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INTRODUCTION

Authorisation

Vectos was instructed on behalf of *** ('the Client') to provide a Flood Consequence Assessment (FCA) to support the planning application for the proposed conversion of No. 33 and 34 Marine Terrace, Aberystwyth (see Appendix A), to a series of residential and retail properties.

Background

Marine Terrace, to the front of the existing properties, is located in Zone C2 of the Welsh Assembly Governments (WAGs) Development Advice Maps (DAMs). This is based on the National Resource Wales (NRW) Extreme Flood Outline (i.e. the 1 in 1000 year return period flood event) and is without significant flood defence infrastructure. The rear of the existing properties is located in Zone B, which are classified as areas known to have been flooded in the past. Consequently, an FCA is required to support the planning submission.

Proposed Development

The proposed development consists of the conversion of No. 33 and 34 Marine Terrace, Aberystwyth, to a retail unit, and a series of residential properties. Existing and proposed plans are enclosed in Appendix B.

No. 33 will be converted to two separate town houses, which will both be accessed from the rear, via the basement level, and two new door openings, to the front, on Marine Terrace.

No. 34 will be converted to a retail unit on the ground floor. The first floor and above will be converted to 5 residential apartments. The basement level will be used for parking.

To the rear of the properties, further parking will be provided, gardens will be formalised and a ramp will be created to the basement parking area that is included within No. 34.

Aims and Objectives

The aim of this FCA is to demonstrate that the site can be developed safely, without exposing it to an unacceptable degree of flood risk or increasing the flood risk to third parties. The objectives of this FCA are to:

Review the relevant planning policy documents and guidance to ensure that the development proposals are in accordance with regional and local requirements;

Undertake an appraisal of flood consequence and identify any mitigation measures to protect the site from flooding, if necessary, to ensure the development is considered to be safe;

Provide a conceptual surface water drainage strategy for the proposed development.

This FCA has been prepared based upon the requirements of Technical Advice Note 15 (TAN15) on Development and Flood Risk. It has been informed by information provided by NRW (Appendix C) and also Ceredigion County Council (Appendix D).

Limitations

The general limitations of this assessment are that:

A number of sources have been used to compile this document, whilst Vectos believe them to be trustworthy; Vectos is unable to guarantee the accuracy of the information that has been provided by others.

This report is based on information available at the time of preparation. Consequently, there is potential for further information to become available. These changes may lead to future alteration to the conclusions drawn in this report for which Vectos cannot be held responsible.

SITE DESCRIPTION

The site is located at No. 33 and 34 Marine Terrace, Aberystwyth, which currently consists of two large residential buildings.

The rear of the properties is occupied by areas of paving and grass. The overall site has an approximate area of 900 m² and is centred at OS grid reference of SN583819. A site location plan is included within the Appendix A.

Site Topography

A topographical survey is available for the rear of the property, which is enclosed in Appendix E. It shows that ground levels at the rear are approximately 4.8m AOD.

Given the absence of surveyed ground level data for the whole site, LiDAR Digital Terrain Mapping (DTM) data was downloaded in order to understand approximate ground levels on Marine Terrace to the front of the properties, and the wider area. This shows ground levels to be approximately 6.2m AOD on Marine Terrace, adjacent to the site.

Ground floor levels of the existing buildings are approximately 0.3m above Marine Terrace. On this basis, existing ground floor levels are estimated to be approximately 6.5m AOD.

Hydrology

There are no watercourses on the site or immediately adjacent to it.

The Penglais Stream is located approximately 1km to the east of the site and is believed to be culverted through Aberystwyth, before it drains into the sea.

The Afon Rheidol flows into the harbour and is located approximately 0.7km to the south of the site.

Geology and Hydrogeology

The British Geological Survey (BGS) 1: 50,000 geological online maps indicate that the bedrock beneath the site is Aberystwyth Grits Group - Sandstone and Mudstone. Superficial deposits beneath the site consist of Alluvium - Clay, Silt, Sand and Gravel.

Available BGS borehole records available for the nearby vicinity of the site confirm that the location is underlain by material consistent with alluvial deposits. Groundwater was identified in some of those boreholes observed at depths of 7-8m below ground level.

Existing Drainage

The existing site is positively drained by down pipes from the roof areas, as well as gullies to the rear. It is assumed that surface water from the site discharges to a public combined sewer, which passes through the rear of the property within the gardens (see Appendix F).

PLANNING POLICY AND GUIDANCE

Planning Policy Wales – TAN 15

Technical Advice Note 15 (TAN15) provides technical guidance in relation to development and flood risk, to supplement the requirements set out in Planning Policy Wales (PPW). It provides a framework within which risks arising from both river and coastal flooding, and from additional surface water run-off associated with development, can be assessed and the consequences of these then considered. Section 8 of TAN15 addresses requirements for the management of surface water from development.

Managing flooding is an important part of contributing towards achieving sustainable development. Paragraph 2.11 of TAN15 advises that the relevant sustainable development considerations must be considered with regards to flood risk:

- Guiding development to locations at little or no risk from river, tidal or coastal flooding or from run off arising from development in any location;
- Managing the consequences of flooding where development can be justified and the consequences are considered to be acceptable;
- Making provision for future changes in flood risk, for example taking account of climate change where they can be anticipated.

The planning authority will need to be satisfied that a development proposal is justified and that the consequences of flooding are acceptable. Where the risks and consequences of flooding cannot be managed to an acceptable level, then developing in these areas should be avoided.

Development Advice Maps

Under the guidance in TAN15, the Welsh Assembly Governments (WAGs) Development Advice Maps (DAMs) are used to determine whether the consequences of a particular frequency of flood event are acceptable for the location of a specific type of development or land use.

There are three DAM Flood Zones (A, B and C) to which are attributed different planning actions, as summarised in the extract of Figure 1 from TAN15 on the following page.

Figure TAN15 – composition and use of different zones

Description of Zone		Use within the precautionary framework
Considered to be at little or no risk of fluvial or tidal/coastal flooding.	A	Used to indicate that justification test is not applicable and no need to consider flood risk further.
Areas known to have been flooded in the past evidenced by sedimentary deposits.	B	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.
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	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.
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	C1	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.
Areas of the floodplain without significant flood defence infrastructure.	C2	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.

The DAM for the area shows that Marine Terrace, i.e. to the front of the existing properties, is located in Zone C2. This is based on the National Resource Wales Extreme Flood Outline (i.e. the 1 in 1000 year return period flood event) and is without significant flood defence infrastructure.

The rear of the existing properties is located in Zone B, which are classified as areas known to have been flooded in the past. This is based on the presence of alluvium, with this a geological index of where flooding historically occurred.

As shown in Figure 1, TAN15 suggests that only Less Vulnerable development should be located in

Zone C2. According to TAN15, residential development is defined as More Vulnerable development, and would not be appropriate in Zone C2. However, these flood extents are investigated in more detail, at a site specific level, in Section 4. This has demonstrated that the site is not located in Zone C2 and therefore that the proposed development is considered to be in accordance with TAN15.

FLOOD CONSEQUENCE ASSESSMENT

Tidal Flood Risk

As discussed earlier in this FCA, the DAMs show the front of the site to be located in Zone C2, whilst the rear is located in Zone B. The DAM is provided for the site in Figure 2. These flood extents are understood to be a result of tidal / coastal flooding.

In order to better understand this tidal flood risk at the site, extreme water levels were obtained from the Environment Agency website, as advised by NRW (refer to Appendix C). These tidal levels are summarised in Table 1.

Return Perio	Present Day	Future (with 100 years of Climate Change)
1 in 100 year	3.81	4.87
1 in 200 year	3.89	4.95
1 in 1000 year	4.06	5.12

Table 1: Extreme Tidal Water Levels – all levels in m AOD

LiDAR Digital Terrain Mapping (DTM) data for the site and surrounding area was obtained from the Lle Geo-Portal for Wales. This data was contoured at 0.25m intervals, which is shown in Figure 3. It shows that Marine Terrace opposite the site is elevated at around 6.2 to 6.3m AOD. The road and adjoining promenade slope downward towards the sea.

The level of Marine Terrace is significantly raised above the extreme water levels. Still water levels are therefore retained to the beach side of the promenade.

The ground floor levels of the existing properties was identified in Section 2, to be approximately 6.5m AOD. This is almost 1.4m above the 1 in 1000 plus 100 years of climate change still water level. The rear of the property, including the basement, is set at a lower elevation. However, this is surrounded by higher ground and there is no pathway for inundation (see Figure 3).

The Ceredigion County Council Aberystwyth Strategic Flood Consequence Assessment (SFCA) was prepared in 2009. It includes 2D flood modelling of the tidal overtopping, which demonstrates 'backdoor' flooding in the proximity of the site, which is sourced from the harbour area. However, the tidal water levels used in the study are greater than that identified above. The 1 in 1000 year with 100 years of climate change level was 5.58m AOD, which is a greater level than the extreme water level identified in Table 1. Considering that the SFRA was prepared in 2009, it is assumed to be out of date and this 'backdoor' flooding is not expected with the most up to date extreme water levels.

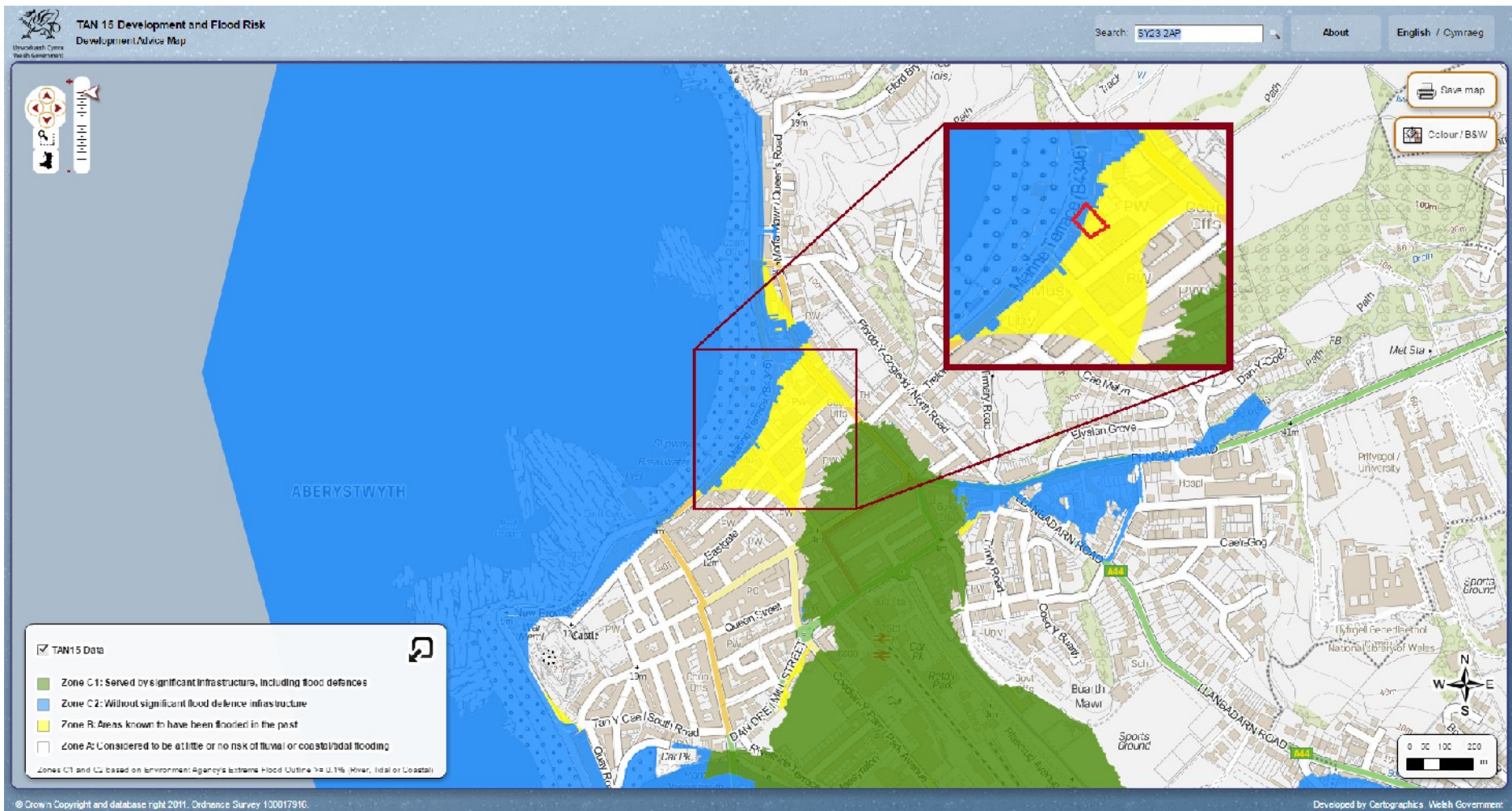


Figure 2 Natural Resource Wales Development Advice Map

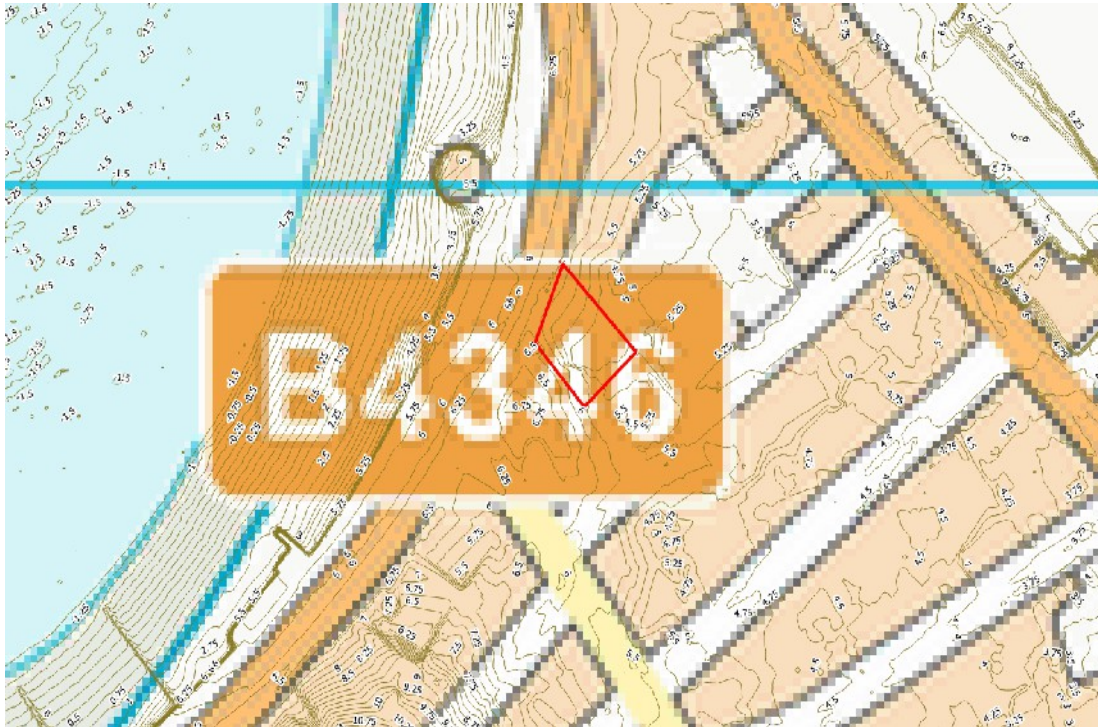


Figure 3: Extreme Tidal Water Levels

Given the above, the site is not considered to be located in Zone C2. Instead it is regarded that Zone B is an appropriate designation for the entire site (based on the presence of alluvium). More Vulnerable development (i.e. residential) is considered to be an appropriate land use in Zone B, as is Less Vulnerable development (i.e. retail).

This source of flooding is therefore considered to be of low risk and does not warrant any further consideration as part of this FCA.

Impact of Waves

The tidal water levels discussed above are still water levels, i.e. they take no account of the impact from waves. Aberystwyth has experienced wave forcing large amounts of spray and sea water onto the promenade in the recent past. This was a result of waves hitting the sea wall adjacent to the promenade.

NRW have confirmed that they have no information with respect to the impact of waves and recommended consultation with Ceredigion County Council.

Ceredigion County Council provided some information to inform this FCA. This information is enclosed in Appendix D. The information relevant to wave overtopping is replicated below:

Wave overtopping in the area of the site has been identified as an issue and that it must be addressed within the Flood Consequences Assessment. Observations of the behaviour of the Aberystwyth promenade under flood conditions due to wave-induced overtopping, indicate that run-back of overtopping water probably plays a significant role in reducing the level of flood damage. For example, during the storm of January 2014, the mean water level at the crest of the defence was exceptionally high, due to set-up effects generated by the incoming long-period waves, combined with a high tidal elevation. Photographs taken at the time supply clear evidence of this fact, whilst other photographs of the same event also show substantial volumes of overtopping water running back into the sea, since the defence generally has no parapet wall that would otherwise trap the flood waters. The promenade also slopes towards the sea and this characteristic, combined with the absence of a parapet wall, means that a substantial volume of water that overtops the defence is easily able to return back to the sea, without flowing into the frontage properties and beyond.

However, given the observations identified by Ceredigion County Council, the impact is somewhat reduced as a result of ground levels etc.

Nevertheless, in very extreme conditions, it is conceivable that a greater volume of water could spill onto the promenade, all of which may not flow back into the sea. In the proximity of the site, the main flow path would be down Terrace Road. Ground levels along Terrace Road, and the surrounding area, fall away from the site towards the harbour and a pathway into the property from the rear is not considered to exist (see Figure 3).

An alternative, less significant, pathway, that could exist, is directly from the front of the property,

via the basement. Therefore, a series of flood mitigation proposals have been identified in Section 5, to further minimise the impact from waves to the proposed development.

Fluvial Flood Risk

The DAMs also show the risk of flooding from fluvial sources. However, at the site, it is understood that the flood zone designation is a result of tidal flooding only. Nevertheless, a Product 4 data request was made to NRW in order to obtain fluvial flood data.

The data consisted of flood model results, which were viewed in GIS software. The data was available for all fluvial sources of flooding in the proximity of the site, which is associated with Afon Rheidol, Penglais Stream and Plasgrug Ditch. Review of the information confirmed that the site is unaffected by fluvial flooding. This is shown in Figure 4.

This source of flooding is therefore considered to be of low risk and does not warrant any further consideration as part of this FCA.



Figure 4: Extreme Fluvial Flood Extents (1 in 1000 year undefended)

entire site (no shading). This has also been confirmed by Ceredigion County Council (refer to Appendix D).

This source of flooding is therefore considered to be of very low risk and does not warrant any further consideration as part of this FCA.

Groundwater Flooding

There is limited local information available providing evidence on groundwater flood risk in Aberystwyth. The SFRA provides no information on groundwater flooding. As discussed in Section 2, available BGS borehole records in the nearby vicinity of the site identified groundwater at depths of 7-8m below ground level. Given this, the likelihood of groundwater emerging at the surface is considered low.

This source of flooding is therefore considered to be of low risk and does not warrant any further consideration as part of this FCA.

Drainage Infrastructure

Drainage infrastructure flooding occurs when sewerage systems are overwhelmed and result in flooding, which may occur alone or be combined with other flood sources (e.g. fluvial or surface water).

A 300mm combined sewer passes through the rear of the site. The volume of flood water that could emanate from this source is considered to be relatively small and the likelihood of flooding is low, but were it to occur, the consequences would be moderate.

The 300mm combined sewer connects to a larger network to the south. If flooding from the larger network was to occur, ground levels fall in a southerly direction towards the harbour and any floodwater would be conveyed away from the site.

Flood risk associated with this source is anticipated to be low to moderate.

Non-Natural or Artificial Sources

Non-natural or artificial sources of flooding can include reservoirs, lakes, canals etc.

According to the NRW Risk of Flooding from Reservoirs Map, the development site (and surrounding area) is located within the reservoir flood inundation zone from reservoirs that are located upstream of Aberystwyth. The information provided by NRW to accompany the reservoir risk map has been copied below.

“Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in Wales, we ensure that reservoirs are inspected regularly and essential safety work is carried out.”

Based on this guidance from NRW, whilst the site is located within the reservoir flood inundation zone, the actual risk from reservoir flooding is considered to be low and has not been considered any further within this FCA.

No other artificial sources of flooding are known to exist in the vicinity of the site. Given the above, flood risk from this source is considered to be low and does not warrant any further consideration as part of this FCA.

FLOOD MITIGATION

The majority of flood sources at the site have been identified to be low or negligible and flood risk mitigation measures are not required. However, the impact from waves results in a different mechanism that could affect the proposed development.

The proposed development has been modified from that originally discussed with NRW, to reduce the consequence of flooding, and to allow flood mitigation measures to be incorporated.

This will include the following:

There will be no self-contained residential units on basement or ground floor levels.

All sleeping accommodation will be located at the first floor or above.

The basement will be utilised for car parking (No. 34) and non-sleeping accommodation (No. 33).

Demountable defence barriers will be incorporated to protect openings into the building. This would most likely involve the installation of slots either side of windows and doorways, at least on the ground floor, and below, into which water-tight barriers are slotted during times of flood risk.

It is recommended that the wall to the front of the properties is raised, with the existing cast iron railings then replaced at a higher level. This will help to reduce a pathway of spray to the basement level.

The ground floor, and in particular, the basement level will be constructed using flood resilient measures throughout, to minimise damage, if in the event, the wider measures discussed above, are not entirely successful. It is recommended that this is considered as part of the detailed design.

A Flood Emergency Plan will be prepared, once planning has been granted. As part of this, all occupants should sign up to the free flood warning service, so are aware of incoming storms and can initiate appropriate procedural requirements, such as moving cars, and placing barriers in the slots.

The measures identified above will also offer protection in the unlikely event of flooding from

public sewers, to the rear of the property.

It should be noted that whilst the current properties are disused, the existing basements were habitable space. As part of the conversion, the incorporation of flood resilient measures is considered an improvement to the existing conditions on site.

SURFACE WATER DRAINAGE

Overview

Runoff from developments can, if not properly controlled, result in flooding at other locations and significantly alter the frequency and extent of floods further down the catchment. Built development tends to increase the surface area of impermeable ground, this has the effect of reducing the time it takes for precipitation to enter the watercourse and consequently increasing the peak discharge. Guidance on surface water runoff from development is given in TAN15 and the Non-Statutory Standards for SuDS in Wales.

This FCA demonstrates how the surface water runoff regime can be managed to meet these policy requirements.

Given that the proposals consist of the conversion of existing properties, which are already accommodated by a surface water drainage arrangement, the proposed development will result in a negligible impact upon the existing surface water runoff regime. A small amount of garden may be lost with the formation of parking and access. However, the parking areas will be constructed using permeable materials, which will allow infiltration into the ground, similar to the existing conditions.

Furthermore, it is recommended that some water will be collected from roof surfaces by newly installed water butts for the watering of garden plant etc.

Excess rainfall will be directed to the existing private drainage arrangement, similar to the present conditions.

A detailed design of the drainage arrangements discussed above is recommended, once planning has been granted.

CONCLUSIONS

A Flood Consequence Assessment (FCA) has been prepared for the proposed conversion of No. 33 and 34 Marine Terrace, Aberystwyth, to a series of residential and retail properties.

According to the Development Advice Maps (DAMs), the site is shown to be partially located in Zone C2 and therefore this FCA was required to support the planning submission. Zone C2 is based on the National Resource Wales Extreme Flood Outline (i.e. the 1 in 1000 year return period flood event) and is without significant flood defence infrastructure.

At this location, Zone C2 is attributed to tidal sources of flooding. A review of ground level and extreme tidal level data has suggested that the site is located outside of Zone C2. The proposed development is therefore considered acceptable in accordance with the requirements of TAN15.

However, Marine Terrace is known to experience wave overtopping, which could impact the proposed development. Ceredigion County Council have provided information to demonstrate that the impact of waves is reduced as a result of Marine Terrace and the adjoining promenade sloping towards the sea. However, a series of mitigation measures have been suggested for the proposed development to further reduce the impact from waves.

All other sources of flooding were assessed to represent a low or negligible risk.

An existing surface water drainage arrangement is already in place for the properties, which will be retained. New parking arrangements to the rear will be constructed using permeable materials, to allow rainfall to infiltration into the ground.

APPENDIX A

Site Location

APPENDIX B

Existing and Proposed Drawings

APPENDIX C

Natural Resource Wales Correspondence

APPENDIX D

Ceredigion County Council Correspondence

APPENDIX E

Topographic Survey

APPENDIX F

DCWW Sewer Plans