

Queens Market

Flood Consequence Assessment

July 2020

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Revision History

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Contract

This report describes work commissioned by Jason Cain, on behalf of Ion Property Developments, by an email dated 01 June 2020. Joseph Landells-Molloy of JBA Consulting carried out this work.

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Purpose

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Contents

1	Introduction	1	
1.1	Overview	1	
1.2	Scope of this FCA	1	
2	Development description and location	1	
2.1	Development proposals	2	
3	Review of flood risk	4	
3.1	Development Advice Map (DAM)	4	
3.2	Access and Egress	5	
3.3	Tidal Flood Risk	6	
3.3.1	Tidal – Extreme Sea Levels	6	
3.3.2	Tidal – Wave Overtopping	8	
3.4	Surface water flood risk	10	
4	Surface water management	11	
5	Conclusion and discussion	12	
A	Topographic Survey		13

List of Figures

Figure 2-1: Location plan	2
Figure 2-2: Masterplan drawing - ground floor	3
Figure 3-1: DAM Zone mapping	4
Figure 3-2: Primary access/egress route plan	5
Figure 3-3: DAM Zone C1 topographic survey levels	8
Figure 3-4: DCC02 defence location	9
Figure 3-5: NRW Risk of Flooding from Surface Water mapping	10

List of Tables

Table 2-1: Site description	1
Table 3-1: Cumulative Sea Level Rise calculation	6
Table 3-2: Present and Future Still Water Levels	6
Table 3-3: Extreme Sea Levels (still water levels) at Rhyl	7
Table 3-4: Calculated peak overtopping rates at DCC02	9

1 Introduction

1.1 Overview

This report has been prepared following an initial email request of 14 January 2020 by ION Developments for a Flood Consequence Assessment (FCA) for the regeneration of the Queens Market site, Rhyl.

It is highlighted that the proposed development is located in Development Advice Map (DAM) Zone A, however, the adjacent High Street (entirely) and Sussex Street (partially) are located within DAM Zone C1. As a result, safe access and egress could be inhibited by flood risk. DAM Zone C is based on the Flood Zone B (0.1% AEP) undefended extent. Zone C1, however, indicates that an area is served by substantive flood defence infrastructure and raised sea walls.

1.2 Scope of this FCA

This FCA has been undertaken with consideration of Technical Advice Note 15 (TAN15)¹ and is based on a desktop review of available information, including options for safe site access and egress. An assessment of coastal flood risk has been undertaken based on existing modelling results from the adjacent Rhyl Aquatics Centre FCA (2016) undertaken by JBA Consulting.

A drainage strategy has been prepared outside of this commission (by Curtins). Whilst the drainage strategy should be referred to for detailed analysis, this FCA will summarise the proposals for surface water management in order to demonstrate that runoff can be appropriately managed on site, therefore, ensuring that flood risk will not be increased elsewhere. This report does not, therefore, include consideration of contamination issues, detailed drainage or the design of Sustainable Drainage Systems (SuDS) or SuDS Approval Body (SAB) requirements.

2 Development description and location

Table 2-1: Site description

Site Name	Queens Market
Site Area (ha)	0.92
Existing Land Use	Multi but residential (hotels) is considered critical under TAN15
Proposed Land Use	Multi but residential is considered critical under TAN15
Proposed Vulnerability Classification	Highly Vulnerable (based on most vulnerable development)
OS-NGR	SJ007815
Local Planning Authority (LPA)	Denbighshire County Council

Queens Market is located in Rhyl on the north-east coast of Wales (see Figure 2-1). Denbighshire County Council (DCC) is the Local Planning Authority (LPA) for this area. Rhyl is protected by flood defences along its coastline. It is noted that these coastal defences have a 0.5% Annual Exceedance Probability (AEP) standard of protection (SOP).

¹ <https://gov.wales/sites/default/files/publications/2018-09/tan15-development-flood-risk.pdf>

The site is entirely bounded by existing highways and associated development, the site is bounded to the north east by High Street, a pedestrianised shopping street, and a further pedestrianised shopping street to the south east, Sussex Street. Queen Street bounds the site to the south west and the B5118 (West Parade) to the north west.

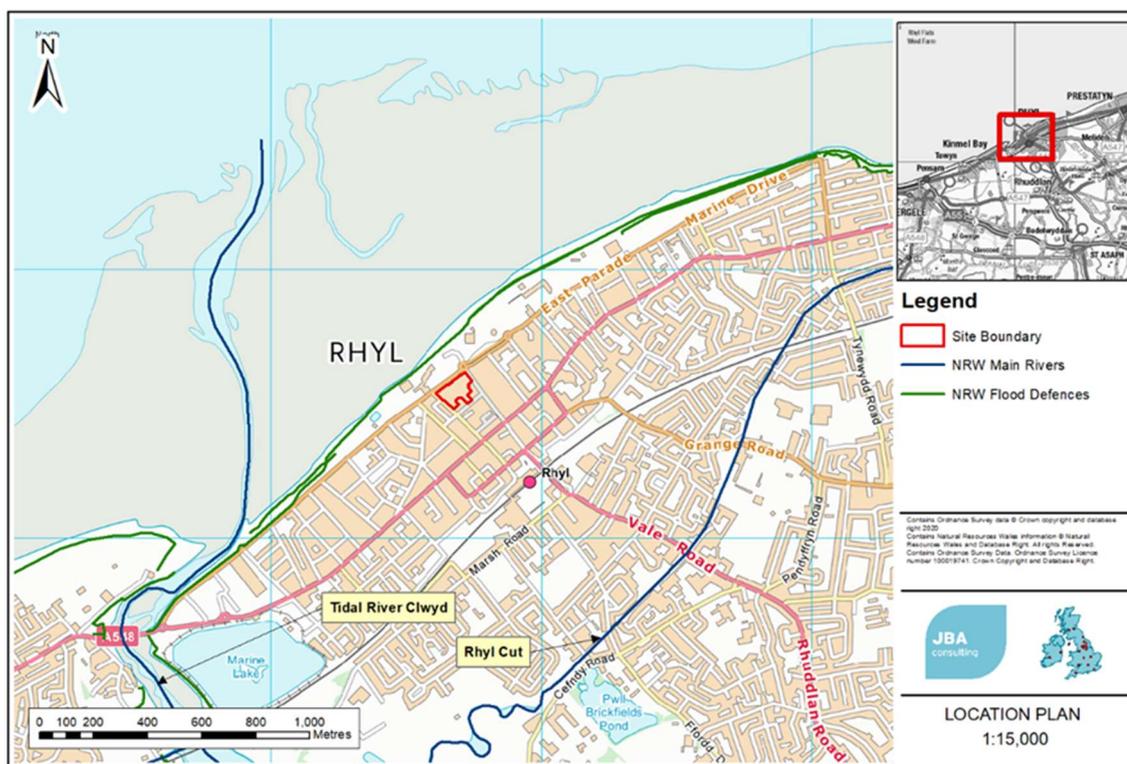


Figure 2-1: Location plan

2.1 Development proposals

The site is currently developed with satellite imagery confirming that 100% of the site is impermeable, and it is proposed to demolish existing development and redevelop as a multi-use site, including residential, retail, event spaces and offices.

TAN15 sets out the policy in relation to developments and flooding, categorising land use based on the consequences of flooding to a particular site. TAN15 classifies industrial, employment and commercial development as less vulnerable, and residential use, including hotels as highly vulnerable.

Redevelopment proposals comprise:

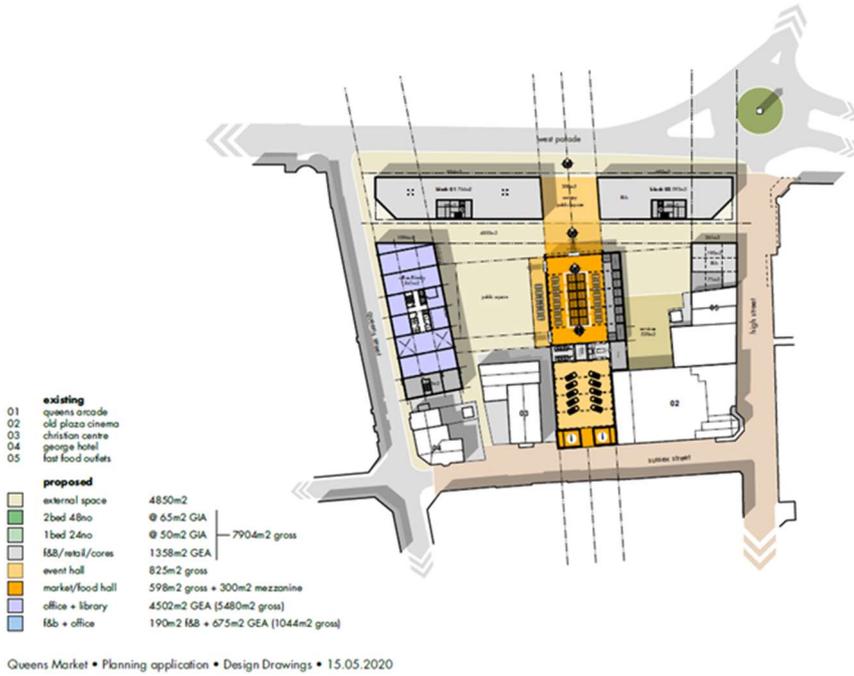
- External space;
- Residential (2bed 48no and 1bed 24no);
- Retail including food and beverage;
- Event hall;
- Market/food hall;
- Office; and
- Library.

In accordance with TAN15, redevelopment proposals include for employment, commercial and retail which are classified as less vulnerable development and residential premises and public buildings (library) which are classified as highly vulnerable development.

The proposed site layout, as provided by ION Developments, is included presented in Figure 2-2.

masterplan drawings

1.4 ground floor



shedkm

Figure 2-2: Masterplan drawing - ground floor

3 Review of flood risk

3.1 Development Advice Map (DAM)

The Natural Resources Wales’ (NRW) Development Advice Map (DAM) is presented in Figure 3-1 and indicates that the proposed development is located in DAM Zone A, however, the adjacent High Street (entirely) and Sussex Street (partially) are located within DAM Zone C1. DAM Zone maps are based on Natural Resources Wales extreme flood outlines (Zone C) and the British Geological Survey 10k Superficial Geology data (Zone B). It is noted that NRW’s Development Advice Map is based on the modelled undefended scenario should defence failure occur. DAM Zone C1 represents "areas of the floodplain which are developed and served by significant infrastructure, including flood defences" and covers 51% of the total site area.

Under TAN15, all development is acceptable in DAM Zone A, however, safe access and egress could potentially be impeded by DAM Zone C1 hence flood risk.

However, based on the DAM Zone C1 extent it is shown as a highly localised flow route and the width would indicate shallow depth unlikely to prevent egress. It appears that it is limited flooding only at the roundabout, therefore, an escape route should be via the B5118 north.

It is noted that the risk of failure of the raised seawalls in this area is not considered likely.

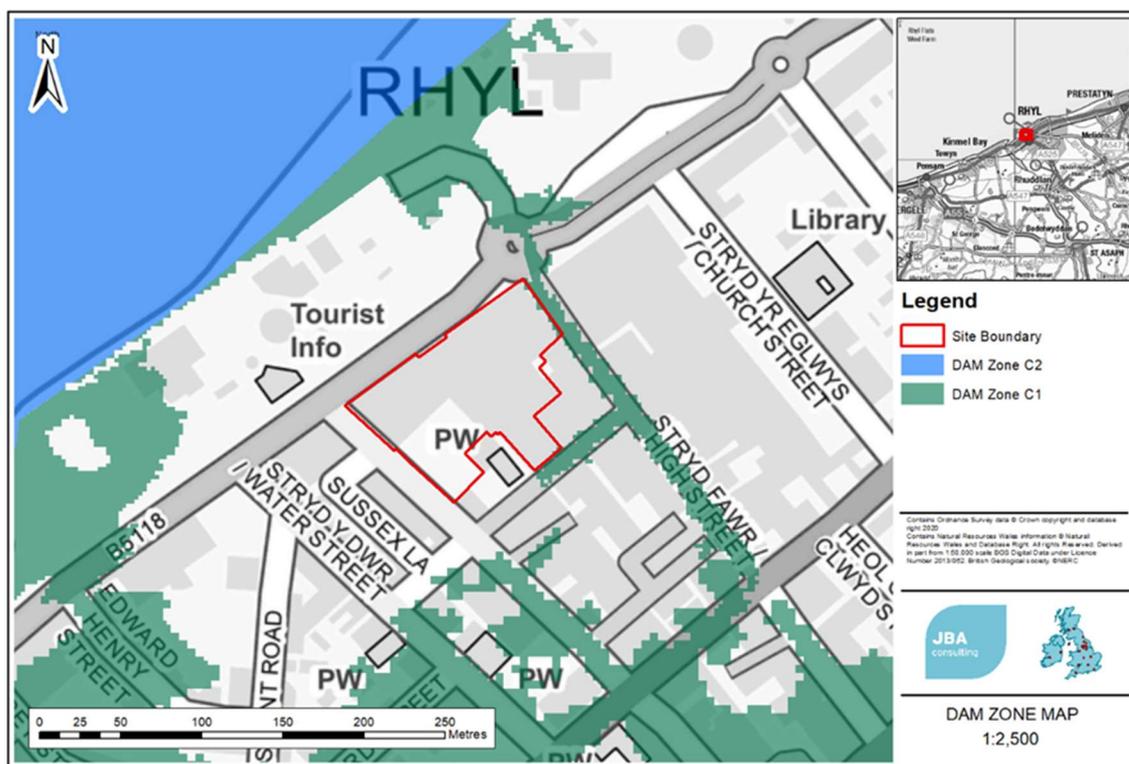


Figure 3-1: DAM Zone mapping

Rhyl Cut and the tidal River Clwyd (as indicated on Figure 2-1) are both NRW Main Rivers within the wider locality. Rhyl Cut flows in a south westerly direction approximately one kilometre from the Queens Market site boundary and outfalls into the River Clwyd which flows northward into the Irish Sea approximately 1.5 kilometres to the west of the site. It appears that the DAM Zone C1 extent at High Street and Sussex Street is due to potential coastal inundation immediately to the north of the site, therefore, the site is not considered to be at risk of fluvial inundation. There is, however, potential for tidal/fluvial connectivity to the south of the site.

3.2 Access and Egress

Whilst the site itself is in DAM Zone A, adjacent areas (High Street and Sussex Street) are in DAM Zone C1, therefore, an emergency plan needs to take account of this when considering safe access and egress.

It is recommended that emergency access to and egress from the site is to be via the B5118 (West Parade) north as DAM Zone C1 indicates a limited flow route likely to be shallow and within kerb lines at this location (see Figure 3-2). However, there is also alternative pedestrian access via an existing raised promenade access road/walkway to the north of West Parade.

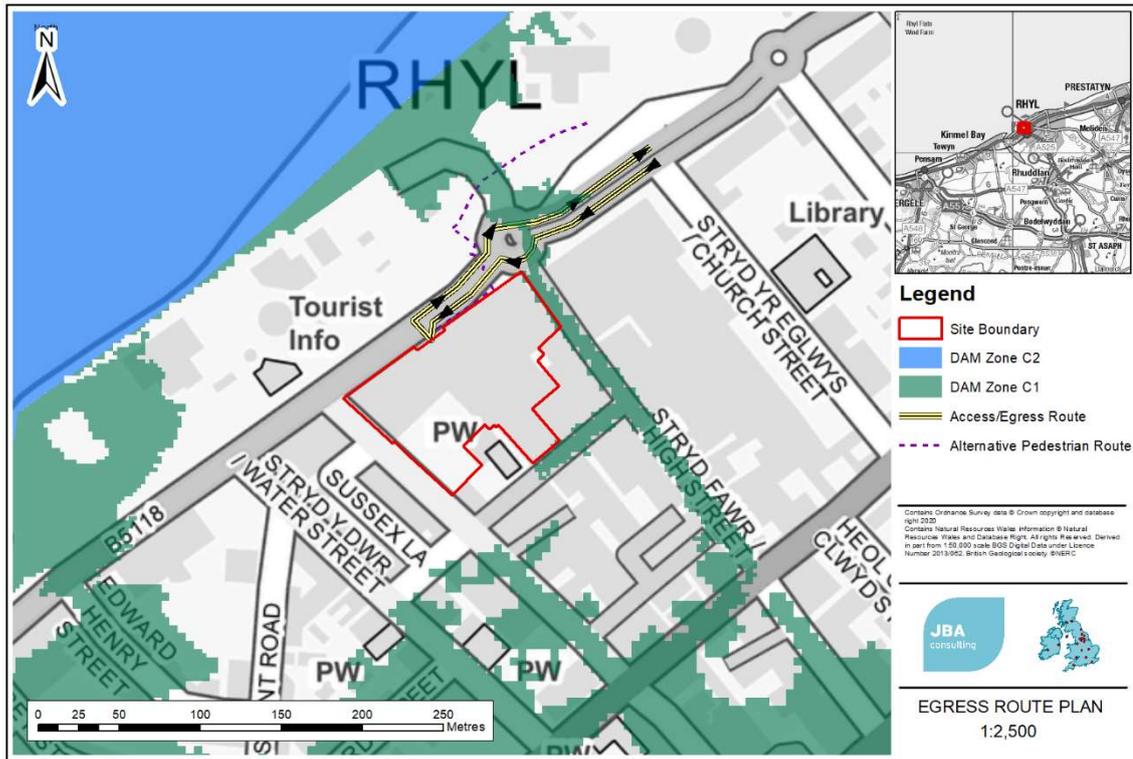


Figure 3-2: Primary access/egress route plan

Based on the provided masterplan (Figure 2-2) it appears that there is alternative access to the site off Queen Street and High Street. Whilst Queen Street is in DAM Zone A and the primary access/egress route presented in Figure 3-2 could be followed, it is recommended that the High Street access is restricted under flood event conditions and is sufficiently raised to prevent potential ingress of floodwaters (High Street is currently fully developed with buildings at this location).

3.3 Tidal Flood Risk

3.3.1 Tidal – Extreme Sea Levels

In accordance with TAN15, Flood Zone B should be "used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level, in this instance, this is relevant for safe site access and egress via High Street and/or Sussex Street. 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."

Extreme Sea Levels were obtained from the EA Coastal flood boundary conditions for UK mainland and islands project, which produced the Coastal Flood Boundary Dataset (CFBD). The CFBD contains the estimated extreme sea levels throughout the UK based on research involving more than 40 Class A water level gauges². These extreme sea levels include both the underlying astronomical tide and storm surges.

Based on the 2018 project update, the predicted present day (base year 2017) water level at Rhyl for the 0.1% AEP event is 5.73 mAOD. Table 3-3 presents an updated assessment (to that undertaken for the Rhyl Aquatics Centre FCA) of the extreme sea levels at Rhyl to a 2017 baseline in accordance with Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (2017)³. Table 3-1 and Table 3-2 present the predicted Sea Level rise calculations in accordance with the guidance. It is noted that no new modelling has been undertaken as part of this review.

Table 3-1: Cumulative Sea Level Rise calculation

Period	mm increase	Cumulative Rise
2017 – 2025	9 years x 3.5mm/yr	31.5mm
2025 – 2055	30 years x 8.0mm/yr	240mm
2056 – 2085	30 years x 11.5mm/yr	345mm
2086 – 2116	7 years x 14.5mm/yr	449.5mm
2116 future Sea Level	add	1066mm

Table 3-2: Present and Future Still Water Levels

	Design Level (median value)
Baseline T1000 (2017)	5.73m AOD
Present Day (2020)	5.73m AOD + (4yrs x 3.5mm) = 5.744m AOD Round up to 1 D.P. 5.8m AOD
Future Scenario (2116)	5.73m AOD + 1066mm = 6.796m AOD Round up to 1 D.P. 6.8m AOD

² Coastal flood boundary conditions for the UK: 2018 update - GOV.UK

³ <https://gov.wales/sites/default/files/publications/2019-06/adapting-to-climate-change-guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales.pdf>

Table 3-3: Extreme Sea Levels (still water levels) at Rhyll

Sea Level event – AEP (and return period)	Baseline (2017) water levels (mAOD)	Present Day (2020) water levels (mAOD) (2017 level + 0.014 m)	2116 water levels (mAOD) (2017 level + 1.066 m)
0.1% (1,000-year)	5.73	5.74	6.80
0.5% (200-year)	5.52	5.53	6.59
1% (100-year)	5.43	5.44	6.50
2% (50-year)	5.35	5.36	6.42
5% (20-year)	5.24	5.25	6.31
10% (10-year)	5.16	5.17	6.23
20% (5-year)	5.07	5.08	6.14
100% (1-year)	4.87	4.88	5.94

A 2020 topographical survey of the site was completed and select surveyed levels for the adjacent areas of DAM Zone C1 at High Street and Sussex Street are presented in Figure Figure 3-3. Appendix A contains the full topographical survey. High Street at its northernmost extent is set at 6.66 mAOD and falls away to the south to 5.94 mAOD at the junction with Sussex Street. Similarly, at the westernmost extent of DAM Zone C1 on Sussex Street the site falls away to the east from 6.24 mAOD to the previously mentioned 5.94 mAOD.

Based on the surveyed levels, safe access and egress via High Street and/or Sussex Street is achievable under present day conditions only. Under a climate change scenario, this route becomes inundated to depths of between 0.14 and 0.86 metres. It is noted that the southern areas of High Street are potentially at increased risk during combined further climate change and breach events

However, at the B5118 (West Parade) where access/egress is proposed, the surveyed level of 6.80 mAOD is equivalent to the predicted climate change Extreme Sea Level, therefore, access at this location is considered acceptable.

It is noted that development should consider sufficient freeboard and safe development levels into the future development against the 0.5% AEP and 0.1% AEP climate change Extreme Sea Levels defined in Table 3-3, 6.59 and 6.80 mAOD respectively.

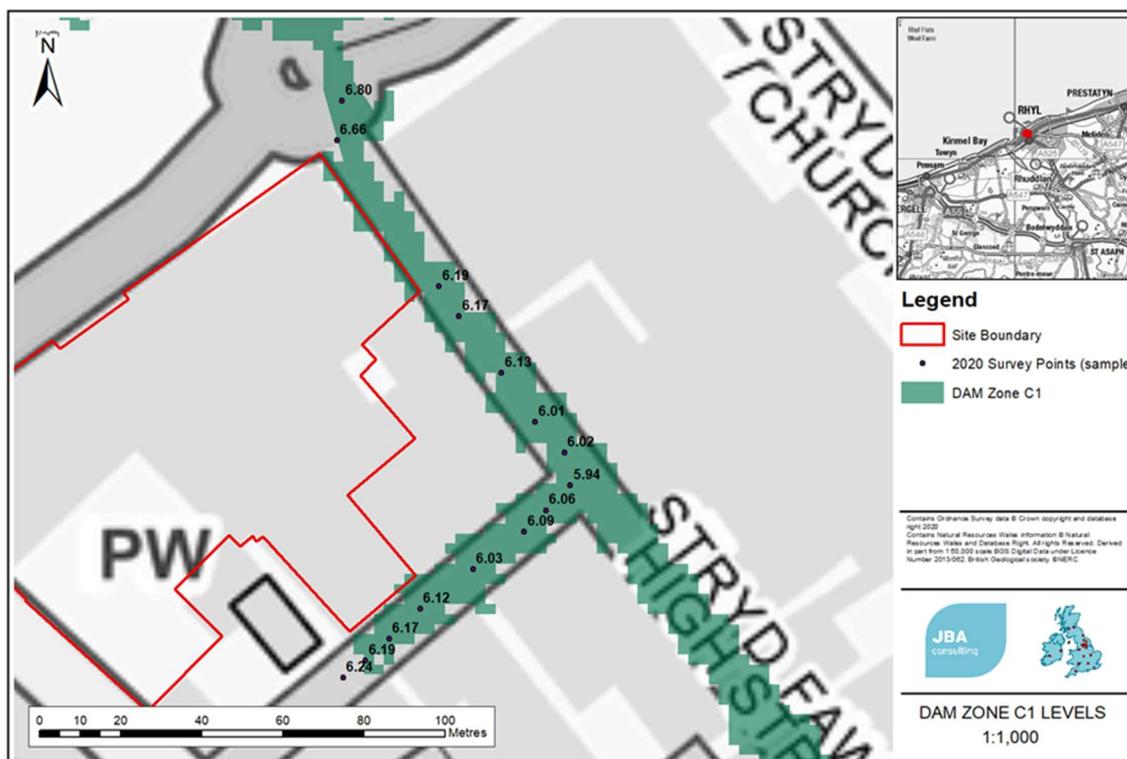


Figure 3-3: DAM Zone C1 topographic survey levels

3.3.2 Tidal – Wave Overtopping

DAM Zones define the extent of flooding based on still water levels in the absence of flood defences. JBA undertook a modelling appraisal to confirm likely wave impact and consideration of any overtopping of defences at this location as part of the Rhyll Aquatics Centre FCA (2016).

Whilst the existing coastal defences (sea wall) will help to protect against extreme sea levels, there is still potential for wave action to cause overtopping of the wall during significant design storm events. At Rhyll, the sea defences are formed of a concrete flood wall. Whilst the risk of failure is considered to be low, the residual risk associated with overtopping remains.

In modelling for the Rhyll Aquatics Centre FCA, the schematised defence section DCC02 is located approximately 100m to the north of the Queens Market site boundary (see Figure 3-4). Previously, wave overtopping rates were calculated for a 0.5% AEP (200-year) event under both present day and climate change scenarios. It is noted that the now superseded values for Extreme Sea Level were greater than those presented in Section 3.3.1 of this report and the 10% uplift applied to offshore wave heights and wind speeds for climate change are appropriate under Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (2017) guidance. The results at DCC02 are presented in Table 3-4.

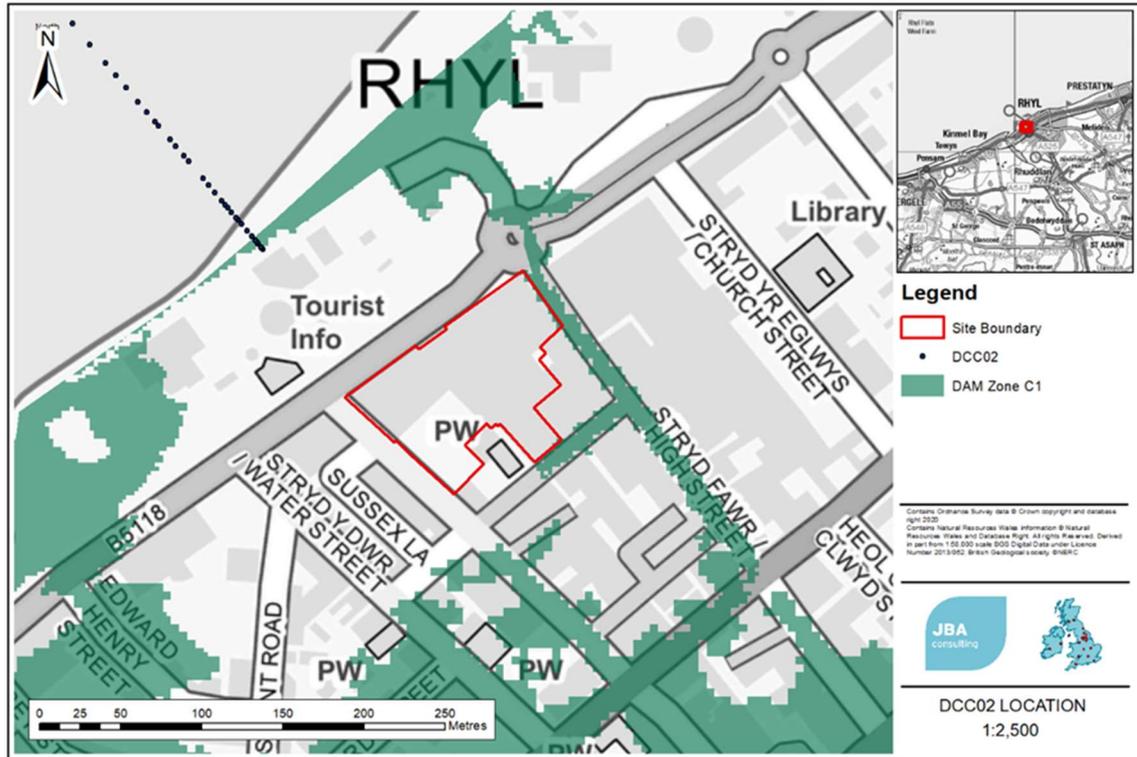


Figure 3-4: DCC02 defence location

Table 3-4: Calculated peak overtopping rates at DCC02

AEP - % (RP – years)	Overtopping rate (l/s/m)	
	Present Day	2115 Climate Change (FCDPAG3)
0.5% (200-year)	0.47	14.90
0.1% (1000-year)	1.44	Not calculated

However, there are a number of unknowns which mean that it is not possible to quantify the precise volumes of flooding following the DAM Zone C1 flood extent along High Street (overtopping duration, the transformed rates that actually overtop the site walls or promenade access way, local drainage effects, etc.).

Based on climate change overtopping rates, wave overtopping could lead to an increase in flood depths at High Street and Sussex Street as flows will likely follow the DAM Zone C1 flood extent but remain unlikely to exceed undefended extents as per NRW DAM Zone mapping.

3.4 Surface water flood risk

NRW's Risk of Flooding from Surface Water (RoFSW) mapping (see Figure 3-5: NRW Risk of Flooding from Surface Water mapping) indicates that the development site is generally at low risk of surface water flooding, with one instance of surface water ponding against existing development in the 1% AEP event. In the 0.1% AEP (low risk) event, there are a couple more instance of localised surface water ponding against surface water development. RoFSW mapping does not indicate the presence of offsite flow routes that would need to be managed as part of development proposals, instead, surface water appears to be contained by existing development at the site. However, ponding along High Street and Sussex Street adjacent to the site is evident in the 0.1% AEP event.

It is understood that development proposals include for an increase in public open space within the development, therefore, the depth of surface water ponding would be less contained in larger events and enter the drainage network when capacity becomes available. In accordance with the drainage strategy, surface water will be managed onsite to ensure that flood risk is not increased elsewhere.

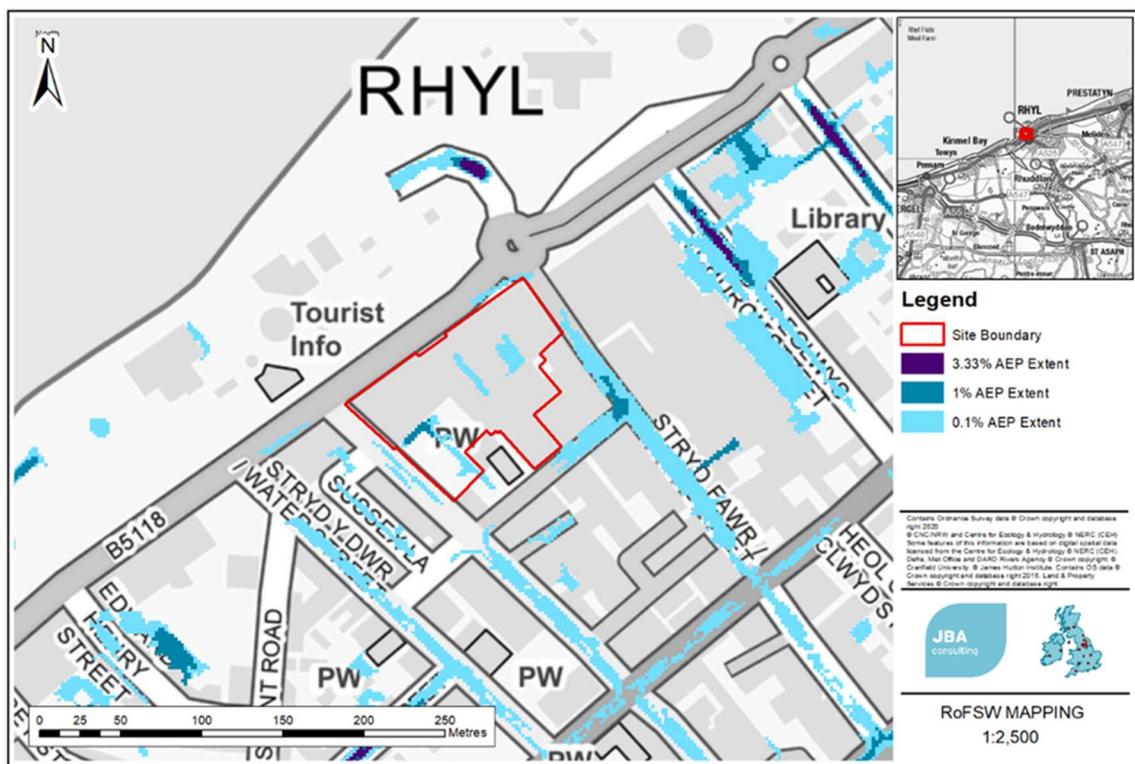


Figure 3-5: NRW Risk of Flooding from Surface Water mapping

4 Surface water management

A separate drainage strategy and Denbighshire SAB pre-application has been prepared by Curtins. Refer to the drainage strategy document for further details on drainage design and attenuation. At this stage, greenfield discharge is assumed with below ground storage (if discharge to sewer is required).

Based on satellite imagery of the current development and the provided masterplan, impermeable area will not increase – the site is currently 100% impermeable and this will be true post-development.

It is understood that surface water will be managed onsite so as not to increase flood risk elsewhere. Welsh Water pre-application consultation has confirmed that Welsh Water will not accept discharge to sewer unless priority discharge destinations in accordance with the drainage hierarchy have been discounted. Curtins are undertaking infiltration testing to confirm the potential for discharge to ground.

It is also noted that infiltration testing as part of the drainage assessment will confirm presence of groundwater and any implications for development.

5 Conclusion and discussion

This report has been prepared following an initial email request of 14 January 2020 by ION Developments for a Flood Consequence Assessment (FCA) for the regeneration of the Queens Market site, Rhyl.

It is highlighted that the proposed development is located in Development Advice Map (DAM) Zone A, however, the adjacent High Street (entirely) and Sussex Street (partially) are located within DAM Zone C1. As a result, safe access and egress could be impeded by flood risk. However, the development is not within a defined flood zone and redevelopment of the site is therefore considered appropriate in terms of flood risk. DAM Zone C1 indicates that the area is served by substantive flood defence infrastructure and raised sea walls. It is noted that the risk of failure of the raised seawalls in this area is not considered likely.

It is proposed to demolish existing development and redevelop as a multi-use site, including residential, retail, event spaces and offices. Residential is considered to be highly vulnerable development under TAN15, therefore, safe site access and egress must be considered.

Based on NRW's Development Advice Map, it appears that the DAM Zone C1 extent adjacent to the site at High Street and Sussex Street is due to coastal inundation immediately to the north of the site. It is shown as a highly localised flow route and the width would indicate shallow depth unlikely to prevent egress. It appears that it is limited flooding only at the roundabout, therefore, an escape route should be via the B5118 north.

Based on the surveyed levels, safe access and egress via High Street and/or Sussex Street is achievable under present day conditions only. Under a climate change scenario, this route becomes inundated to depths of between 0.14 and 0.86 metres based on a predicted climate change Extreme Sea Level of 6.80mAOD in the 0.1% AEP event. However, at the B5118 (West Parade) where access/egress is proposed, the surveyed level of 6.80 mAOD is equivalent to the predicted climate change Extreme Sea Level, therefore, access at this location is considered acceptable.

NRW's Risk of Flooding from Surface Water (RoFSW) mapping indicates that the development site is generally at low risk of surface water flooding which is constrained by existing development in higher return period events.

A separate drainage strategy and Denbighshire SAB pre-application has been prepared by Curtins. Refer to the drainage strategy document for further details on drainage design and attenuation. However, in summary, impermeable areas will not increase post-development (currently 100% as the site is developed) and surface water will be managed onsite so as not to increase flood risk elsewhere.

It is noted that development should consider sufficient freeboard and safe development into the future development against the 0.5% AEP and 0.1% AEP climate change Extreme Sea Levels, 6.59 and 6.80 mAOD respectively.

A Appendices
Topographic Survey

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