

Technical Appendix 2.10:

Flood Risk Assessment

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FALMOUTH DOCKS DEVELOPMENT FLOOD RISK ASSESSMENT

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EXECUTIVE SUMMARY

Ramboll UK Limited has been appointed to undertake a Flood Risk Assessment to support the proposed development at Falmouth Docks. The proposed development would redevelop and modernise the existing facilities at Falmouth Docks to reinstate full alongside berth capability and increase berth capacity.

A review of available information relating to flood risk has been undertaken, and an assessment made of both the existing baseline flood risk and the potential future risk to the development and to surrounding receptors. A summary of the risk from each source is as follows:

- **Fluvial/Tidal flooding**– Approximately 95% of the existing site is located in Flood Zone 1. The remaining 5% is located within Flood Zones 2 and 3. This is limited to isolated areas adjacent to the water. Hydraulic modelling provided by the Environment Agency indicates that the proposed development is unaffected under all the modelled events including the 1 in 1,000-year event with an allowance for climate change and potential increases in wave height (predicted as a result of the proposed development);
- **Surface water flooding**– Approximately 95% of the existing site is considered to be at a Very Low risk from surface water flooding. The remaining 5% is limited to isolated areas in the south-west of the site. Indicated areas of risk do not account for drainage assets such as gullies draining specific areas. Assuming the proposed drainage is maintained in an appropriate condition the proposed development is unlikely to be at significant risk from surface water flooding. Overall, the risk from surface water flooding is considered to be low;
- **Groundwater flooding**– The existing site is considered to be at low risk of groundwater flooding based on a review of groundwater levels and site geology. Furthermore, no basement levels are being proposed as part of the development. The nature of the proposed development means the risk from groundwater flooding is considered to be low; and
- **Reservoirs, canals and other artificial sources of flooding** – Whilst the western part of the site is shown to be at risk from artificial sources of flooding, this does not include the physical docks and is limited to the Inner Harbour. Furthermore, the safety record and stringent operation of reservoirs in the UK make a structural failure extremely unlikely. In addition, given that existing deck levels are being raised as part of the proposed development, any risk to the site from a reservoir failure will be lower as a result of the proposed development.

It is expected flood risk and surface water from the site can be managed in a safe and sustainable manner.

1. INTRODUCTION

1.1 Appointment and Brief

- 1.1.1 Ramboll UK Limited (Ramboll) has been appointed by Falmouth Docks and Engineering Company (FDEC), to undertake a Flood Risk Assessment (FRA) to support the proposed development at Falmouth Docks, Cornwall ('the site'). The proposed development would redevelop and modernise the existing facilities at Falmouth Docks to reinstate full alongside berth capability and increase berth capacity. The objectives of the proposed development are to repair and update the currently poor condition port infrastructure in order to maintain existing business and future proof the port with respect to cruise capacity, cargo capacity and renewable floating offshore wind (FLOW) (supporting the offshore wind market). The site and the works proposed are considered to be in the jurisdiction of Cornwall Council (CC) and the Marine Management Organisation (MMO).

1.2 Scope and Objectives

- 1.2.1 This report considers the risks of various sources of flooding to the site and has been carried out in accordance with the National Planning Policy Framework (NPPF)¹. It is to be used to assist the Local Planning Authority (LPA) and relevant statutory consultees when considering the flooding issues of the proposed development, as part of a planning application.
- 1.2.2 This report provides the following information:
1. A review of the flood risk to the site based upon flood data and the flood maps provided by the Environment Agency (EA) and the relevant Strategic Flood Risk Assessment (SFRA);
 2. An assessment of flood risk from all sources including tidal, fluvial, pluvial, groundwater and other artificial sources;
 3. An assessment of the compatibility of the proposed development for its location based on flood risk and its proposed usage; and
 4. Proposals to mitigate any residual flood risks to the development.

1.3 General Limitations and Reliance

- 1.3.1 In preparation of the report and performance of any other services, Ramboll has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions reached in this report are valid only to the extent that the information provided to Ramboll was accurate, complete, and available to Ramboll within the reporting schedule.
- 1.3.2 The key sources of information used to prepare this report are footnoted within the document. Ramboll cannot accept liability for the accuracy or otherwise of any information derived from third party sources.
- 1.3.3 Ramboll's services are not intended as legal advice, nor an exhaustive review of site conditions and/or compliance. This report and accompanying documents are initial and intended solely for the use and benefit of the client for this purpose only and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party, unless formally agreed by Ramboll through that party entering into, at Ramboll's sole discretion, a written reliance agreement.
- 1.3.4 Unless otherwise stated in this report, the scope of services, assessment and conclusions made assume that the site will continue to be used for its proposed end-use without further significant changes onsite. Unless stated otherwise, the geological information provided is for general environmental interpretation and should not be used for geotechnical and/or design purposes.

¹ GOV.UK, National Planning Policy Framework, December 2024 [online]. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2>. Accessed December 2024.

2. SITE DESCRIPTION

2.1 Application Site Description

- 2.1.1 The site is located at Falmouth Docks, Falmouth, Cornwall, TR11 4NR at approximate location SW 81765 32796. The existing site consists of a series of wharves located adjacent to the Carrick Roads estuary at the mouth of the harbour.
- 2.1.2 The boundaries and immediate surroundings of the site comprises the following:
- The north of the site is surrounded by the Carrick Roads channel, leading to the English Channel. The Flushing headland lies approximately 500 m to the north.
 - The A&P dry docks lie immediately to the east of the site, followed by the Pendennis Shipyard. The Eastern Breakwater is located approximately 430 m further east. Pendennis Castle lies approximately 1 km south-east.
 - Tinnars Walk is located south of the site, beyond which are the Falmouth Docks operational buildings, and further beyond is Falmouth train station.
 - Immediately to the south-west of the site lies RNLI Falmouth Lifeboat Station, Cockwells at the Lock House and Port Pendennis Marina, beyond which lies the National Maritime Museum Cornwall. A number of visitor moorings are also present adjacent to the site within the Carrick Roads/Falmouth Bay area. The St Mawes-Falmouth ferry service runs adjacent to the site boundary along a west to north orientation. Falmouth town and residential area lies further west of the site.
- 2.1.3 Of the areas that lie above Mean High Water Springs (MHWS), most of the dock site lies between approximately 5.0 and 6.0 m AOD (Above Ordnance Datum)². Queen's Wharf sits at approximately 5.41 to 5.46 m AOD. To the south of Queen's Wharf along the western side of the causeway, the site lies between 4.35 and 5.11 m AOD. The Northern Arm sits between approximately 5.14 and 5.35 m AOD. To the south, the Western Wharf sits at approximately 4.62 m AOD at its northern end, before gradually rising to approximately 5.29 m AOD at its southern end.
- 2.1.4 In the southern parcel of site, bounded by the County and Duchy Wharves in the west and north respectively, terrain is typically between 5.1 and 5.5 m AOD, with a lower area to the south of Duchy Wharf sitting at between approximately 4.8 and 5.1 m AOD.
- 2.1.5 The Site Location Plan is presented in Figure 2.1. Figure 2.2 identifies the different wharves present at the site.

² RPS Design, Falmouth Docks, Topographical Survey, 2007. Accessed August 2023

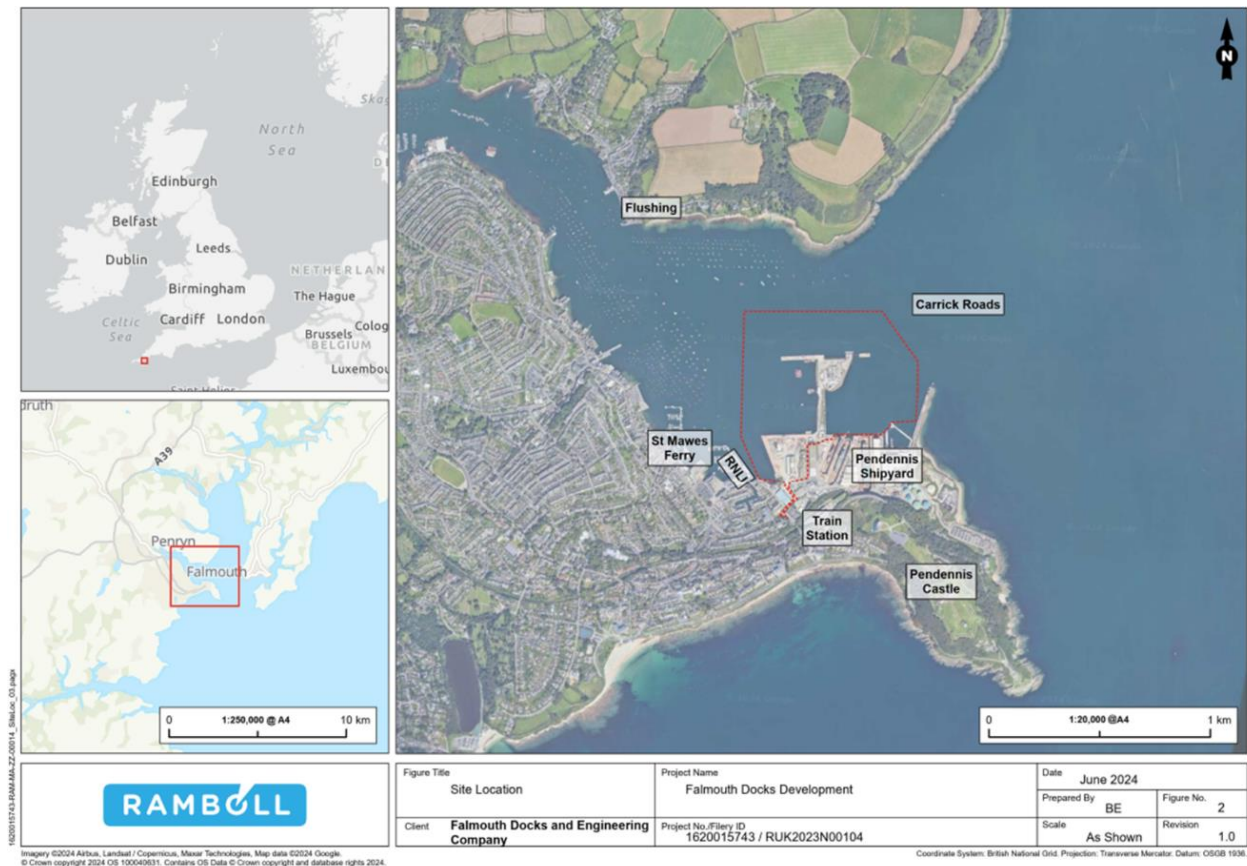


Figure 2.1: Site Location

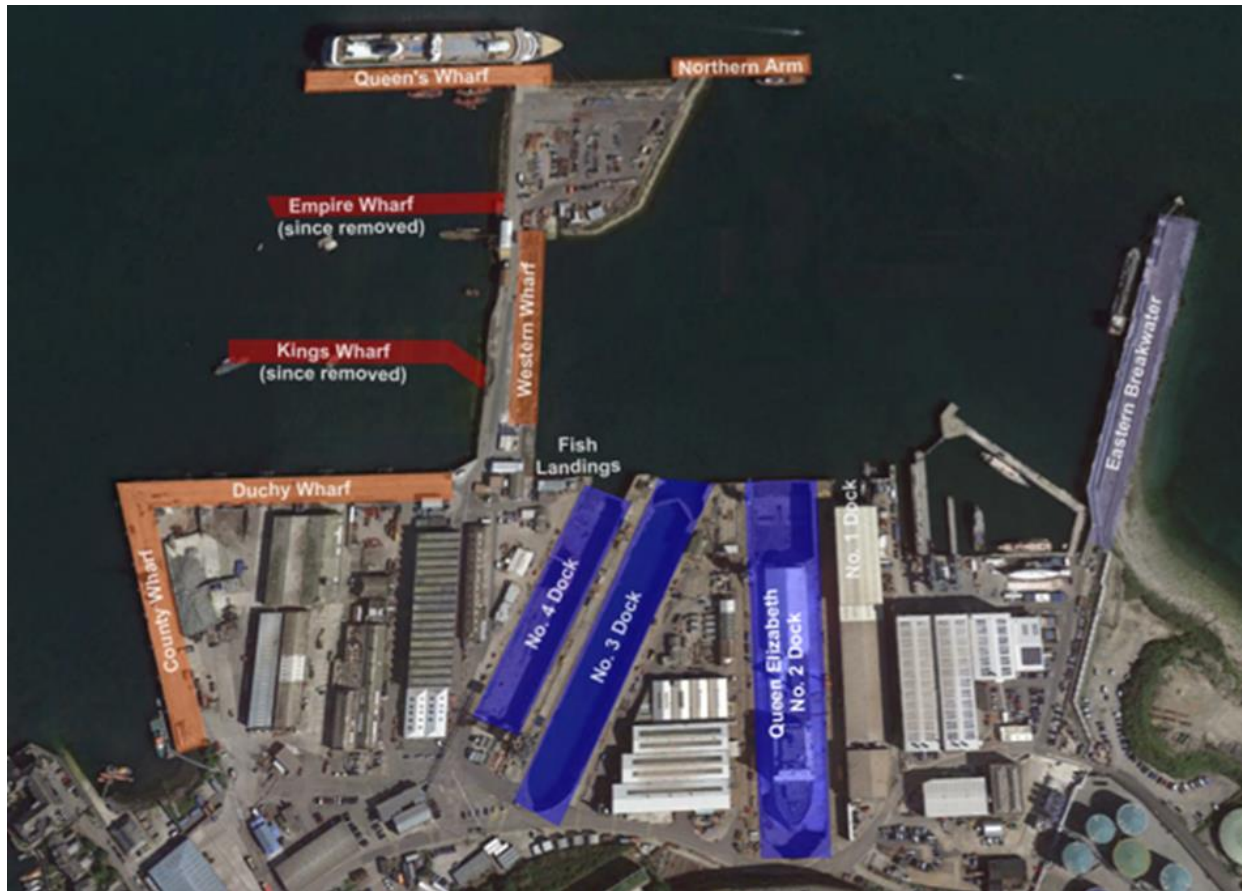


Figure 2.2: Falmouth Docks

2.2 Proposed Development

2.2.1 The planning application and marine licence application (MLA) would comprise the following redevelopment activities:

- Pocket dredge of berth areas to achieve required underkeel clearance for larger cruise vessels (up to Excellence class) and the FLOW renewable energy device underkeel requirements (considered to be - 10.5 m Chart Datum (CD));
- Removal of foul ground within areas of the former Kings and Empire Wharves;
- Surface skim of seabed on eastern side of the site to maintain - 5.5 m CD;
- Demolition of the remaining existing Western Wharf timber piles and above surface infrastructure;
- Construction of a new Western Wharf suspended deck structure with a deck level of +8.36 m CD (5.45 m AOD);
- Demolition of the Northern Arm concrete structure and substructure to below seabed level and removal of the gang walkway and old timber piles that are located west of this structure;
- Construction of a suspended deck structure (Northern Wharf) in the existing 90 m gap between Queen's Wharf and the Northern Arm to create a longer functional wharf length, with a deck level of +8.36 m CD (5.45 m AOD);
- Upgrades to the existing Queen's Wharf structure;
- Extension of the Queen's Wharf suspended deck structure 50 m westward with a deck level of +8.4 m CD (5.49 m AOD);
- Installation of a 290 m deck (the 'FLOW Deck') to facilitate a FLOW device with a deck level of +8.36 m CD (5.45 m AOD);
- Upgrades to the existing Duchy Wharf structure to facilitate a FLOW device with a deck level of +8.24 m CD (5.33 m AOD);
- Potential strengthening works to Duchy and County Wharf piles; and
- Demolition of onsite buildings and re-configuration of Falmouth Dock activities.

The proposed development plans are presented in Technical Appendix A.

3. POLICY FRAMEWORK

3.1 National Policy Framework

3.1.1 The NPPF was most recently updated in December 2024, with flood risk remaining primarily regulated through planning policy³. The NPPF requires that a site-specific FRA be provided for all development in Flood Zones 2 and 3; all development sites over 1 hectare (ha) in area; land which has been identified in a strategic flood risk assessment as being at increased flood risk in the future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

3.1.2 In terms of flood risk, the NPPF classifies land uses according to vulnerability as follows:

- Essential infrastructure;
- Highly vulnerable;
- More vulnerable;
- Less vulnerable; and
- Water-compatible development.

3.2 Cornwall Local Plan, 2016

3.2.1 The Cornwall Local Plan⁴ sets out how development will be managed up to 2030.

3.2.2 Policy 26 (Flood risk management and coastal change) outlines the following:

1. *Development should take account of and be consistent with any adopted strategic and local flood and coastal management strategies including the Shoreline Management Plan and Catchment Flood Management Plans for Cornwall and the South West River Basin Plan.*
2. *Development should be sited, designed, of a type and where necessary relocated in a manner that:*
 - a. *increases flood resilience of the area, taking account of the area's vulnerability to the impacts of climate change and coastal change and the need to avoid areas of flood risk, in the first instance, taking into account the vulnerability of the use proposed; and*
 - b. *minimises, or reduces and where possible, eliminates flood risk onsite and in the area; and*
 - c. *enables or replicates natural ground and surface water flows and decreases surface water runoff, particularly in Critical Drainage Areas, through sustainable urban drainage systems (SuDS), utilising green infrastructure where possible and as guided by local standards, including Cornwall drainage guidance; and*
 - d. *the safeguarding of land, where it is identified to be functional flood storage, to make space for water at times of flood; and*
 - e. *where applicable, supports community-led local solutions to managing flood risk and coastal change; and*
 - f. *does not create avoidable future liability for maintenance for public bodies and communities.*
3. *Development proposals of 10 dwellings or more or over 0.5 ha should provide a long-term water management plan, which includes maintenance of surface water drainage systems, measures to improve the network of surface water drainage systems on and around the site (e.g., culverts etc.) and identifies opportunities and funding for future enhancement.*

3.3 Cornwall Local Flood Risk Management Strategy

3.3.1 The Cornwall Local Flood Risk Management Strategy⁵ aims to provide a transparent approach for managing and reducing flood risk in a way that benefits people, property, and the environment.

3.3.2 The strategy is the first of three stages in delivering a strategic approach to flood risk management. Stage 2 consists of a series of community level Local Flood Risk Management Profiles. Stage 3 is a yearly report presented to the Council: The Flood and Coastal Erosion Risk Management Annual Report.

³ GOV.UK, National Planning Policy Framework, 2024 [online]. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2#full-publication-update-history>. Accessed December 2024.

⁴ Cornwall Council, Cornwall Local Plan, Strategic Policies 2010 – 2030 [online]. Available at: <https://www.cornwall.gov.uk/media/ozhj5k0z/adopted-local-plan-strategic-policies-2016.pdf>. Accessed September 2023.

⁵ Cornwall Council, The Cornwall Local Flood Risk Management Strategy, 2020-2026 [online]. Available at: https://www.cornwall.gov.uk/media/uhbenzqm/local-flood-risk-management-strategy_2020_final.pdf. Accessed September 2023.

3.4 Cornwall Council Strategic Flood Risk Assessment (SFRA), 2023

- 3.4.1 The Cornwall Council SFRA⁶ presents data on flood and coastal risk including data on tidal extremes including a projection for sea level rise. This is presented as areas at a medium risk today, areas at a medium risk in 50 years, and areas at a medium risk in 100 years.

3.5 South West River Basin District River Basin Management Plan, 2022

- 3.5.1 The South West river basin district (RBD) river basin management plan⁷ describes the challenges that threaten the water environment and how these challenges can be managed.

3.6 West Cornwall Catchment Flood Management Plan, 2012

- 3.6.1 The West Cornwall Catchment Flood Management Plan (CFMP)⁸ considers all types of inland flooding including rivers, groundwater, surface water and tidal flooding but not coastal flooding as this is covered by Shoreline Management Plans (SMPs).
- 3.6.2 The Plan aims to establish flood risk management policies which will deliver sustainable flood risk management for the long term.

3.7 Climate Emergency Development Plan, 2023

- 3.7.1 The Cornwall Council Climate Emergency Development Plan⁹ states under Policy CC1 (Coastal Vulnerability Zone) that new development within the Coastal Vulnerability Zone (CVZ) will only be permitted where it can be demonstrated through a Coastal Vulnerability Assessment that it:
- a) *is consistent with policy statements for the local policy unit in the current Shoreline Management Plan; and*
 - b) *would not impair the ability of communities and the natural environment/biodiversity to adapt sustainably to the impacts of coastal change (including coastal squeeze); and*
 - c) *will be safe through its planned lifetime, without increasing risk to life or property; and*
 - d) *provides safe access and egress for the site and its users; and*
 - e) *would not affect the natural balance and stability of the coastline or exacerbate the rate of shoreline change to the extent that changes to the coastline are increased nearby or elsewhere; and*
 - f) *where applicable, makes provision for coastal access and the South West Coast path to be rolled back (moved inland).*

3.8 Shoreline Management Plan, 2011

- 3.8.1 The Cornwall Council SMP¹⁰ provides a large-scale assessment of the risks associated with coastal evolution and presents a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner. At the Fal Estuary the selected policy is Policy 4. This is defined as 'areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change'. The policy allows for a range of flood risk management actions to be considered, such as sustaining existing flood alleviation schemes, whilst also considering areas for potential managed retreat in the Fal Estuary.

⁶ Cornwall Council, 2023, Strategic Flood Risk Assessment [online]. Available at:

<https://map.cornwall.gov.uk/website/ccmap/?zoomlevel=8&xcoord=181654&ycoord=32799&wsName=SFRA&layerName=>. Accessed May 2024.

⁷ GOV.UK, South West river basin district river basin management plan: updated 2022 [online]. Available at: <https://www.gov.uk/guidance/south-west-river-basin-district-river-basin-management-plan-updated-2022>. Accessed September 2023.

⁸ Environment Agency, West Cornwall Catchment Flood Management Plan, Managing Flood Risk, 2012 [online]. Available at:

https://assets.publishing.service.gov.uk/media/5a7c3a7940f0b67d0b11fbbf/West_Cornwall_Catchment_Flood_Management_Plan.pdf. Accessed September 2023.

⁹ Cornwall Council, Climate Emergency Development Plan Document, February 2023 [online]. Available at:

<https://www.cornwall.gov.uk/media/uxgjk4jn/climate-emergency-dpd.pdf>. Accessed June 2024.

¹⁰ Cornwall Council, Shoreline Management Plan 2011 SMP2, 2011 [online]. Available at: <https://www.cornwall.gov.uk/environment/countryside/flood-risk/shoreline-management-plan-2011-smp2/>. Accessed September 2023.

4. REVIEW OF BASELINE FLOOD RISK DATA

4.1 Hydrological Setting

- 4.1.1 The site is located at Falmouth Docks. Falmouth Docks lie at the mouth of Penryn River, with the Inner Harbour located to the west, and Carrick Roads (estuary of the River Fal) located to the east. On the far side of the peninsula, to the south of the site, lies Falmouth Bay.
- 4.1.2 According to GIS mapping¹¹ of flood defences published by the EA, the site is not protected by any formal flood defences. According to the South West RBD river basin management plan⁷, the following are considered the most important challenges to the current and potential future uses and benefits of the water environment:
1. Climate emergency;
 2. Biodiversity crisis;
 3. Physical modifications;
 4. Pollution from agriculture and rural areas;
 5. Pollution from water industry wastewater;
 6. Invasive non-native species;
 7. Pollution from towns, cities and transport;
 8. Changes to water levels and flows;
 9. Chemicals in the water environment;
 10. Pollution from abandoned mines; and
 11. Plastics pollution.
- 4.1.3 Recorded challenges at the Carrick Roads Outer Water Body¹² (where the site is located) are listed as:
- Pollution from rural areas;
 - Pollution from towns, cities and transport; and
 - Pollution from wastewater.

4.2 EA Flood Zone Designation (Fluvial and Tidal Flood Risk)

- 4.2.1 According to the EA Flood Map for Planning¹³ (reproduced in Figure 4.1), approximately 95% of the site is located within Flood Zone 1. The remaining 5% is located within Flood Zones 2 and 3. This is limited to isolated areas adjacent to the water. The Flood Zones are defined as follows:
- Flood Zone 1 – Land defined as having a less than 0.1% annual probability of river or sea flooding;
 - Flood Zone 2 – Land defined as having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding; and
 - Flood Zone 3 – Land defined as having a 1% or greater annual probability of river flooding; or land having a 0.5% or greater annual probability of sea flooding.

¹¹ Department for Environment Food and Rural Affairs, AIMS Spatial Flood Defences [online]. Available at: <https://environment.data.gov.uk/dataset/8e5be50f-d465-11e4-ba9a-f0def148f590>. Accessed September 2023.

¹² Department for Environment Food & Rural Affairs, Carrick Roads Outer Water Body [online]. Available at: <https://environment.data.gov.uk/catchment-planning/v/c3-plan/WaterBody/GB650806250000>. Accessed May 2024.

¹³ GOV.UK, Flood map for planning [online]. Available at: <https://flood-map-for-planning.service.gov.uk>. Accessed October 2023.

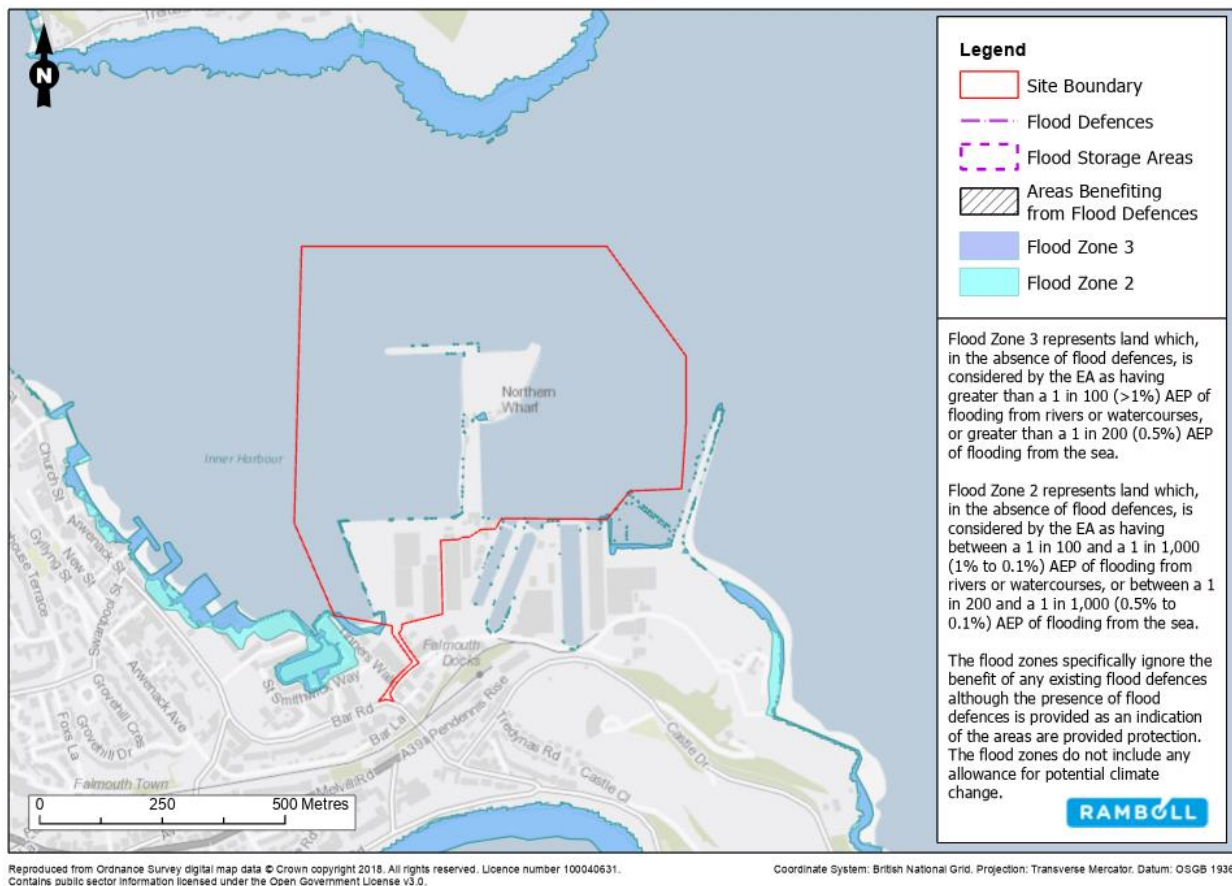


Figure 4.1: EA Flood Map for Planning

4.3 Tidal Flood Risk Modelling

Cornwall Council Strategic Flood Risk Assessment

- 4.3.1 Modelling extents of tidal extremes are presented in the Cornwall Council SFRA.
- 4.3.2 Under areas at a medium risk today, defined as the extent of the present day 1 in 200-year still water extreme tide event, approximately 50% of the Western Wharf, and approximately 90 - 95% of the Northern Arm and Queen's Wharf are modelled to be affected, along with isolated areas between Duchy Wharf and County Wharf.
- 4.3.3 Under areas at a medium risk in 50 years time, defined as the extent of the 1 in 200-year still water extreme tide event in 50 years time, approximately 65% of the Western Wharf, and approximately 90 - 95% of the Northern Arm and Queen's Wharf are modelled to be affected, along with isolated areas between Duchy Wharf and County Wharf.
- 4.3.4 Under areas at a medium risk in 100 years time, defined as the extent of the 1 in 200-year still water extreme tide event in 100 years time, approximately all the site is shown to be affected, with the exception of an isolated area in the northern part of the Western Wharf, amounting to approximately 20% of the wharf's area.

Fal Estuary Modelling March 2021

- 4.3.5 The EA has provided data from 2021 tidal flood risk modelling of the Fal Estuary¹⁴. Multiple scenarios have been modelled including those adjusted for the potential impacts of climate change.

¹⁴ CAPITA AECOM, WEM Lot 1 - Package 16, Fal Estuary Modelling Report, March 2021 Final Report.

- 4.3.6 Under all the modelled events, the proposed area modelled to be affected by flooding within the site boundary is limited to minimal areas adjacent to the water along the edges of the wharves.
- 4.3.7 Figures 4.2 – 4.5 visualise the modelled extents and depths under the 1 in 100, 1 in 200 and the 1 in 1,000 Annual Exceedance Probability (AEP) events, as well as the 1 in 1,000 AEP event adjusted for the potential impacts of climate change. The peak modelled flood levels on-site are approximately as follows:
- 1 in 100 AEP event - 3.37 m AOD;
 - 1 in 200 AEP event - 3.43 m AOD;
 - 1 in 1,000 AEP event - 3.56 m AOD;
 - 1 in 1,000 AEP event adjusted for climate change (for the year 2118) - 4.35 m AOD.

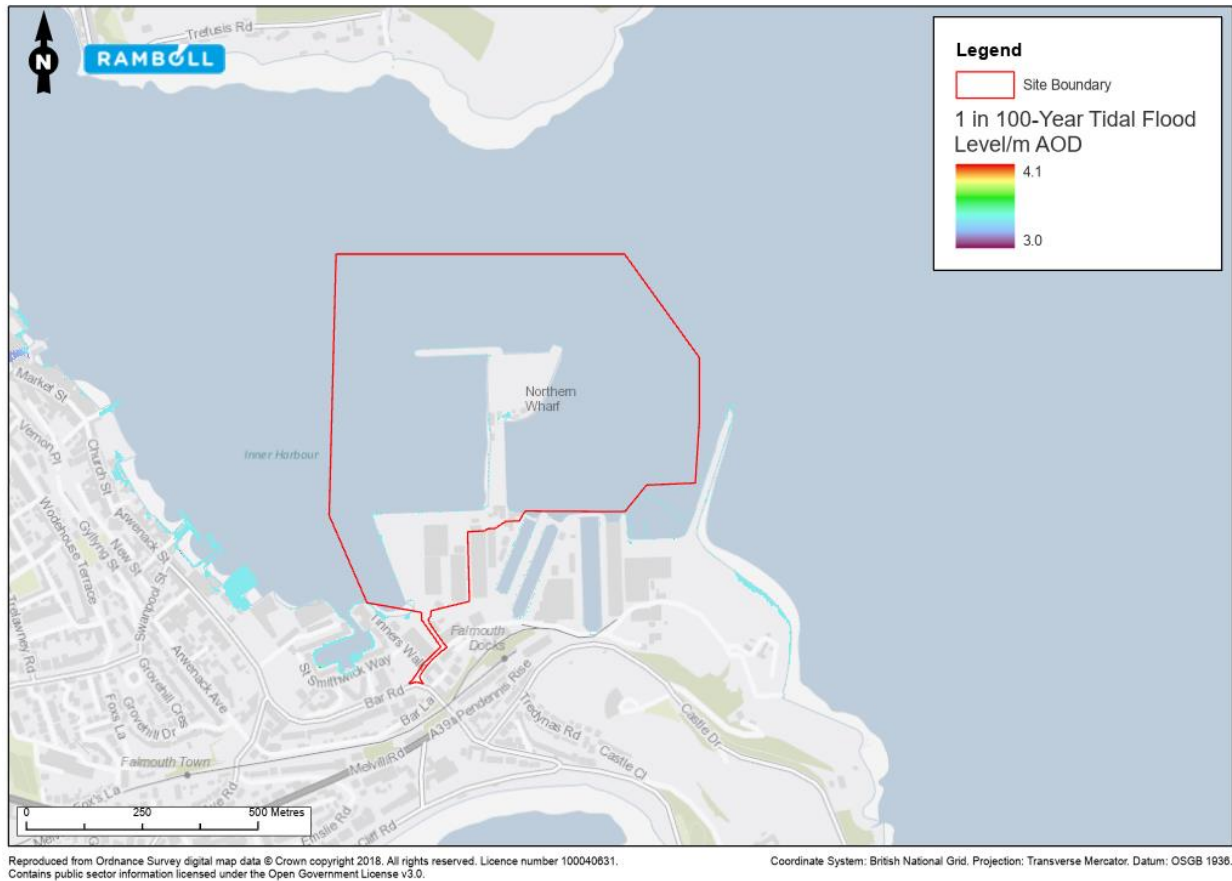


Figure 4.2: 1 in 100-Year Tidal Extent

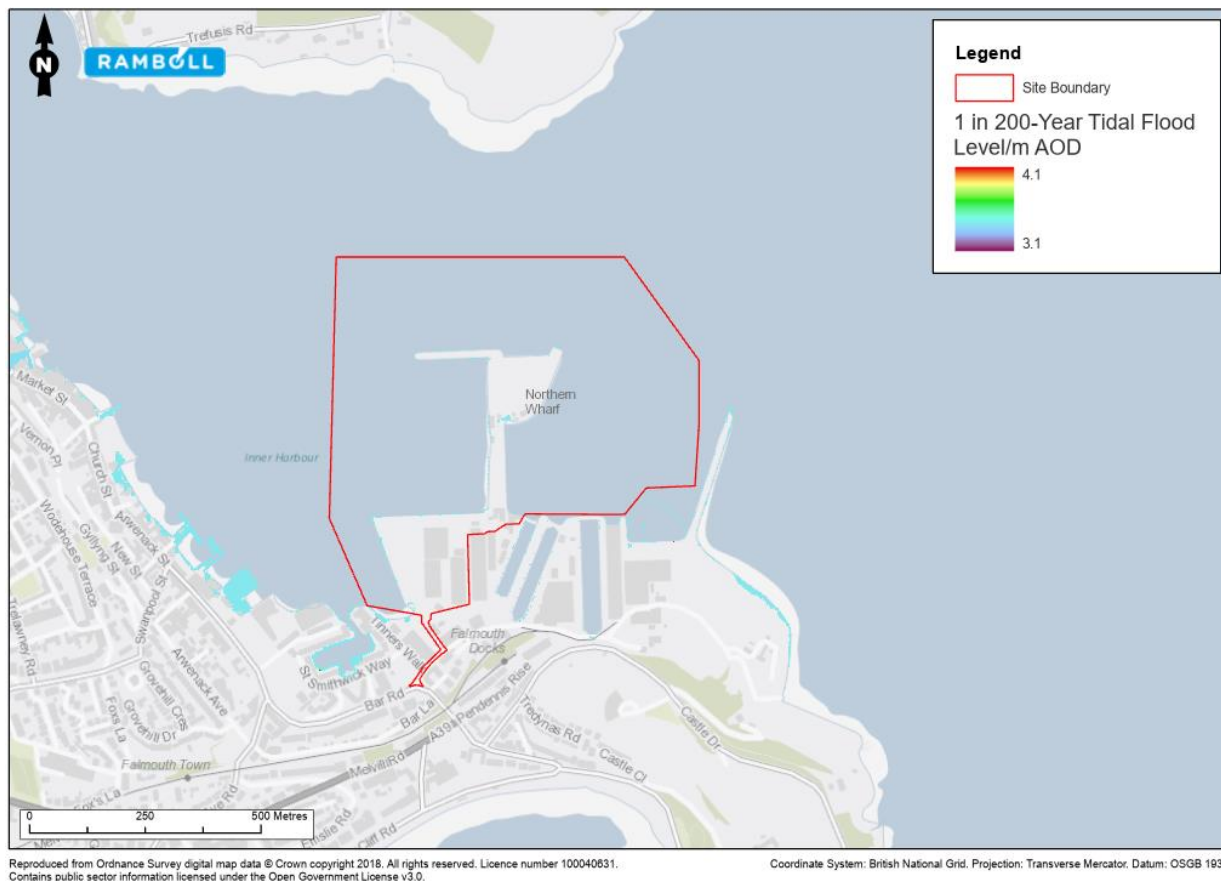


Figure 4.3: 1 in 200-Year Tidal Extent

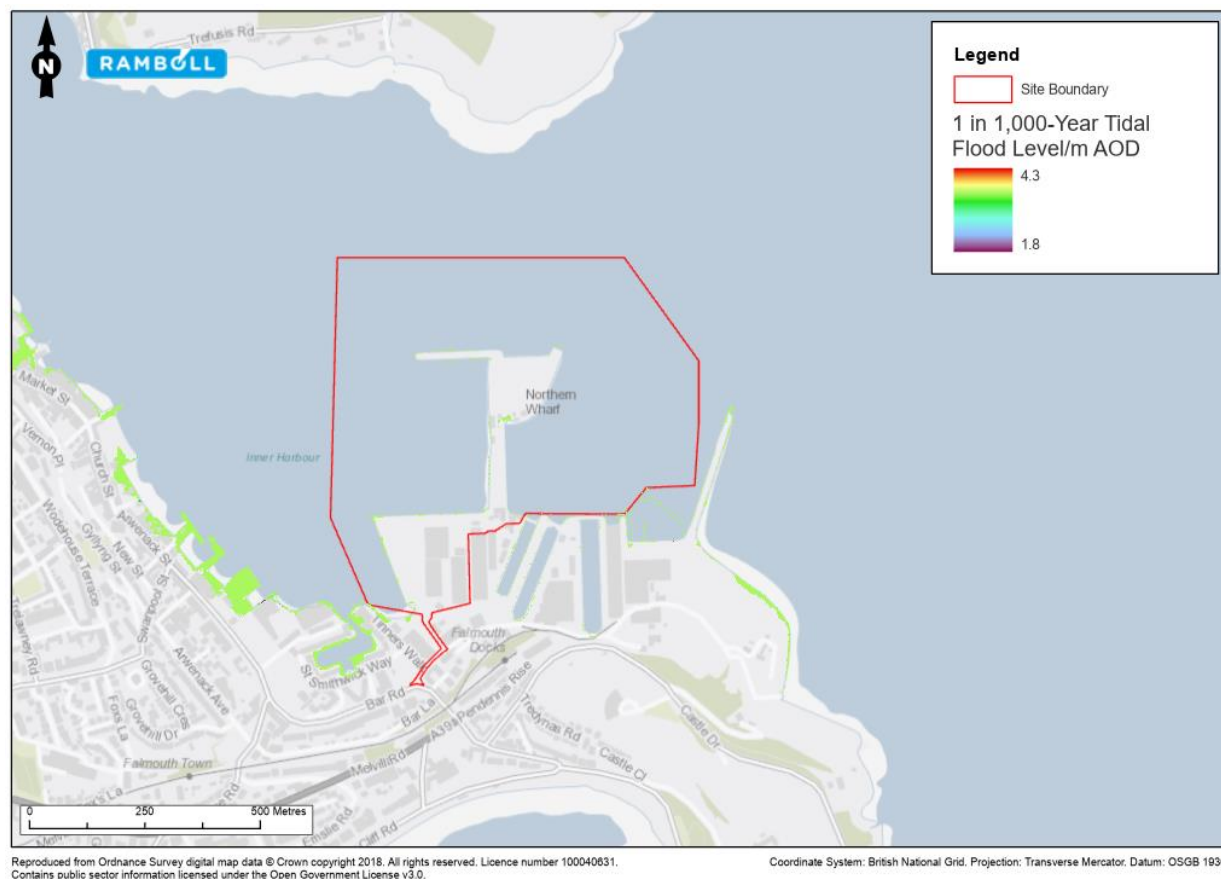


Figure 4.4: 1 in 1,000-Year Tidal Extent

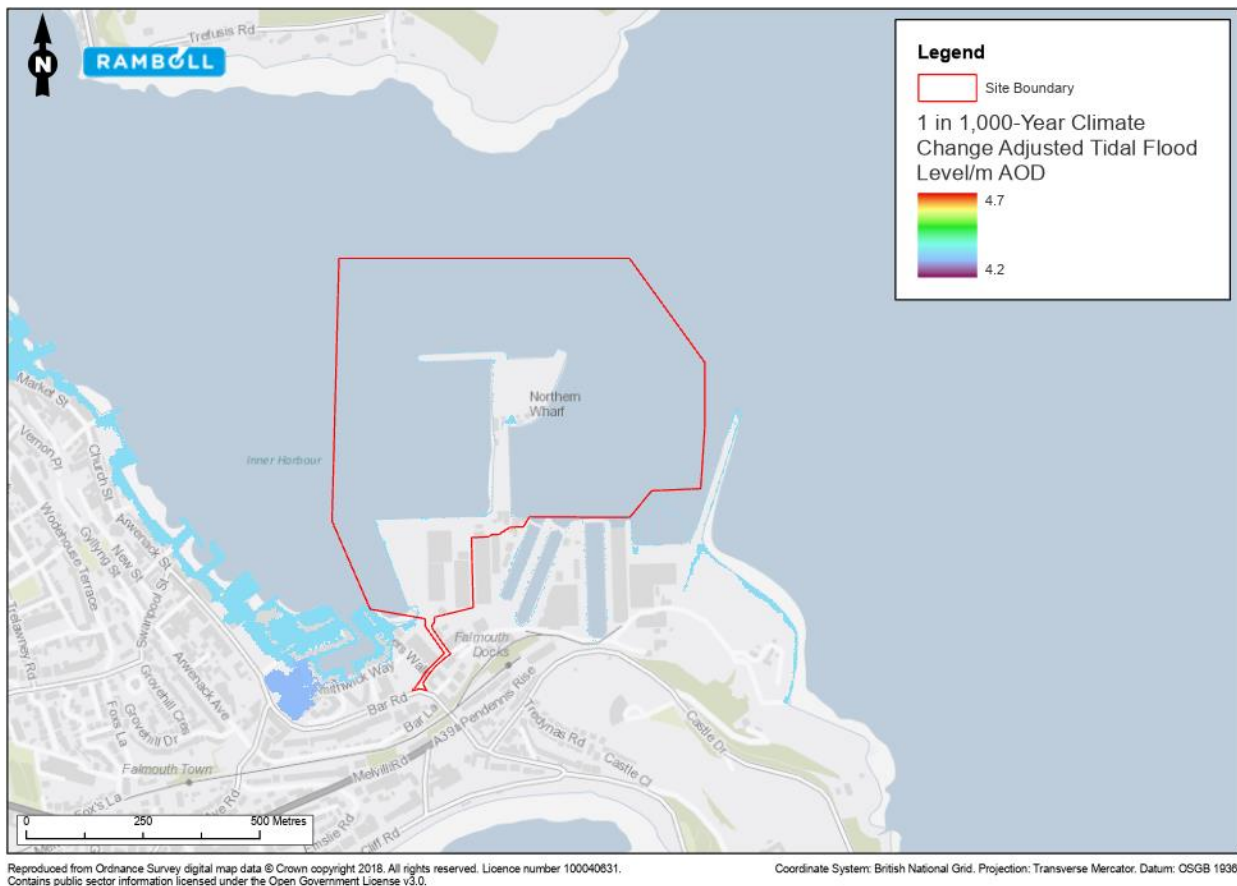


Figure 4.5: 1 in 1,000-Year Climate Change Adjusted Tidal Extent

- 4.3.8 The maximum modelled flood level onsite of 4.35 m AOD under the 1 in 1,000-year climate change adjusted scenario is approximately the same as the minimum existing site level according to the topographic survey² as detailed in Section 2.1. The maximum modelled flood level onsite of 3.56 m AOD under the 1 in 1,000-year scenario (without climate change allowance) is approximately 0.79 m below minimum existing site levels according to the topographic survey.

4.4 Surface Water Flood Risk

- 4.4.1 The surrounding land is predominantly impermeable and is mostly made up of the docks and surrounding residential areas which are likely to be served by existing drainage assets.
- 4.4.2 According to EA mapping¹⁵ (reproduced in Figure 4.6), approximately 95% of the site is considered to be at a Very Low risk from surface water flooding. The remaining 5%, at High, Medium and Low risk, is limited to isolated areas in the south-west of the site. Under a High risk scenario, water depths are modelled to remain below 300 mm in affected areas and at close to zero in over 98% of the site. Under a Medium risk scenario, water depths are modelled to remain between 300 mm and 900 mm in the worst affected areas and close to zero in over 95% of the site. Under a Low risk scenario, water depths are modelled to remain between 300 mm and 900 mm in the worst affected areas and close to zero in approximately 95% of the site. No overland flow paths are shown to be entering or leaving the site. It should be noted that the surface water mapping presents the baseline risk and does not account for any changes to site levels undertaken as part of the proposed development. Furthermore, the areas of risk in the south-west of the site, as shown in Figure 4.6, are considered to be the result of the terrain data that is used in the underlying modelling which is simplified and therefore assumes these areas of risk to be topographic depressions within the terrestrial area and not specific areas of the docks.

¹⁵ GOV.UK, Check you long term flood risk [online]. Available at: <https://check-long-term-flood-risk.service.gov.uk>. Accessed October 2023.

4.4.3 The different surface water risk categories are defined below:

- High – Greater than a 1 in 30 (3.33%) annual probability;
- Medium – Between a 1 in 30 and 1 in 100 (3.33% to 1%) annual probability;
- Low – Between a 1 in 100 and 1 in 1,000 (1% to 0.1%) annual probability; and
- Very Low – Less than a 1 in 1,000 (0.1%) annual probability.

4.4.4 Surface water drainage networks are typically designed to accommodate only a 1 in 30 (3.3%) annual probability rainfall event. Older drainage networks may have a lower capacity, especially if they have not been maintained adequately. Although not true of every situation, surface water flooding is typically relatively shallow and would be expected to subside following the storm event assuming drainage assets are maintained in an appropriate condition.

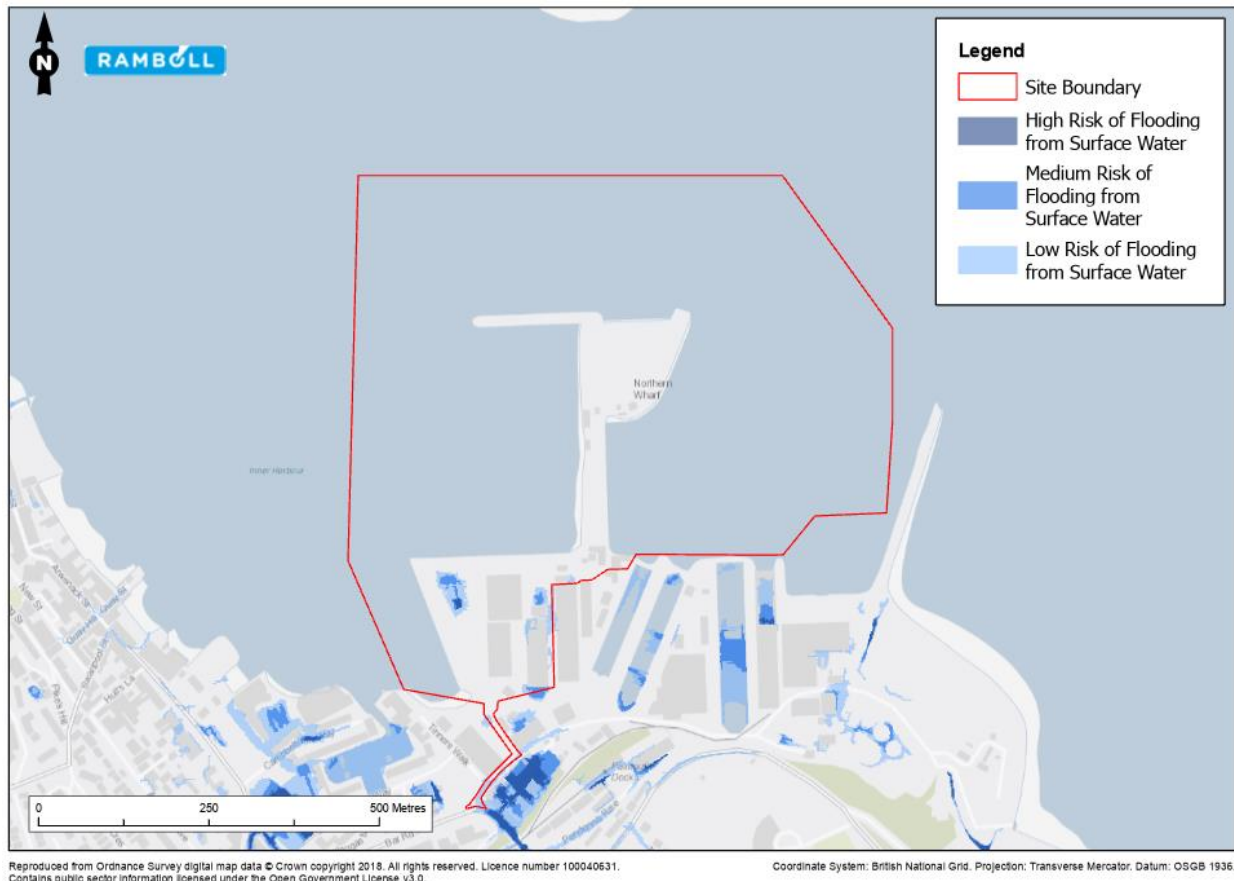


Figure 4.6: Surface Water Flood Risk

4.5 Geological and Hydrogeological Setting

- 4.5.1 According to the British Geological Society (BGS) Geology data¹⁶, no superficial geology has been recorded at the site. In terms of bedrock geology, the site is underlain by the Portscatho Formation, described as sandstone and argillaceous rocks, interbedded, and formed during the Devonian period.
- 4.5.2 According to the two borehole logs detailed in the Ground Investigation Report¹⁷, of depths 21.5 m and 22.5 m Below Ground Level (BGL), the geology down to approximately 5.0 – 7.0 m is described as Made Ground which is typically sand and gravel with the proportion of gravel in relation to sand increasing with depth. Clay is present from approximately 11.0 – 13.0 m BGL. Mudstone was found in both boreholes from between 18.0 and 20.0 m BGL.

¹⁶ British Geological Survey (BGS) Geology Viewer [online]. Available at: <https://geologyviewer.bgs.ac.uk>. Accessed September 2023.

¹⁷ Geotechnical, Falmouth Causeway, Factual Ground Investigation Report, 36988, 2022.

- 4.5.3 BGS Hydrogeology data¹⁸ characterises the rock unit that underlies the site, defined as Middle Devonian, as a low productivity aquifer. The Aquifer Designation Dataset for England and Wales¹⁹, accessed through the Department for Environment Food and Rural Affairs (DEFRA) MAGIC Maps²⁰, categorises the underlying bedrock as a Secondary A aquifer.
- 4.5.4 The Ground Investigation Report¹⁷ states that for the first borehole, groundwater was struck at a depth of 4.1 m BGL.

4.6 Risk from Reservoirs, Canals and Other Artificial Sources

- 4.6.1 According to EA mapping¹⁵, the western part of the site is shown to be at risk of flooding following a reservoir failure. This is limited to the part of the site located within the Inner Harbour. The physical docks are not within this area of risk.
- 4.6.2 It should be noted that reservoirs across England have an excellent safety record, with the last fatal failure being nearly 100 years ago. Dams in England are regulated by the Reservoirs Act 1975²¹ which sets out stringent conditions for the operation of reservoirs to ensure high levels of safety. The EA routinely visits reservoirs across the country to assess risk, monitor progress and serve enforcement notices requiring operators to complete specific actions.
- 4.6.3 No other artificial sources have been identified that presently pose a flooding risk to the site as a result of artificial sources.

4.7 Historic Flooding

- 4.7.1 According to the EA's Recorded Flood Outlines dataset²² (Figure 4.7), there are no records of historical flooding at the site. The nearest of which, dated to March 2018, is located approximately 380 m south of the site and is attributed to the overtopping of sea defences.

¹⁸ BGS British Geological Survey, GeoIndex Onshore [online]. Available at: <https://mapapps2.bgs.ac.uk/geoindex/home.html>. Accessed September 2023.

¹⁹ Aquifer Designation Dataset for England and Wales, British Geological Survey (BGS) [online]. Available at: <https://www.data.gov.uk/dataset/616469ae-3ff2-41f4-901f-6686feb1d5b6/aquifer-designation-dataset-for-england-and-wales>. Accessed September 2023.

²⁰ MAGIC [online]. Available at: <https://magic.defra.gov.uk/MagicMap.aspx>. Accessed September 2023.

²¹ Legislation.gov.uk, Reservoirs Act 1975 [online]. Available at: <https://www.legislation.gov.uk/ukpga/1975/23/contents>. Accessed August 2024.

²² Department for Environment Food and Rural Affairs, Recorded Flood Outlines [online]. Available at: <https://environment.data.gov.uk/dataset/8c75e700-d465-11e4-8b5b-f0def148f590>. Accessed October 2023.

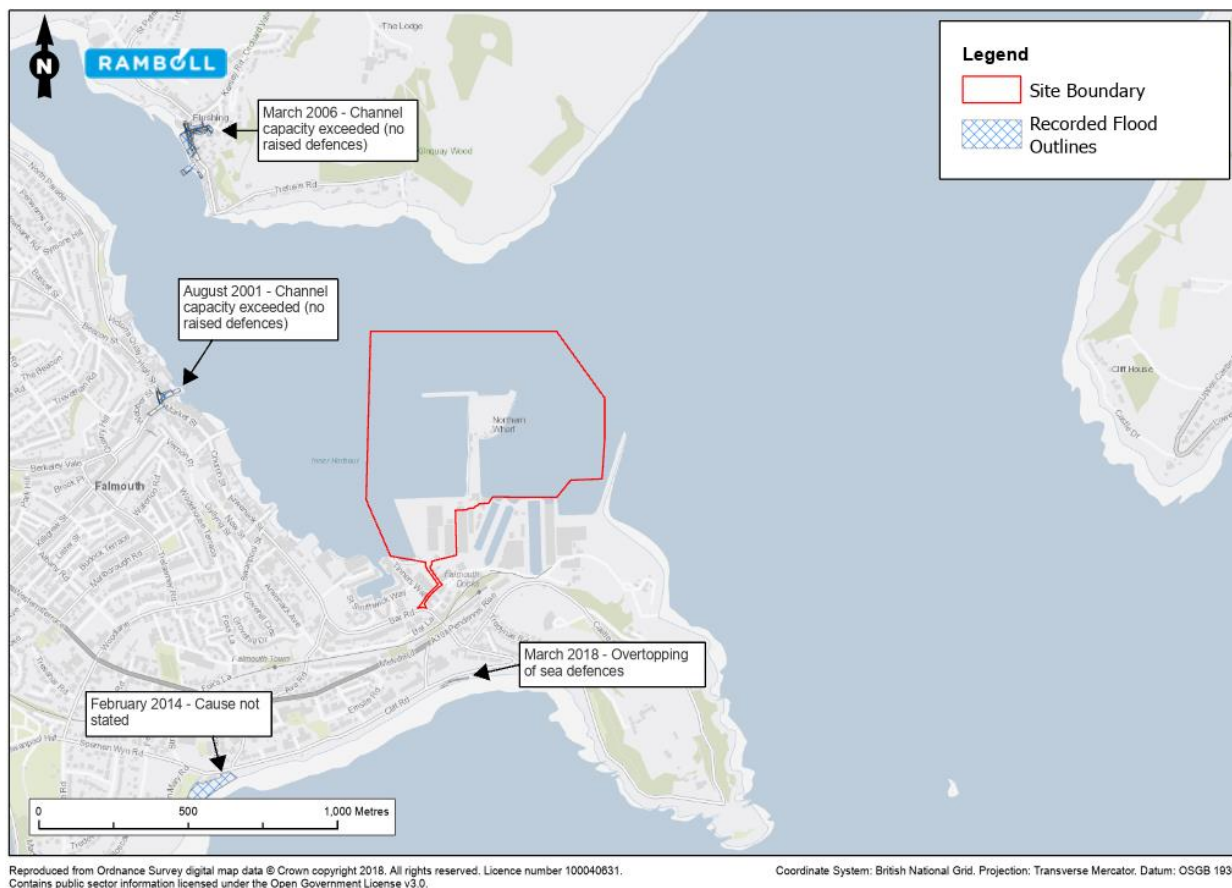


Figure 4.7: Historic Flooding

5. ASSESSMENT OF FLOOD RISK

5.1 Sources of Flood Risk

Fluvial and Tidal

HR Wallingford – Falmouth Docks Redevelopment Wave Modelling Assessment (2024)

5.1.1 HR Wallingford have undertaken a wave modelling study²³ to predict the effects of the proposed development on wave conditions (February 2024). Key effects of the proposed development on wave conditions are summarised as follows:

- Differences in significant wave heights are localised in the bay around the proposed development.
- Predicted conditions from north-west will cause an increase in significant wave height of up to 0.3 m along the proposed Northern Wharf for the 1 year conditions.
- Predicted conditions from south-east will cause an increase in significant wave height of up to 0.35 m along the proposed Northern Wharf for the 1 year conditions.
- Predicted conditions from north-east will lead to an increase in significant wave height of up to 0.3 m along the new proposed Western Wharf and in the corner of the existing Western Wharf.

5.1.2 Table 5.1 presents the modelled flood level scenarios, including allowing for the potential worst increase in wave height of 0.35 m. This provides a maximum modelled flood level of 4.7 m AOD for the 1 in 1,000 year event with climate change and a 0.35 m wave height allowance.

Table 5.1: Maximum Modelled Flood Level Scenarios

Annual Probability Scenario	Maximum Modelled Flood Level /m AOD	Maximum Modelled Flood Level with increased wave height allowance - +0.35)/m AOD
1 in 100	3.37	3.72
1 in 200	3.43	3.78
1 in 1,000	3.56	3.91
1 in 1,000 (with adjustment for climate change to year 2118)	4.35	4.7

As set out in Section 2.2, the proposed development involves the construction and re-construction of a number of wharfs around the perimeter of the existing dock infrastructure. Proposed deck levels range from 5.33 m AOD to 5.49 m AOD. These are all above the modelled flood levels, with wave height allowance for all annual probability scenarios.

Surface Water

5.1.3 Limited areas in the south-west of the site are considered to be at risk from surface water flooding. Approximately 95% of the site is considered to be at a Very Low risk from surface water flooding. It is noted that the areas of risk shown in Figure 4.6 are likely associated with areas of localised low topography. Surface water flooding is typically relatively shallow and would be expected to subside following a potential storm event assuming drainage assets are maintained in an appropriate condition. Note that the surface water mapping does not account for drainage assets such as existing gullies draining specific external areas.

Other Sources

5.1.4 The geology at the site is described as a low productivity aquifer and limited borehole records suggest a groundwater level of approximately 4.1 m BGL. No basement levels are being proposed as part of the development. The risk from groundwater flooding is therefore considered to be low.

²³ Falmouth Docks Redevelopment Wave Modelling. HR Wallingford 2024.

- 5.1.5 While part of the site is shown to be at risk of flooding following a reservoir failure this is limited to the Inner Harbour and does not extend to the physical docks. Furthermore, the safety record and stringent operation of reservoirs in the UK make a structural failure extremely unlikely.
- 5.1.6 No other sources of flood risk due to artificial sources have been identified.

5.2 Flood Risk Vulnerability

- 5.2.1 According to the flood risk vulnerability classification²⁴ in the Planning Practice Guidance to the NPPF²⁵, the site is defined as a 'Water-compatible' development on account of it being classed as 'docks, marinas and wharves'.
- 5.2.2 According to Table 2 (Flood risk vulnerability and flood zone 'incompatibility') of the Planning Practice Guidance to the NPPF²⁵, a 'Water-compatible' development is appropriate for Flood Zone 3 and the Exception Test is not required.

5.3 Sequential Test

- 5.3.1 The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered.
- 5.3.2 As the proposed development proposes redevelopment of an existing site, there is not considered to be another suitable location for the development. In addition, the nature of the development is considered appropriate for Flood Zone 3. Therefore, the proposed development is considered to have passed the Sequential Test.

5.4 Mitigation Measures

- 5.4.1 Limited areas in the south-west of the site are considered to be at risk from surface water flooding. Where there is an existing risk of surface water flooding associated with areas of localised low topography, this is expected to subside following a potential storm event assuming drainage assets are maintained in an appropriate condition. Therefore, no specific mitigation measures are deemed necessary as a result of the proposed development other than ensuring existing drainage systems are regularly checked and maintained.

5.5 Assessment of Residual Risk

- 5.5.1 As indicated by Table 5.1, there is not considered to be a residual risk to the site as minimum proposed deck levels are set approximately 600 mm above the peak maximum modelled flood level, the 1 in 1,000-year event adjusted for climate change whilst accounting for the maximum increased wave allowance as determined in the HR Wallingford Wave Modelling Assessment.
- 5.5.2 The proposed works are considered to be appropriate development for the area and as such no specific mitigation measures beyond those already in place are proposed.

5.6 Coastal Vulnerability Assessment

- 5.6.1 The Cornwall Coastal Vulnerability Zone (CVZ) represents a potential coastal erosion zone and is used to identify planning proposals that might be vulnerable to coastal erosion⁹. The Cornwall CVZ is designated around the whole of the Cornish coast, with variance regarding how far inland the zone extends appearing to depend on topography and geology. Therefore, due to the coastal frontage location, the Cornwall CVZ includes the area of the site.

²⁴ GOV.UK, National Planning Policy Framework, Annex 3: Flood risk vulnerability classification [online]. Available at:

<https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification>. Accessed October 2023.

²⁵ GOV.UK, Guidance, Flood risk and coastal change [online]. Available at: <https://www.gov.uk/guidance/flood-risk-and-coastal-change>. Accessed October 2023.

- 5.6.2 The purpose of Coastal Change Management Areas (CCMAs) is to highlight issues of coastal change and allow them to be planned for. There are currently three active CCMAs in Cornwall²⁶. These are in Newquay, Looe and Perranuthnoe. Of the list of 'Candidate CCMAs' presented in the Climate Emergency Development Plan⁹, Falmouth is not included.
- 5.6.3 The Shoreline Management Plan²⁷ confirms that the approach at Falmouth is to continue to maintain defences at the port to sustain its economic value. Furthermore, it is stated that there is significantly less pressure from coastal hazards at Falmouth than in other areas due to shelter from high energy waves. The 'Hold the line' policy is expected to remain in the area up until at least 2105. This policy states:
- 'Where protection is currently provided by coastal defence structures or managed beaches, and the intention is to retain a defence along approximately the current alignment. This will involve replacing defences when needed. Defence type, method and standard of protection may be modified over time.'*
- 5.6.4 The proposed development is therefore considered to 'hold the line' as it maintains and improves the flood defences by repairing wharfs that are in a state of disrepair. It raises deck levels in some locations from existing levels, and involves some localised realignment to improve operations at the docks. Based on the flood modelling data acquired from the EA, it is shown that the proposed development is not expected to be at significant risk of flooding under all modelled events including the 1 in 1,000-year event with an allowance for climate change and modelled wave height.
- 5.6.5 It is therefore considered that a standalone Coastal Vulnerability Assessment is not necessary for the proposed development and the site is not expected to be at risk from coastal erosion for the duration of its lifetime.

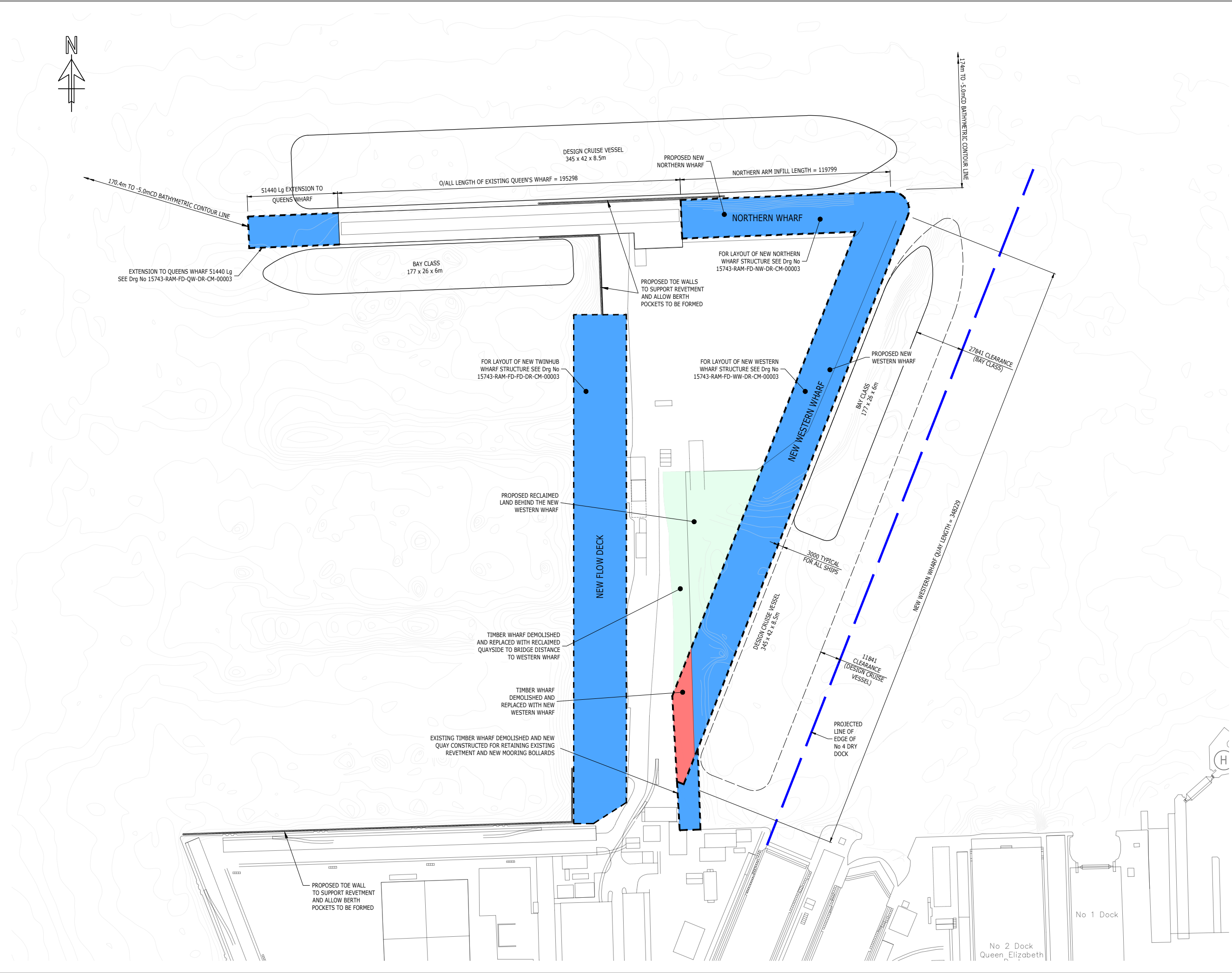
²⁶ Cornwall Council, Planning applications on the coast [online]. Available at: <https://www.cornwall.gov.uk/environment/environmental-protection/coastal-protection/planning-applications-on-the-coast/>. Accessed June 2024.

²⁷ Environment Agency, Shoreline Management Plans [online]. Available at: <https://environment.data.gov.uk/shoreline-planning/unit/SMP17/11.10>. Accessed June 2024.

6. CONCLUSIONS

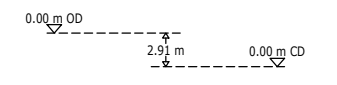
- 6.1.1 Based on the findings of this Flood Risk Assessment it is concluded that any flood risk is appropriately managed by the proposed development over the lifetime of the development, taking climate change into account and fittingly for the vulnerability of proposed users.
- 6.1.2 Approximately 95% of the site is located within Flood Zone 1 (Low risk). The remainder is in Flood Zone 2 (Medium risk) and Flood Zone 3 (High risk). This is limited to isolated areas adjacent to the water.
- 6.1.3 Based on the flood modelling data acquired from the EA, it is shown that the proposed development is not expected to be at significant risk of flooding under all modelled events including the 1 in 1,000-year event with an allowance for climate change and modelled wave height.
- 6.1.4 Approximately 95% of the site is in an area considered to be at a Very Low risk from surface water flooding. The remaining areas of risk are limited to isolated areas in the south-west of the site. It is noted that the surface water flood risk is likely associated with areas of localised low topography which would be expected to subside following a potential storm event assuming drainage assets are maintained in an appropriate condition.
- 6.1.5 No further flood risk assessment is deemed necessary.

APPENDIX A – PROPOSED DEVELOPMENT DRAWINGS



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- Notes
- DO NOT SCALE FROM THIS DRAWING.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
 - ALL DIMENSIONS ARE IN MILLIMETRES U.N.O.
 - ALL CO-ORDINATES ARE IN METERS U.N.O.
 - ALL LEVELS ARE IN METRES ABOVE CHART DATUM U.N.O.
 - FOR THE RELATIONSHIP BETWEEN THE CHART DATUM AND ORDNANCE DATUM REFER TO THE DIAGRAM BELOW:



TIDAL LEVELS		
TIDAL LEVEL DESCRIPTION	ABBREVIATION	LEVEL
HIGHEST ASTRONOMICAL TIDE	HAT	+5.70m C.D.
MEAN HIGH WATER SPRINGS	MHWS	+5.10m C.D.
MEAN HIGH WATER NEAPS	MHWN	+4.10m C.D.
MEAN SEA LEVEL	MSL	+3.00m C.D.
MEAN LOW WATER NEAPS	MLWN	+1.80m C.D.
MEAN LOW WATER SPRINGS	MLWS	+0.50m C.D.
LOWEST ASTRONOMICAL TIDE	LAT	-0.20m C.D.

KEY :-

PROPOSED NEW WHARF STRUCTURE

S1-03	DEMOLISHED STRUCTURES REMOVED	28.03.2024	SPF	GW
S1-02	PRELIMINARY	24.11.2023	IDF	GW
S1-01	PRELIMINARY ISSUE	25.09.2023	SPF	GW
Rev	Description	Date	By	App
			CHK	

PRELIMINARY

FALMOUTH DOCKS REDEVELOPMENT

RAMBOLL

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**CONCEPT DESIGN
PROPOSED
GENERAL ARRANGEMENT
BERTH LAYOUT**

Project No: 1620015743	Scale (8A1): 1:1000	Drawn: SPF	Date: SEPT 2023
Drawing No: 15743-RAM-FD-SW-DR-CM-00003	Rev: S1-03		

