

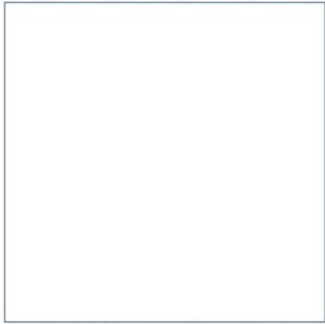
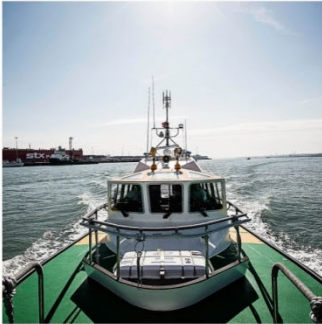
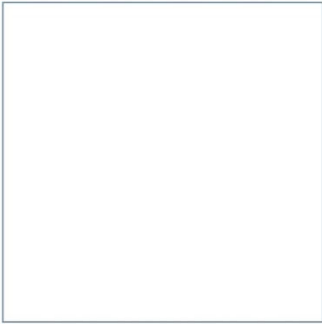
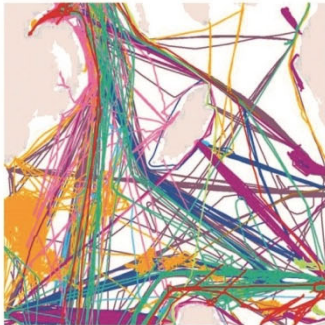
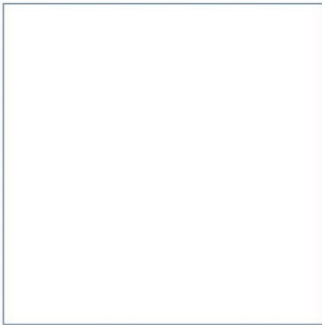
Port of Mostyn

Mostyn Energy Park Extension

Environmental Statement

Appendix 11.1: Flood Consequence Assessment

December 2022



Innovative Thinking - Sustainable Solutions



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Mostyn Energy Park Extension

Environmental Statement



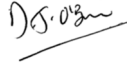
Appendix 11.1: Flood Consequence Assessment

December 2022



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ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
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MINERAL ESTATES
WASTE RESOURCE MANAGEMENT



PORT OF MOSTYN

MOSTYN ENERGY PARK EXTENSION

FLOOD CONSEQUENCE ASSESSMENT

NOVEMBER 2022

DATE ISSUED: NOVEMBER 2022

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PORT OF MOSTYN

MOSTYN ENERGY PARK EXTENSION

FLOOD CONSEQUENCE ASSESSMENT

NOVEMBER 2022

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1 INTRODUCTION

1.1 General

1.1.1 Wardell Armstrong LLP has been commissioned to undertake a Flood Consequence Assessment (FCA) on behalf of The Port of Mostyn Limited, relating to the proposed MEPE Project at the Port of Mostyn, Holywell.

1.1.2 This assessment has been carried out in accordance with the guidance set out in the Welsh Government Technical Advice Note 15 'Development and Flood Risk' (TAN15).

1.2 Methodology

1.2.1 The methodology for this FCA has comprised a desktop study supplemented by liaison with the Lead Local Flood Authority (Gwynedd Council) and Natural Resources Wales (NRW).

1.2.2 In accordance with TAN15, the following has been carried out in preparing this assessment:

- an assessment of the consequences of flooding to the development from a range of sources;
- an assessment of the consequences of flooding from the proposed development site; and
- consideration of recommendations for the management of the identified consequences.

1.2.3 In carrying out this assessment, reference has been made to relevant plans and documents, including:

- Planning Policy Wales (1998) Technical Advice Note 14: Coastal Planning
- Planning Policy Wales (2021) Technical Advice Note 15: Development and Flood Risk;
- Flintshire County Council (2011) Preliminary Flood Risk Assessment Report;
- Flintshire County Council (2013) Flintshire Local Flood Risk Management Strategy;
- North West and North Wales Coastal Group (2011) North West England and North Wales Shoreline Management Plan SMP2.

Planning Policy Wales – Technical Advice Note (TAN 15)

- 1.2.4 Technical Advice Note 15 (TAN 15) ‘Development and Flood Risk’ was published in July 2004 by the Welsh Assembly Government and gives guidance to planning authorities in Wales on how to respond on flood risk grounds to development proposals. TAN15 expects planning authorities to apply a risk-based approach to development planning and control through a Sequential Test involving location justification, type of development and flooding consequences.
- 1.2.5 TAN15 was revised in December 2021 and renamed ‘Development, Flooding and Coastal Erosion’. This revision will come into use fully in June 2023, but its use within this FCA was requested in the NRW Screening and Scoping Opinion. Both the 2004 and 2021 TAN15 reports have, therefore, been referred to within the FCA where appropriate.
- 1.2.6 In October 2017, the Welsh Government published the latest TAN15 Development Advice Maps (DAM’s) which show areas potentially at risk from flood events of a 0.1% annual probability for river, tidal or coastal areas (ie 1 in 1,000 year). The Development Advice Maps divide the land area of Wales into three flood risk zones. These are denoted A, B and C, with Zone C further sub-divided into Zones C1 and C2. The Flood Zones are described in further detail in Table 1 below.

Table 1: TAN15 Development Advice Map Flood Zones		
Zone	Description	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 flood risk further.
B	Areas known to have been flooded in the past evidenced by sedimentary deposits.	Used as part of a 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 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.

Table 1: TAN15 Development Advice Map Flood Zones		
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.

1.2.7 Section 5 of the 2004 TAN15 (Section 6 of the 2021 TAN15) categorises development according to its vulnerability to flooding. There are three categories: emergency services; highly vulnerable development; and less vulnerable development. All residential premises and vulnerable industrial developments are categorised as highly vulnerable developments. Commercial, retail, and general industrial development are categorised as less vulnerable developments.

1.2.8 The 2021 TAN15 would consider the proposed development a ‘Water Compatible’ development which is a fourth vulnerability category added as part of the 2021 TAN15 update.

Planning Policy Wales – Technical Advice Note (TAN 14)

1.2.9 Technical Advice Note 14 (TAN 14) ‘Coastal Planning’ was published in March 1998 by the Welsh Assembly Government and gives guidance to planning authorities in Wales on the considerations to be given for proposed developments in coastal zones. This has since been incorporated into the December 2021 update to Technical Advice Note 15.

The National Strategy for Flood and Coastal Erosion Risk Management in Wales 2010

1.2.10 This UK National Strategy for flood and coastal erosion risk management was adopted in Wales in 2010. This strategic document sets national policies on flood and coastal erosion risk management in Wales in order to reduce the consequences from flooding and coastal erosion, to raise awareness on flood and coastal erosion risk, and to provide an effective response system to flood and coastal erosion events.

North West England and North Wales Shoreline Management Plan 2 (SMP2)

1.2.11 The Shoreline Management Plan 2 (SMP2) is the second generation SMP produced in 2012 following a review of the previous SMP. This sets the policy for sustainable management of the estuary and coastal shorelines to avoid negative effects such as increased erosion and flooding and maximise the beneficial effects of better beaches

and habitats and flood and coastal protection. The aim of the SMP is to seek to provide a balanced plan which considers people, natural and historic interests and socio-economic conditions.

1.2.12 SMP2 identifies the most sustainable policies for managing coastal flood and erosion risks in the short, medium and long term based on four policies:

- Hold the line – maintaining the current standard of coastline protection by rebuilding existing structures or building secondary structures behind existing defences.
- Advance the line – building new defences on the seaward side of existing defences. This is limited to areas where significant land reclamation is considered
- Managed realignment – allowing the shoreline to move backwards or forwards by controlling or limiting the movement of sediment.
- No active intervention – where there is no investment in coastal defences.

1.2.13 The Port of Mostyn (the Port) is located within sub cell 11a 5.1 ('Point of Ayr to Mostyn, south of Mostyn Dock'). There is a 'hold the line' policy approach in this section of coastline in the short, medium and long term.

Welsh National Marine Plan

1.2.14 The Welsh National Marine Plan (WNMP) was published in November 2019 by the Welsh Government. The plan proposes a series of objectives to contribute to the sustainable development within the Welsh marine regions. The plan includes a sector policy for Ports and Shipping which covers the construction, operation and maintenance of ports and harbours.

Dee River Basin Management Plan 2021 – 2027 Summary (2022)

1.2.15 River Basin Management Plans (RBMP) are required for each River Basin District under the WFD regulations. The Dee River Basin RBMP was undertaken jointly by NRW and the Environment Agency and the 2022 report is the second of three planning cycles. The RBMP outlines the current condition of the River Basin District plus the Programme of Measures for improving the water environment by 2027.

Dee River Basin District Flood Risk Management Plan (2016)

1.2.16 Flood Risk Management Plans (FRMPs) are produced every six years and identify the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs within a river basin, and confirm how flood and coastal risk will be managed, setting measures for the next six years. The River Dee extends from Snowdonia to the Dee Estuary, with the site area situated at the northern extent of the district.

River Dee Catchment Flood Management Plan (2010)

1.2.17 The River Dee Catchment Flood Management Plan (CFMP) was produced in January 2010 by the Environment Agency Wales. The plan sets new policies to manage existing and future flood risk within catchments. The Port of Mostyn is located within Sub-area 6 'Deeside, Wirral and North Flintshire'. As stated in the CFMP, the area has a dependence on flood defences to reduce the likelihood of flooding and whilst sea defences will be maintained, these may not have their height increased in the future.

Flintshire County Council Preliminary Flood Risk Assessment (2011)

1.2.18 The Flintshire County Council Preliminary Flood Risk Assessment (PFRA) was produced in 2011 by Flintshire County Council to provide a high level summary of past and future flood risk from a range of sources, and to identify areas of significant flood risk ('Flood Risk Areas').

1.2.19 The report shows that the site is not located within a 1km grid square determined to be above the flood risk 'threshold' (based on the number of people, business or services flooded to depths of more than 0.3m during the 1 in 200 year storm event).

Updated Wave Overtopping and Assessment Manual and Calculation Tool

1.2.20 The report, produced as part of the Flood Risk and Coastal Erosion Risk Management and Research Programme contains guidance on predicting the rate that waves will overtop sea walls and other structures. The estimations are made using the online calculation tool (Bayonet GPE) and based on several inputs, including the design of the structure, depth of water and the height and frequency of the waves.

2 SITE AND CATCHMENT CHARACTERISTICS

2.1 Site Description and Location

2.1.1 A summary of the site and its characteristics is provided in Table 2.

Table 2: Site Summary	
Site Name	Mostyn Energy Park
Site Address	Port of Mostyn Coast Road, Mostyn, Holywell CH8 9HE
Site Area	c.5ha
National Grid Reference	SJ 15983 81594
Proposed Development	Extension of existing quay
Local Planning Authority	Flintshire County Council
Lead Local Flood Authority	Flintshire County Council
Sewerage Undertaker	Welsh Water

2.1.2 The site is located on the Welsh side of the Dee Estuary within the Port of Mostyn, approximately 0.5km to the north of the village of Mostyn. An approximate National Grid Reference for the centre of the site is SJ 15983 81594 and the nearest postcode is CH8 9HE.

2.1.3 The site area is bounded to the south by the Mostyn Energy Park (MEP) which comprises warehouses, jetties and areas of hardstanding. The site is bounded on all other sides by the sands and open waters of the Dee Estuary.

2.1.4 The western area of the site presently comprises a narrow breakwater structure. The breakwater is approximately 320m in length which consists of a raised platform with steep slopes extending down to the water level. The eastern part of the site is open water.

2.1.5 Topographical surveys show that ground levels within the Port of Mostyn are relatively flat, ranging between approximately 7mAOD and 8mAOD. The ground levels along the breakwater range between approximately 8.43mAOD and 7.24mAOD. The topography of the breakwater and areas of the Port of Mostyn are shown on Drawing No. ST19488-001 '*Port of Mostyn Topography*'.

2.2 Existing Watercourses and Waterbodies

2.2.1 The site is located within the estuary of the River Dee. The closest Main Rivers to the site are a network of unnamed channels to the north-west of the village of

Ffynnongroyw, approximately 3km to the north-west of the site, and an unnamed watercourse discharging to the Dee Estuary in Holywell approximately 5km to the south-east of the site. The closest watercourse to the site is an unnamed watercourse flowing north-eastwards through Mostyn and passing beneath Coast Road (A548) to discharge to the River Dee. The watercourse is approximately 730m to the south-west of the site at its closest point.

2.3 Existing Drainage Regime

2.3.1 It is assumed that there is no formal drainage within the breakwater extending along the western boundary of the site. It is understood that the Port area to the south of the site is served by a private surface water drainage network, with surface water runoff from areas of hardstanding collected by a series of gullies. Surface water then discharges via soakaways (identified in previous drainage surveys within this area of the site) or to the Dee Estuary via a single outfall point in the west of the MEP. Unsurfaced areas of the Port are allowed to drain naturally via infiltration and evaporation. Surface water runoff from office areas in the southern corner of the Port discharge to the public sewer network within Coast Road.

2.4 Ground Conditions

2.4.1 The British Geological Survey 'Geology of Britain Viewer'¹, available online, shows that the Port and quay in the west of the site are underlain by mudstone and siltstone bedrock of the Pennine Middle Coal Measures Formation. The online NRW 'Natural Environment' mapping² shows the bedrock is classified as a Secondary A aquifer, defined as '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*'.

2.4.2 The existing breakwater is understood to be constructed from slag from the iron industry, with the wider Port constructed on land reclaimed by infilling with industrial waste and other fill. This is confirmed by NRW in their response to the pre-application enquiry (see Appendix 1).

¹ BRITISH GEOLOGICAL SURVEY *Geology of Britain Viewer*. Available from <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

² NATURAL RESOURCES WALES *Natural Environment Interactive Map*. Available from <https://naturalresources.wales/evidence-and-data/maps/browse-map-of-data-about-the-natural-environment/>

2.4.3 The surrounding areas are underlain by superficial tidal flat deposits, classified as an undifferentiated Secondary aquifer and bedrock of the Pennine Middle Coal Measures, defined as a Secondary A aquifer.

3 DEVELOPMENT PROPOSALS

3.1 Description of Proposals

3.1.1 The proposed development will be part of a wider scheme of works to extend the existing MEP (also referred to as the MEPE Project) to provide new areas of hardstanding for storage and laydown, and new workshops and office space. The proposed development which this FCA focusses on will be the reclamation of approximately 4ha of existing open water for use as areas of hardstanding. These works can be divided into 'marine works' and 'landside works' and are shown on Figure 1 below.

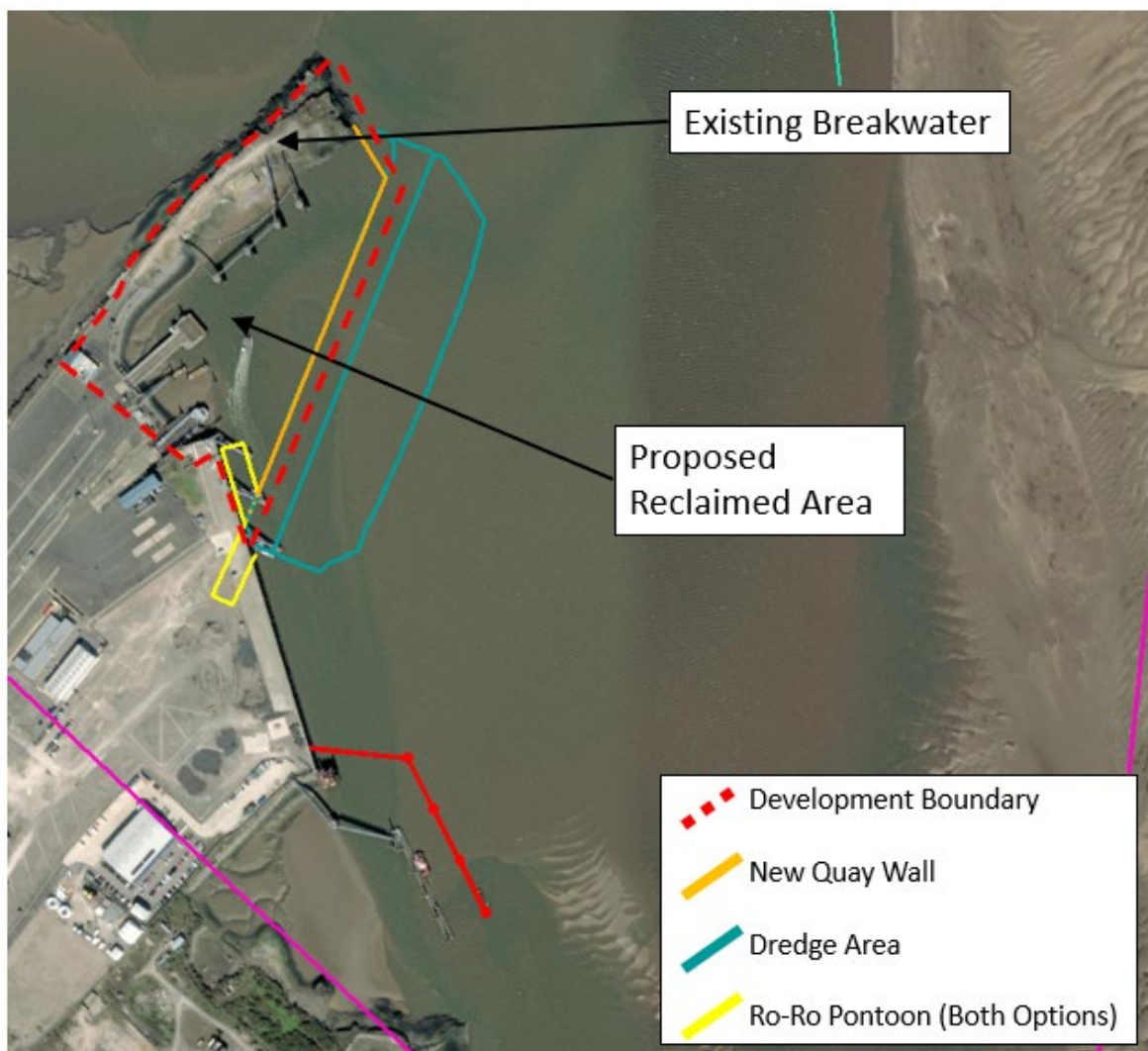


Figure 1. Proposed Development Areas

Marine Works

- 3.1.2 The marine works will comprise the construction of a 360m length of new quay wall in the eastern area of the site. This will be constructed from a series of tubular piles with sheet pile infills (combination piles). An area to the east of this new quay will be dredged to create a deeper berth pocket for ships to access.

Landside Works

- 3.1.3 The proposed development will retain and upgrade the existing breakwater in the west of the site, and landside works will involve filling the area of water between this and the new quay wall constructed during the marine works. Approximately 600,000m³ of engineered fill will be used, which will consist of a selected proportion of the suitable capital dredge arisings from the berth pockets and main navigation channel. The quay will be finished with a 1m layer of type 1 stone.
- 3.1.4 The compacted infill material will be topped with a capping layer of crushed graded rock fill. Specially loaded areas are likely to require a reinforced concrete foundation. No other permanent infrastructure will be constructed within this area.
- 3.1.5 There is the potential requirement for a 200m by 25m roll-on-roll off (RoRo) linkspan pontoon to be installed, with options to install this alongside the new quay wall, or alongside the existing quay.
- 3.1.6 An upgrade to the existing breakwater may also be required to provide protection and stabilisation, with low-lying rubble drawn back to form a steep slope which will be resurfaced with protective armourstone. Upgrading existing structures such as the breakwater could be considered a 'hold the line' approach to coastal management, as outlined in SMP2.
- 3.1.7 The proposed works will also remove several hectares of rubble from the armourstone in western areas of the dock to expose a mudflat habitat and, therefore, enhance the marine ecology of the port area and its surroundings.

3.2 Development Advice Map

- 3.2.1 The 'Development Advice Map' for flood risk obtained from the Natural Resources Wales website is included as Figure 2 below.



Figure 2 Natural Resources Wales Development Advice Map Extract

3.2.2 Mapping shows that the raised sections of the breakwater are situated in Zone B ‘areas know to have flooded in the past evidenced by sedimentary deposits’. Lower-lying sections of the breakwater extending down to the water, and areas of the wider Port and all marine areas are situated in Zone C2, described as ‘Areas of the floodplain without significant flood defence infrastructure.’

3.3 Flood Risk Vulnerability

3.3.1 The proposed development will comprise of a storage area with no permanent structures and, by its nature, is required to be in its tidal location. It will not be regularly occupied by people.

3.3.2 The proposed development would, therefore, be classified as a ‘Water Compatible’ development (‘boatyards, marinas and essential works required at mooring basins’) in Figure 3 of the 2021 TAN 15.

3.4 Justification Test

3.4.1 The Justification Test, outlined in Section 6 of the 2004 TAN 15 (and Section 10 of the 2021 TAN 15), aims to direct new development away from Zone C and towards land in Zone A (or otherwise Zone B). A new ‘Less Vulnerable’ development would only be permitted within Zone C if it is deemed to be justified in that location. A development would only be justified if it demonstrates that:

- 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 are found to be acceptable.

3.4.2 Based on paragraph 6.4 of the 2021 TAN 15, the Justification Test would not be required for Water Compatible developments. During the construction phase, however, the development would be occupied by persons for extended periods and could, therefore, be considered a 'Less Vulnerable' development. The Justification Test would, therefore, be required.

3.4.3 The proposed development will extend the MEP to allow the Port to continue to support and service the current and future offshore windfarm development and it is considered that it will provide key employment opportunities to the area, in accordance with item II of the Justification Test.

3.4.4 The proposed development will incorporate an area of existing breakwater and will act as an extension to the existing hardstanding to the south. This would meet the definition of previously developed land, as outlined in Planning Policy Wales (*'land is that which is or was occupied by a permanent structure.... and associated fixed surface infrastructure'*). This would, therefore, be in accordance with item III of the Justification Test.

3.4.5 With the potential consequences of flooding events considered and addressed as part of this Flood Consequence Assessment, item IV of Justification Test will also be met, and the overall Justification Test is considered to be passed.

4 FLOOD CONSEQUENCE ASSESSMENT

4.1 Historical Flooding

4.1.1 The Natural Resources Wales 'Recorded Flood Extents' mapping (see Figure 3) does not show any recorded historical flooding events in the vicinity of the site. The closest area recorded as being affected is along the A548, extending into the south-western corner of the Port, approximately 600m from the site at its closest point. This event occurred in 1990 when existing defences were overtopped. Based on reporting from staff present on site during the event, the actual extent of flooding is not as great as shown on the mapping, with only a small area in the western corner of the Port affected and the access road unaffected.



Figure 3. Historical Flood Risk

4.1.2 The Flintshire County Council PFRA lists five historical flooding events that affected more than five properties, all of which occurred in 2000. The closest flooding event was approximately 8.4km to the south-east of the site in the town of Bagilit. The 2018 PFRA addendum refers to a flooding event in Bagilit in 2016 where flooding from an ordinary watercourse led to 'locally significant harmful consequences'.

4.2 Consequences of Flooding to the Development

4.2.1 Flooding can occur from a range of sources including, but not limited to rivers, tidal waters and the sea, surface water runoff, groundwater, sewers and drains, and artificial sources such as canals and reservoirs. The presence of a potential flooding source does not, however, necessarily translate into a high risk of flooding. Following the source-pathway-receptor approach, flooding can only affect the site (receptor) if there is a pathway from the identified sources.

4.3 Flooding Consequences to the Proposed Development

Fluvial Flooding

4.3.1 The Natural Resources Wales fluvial flood map assigns Low, Medium and High risk to areas susceptible to fluvial flooding. These are defined as follows:

- Low – each year, these areas have a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%);
- Medium – each year, these areas have a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%);
- High – each year, these areas have a chance of flooding of greater than 1 in 30 (>3.3%).

4.3.2 All other areas will have an annual probability of flooding of less than 1 in 1000 (<0.1%) and are considered to be at a 'very low' risk. An extract from the NRW fluvial flood risk mapping is included as Figure 4 below.

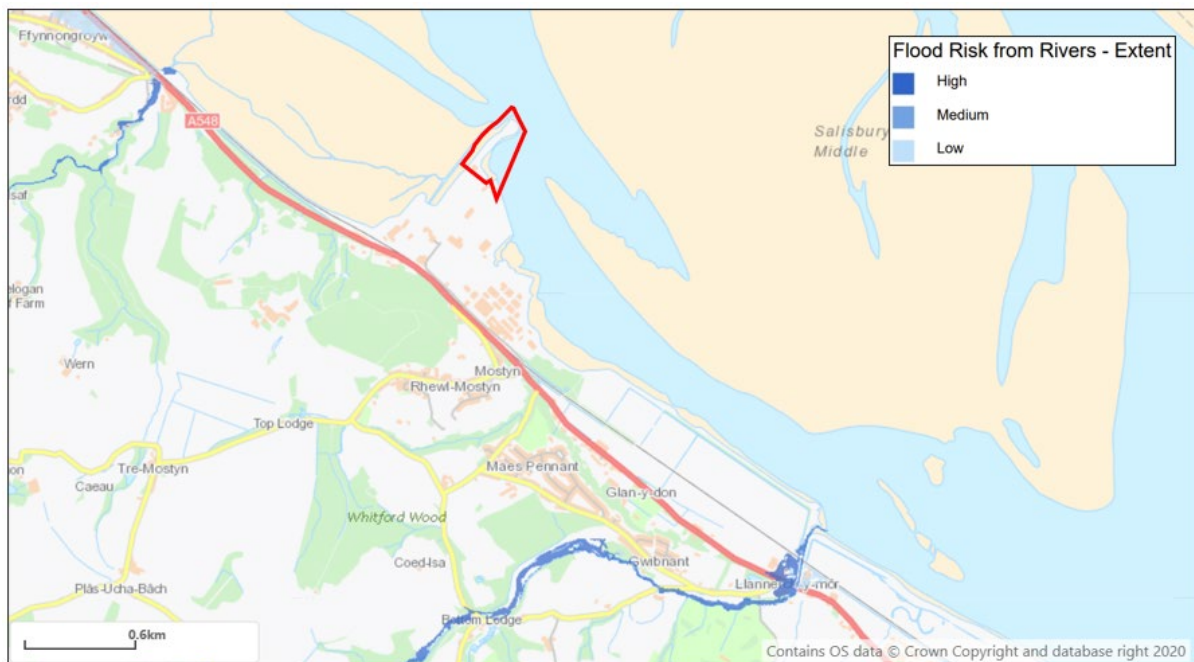


Figure 4. Fluvial Flood Risk

4.3.3 As shown in Figure 4, the site and the Port is situated outside of any area with an increased risk of fluvial flooding, with the closest area located approximately 1.9km to the north-west of the site. The section of the River Dee adjacent to the site is tidally-influenced and does not pose a risk of fluvial flooding.

Tidal Flooding

4.3.4 The NRW flood risk map for tidal flooding assigns Low, Medium and High risk to areas susceptible to tidal flooding. These are defined as follows:

- Low – each year, these areas have a chance of flooding of between 1 in 1000 (0.1%) and 1 in 200 (0.5%);
- Medium – each year, these areas have a chance of flooding of between 1 in 200 (0.5%) and 1 in 30 (3.3%);
- High – each year, these areas have a chance of flooding of greater than 1 in 30 (>3.3%).

4.3.5 All other areas are considered to be at a very low risk of tidal flooding. The NRW tidal risk map (included as Figure 5) shows areas of the existing breakwater would be at a High risk of tidal flooding. This would also extend into areas of the Port to the south-west of the site.

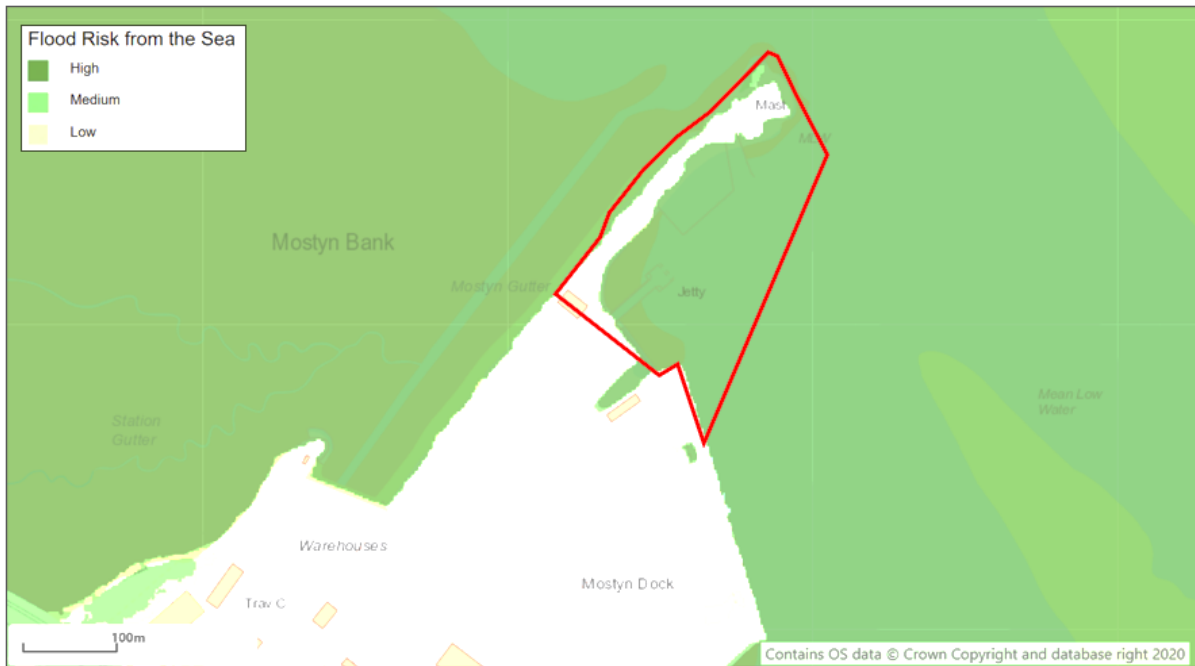


Figure 5. Tidal Flood Risk

4.3.6 The areas with an increased risk of tidal flooding generally correspond with the area of Zone C2 shown on the Development Advice Map (DAM) as shown in Figure 1. The area of Zone C2, however, extends further into the Port area to the south of the site.

Surface Water Flooding

4.3.7 The NRW mapping for the flood risk from surface water runoff and small (ordinary) watercourses assigns Low, Medium and High risk to areas susceptible to flooding from these sources. All other areas can be considered to be at a very low risk. An extract from the NRW map for flooding from surface water and small watercourses is included as Figure 6 below.



Figure 6. Surface Water Runoff (Overland Flow) and Small Watercourses Flooding Extent

4.3.8 As shown in Figure 6, the existing breakwater within the site area is not at a risk of surface water flooding. Small, isolated areas of the Port to the south-west of the site are shown to have a High risk of surface water flooding and it is assumed that these are isolated topographical depressions where surface water runoff could accumulate during extreme storm events. Larger areas adjacent to the offices in the southern corner of the Port are also at a High risk. Ground levels within southern areas of the Port are generally lower than the MEP site and Figure 6 shows no evidence of any connectivity between the potential flooding around the offices and the isolated areas within the Port, and the areas and land within the proposed development.

4.3.9 As ground levels are relatively flat within the MEP, and at a similar level to the breakwater, it is considered that there would be no overland flow routes from the adjacent areas of the MEP to the breakwater.

Groundwater Flooding

4.3.10 The existing breakwater is constructed from engineered materials and it is assumed that there is no natural bedrock present within the structure, or adjacent areas of the Port. The risk of flooding from groundwater is, therefore, discounted.

Sewer Flooding

4.3.11 The wider Port area is served by a combination of soakaways and a surface water drainage network discharging to the Dee Estuary. It is assumed that there is no formal drainage within the breakwater area, however, and the risk of flooding from this source is discounted.

Artificial Flooding

4.3.12 There are no reservoirs or impounded bodies of water in the vicinity of the site and the risk of flooding from this source is discounted

4.4 Potential Sources of Flooding

4.4.1 Table 3 summarises the flood consequences to the proposed development. The risk is described in further detail in this section.

Table 3: Summary of Flood Consequences to the Site			
Type	Source	Pathway	Risk
Fluvial Flooding (Rivers)	N	-	-
Tidal Flooding	Y	Y	LOW
Surface Water Runoff	Y	N	-
Groundwater Flooding	N	-	-
Sewer/Drain Flooding	Y	N	-
Artificial Flooding	N	-	-

4.4.2 The only potential source with a pathway to the site is, therefore, tidal flooding.

Tidal Flooding Risk

4.4.3 Extreme sea level data was obtained from Natural Resources Wales for the Welsh coastline. The sea level data for the four node points closest to the site was extracted from the dataset. This is summarised in Table 4 below, with the location of the node points shown on Figure 7.

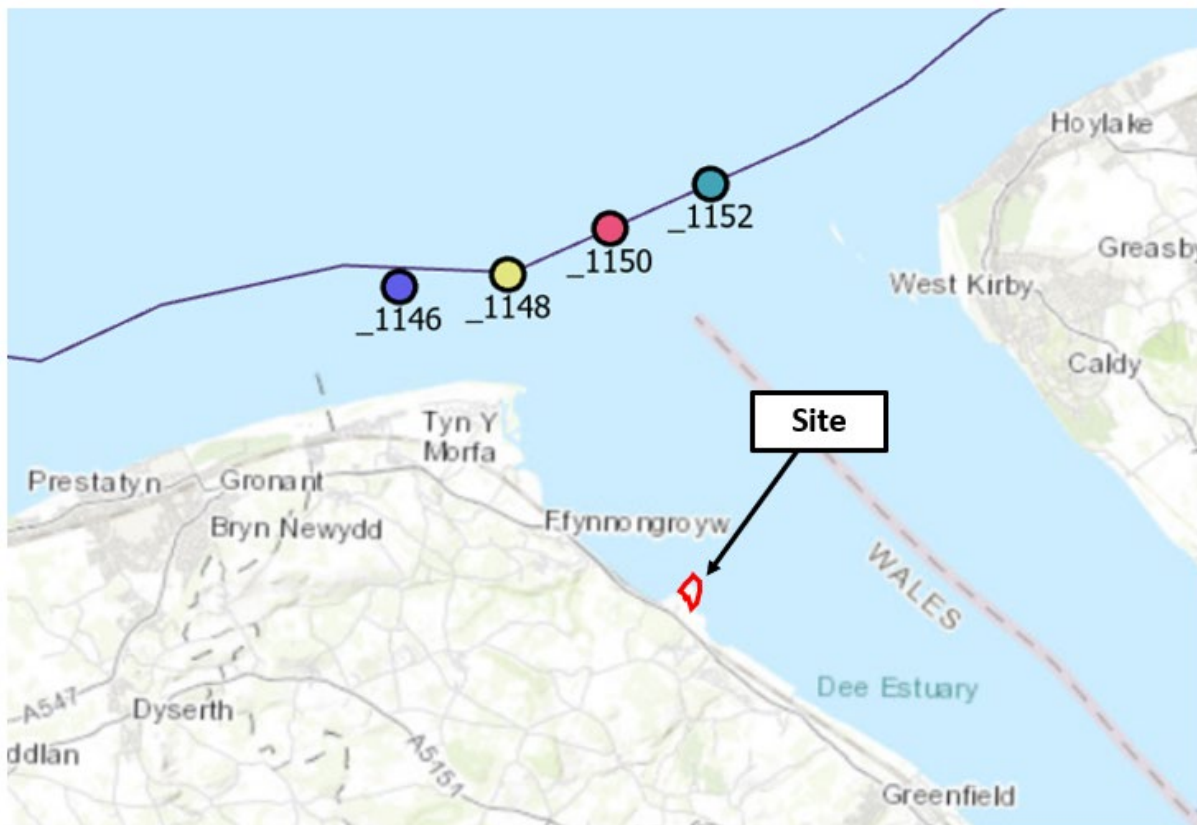


Figure 7. Extreme Sea Level Model Nodes

Table 4. Extreme Sea Levels							
Node ID	HAT ¹ (mAOD)	MHWS ² (mAOD)	Return Period				
			1:1 (mAOD)	1:25 (mAOD)	1:100 (mAOD)	1:200 (mAOD)	1:1000 (mAOD)
1146	5.14	3.93	5.06	5.49	5.67	5.76	6.27
1148	5.19	3.96	5.10	5.54	5.72	5.81	6.32
1150	5.23	3.99	5.15	5.59	5.77	5.86	6.38
1152	5.26	4.03	5.19	5.64	5.82	5.91	6.44

1. HAT (Highest Annual Tide Level)
 2. MHWS (Mean High Water Spring Tide Level)

4.4.4 As shown on the topographical survey, the edge of the existing breakwater ranges between 8.43mAOD and 7.24mAOD, which is significantly higher than the extreme sea level in all return periods. This would confirm the Zone B classification on the

Development Advice Map (see Figure 1) and also confirms that the site is located outside areas at risk of tidal flooding. Ground levels within the wider Port also exceed 7mAOD.

- 4.4.5 The elevation of the proposed extension will be approximately 7.5mAOD, therefore, there will be no pathway for tidal flooding to extend into any area of the new development.
- 4.4.6 During the construction of the piles for the new quay wall, a temporary raised stone bund behind the line of the new quay wall or alternatively 'jack-up' barges will be utilised and these will be situated within the estuary. The jack-up barges will be raised above the water level and would not be at risk from high water levels. The initial infilling works to reclaim the new area of land will be done using dredge arisings pumped from the dredger located beyond the new quay wall. The placement of engineered fill and the final surfacing will be done from behind the quay wall and would be protected from tidal flooding.
- 4.4.7 The risk of tidal flooding to the proposed development will, therefore, be **LOW** during both the construction and operational phases.
- 4.4.8 There is also a risk of waves overtopping sea wall structures and impacting on adjacent landside areas. The rate of wave overtopping can be estimated using the online Bayonet GPE tool. The tool bases the rate of overtopping on the design of the sea wall structure, and depth of water and wave height. The rate of wave overtopping should, therefore, be confirmed as part of future works. It is considered, however, that if stockpiled objects are suitably protected and secured, there would be no impact on the proposed development as a result of wave overtopping.

4.5 Flooding Consequences from the Proposed Development

- 4.5.1 New development can pose a risk of flooding to neighbouring properties and areas downstream of the site often as a result of the loss of floodplain storage, an increase in impermeable area which has the effect of increasing the rate and volume of surface water runoff, or alterations to the surface water flow regime.

Tidal/Fluvial Flooding

- 4.5.2 The marine areas of the site are located within Zone C2 of the Dee Estuary, and the proposed works would raise this area to Zone B. This would theoretically reduce floodplain storage. In tidal areas where the impact of any land raising is spread over a

large area, such as the Dee Estuary, there would be no discernible change to tidal flood levels. The impact from the development would, therefore, be negligible and compensatory floodplain storage would not be required.

Surface Water Flooding

4.5.3 The majority of the 4ha site area consists of open water, with the small section of breakwater comprising the only ‘landside’ development. The majority of the breakwater area comprises loose material with approximately 0.8 ha of hardstanding. The new quay will be a wholly impermeable area of hardstanding and will incorporate the 0.8ha existing impermeable area along with an additional 4 ha of reclaimed land. There will, therefore, be a large increase in impermeable area as a result of the proposed development.

4.5.4 Table 5 below shows the estimated surface water runoff rates from the existing 0.80 ha of hardstanding along the top of the existing breakwater and the proposed 4.80 ha area of reclaimed land. Calculations are contained in Appendix 2 and use the Modified Rational Method (HR Wallingford 1981), which is stated in the CIRIA ‘SuDS Manual’ as a method for determining runoff from developed areas. The rates are based on the six hour storm event.

Table 5: Existing and Proposed Surface Water Runoff Rates			
Return Period	Existing Runoff Rate	Proposed Runoff Rate	Increase
1 in 1	6.57 l/s	39.41 l/s	32.84 l/s
1 in 30	14.98 l/s	89.89 l/s	74.91 l/s
1 in 100	19.60 l/s	117.60 l/s	98.00 l/s
Based on Modified Rational Method and a 6 hour storm duration			

4.5.5 Where surface water runoff generated within the new development is able to flow into the Dee Estuary, the impact on tidal flood levels would be minimal. Runoff entering the private surface water drainage network within the Port area may, however, cause the capacity of the network to be exceeded. Without mitigation this could lead to an increase in flood risk within the Port, however, as the network is contained within the Port and would discharge to the Dee Estuary, it is considered that the risk to off-site areas would be minimal.

4.6 Climate Change

4.6.1 It is also necessary to take account of climate change for the lifetime of the development when assessing future flood risk. NRW and UK Government guidance provides predictions of anticipated changes to peak river flows and rainfall intensity for consideration on new developments. In assessing the risk of flooding from the proposed development, the climate change predictions for peak rainfall intensity for the lifetime of the development need to be taken into account as an increase in the intensity and frequency of rainfall could increase the rate and volume of surface water generated during a storm event.

4.6.2 The 2021 Welsh Government 'Flood Consequences Assessment: Climate Change Allowances' report states that non-residential developments will have an assumed lifespan of 75 years and based on Table 2 of the report (reproduced as Table 5 below), a 40% increase in rainfall intensity should be considered.

Table 5: Peak Rainfall Intensity Allowances			
Time Period	'2020s' (2015 – 2039)	'2050s' 2040 – 2069	'2080s' 2070 – 2115
Peak Rainfall Intensity – Upper End	10%	20%	40%
Peak Rainfall Intensity – Central	5%	10%	20%

4.6.3 An allowance for sea level rises as a result of climate change should also be considered for coastal developments. Table 6 shows the projections for sea level rise within the Flintshire Local Authority Area for the central and upper end allowances.

Table 6: Peak Rainfall Intensity Allowances		
Allowance	Mean Sea Level Rise by 2100	Mean Sea Level Rise by 2120
Central (70 th Percentile)	0.76m	0.91m
Upper End (95 th Percentile)	1.03m	1.23m

4.6.4 Table 7 shows the extreme sea level data from Table 4, modified to account for the Upper End 2120 mean sea level rise (ie the worst case scenario).

Table 7. Extreme Sea Levels							
Node ID	HAT ¹ (mAOD)	MHWS ² (mAOD)	Return Period				
			1:1 (mAOD)	1:25 (mAOD)	1:100 (mAOD)	1:200 (mAOD)	1:1000 (mAOD)
1146	6.37	5.16	6.29	6.72	6.90	6.99	7.50
1148	6.42	5.19	6.33	6.77	6.95	7.04	7.55
1150	6.46	5.22	6.38	6.82	7.00	7.09	7.61
1152	6.49	5.26	6.42	6.87	7.05	7.14	7.67

1. HAT (Highest Annual Tide Level)
 2. MHWS (Mean High Water Spring Tide Level)

4.6.5 The topographical survey data for the existing breakwater shows that ground levels along the western edge are between approximately 8.43mAOD and 7.24mAOD (see Drawing No.ST19488-001 'Port of Mostyn Topography'. Ground levels within the wider Port adjacent to the site are generally over 7.10mAOD. It is proposed that the elevation of the new development will be approximately 7.5mAOD. The proposed development and existing Port area would, therefore, be unaffected by extreme sea levels in the 1 in 200 year return period (0.5% Annual Exceedance Probability) tidal flood event. NRW also state in their pre-application enquiry response that the development, where possible, would be unaffected by the 0.5% Annual Exceedance Probability event with an allowance for climate change pre-application response (see Appendix 1).

4.7 Flood Management Plan

Surface Water Management

4.7.1 It is considered that the runoff from the additional areas of hardstanding would have minimal impact where discharged to a large tidal estuary, and that the rate of discharge from the development will not need to be restricted.

- 4.7.2 There is a risk, however, that runoff from the proposed development may contain elevated levels of sediments, suspended solids and other contaminants. Mitigation may be required to prevent contamination.

Residual Risk

- 4.7.3 There is always a possibility of a storm event that exceeds the design standards of the proposed surface water management regime for new developments. Potential risks include the exceedance of the surface water drainage networks during extreme storm events.
- 4.7.4 It is proposed that exceedance routes for any surface water drainage networks within the proposed development direct flows away from the wider Port area and away from areas where persons would be present.

5 DRAINAGE STRATEGY

5.1 Surface Water Runoff

5.1.1 The final surface of the proposed new hardstanding has yet to be confirmed. It is proposed that the majority of surfaces will comprise areas of freely draining type 1 stone. Within these areas, surface water will disperse naturally via infiltration as per the situation in other unsurfaced areas of the Port.

5.1.2 Where areas of hardstanding are required, such as for parking, it is proposed that a formal surface water drainage network will be used, with runoff from the hardstanding intercepted by a series of gullies and/or linear drainage channels.

5.1.3 Previous drainage surveys of the wider Port area to the south of the site identified soakaway structures are used to disperse surface water runoff from areas adjacent to the quay wall, with no positive outfall to the estuary.

5.1.4 The reclaimed area within the proposed development will be constructed from dredged material and engineered fill, and depending on the permeability of the underlying material, soakaway structures could be incorporated into the proposed surface water drainage network.

5.1.5 If it is not feasible to incorporate infiltration drainage into the surface water drainage regime, it is proposed that surface water runoff is discharged to the Dee Estuary. The proposed surface water drainage network would either connect to the existing surface water drainage network within the Port to discharge via the existing outfall, or discharge via a new outfall.

5.2 Surface Water Quality

5.2.1 It is understood that the discharge of surface water runoff from the wider Port to the Dee Estuary is in accordance with a discharge licence from NRW. Oil interceptors are incorporated into the drainage network to provide treatment to surface water runoff prior to discharge. If surface water runoff is discharged from the proposed development via a new outfall, similar methods of water treatment will be incorporated within the proposed drainage network.

5.2.2 Potential methods for surface water treatment would include:

- silt traps fitted to gullies and liner drainage channels;

- stone-filled filter drains;
- oil interceptors and vortex grit separators.

6 CONCLUSIONS

- 6.1.1 This report gives details of the Flood Consequence Assessment, which has been carried out in accordance with TAN 15. The site presently comprises a narrow breakwater structure and an area of open water located within the wider Mostyn Energy Park (MEP) at the Port of Mostyn (the Port).
- 6.1.2 The breakwater is situated within Zone B, described in TAN 15 as *'areas known to have flooded in the past evidenced by sedimentary deposits'* on the Welsh Government's Development Advice Map. Lower-lying sections of the breakwater extending down to the water, and areas of the wider Port are situated in Zone C2, described as *'Areas of the floodplain without significant flood defence infrastructure.'*
- 6.1.3 The proposed development would extend the quay area within the MEP to provide new areas of hardstanding for storage. A new quay wall will be constructed at the eastern extent of the development, and the area of open water between this and the existing breakwater will be infilled with dredged material and engineered fill.
- 6.1.4 The proposed development would be classified as a 'Water Compatible' development in the 2021 TAN 15, and a 'Less Vulnerable' development in the 2015 TAN 15. Construction works could also be considered a 'Less Vulnerable' development.
- 6.1.5 A new Less Vulnerable development would only be permitted within Zone C if it is deemed to be justified in that location via the 'Justification Test'. The existing breakwater structure (and adjacent areas of the Port) would constitute previously developed 'brownfield' land, and the proposed extension of the MEP, would provide employment opportunities. This would, therefore, meet the requirements of the Justification Test. This FCA report demonstrates that all potential consequences of flooding can be managed, and it is considered that the Justification Test has been passed.
- 6.1.6 Based on the source-pathway-receptor approach, the site is at risk of flooding from the adjacent tidal River Dee. The risk of flooding from fluvial, surface water, groundwater, sewer and artificial sources is discounted.
- 6.1.7 Modelled sea level data obtained from Natural Resources Wales (NRW) shows that the raised area of the breakwater is above the extreme sea level for all return periods up to and including the 1 in 1000 return period, include allowances for climate change.

If the elevation of the reclaimed land was coincident with these ground levels, it is considered that the risk of tidal flooding would be very low.

6.1.8 It is understood that areas of the Port drain via infiltration and discharge to the Dee Estuary or to the public sewer network. The proposed surface water drainage strategy would favour using infiltration as the primary means of discharging surface water runoff. If this is not feasible, surface water runoff will be discharged to the River Dee via an existing or new outfall. Surface water runoff will be treated prior to discharge.

6.1.9 On the basis of the findings of this report it is concluded that the flooding consequences to and from the site will be effectively managed and the Justification Test is passed. The site is, therefore, considered suitable for the type of development proposed

APPENDICES

APPENDIX 1

NRW Pre-Application Advice Response

Bryn Griffiths
Wardell-Armstrong
Sir Henry Doulton House
Forge Lane
Etruria
Stoke on Trent
ST1 5BD

ebost/email:
northplanning@cyfoethnaturiolcymru.gov.uk

26/10/2022

Dear Sir/Madam

PRELIMINARY PRE-APPLICATION ADVICE

BWRIAD / PROPOSAL: THE PROPOSED DEVELOPMENT WILL EXTEND THE EXISTING PORT OF MOSTYN TO INCLUDE A NEW QUAY AREA, AN AREA BEHIND THE NEW QUAY WILL BE DREDGED TO CREATE A NEW INFILLED HARDSTANDING AREA AND A NEW ROLL-ON/ROLL-OFF PONTOON WILL BE CONSTRUCTED. THIS WORK IS LINKED TO CONTINUING SUPPORT AND SERVICE FOR THE WINDFARM DEVELOPMENT.

LLEOLIAD / LOCATION: PORT OF MOSTYN, DOCK ROAD, MOSTYN, CH8 9HE

Thank you for consulting Cyfoeth Naturiol Cymru / Natural Resources Wales about the above pre-application enquiry, which we received on 10th October 2022.

We have considered your enquiry in relation to our Development Planning [Consultations Topics](#) document (September 2018). We advise that the following matters are relevant to your site / proposed development and suggest you consider these further prior to the submission of any planning application:

Flood Risk

Our Flood Risk Map confirms the majority of the site is located within Zone C2 of the Development Advice Map (DAM) as referred to in Technical Advice Note (TAN) 15: Development and Flood Risk, with a small section located in Zone B. The Flood Map for Planning (FMfP) indicates that the majority of the site is located within Flood Zones 2 and 3.

We note that the development proposal is for the extension of the existing Port to provide a new quay area, hardstanding and construction of a new roll-on/roll-off pontoon.

A Flood Consequences Assessment (FCA) would be required in support of the planning application. The FCA would need to demonstrate that the consequences of flooding are acceptable in accordance with the requirements of TAN15. The FCA would need to consider the flood risk from all sources, over the lifetime of development. Guidance on the preparation of a FCA can be found [here](#).

Ideally, the FCA should show that the new infilled hardstanding area can be designed to be flood free in the 0.5% Annual Exceedance Probability (AEP) event with an allowance for climate change, although we do note that this is an extension to an existing structure and proposed levels will need to tie into existing, so it may be difficult to demonstrate full compliance with the requirements of TAN15.

We would also expect the FCA to assess the impact of the proposal on flood risk elsewhere.

The criteria for the FCA, which should normally be undertaken by a suitably qualified person carrying an appropriate professional indemnity, are given under Section 7 and Appendix 1 of TAN15.

A Flood Risk Activity Permit (FRAP) (Environmental Permitting Regulations England & Wales, 2016) may be required for any works in, over, under or within 16 m of a tidal main river (including any defences on that main river) or within a flood plain. See our website for further information: [Natural Resources Wales / Flood risk activity permits](#).

The Dee Conservancy

Navigational marks

The developer should contact the Dee Conservancy Harbour Master (Captain Graeme Proctor harbourmaster@deeconservancy.org) to discuss the marking of any new infrastructure during groundwork/planning, construction and operational phases of the proposed project, to ensure the safety of other users operating within the estuary.

Channel morphology

Natural Resources Wales would expect a report detailing channel survey and channel morphology modelling from the developer to evidence impacts and mitigation of the dredge campaigns and new dock profile on the main navigable channel within the estuary.

Land Ownership

NRW, as the Harbour Authority for the Dee Estuary, expect that all of the proposed works will be within the Port's ownership. Clearly marked landownership plans should be provided with any subsequent full planning application.

Groundwater Protection, Land Contamination and Historic Landfill

Controlled waters are considered at risk as the proposal development area is partially within a historic landfill site. Given the presence of the historic landfill, contamination is strongly suspected at the site. We would strongly recommend that no dredging takes place within the boundary of the historic landfill and advise that you may wish to consult the Local Authority's Environmental Health department with regard to this aspect. A preliminary risk assessment (PRA) that satisfactorily addresses the potentially unacceptable risks has not been submitted to demonstrate that a viable generic remediation option is available. We would require as a minimum a preliminary risk assessment at the full application stage to assess the risk

The preliminary risk assessment should identify:

- all previous uses
- potential contaminants associated with those uses
- a conceptual model of the site indicating sources, pathways and receptors
- potentially unacceptable risks arising from contamination at the site

Depending upon the outcome of the PRA and the details of the development there could be a requirement to carry out:

- A site investigation scheme, based on the PRA to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.
- an options appraisal and remediation strategy (based on the site investigation results) giving full details of the remediation measures required and how they are to be undertaken.
- A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.

Natural Resources Wales recommends that developers should:

1. Follow the risk management framework provided in [Land contamination risk management \(LCRM\)](#)
2. Refer to '[Land Contamination: a guide for developers](#) (WLGA, 2017) for the type of information that we require in order to assess risks to controlled waters from the site. The Local Authority can advise on risk to other receptors, such as human health.
3. Refer to the [Environment Agency's \(2017\) 'Approach to Groundwater Protection'](#)

We would also recommend that you refer to our guidance on waste management in relation to the re-use of materials on site for activities such as backfilling in the extended dock area.

[Natural Resources Wales / Waste management](#)

Protected Sites

The site lies partially within The Dee Estuary Special Area of Conservation (SAC), Dee Estuary Site of Special Scientific Interest, The Dee Estuary (Wales) Ramsar and Special Area of Protection (SPA). The proposals also have the potential to impact on mobile features of the River Dee and Bala Lake SAC, the Dee Estuary SSSI and the Liverpool Bay SPA

We note that some discussions are already underway between the applicants environmental consultant and our Marine Advice & Management Team in respect of the protected sites. Any formal application must appropriately consider all direct and indirect impact pathways to features of these sites as well as providing the details of any avoidance or mitigation measures required.

The Local Planning Authority is a Competent Authority for the purposes of the *Conservation of Habitats and Species 2017 Regulations*. As such, they must not agree to any plan or project unless they are certain that it will not adversely affect the integrity of a Special Area of Conservation (SAC).

The Local Planning Authority should carry out a test of likely significant effects (TLSE) for the SAC, which is required under Regulation 63 of the *Conservation of Habitats and Species Regulations 2017*. This test applies to impacts on the SACs from the proposed works, either alone or in combination with other plans and projects.

If the test concludes there is likely to be a significant effect then an appropriate assessment of the impacts on the SAC from the proposed works, either alone or in combination with other plans and projects, will be required. We would be able to assist with that assessment in our role as the statutory nature conservation body under the above Regulations.

Site of Special Scientific Interest (SSSI)

The Wildlife and Countryside Act 1981 (as amended) places a duty on public authorities in exercising their functions, so far as this is likely to affect the flora, fauna, geological or physiological features of a SSSI, to take reasonable steps consistent with the proper exercise of their functions to further the conservation and enhancement of those features.

We refer you to our [website](#) for further advice.

Protected Species

Our records show there may be protected species in the vicinity of the site including bats (*Chiroptera*), Otter (*Lutra Lutra*) and common porpoise (*Phocoena phocoena*). Any full application would have to give appropriate consideration to any species likely to be impacted directly or indirectly by the proposals and we advise liaison with the LPA's ecologist to discuss and agree the scope of any surveys required.

We refer you to our [website](#) for further advice.

Foul Drainage

Before deciding a planning application, the LPA needs to be satisfied the foul drainage arrangements for the proposed development are suitable. From the details submitted there is no reference to the foul drainage arrangements for the proposed development and it is unclear whether any additional facilities would be needed. We recommend you provide details regarding foul drainage arrangements with any planning application.

We refer you to WG Circular 008/2018 on private drainage, and specifically paragraphs 2.3-2.5, which stress the first presumption must be to provide a system of foul drainage discharging into a public sewer.

Provision of Data

In addition to the above, please note, we can also provide certain data free of charge, as set out in our [Open Data Policy](#). Customers can [access our data via our website](#).

Other Matters

Please note the view expressed in this letter is a response to a pre-planning enquiry only. We trust these comments will prove helpful but they should not set a precedent for any future Natural Resources Wales' response to any formal application for planning permission or other legal consent. Such applications shall be assessed on the information submitted and regulations of relevance at that time. The details contained in this letter are based on the information available to date.

As part of our discretionary advice service we can provide further advice relating to land contamination, groundwater and flood risk prior to your planning application being submitted. There is a charge for this service. Further details are available on our website.

If you have any queries on the above please do not hesitate to contact us.

Yn gywir / Yours faithfully

Rachael Burke

Cynghorydd - Cynllunio Datblygu / Advisor - Development Planning
Cyfoeth Naturiol Cymru / Natural Resources Wales

APPENDIX 2

Surface Water Runoff Calculations

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.:
			PAGE: 1 OF 9
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Rainfall Intensity - 6 Hour Storm Event (1 in 1 Year Return Period)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 19-Oct-22	DATE:	DATE:

Following the Wallingford Procedure

M5-60 = 17 mm
Ratio r = 0.4
Duration (D)= 360 minutes
Z1 = 1.6
 M5- 360 = M5-60 x Z1
 = 27.2 mm

Return Period = 1
Z2= 0.67
M1 360 = M5- 360 x Z2
 = 27.2 x 0.67
 = **18.2 mm**

Rainfall intensity (mm/hr) = $\frac{MT-D}{D/60}$
 = $\frac{18.2}{6.00}$
 = **3.03 mm/hr**

Including an allowance for climate change:

- 20% = **3.63 mm/hr**
- 30% = **3.94 mm/hr**
- 40% = **4.24 mm/hr**

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.: PAGE: 2 OF 9
CALCULATION Rainfall Intensity - 6 Hour Storm Event (1 in 30 Year Return Period)	CALC. BY: (NAME AND SIGNATURE) B Griffiths DATE: 19-Oct-22	CHECKED BY: (NAME AND SIGNATURE) DATE:	APPROVED BY: (NAME AND SIGNATURE) DATE:

Following the Wallingford Procedure

M5-60 = 17 mm
Ratio r = 0.4
Duration (D)= 360 minutes
Z1 = 1.6
 M5- 360 = M5-60 x Z1
 = 27.2 mm

Return Period = 30
Z2= 1.53
M30 360 = M5- 360 x Z2
 = 27.2 x 1.53
 = **41.5 mm**

Rainfall intensity (mm/hr) = $\frac{MT-D}{D/60}$
 = $\frac{41.5}{6.00}$
 = **6.91 mm/hr**

Including an allowance for climate change:

- 20% = **8.30 mm/hr**
- 30% = **8.99 mm/hr**
- 40% = **9.68 mm/hr**

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.: PAGE: 3 OF 9
CALCULATION Rainfall Intensity - 6 Hour Storm Event (1 in 100 Year Return Period)	CALC. BY: (NAME AND SIGNATURE) B Griffiths DATE: 19-Oct-22	CHECKED BY: (NAME AND SIGNATURE) DATE:	APPROVED BY: (NAME AND SIGNATURE) DATE:

Following the Wallingford Procedure

M5-60 = 17 mm
Ratio r = 0.4
Duration (D)= 360 minutes
Z1 = 1.6
 M5- 360 = M5-60 x Z1
 = 27.2 mm

Return Period = 100
Z2= 1.99
M100 360 = M5- 360 x Z2
 = 27.2 x 1.99
 = **54.2 mm**

Rainfall intensity (mm/hr) = $\frac{MT-D}{D/60}$
 = $\frac{54.2}{6.00}$
 = **9.04 mm/hr**

Including an allowance for climate change:

- 20% = **10.85 mm/hr**
- 30% = **11.75 mm/hr**
- 40% = **12.66 mm/hr**

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.: PAGE: 4 OF 9
CALCULATION Runoff Rate Existing Development - 1 in 1 Year Storm Event	CALC. BY: (NAME AND SIGNATURE) B Griffiths	CHECKED BY: (NAME AND SIGNATURE)	APPROVED BY: (NAME AND SIGNATURE)
	DATE: 19-Oct-22	DATE:	DATE:

Following the Rationale Method as described by the Wallingford Procedure

$$Q_p = C i A$$

Q_p = runoff (litres/second)

C = runoff coefficient

i = rainfall intensity (mm/hr) = 3.03

A = area (hectares) = 0.8

If the units are as follows then the equation becomes **Q_p = 2.78C i A**;

Runoff coefficient C = C_v C_r, as standard values of 0.75 and 1.30 are used for C_v and C_r respectively.

If the above values for C are used the equation becomes:

$$Q_p = 3.61C_v i A$$

$$= 2.71 i A$$

$$= 2.71 \times 3.03 \times 0.8$$

$$= 6.57 \text{ litres/second}$$

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.:
			PAGE: 5 OF 9
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Runoff Rate Proposed Development - 1 in 1 Year Storm Event	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	B Griffiths		
	DATE: 19-Oct-22	DATE:	DATE:

Following the Rationale Method as described by the Wallingford Procedure

$$Q_p = C i A$$

Q_p = runoff (litres/second)

C = runoff coefficient

i = rainfall intensity (mm/hr) = 3.03

A = area (hectares) = 4.8

If the units are as follows then the equation becomes **Q_p = 2.78C i A**;

Runoff coefficient C = C_v C_r, as standard values of 0.75 and 1.30 are used for C_v and C_r respectively.

If the above values for C are used the equation becomes:

$$Q_p = 3.61C_v i A$$

$$= 2.71 i A$$

$$= 2.71 \times 3.03 \times 4.8$$

$$= 39.41 \text{ litres/second}$$

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.: PAGE: 6 OF 9
CALCULATION Runoff Rate Existing Development - 1 in 30 Year Storm Event	CALC. BY: (NAME AND SIGNATURE) B Griffiths	CHECKED BY: (NAME AND SIGNATURE)	APPROVED BY: (NAME AND SIGNATURE)
	DATE: 19-Oct-22	DATE:	DATE:

Following the Rationale Method as described by the Wallingford Procedure

$$Q_p = C i A$$

Q_p = runoff (litres/second)

C = runoff coefficient

i = rainfall intensity (mm/hr) = 6.91

A = area (hectares) = 0.8

If the units are as follows then the equation becomes **Q_p = 2.78C i A**;

Runoff coefficient C = C_v C_r, as standard values of 0.75 and 1.30 are used for C_v and C_r respectively.

If the above values for C are used the equation becomes:

$$Q_p = 3.61C_v i A$$

$$= 2.71 i A$$

$$= 2.71 \times 6.91 \times 0.8$$

$$= 14.98 \text{ litres/second}$$

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.: PAGE: 7 OF 9
CALCULATION Runoff Rate Proposed Development - 1 in 30 Year Storm Event	CALC. BY: (NAME AND SIGNATURE) B Griffiths	CHECKED BY: (NAME AND SIGNATURE)	APPROVED BY: (NAME AND SIGNATURE)
	DATE: 19-Oct-22	DATE:	DATE:

Following the Rationale Method as described by the Wallingford Procedure

$$Q_p = C i A$$

Q_p = runoff (litres/second)

C = runoff coefficient

i = rainfall intensity (mm/hr) = 6.91

A = area (hectares) = 4.8

If the units are as follows then the equation becomes **Q_p = 2.78C i A**;

Runoff coefficient C = C_v C_r, as standard values of 0.75 and 1.30 are used for C_v and C_r respectively.

If the above values for C are used the equation becomes:

$$Q_p = 3.61C_v i A$$

$$= 2.71 i A$$

$$= 2.71 \times 6.91 \times 4.8$$

$$= 89.89 \text{ litres/second}$$

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.: PAGE: 8 OF 9
CALCULATION Runoff Rate Existing Development - 1 in 100 Year Storm Event	CALC. BY: (NAME AND SIGNATURE) B Griffiths	CHECKED BY: (NAME AND SIGNATURE)	APPROVED BY: (NAME AND SIGNATURE)
	DATE: 19-Oct-22	DATE:	DATE:

Following the Rationale Method as described by the Wallingford Procedure

$$Q_p = C i A$$

Q_p = runoff (litres/second)

C = runoff coefficient

i = rainfall intensity (mm/hr) = 9.04

A = area (hectares) = 0.8

If the units are as follows then the equation becomes **Q_p = 2.78C i A**;

Runoff coefficient C = C_v C_r, as standard values of 0.75 and 1.30 are used for C_v and C_r respectively.

If the above values for C are used the equation becomes:

$$Q_p = 3.61C_v i A$$

$$= 2.71 i A$$

$$= 2.71 \times 9.04 \times 0.8$$

$$= 19.60 \text{ litres/second}$$

Calculation Sheet

REF:

CLIENT: Associated British Ports	PROJECT: Mostyn Energy Park	JOB NO.: ST19488	CALC. REF. NO.: PAGE: 9 OF 9
CALCULATION Runoff Rate Proposed Development - 1 in 100 Year Storm Event	CALC. BY: (NAME AND SIGNATURE) B Griffiths	CHECKED BY: (NAME AND SIGNATURE)	APPROVED BY: (NAME AND SIGNATURE)
	DATE: 19-Oct-22	DATE:	DATE:

Following the Rationale Method as described by the Wallingford Procedure

$$Q_p = C i A$$

Q_p = runoff (litres/second)

C = runoff coefficient

i = rainfall intensity (mm/hr) = 9.04

A = area (hectares) = 4.8

If the units are as follows then the equation becomes **Q_p = 2.78C i A**;

Runoff coefficient C = C_v C_r, as standard values of 0.75 and 1.30 are used for C_v and C_r respectively.

If the above values for C are used the equation becomes:

$$Q_p = 3.61C_v i A$$

$$= 2.71 i A$$

$$= 2.71 \times 9.04 \times 4.8$$

$$= 117.59 \text{ litres/second}$$

DRAWINGS

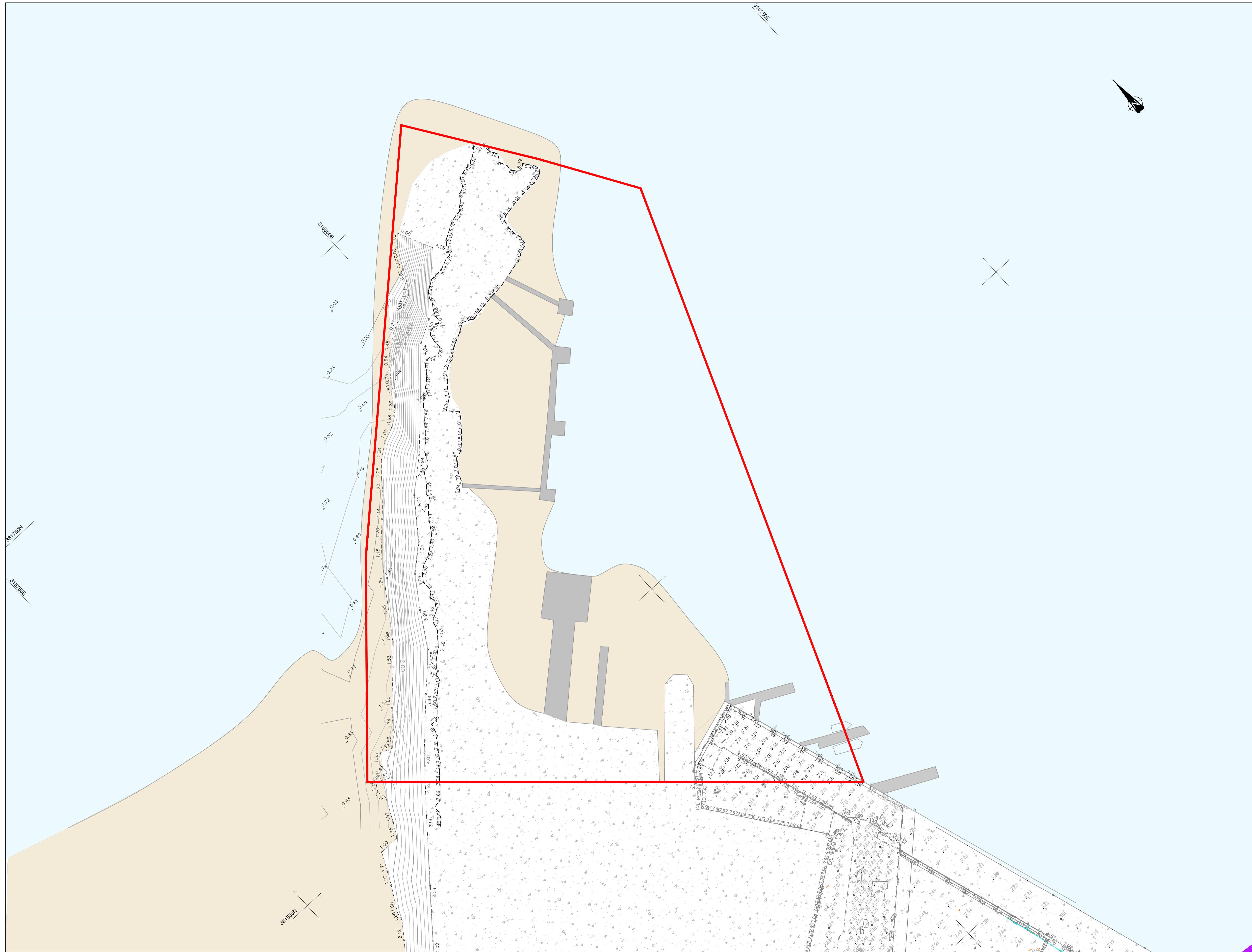
DO NOT SCALE FROM THIS DRAWING

NOTES:

1. TO BE READ IN CONJUNCTION WITH WARDELL ARMSTRONG FLOOD CONSEQUENCE ASSESSMENT (ST19488/0001).
2. TOPOGRAPHY BASED ON SURVEYS BY SITE ENGINEERING PERSONNEL LTD. MAY 2009 (DRAWING NO. 04936) AND MARCH 2012 (DRAWING NO. 06877-T-01) AND BY FREEDOM G-MAP MAY 2012 (DRAWING NO. 366060 REV 07).

KEY

- PROPOSED DEVELOPMENT
- DEE ESTURY
- TIDAL FLAT DEPOSITS
- HARDSTANDING
- JETTIES/PIERS/QUAYSIDE INFRASTRUCTURE



A	FIRST ISSUE	18-11-22	SJB	AEP	AB
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REVISION	DETAILS	DATE	DRAWN	CHECKED	APPROVED
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CLIENT
PORT OF MOSTYN

PROJECT
MOSTYN ENERGY PARK EXTENSION

DRAWING TITLE
PORT OF MOSTYN TOPOGRAPHY

DRG No.	ST19488-001	REV	A	SUIT. CODE	
DRG SIZE	A1	SCALE	1:1000	DATE	18/10/22
DRAWN BY	SJB	CHECKED BY	AEP	APPROVED BY	AB



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