter 1: Geology, hydrogeology and ground conditions of the Environmental Statement).

Solid geology

4.1.5.2 The bedrock underlying the north and east part of the Mona Onshore Development Area is the Clwyd Limestone Group (limestone). A band of Ffernant Formation (mudstone, siltstone and sandstone) is present north of the central area, whilst the remainder of the Mona Onshore Development Area is underlain by Elwy Formation (mudstone, siltstone and sandstone). The bedrock within the Mona Onshore Development Area is shown in Volume 7, Annex 1.1: Aquifers, groundwater abstractions and ground conditions of the Environmental Statement.

Aquifer designation

4.1.5.3 Clwyd Limestone Group (limestone) is categorised as a Principal Aquifer; it is permeable geology able to provide a high level of water storage and able to support water supply and/or river base flow on a strategic scale. Ffernant Formation (mudstone, siltstone and sandstone is classified as a Secondary A aquifer; it includes permeable layers capable of supporting water supplies at a local scale and in some cases forming an important source of base flow to rivers. Elwy Formation (mudstone, siltstone and sandstone) is classified as a Secondary B aquifer; predominantly lower permeability layers which may store and yield limited amounts of groundwater.

Source Protection Zones

4.1.5.4 There are no SPZs within the Mona Onshore Development Area or the 250 m buffer.

4.1.6 Flood risk assessment

Fluvial flooding

Flood Map for Planning

4.1.6.1 The NRW FMfP indicates that the Mona Onshore Development Area, including all temporary construction compound search areas is located entirely within fluvial Flood Zone 1 (as shown in Volume 1, Chapter 3: Project description of the Environmental Statement).

Development Advice Maps

4.1.6.2 The DAM indicates the majority of the Mona Onshore Development Area is located within Zone A; there are isolated areas located within Zone B. Temporary construction compound search areas are predominantly located within Zone A; a small number are

located within Zone B (as shown in Volume 1, Chapter 3: Project description of the Environmental Statement).

Summary

4.1.6.3 The Mona Onshore Development Area is assessed to have a low risk of fluvial flooding.

Tidal flooding

4.1.6.4 Flooding from tidal sources occur when water levels from the sea (i.e. tidal surges) rise above ground levels/flood defences within coastal areas.

Flood Map for Planning

4.1.6.5 The NRW FMfP indicates the landfall area and its associated access/egress is partially located within Flood Zone 2 and 3. Due to the beach profile, land southwards of the mean high water line is located within Flood Zone 1. Land to the north of the mean high-water line is located within Flood Zone 2 and 3. Extents of Flood Zone 2 within the landfall area are generally marginal due to the beach profile limiting the extent of tidal flooding.

Development Advice Maps

4.1.6.6 The DAM broadly corresponds to the FMfP and indicates land benefitting from the coastal wall flood defence within the east extent of the Landfall area is located within Zone C1. The remainder of the Landfall area corresponding with Flood Zone 2 and 3 is located within Zone C2.

4.1.6.7 Land within Zones C1 and C2 within the east extent of the Landfall area is located within the Abergele Sea Road Flood Warning and North Wales coast Flood Alert area reference ‘Abergele Sea Road’ Flood Warning Area reference 101FWTWN415.

4.1.6.8 A marginal area within Zone C2 located within the Landfall area is also located within the North Wales coast (from the Dee estuary to the east coast of Anglesey) flood alert, reference 101WATNE10.

4.1.6.9 Areas of the Landfall area located within Flood Zone 1 are located within Zone A.

Flood model information

4.1.6.10 Product 5 and 6 data of the Point of Ayr to Pensarn 2017 coastal flood model was obtained from NRW and provides flood extents and depths within the east extent of the landfall area a result of coastal defence overtopping and breach. The modelling additionally assessed how flood depths and extents will evolve with climate change; with flood model outputs for the present-day and 2117 scenarios.

4.1.6.11 A further consultation request was made to the NRW to obtain the Llanddulas 2016 flood model to capture flood extents and depths within the far west extent of the landfall area. However model information does not extend into Mona Onshore Development Area and thus land within the west extent of the landfall area classified within Flood Zone 2 and 3 is unable to be further assessed within the report.

Overtopping in flood defences

4.1.6.12 Flood model data from the Point of Ayr to Pensarn 2017 coastal flood model indicates the east extent of the Landfall area within the onshore cable corridor is at risk of flooding from an overtopping of flood defences during the present-day 1 in 200 and 1,000-year events and the 2117 1 in 200-year event.

4.1.6.13 During the present-day 1 in 200 and 1,000-year event that accounts for overtopping of existing flood defences, flooding is restricted to marginal areas of Pensarn Beach with flood depths predominantly below 0.25 m for both events.

4.1.6.14 Flooding becomes more extensive during the 2117 1 in 200-year event, with flooding inundating the entirety of Pensarn Beach and partially inundating access/egress taken from Sea Road. Sea Road is inundated by flood depths up to 0.95 m while Pensarn Beach is predominantly inundated by flood depths up to 1.50 m.

4.1.6.15 It is expected this area of the Mona Onshore Development Area is to be used as a temporary access to the construction area within the Landfall area. A limited number of site personnel are expected to be on-site using the access during construction Furthermore, due to the nature of temporary works associated with construction, site occupants are not expected to become at risk from the impacts of climate change associated with the 2117 1 in 200-year flood defence overtopping event.

Breach in flood defences

4.1.6.16 The Landfall area within the Mona Onshore Development Area is at risk of flooding from a breach in flood defences that offer protection to the east extent of the Landfall area. The closest breach in flood defences modelled within Point of Ayr to Pensarn 2017 coastal flood model that inundates the site is located some 2.6 km to the east of the Landfall.

4.1.6.17 A breach in flood defences under the present-day 1 in 200-year event would result in flooding within the far east extent of the Landfall area with flood depths up to 0.42m. The Landfall area site access/egress on Sea Road would also be inundated with flood depths up to 0.43 m.

4.1.6.18 During the 2117 1 in 200-year breach event, flood extents cover the east extent of the beach within the Landfall area with maximum flood depths of up to 1.73 m. The site access/egress on Sea Road would also be inundated with flood depths up to 1.24 m.

4.1.6.19 Defences are routinely inspected by CCBC and are recorded to be in ‘good’ condition and offer up to a 200-year standard of protection. As such, a breach event is considered to be extremely unlikely.

4.1.6.20 It is expected this area of the Mona Onshore Development Area is to be used as a temporary access to the beach within the Landfall area. Due to the nature of temporary works associated with construction, site occupants are not expected to become at risk from the impacts of climate change associated with the 2117 breach in flood defences event.

Proposed mitigation

4.1.6.21 The majority of land located within Zone C2 in the Landfall area is covered by a Flood Alert or a Flood Warning. The east extent of the Landfall area is located within Zone C1 and benefits from a coastal defence wall designed to offer protection up to at least the 0.5% AEP tidal flood event.

4.1.6.22 Within areas at risk of flooding and not benefitting from flood defences it is anticipated work windows will be scheduled against tide times, with site occupants notified of working times at least two weeks in advance. Site personnel will be briefed prior to commencement of works regarding weather conditions, tide times and heights. It is further anticipated works will be halted three hours prior to high time times. It is additionally anticipated that if a Flood Warning/Flood Alert is issued for the Abergele Sea Road' Flood Warning Area reference 101FWTWN415 and the North Wales Coast Flood Alert area reference 101WATNE10. works within the Landfall area would also be stopped whilst the Flood Warning/Flood Alert is active.

4.1.6.23 Finally, it is anticipated that storage of fuels and chemicals will be within areas benefitting from flood defences, or within areas at low risk of flooding. Refuelling of plant and equipment will only be permitted in designated refuelling areas located above the mean high water level or within areas at low risk of flooding. No refuelling is to be undertaken within the beach area and all refuelling will be undertaken using pumps to reduce spillage.

Summary

4.1.6.24 Due to the beach profile, land southwards of the mean high water line is located within Flood Zone 1 and is classified to have a low risk of tidal flooding. Land to the north of the mean high-water line and the landfall access/egress is located within Flood Zone 2 and 3, corresponding to Zones C1 and C2, and assessed to have a medium – high risk of tidal flooding. Areas benefitting from flood defences are assessed to have a low risk of flooding, with a residual risk of flooding from a breach in flood defences.

4.1.6.25 The majority of land located within Zone C1 and C2 in the Landfall area is covered by a Flood Alert or a Flood Warning.

Surface water flooding

4.1.6.26 Surface water flooding occurs when the amount of rainfall exceeds the drainage or infiltration capacity of the surface it falls upon. Surface water runoff can coalesce into surface water flow pathways as it flows towards a drainage system or watercourse. Surface water can also pond within areas of inadequate drainage.

Flood Map for Planning

4.1.6.27 The NRW FMfP indicates the majority of the Mona Onshore Development Area is located within surface water and small watercourses Flood Zone 1. Small extents of Flood Zone 2 and 3 are present throughout the Mona Onshore Development Area associated with flooding from surface water and small watercourses.

National Flood Hazard Maps

4.1.6.28 The NRW Flood Risk from Surface Water and Small Watercourses mapping shows localised areas along the Mona Onshore Development Area as having 'low to high' risk of flooding from surface water and small watercourses. Flooding is predominantly associated with out-of-bank flows from ordinary watercourses which form tributaries to Main Rivers.

Conwy County Borough Council data

4.1.6.29 The CCBC LFRMS shows no historic surface water flooding event has taken place within the Mona Onshore Development Area. Forty properties or more have been recorded to have been inundated by flooding from ordinary watercourses within proximity to Abergele.

4.1.6.30 Due to the type of development proposed, the Mona Onshore Development Area following installation will not be impacted or cause any adverse effect of surface water flooding.

Groundwater flooding assessment

4.1.6.31 Groundwater flood risk mapping included within the Groundsure Enviro and Geo Insight report shows the majority of the Mona Onshore Development Area has a low to negligible risk of groundwater flooding. The intertidal zone has a low to medium risk of groundwater flooding. There are isolated areas within centre and east with a moderate risk of flooding.

4.1.6.32 Due to the type of development proposed, the overall risk of flooding from groundwater has been assessed to be very low.

Reservoir failure assessment

4.1.6.33 The NRW FMfP includes flood risk from reservoirs mapping which shows the entirety of the Mona Onshore Development Area is located outside the extents of flooding from this source.

4.1.6.34 The overall risk of flooding from reservoir failure has been assessed to be negligible.

Flood defence measures

4.1.6.35 The NRW FMfP provides details of a 1,282 m coastal flood defence wall present along the onshore margin of the intertidal zone of the Mona Onshore Development Area which is maintained by CCBC.

Sewer/water main failure assessment

4.1.6.36 Flooding from sewerage failure occurs when a rainfall event exceeds the maximum capacity of the surrounding network. The most common causes of flooding from sewers are inadequate flow capacity, blockages, pumping station failures, burst water mains, water inflow from rivers or the sea, tide locking, siltation, fats/greases and sewer collapse. Should any of these events occur there is a risk of flooding within the vicinity of the sewer by surcharge where the flood is in excess of the sewer capacity (usually 1 in 30-year event or greater).

4.1.6.37 Sewerage flooding issues may occur along the Mona Onshore Development Area. However, mitigation measures, as identified in Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement, limit the potential impact on the surrounding sewer networks. Flood risk from this source is therefore assessed to be very low.

Historic flooding

4.1.6.38 The NRW FMfP includes recorded flood extents mapping which shows the entirety of the Mona Onshore Development Area is located outside the mapped extent of historical flooding.

Current flood risk

4.1.6.39 The majority of the Mona Onshore Development Area is located within Flood Zone 1 and Zones A and B. The intertidal zone is located within Flood Zone 2 and Flood Zone 3 and Zones C1 and C2.

4.1.6.40 It has been determined that the main risk of flooding to the Mona Onshore Development Area is from tidal flooding sources.

4.2 Flood risk management

4.2.1 Site vulnerability

4.2.1.1 In accordance with the Development Vulnerability Categories in Figure 15 of TAN 15, wind farm developments are classified as 'Less Vulnerable'.

4.2.1.2 Aside from the landfall area, the Mona Onshore Development Area is located entirely within Flood Zone 1 and predominantly located within DAM Zone A, with marginal areas located within DAM Zone B.

4.2.1.3 Due to the beach profile, land to the north of the mean high-water line and the landfall access/egress is located within Flood Zone 2 and 3. The DAM zones further split areas of Flood Zone 2 and 3 into Zones C1 and C2, with land within the Mona Onshore Development Area not benefitting from flood defences shown to be located within Zone C2. Land benefitting from flood defences (which includes areas of the beach within the east extent of the Landfall area and the Landfall area access/egress on Sea Road) is located within Zone C1.

4.2.1.4 All types of development are considered acceptable within Zone A and B. Whilst less vulnerable development can be considered within Zone C1 and C2, the justification test will be applicable to the Mona Offshore Wind Project.

4.2.2 Justification test

4.2.2.1 TAN 15 technical guidance states a requirement for any proposed development within Zone C1 and Zone C2 to be subject to the justification test, including acceptability of consequences. The following must be demonstrated in order to justify development within Zone C:

- *'Development within 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*
- *Development within 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

- *Development concurs with the aims of PPW and meets the definition of previously developed land; and*

- *The potential consequences of a flooding event for the particular type of development have been considered and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable*.'

4.2.2.2 The Mona Offshore Wind Project is classified as a NSIP and will contribute towards meeting the UK Government's targets for generating energy from a renewable energy source; it will generate employment during its construction and operation. Part ii of the justification test is therefore considered to be satisfied. Further detail regarding employment is presented within Volume 4; Chapter 3: Socio-economics of the Environmental Statement.

4.2.2.3 The Mona Onshore Development Area includes the installation of below ground export cables and can be classified as 'Less Vulnerable'. DAM mapping shows the majority of the Mona Onshore Development Area is located within Zone A and B, with a small percentage located within Zone C1 and C2 (93.12 ha or 9.24% and 3.03 ha or 0.3% respectively). The Mona Onshore Development Area will connect the Landfall to the Onshore Substation and therefore, is unable to be routed without crossing areas within Zones C1 and C2. Part iii of the justification test is therefore considered to be satisfied.

4.2.2.4 In regard to part iv of the justification test, potential consequences of a flood event have been assessed regarding development taking place within C1 and C2 in line with Appendix 1 of TAN 15.

4.2.2.5 The intertidal section of the Mona Onshore Development Area located within Zone C2 and is associated with the beach profile. The south extent of the beach within the east extent of the Landfall area is located within Zone C1 benefits from a coastal defence wall designed to offer protection up to at least the 0.5% AEP tidal flood event. The remainder of the Landfall area is located within Zone A.

4.2.2.6 The majority of the Mona Onshore Development Area located within Zone C2 is covered by the Abergele Sea Road Flood Warning or the North Wales Coast Flood Alert area. The Abergele Sea Road Flood Warning Area additionally covers the area of Zone C1 within the east extent of the Landfall area.

4.2.2.7 The areas of Zone C1 and C2 are to be used to access and monitoring purposes only, with no construction activities proposed. During the construction phase the Principal Contractor will sign up to the Flood Warning Service and will be alerted by a phone call or text when a Flood Warning becomes active. The flood warning will be applied to the entire Mona Onshore Development Area located within Zone C1 and C2 to enable site personnel to be evacuated from the site in a timely manner prior to a flood event occurring.

4.2.2.8 The installation of below ground cables will be temporary in nature with no permanent above ground structures proposed within this area. The majority of the construction works are not within previously developed land however, there will be no changes to existing land use. The Mona Onshore Cable Corridor does not increase flood risk to the surrounding area and has negligible risk of flooding to and from the development.

4.2.2.9 Areas of Mona Onshore Development within Zones C1 and C2 are for access and monitoring purposes and as such no flood resistant design is not considered to be appropriate.

4.2.2.10 Any alterations in the existing surface water drainage regime associated with the installation of the below ground cables are expected to be only during the construction stage and thus temporary in nature. Any increase in run-off from the Mona Onshore Cable Corridor during construction will be managed through control principals set out in the Outline CoCP of the Environmental Statement. that will be revised and submitted

to CCBC for approval with consultation with NRW prior to the commencement of works.

4.2.2.11 On this basis, the justification test is determined to be passed.

4.2.3 Flood mitigation measures

4.2.3.1 During construction, site workers will be made aware of areas that are located within Flood Zone 2 and 3 and of the evacuation protocol in the event of a flood (see Outline Flood Management Plan (Document Reference J26.7)). Stockpiled material and construction compounds will be located outside of the floodplain (where possible), minimising loss of floodplain storage area and reducing possibility of silt laden runoff into surrounding watercourses. In accordance with Land Drainage (Wales) Byelaws, no persons shall without the consent of the authority, deposit or store objects or matters within 8 m of the edge of drainage, watercourse and flood risk management features. CCBC has confirmed that they have adopted Land Drainage (Wales) Byelaws with regards to consent requirements for works within 8 m of an ordinary watercourse. No work will be carried out within 8 m of non-tidal water bodies unless agreed with the relevant drainage authority, NRW or LLFA.

4.2.3.2 The Mona Onshore Development Area encounters ordinary watercourses which are anticipated to be crossed by trenchless techniques. A crossing schedule will be prepared and accompany the DCO application (see Volume 5, Annex 4.3: Onshore crossing schedule). Mitigation measures to minimise any potential adverse effects on surrounding watercourses, increase in flood risk, degradation of agricultural land or during construction are set out in Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement and the Outline CoCP (Document reference J26).

4.2.3.3 Trenchless crossing techniques will be used to cross a selected number of ordinary watercourses within the Mona Onshore Development Area. The DCO will include protective provisions for securing the consent from local drainage authorities and/or the NRW for any works within 8 m of non-tidal water bodies and 9 m from the edge of drainage and flood risk management features.

4.3 Summary and conclusions

4.3.1 Summary

4.3.1.1 A site-specific FCA in accordance with section 5.7 of the NPS EN-1, PPW and TAN 15 has been undertaken for the Mona Onshore Development Area which extends approximately 15 km from the Landfall location west of Abergele to the Onshore Substation located to the southwest of St. Asaph and a further 1 km from the Onshore Substation to the National Grid Substation at Bodelwyddan.

4.3.2 Flood risk

4.3.2.1 In accordance with the guidance on development and flood risk the FCA demonstrates that:

- NRW mapping shows the majority of the Mona Onshore Development Area is located within Flood Zone 1, at low risk of fluvial and tidal flooding. Land to the north of the mean high-water line and the beach access/egress is located within Flood Zone 2 and 3 and is assessed to have a medium to high risk of tidal flooding. Areas benefitting from flood defences are assessed to have a low risk of

flooding, with a residual risk of flooding from a breach in flood defences. The DAM zones further split areas of Flood Zone 2 and 3 into Zones C1 and C2

- The justification test has been applied to the portion of the Mona Onshore Development Area located within the intertidal zone within Zone C2. Proposals are considered to meet policy requirements and potential consequences of a flood event have been considered. In terms of the criteria within TAN 15, the development proposals are considered to meet requirements and satisfy the justification test
- The remainder of the Mona Onshore Development Area is not subject to the justification test
- There is no historical evidence of flooding within the 250 m buffer around the Mona Onshore Development Area
- The Mona Onshore Development Area has a low to high risk of surface water flooding, associated with out-of-bank flows from ordinary watercourses. However, with the implementation of mitigation (e.g. drainage alongside the Onshore Cable Corridor), the risk will be reduced to low
- The Mona Onshore Development Area has been assessed to have a very low risk of groundwater flooding
- The Mona Onshore Development Area has been assessed to have a very low risk of sewer flooding
- The Mona Onshore Development Area has been assessed to have a negligible risk of reservoir flooding.

4.3.3 Conclusion

4.3.3.1 The FCA and supporting documentation shows that the Mona Onshore Development Area meets the requirements of the NPS EN-1, PPW and TAN 15.

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