

BRIDGEMAN HOUSE, BANGOR-ON-DEE

FLOOD CONSEQUENCES ASSESSMENT

Final Report v1.0

February 2020

Report Title **Bridgeman House, Bangor-on-Dee**
Flood Consequences Assessment
Final Report v1.0

Client Mr J Cox

Date of issue 6 February 2020

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This document has been prepared solely as a Flood Consequences Assessment for Mr J Cox. This report is confidential to Mr J Cox and Weetwood Services Ltd accepts no responsibility or liability for any use that is made of this document other than by Mr J Cox for the purposes for which it was originally commissioned and prepared.

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by Mr J Cox to prepare a Flood Consequences Assessment (FCA) report to accompany a planning application for the proposed development at Bridgeman House, Bangor-on-Dee.

The site benefits from an extant planning permission (Ref: P/2004/0361 and P/2013/0801) for the conversion of an existing outbuilding, which Wrexham County Borough Council (WCBC) acknowledge has been implemented. The planning application now submitted, therefore relates only to amendments to the design of the conversion and extension.

Within its consultation letter dated 20 December 2019¹, Natural Resources Wales (NRW) acknowledge the above and state that *"the proposed development should be supported by a proportionate flood consequences assessment"*.

This report has been prepared recognising the above and has been undertaken in accordance with the requirements of Technical Advice Note 15 (TAN15).

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

- | | |
|------------------|--|
| Section 1 | Introduction and report structure |
| Section 2 | Presents national and local flood risk and drainage planning policy |
| Section 3 | Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements |
| Section 4 | Assesses the potential sources of flooding to the development site |
| Section 5 | Presents flood risk mitigation measures based on the findings of the assessment |
| Section 6 | Addresses the effect of the proposed development on surface water |
| Section 7 | Presents a summary of key findings |
| Section 8 | Presents the recommendations |

¹ Ref: CAS-101559-G6X6

2 PLANNING POLICY AND GUIDANCE

2.1 NATIONAL PLANNING POLICY AND GUIDANCE

2.1.1 Technical Advice Note 15

The general approach of TAN15 is to set out a precautionary framework to guide planning decisions in areas at high risk of flooding. The overarching aim of the framework is, in order of preference, to:

- Direct new development away from those areas which are at a high risk of flooding.
- Where development has to be considered in high risk areas (i.e. Zone C) only those development which can be justified should be located in such areas.

2.1.1.1 Justification Test

In accordance with Paragraph 6 of TAN15 for the Justification Test to be passed it must be demonstrated 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 Planning Policy Wales (PPW) and meets the definition of previously developed land (PPW Fig 2.1); and,
- iv. The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.

2.1.1.2 Surface Water Drainage

TAN15 provides an overview of the requirements for the management of surface water to ensure that development does not increase flood risk at the site or elsewhere.

Paragraph 8.3 of TAN15 states that *"the aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce runoff where possible. It is accepted that there may be practical difficulties in achieving this aim"*.

2.1.2 Welsh Government

2.1.2.1 Climate Change Allowances for Planning, August 2016

A consultation letter² and supporting guidance note³ issued by Welsh Government in August 2016 sets out allowances for climate change for use in FCAs submitted in support of planning applications.

² Welsh Government consultation letter 23 August, 2016 (Ref: CL-03-16)

When considering new development proposals, TAN15 states that it is necessary to take account of the potential impact of climate change over the lifetime of development. The Welsh Government guidance note states that *"residential development is assumed to have a lifetime of 100 years while a lifetime of 75 years is assumed for non-residential developments. To ensure future development can provide a safe and secure living and /or working environment throughout its lifetime, national planning policy requires proposals in areas of high flood risk to be accompanied by an assessment of flooding consequences to and from the development, taking into account the impacts of climate change"*.

The climate change allowances detailed within the Welsh Government guidance note are informed by latest available information on climate change projections and allowances are provided for different epochs (periods) of time over the next century.

The guidance note should be applied to planning applications (full, outline and reserved matters) submitted from 1 December 2016.

2.1.2.2 Non-Statutory Standards for Sustainable Drainage in Wales

National policy requires that planning applications for all new development proposals should provide Sustainable Drainage Systems (SuDS) for the management of surface water runoff, wherever they will be effective.

Recommended non-statutory standards for SuDS were published by Welsh Government in 2017 in relation to the design, construction and operation of SuDS serving new developments of more than one house or larger than 300 m² floorspace. In addition, guidance states that clear arrangements must be in place for ongoing maintenance of the drainage system for the lifetime of the development.

Standard S2 'Surface water runoff and hydraulic control' of the Sustainable Drainage Systems Standards for Wales⁴ aim is to manage the surface water runoff from and on a site to protect people on the site from flooding from the drainage system for events up to a suitable return period, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage.

Surface water drainage systems should be designed so that:

- Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5 mm
- The surface water runoff rate for the 1:1 annual probability event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the development runoff on the morphology and associated ecology of the receiving surface water bodies.
- The surface water runoff (rate and volume) for the 1:100 annual probability event (or agreed equivalent) should be controlled to help mitigate negative impacts of the development on flood risk in the receiving water body.
- The surface water runoff for events up to the 1:100 annual probability (or agreed equivalent) should be managed to protect people and property on and adjacent to the site from flooding from the drainage system.
- The risks (both on site and off site) associated with the surface water runoff for events greater than the 1:100 annual probability should be considered. Where

³ <https://gov.wales/docs/desh/publications/160831guidance-for-flood-consequence-assessments-climate-change-allowances-en.pdf>

⁴ <http://gov.wales/docs/desh/publications/151230-suds-standards-en.pdf>

the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.

- Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

2.2 LOCAL PLANNING POLICY AND GUIDANCE

2.2.1 Unitary Development Plan, February 2005

The WCBC Unitary Development Plan (UDP) is the adopted development plan for the 15 year period running from 1996 to 2011. Although the adopted UDP expired at the end of 2011, it remains the adopted development plan for the county.

The following policies are relevant in respect of flood risk and drainage:

Policy GDP1: Development Objectives

All new development should:-

Ensure safe and convenient pedestrian and vehicular access to and from development sites, both on site and in the nearby locality.

Ensure that development does not result in, or is subject to, flooding, soil erosion, landslides or contamination, either on or off the site.

Policy EC12; Development and Flood Risk

Development (including the raising of land) within defined flood plains will only be permitted if it:-

- would not be subject to an unacceptable risk of flooding on-site; and/or
- does not result in an unacceptable risk of flooding on or off-site; and/or
- does not adversely affect flood management or maintenance schemes

2.3 CONSENTS

An Environmental Permit for Flood Risk Activities may be required from NRW for work:

- In, under, over or near a main river (including where the river is in a culvert)
- On or near a flood defence on a main river
- In the flood plain of a main river
- On or near a sea defence

Further information can be found at <https://naturalresources.wales/apply-for-a-permit/flood-risk-activities/flood-risk-activity-permits-information/?lang=en>.

If the location of an activity is on any watercourse that lies within an Internal Drainage District (IDD) an application will need to be made to NRW for a Flood Risk Activity Permit. Ordinary Watercourse Consent may be required from the lead local flood authority for work to an ordinary watercourse. Undertaking activities controlled by local Byelaws (made under the Water Resources Act 1991) also requires the relevant consent.

2.4 RELEVANT DOCUMENTS

The assessment has been informed by the following documents:

- Preliminary Flood Risk Assessment (PFRA), WCBC, 2011

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The approximately 0.3 hectare (ha) site is located north of Station Road at Ordnance Survey National Grid Reference SJ 388 455, as shown in **Figure 1**.

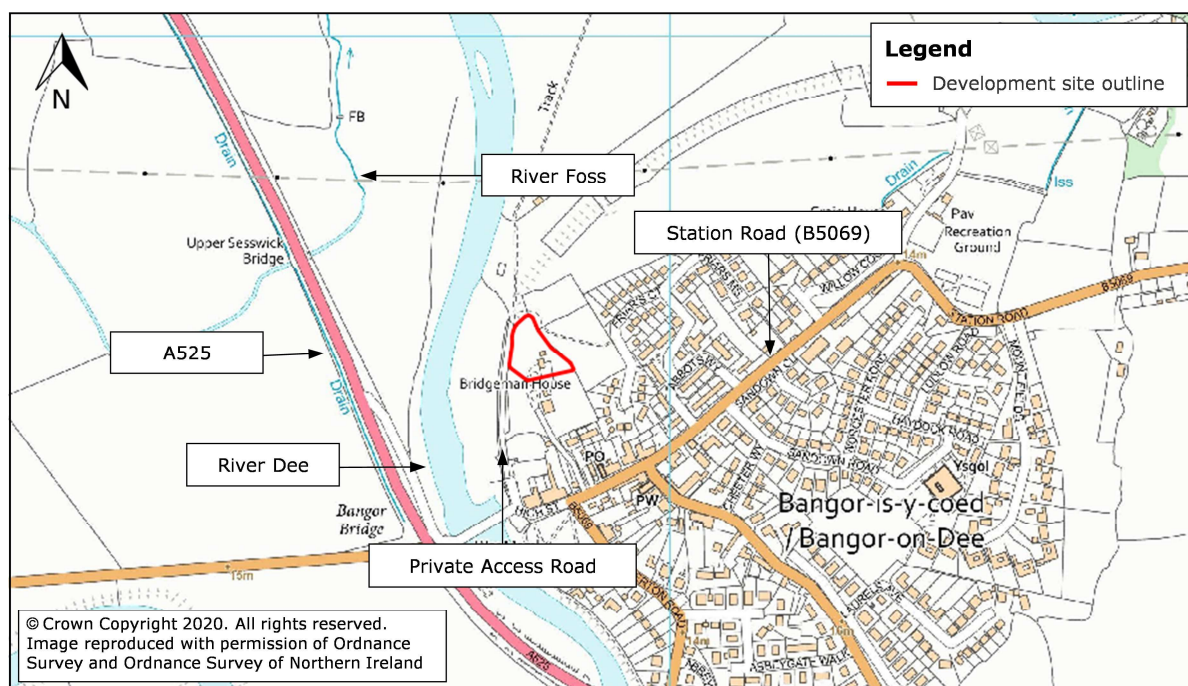


Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The site currently comprises of a residential dwelling (converted outbuilding) and standalone garage, with the latter currently in the process of being converted in accordance with the extant planning permission.

Proposals are for amendments to the design of the conversion to include a link (36 m²) between the existing dwelling and garage conversion (**Appendix A**).

TAN15 classifies residential development as 'highly vulnerable' land use.

3.3 WATERBODIES IN THE VICINITY OF THE SITE

The locations of waterbodies within the vicinity of the site have been identified in **Figure 1**.

The River Dee flows in a northerly direction approximately 65 metres (m) west of the site and is classified as a main river.

The River Foss flows in a north-easterly and then northerly direction approximately 213 m north-west of the site, to the west of the River Dee, and is classified as a main river. The River Foss outfalls to the River Dee approximately 530 m downstream of the site.

3.4 GROUND CONDITIONS

National Soils Research Institute mapping⁵ classifies soil conditions at the site and within the surrounding area as 'freely draining slightly acid loamy soils'.

British Geological Survey (BGS) borehole records⁶ located along the eastern boundary of the site indicate that gravel and sand are interlaid between the depths of 3.96 to 16.45 m below ground level (bgl), overlaying sand and clay interlaid between the depths of 16.45 to 60.96 m bgl.

BGS Surface Geology mapping⁷ indicates the underlying bedrock formation comprises 'Kennerton Sandstone Formation - Sandstone', which is overlain by 'Alluvium - Clay, Silt, Sand and Gravel' superficial deposits.

3.5 SITE LEVELS

LiDAR data has been used to develop a digital elevation model of the site as illustrated in **Figure 2**.

This indicates that ground levels across the site are in the region of 14.1 to 16.8 metres Above Ordnance Datum (m AOD). Levels within the vicinity of the proposals are in the region of 15.3 to 15.4 m AOD.



Figure 2: LiDAR

3.6 ACCESS AND EGRESS

Access and egress is gained via a private access road off Station Road to the west of the site. LiDAR data indicates that levels along the private access road and Station Road are in the region of 15.6 – 17.0 and 14.3 – 15.2 m AOD respectively.

⁵ www.landis.org.uk/soilscapes/

⁶ www.bgs.ac.uk/data/boreholescans/home.html, Ref: SJ34NE4

⁷ <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

4 REVIEW OF FLOOD RISK

4.1 FLOOD ZONE DESIGNATION

Flood zones refer to the probability of river and sea flooding. TAN15 defines flood zones as follows:

- Zone A: Considered to be at little or no risk of fluvial or tidal/coastal flooding.
- Zone B: Areas known to have been flooded in the past evidenced by sedimentary deposits.
- Zone C: Based on [the Natural Resources Wales] flood outline, equal to or greater than 0.1% (river, tidal or coastal). Zone C is subdivided into the following two zones:
 - Zone C1: Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.
 - Zone C2: Areas of the floodplain without significant flood defence infrastructure.

The flood zones are shown on the Development Advice Map. The zones do not account for possible future changes in flooding due to the impact of climate change or the presence of flood defences (although areas benefitting from flood defences may be indicated).

According to the Development Advice Map (**Figure 3**) the site is located in Zone C1.

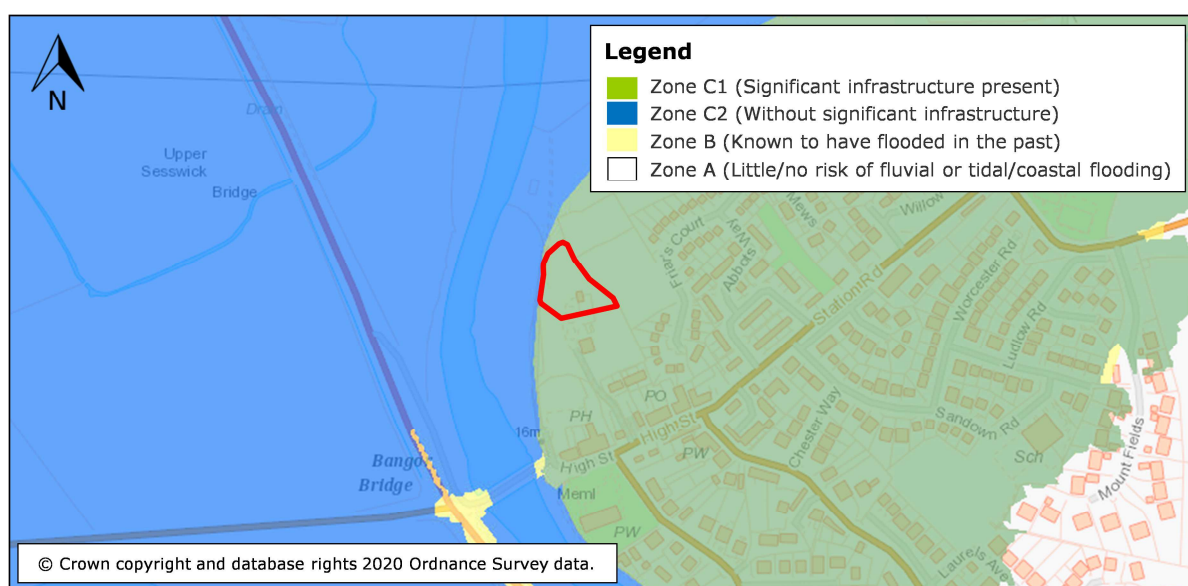


Figure 3: Development Advice Map
(Source: NRW website)

The Flood Risk Map (Rivers and Sea) (**Figure 4**) indicates that the site is located in the defended 1:100 fluvial / 1:200 tidal annual probability flood outline, thereby supporting the sites Zone C1 designation.

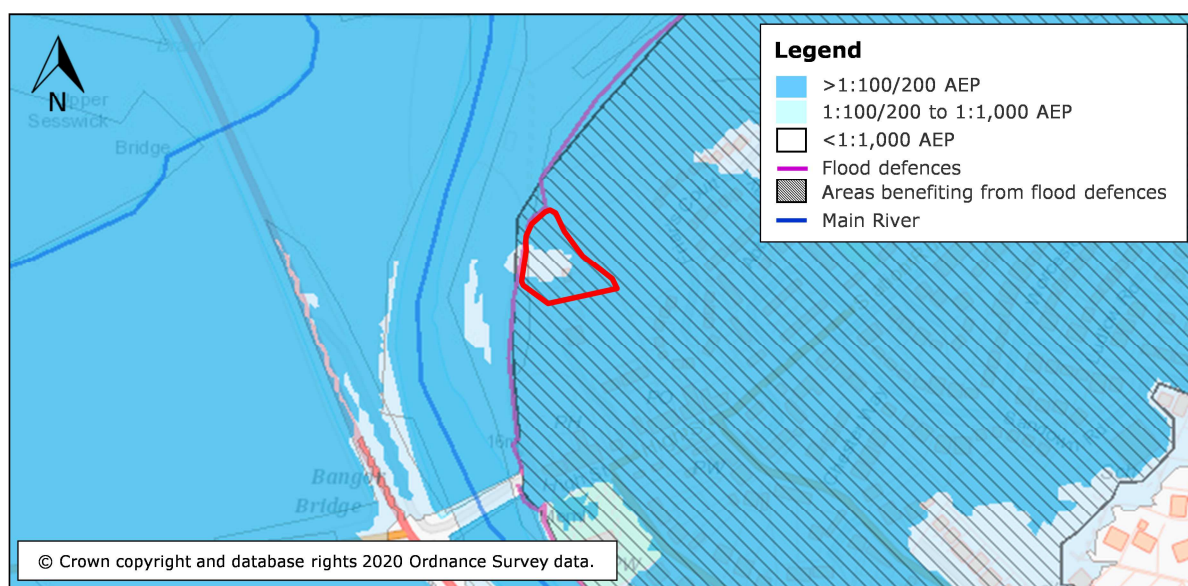


Figure 4: Flood Risk Map (Rivers and Sea)
(Source: NRW website)

4.2 JUSTIFICATION TEST

The site currently benefits from an extant planning permission. It is therefore assumed that the planning requirements of the justification test have already been met.

This report aims to address point iv of the justification test.

4.3 HISTORICAL RECORDS OF FLOODING

The NRW historic flood outlines database⁸ indicates that two historic flood events have impacted the surrounding area, one in January 1964 and the other in November 2000, both caused by water levels exceeding the banks; the spatial flood defence database indicates that there were no flood defences present before 2003.

No further details are provided regarding the depths of flooding that may have been experienced.

⁸ <http://lle.gov.wales/catalogue/item/HistoricFI/?lang=en>



Figure 5: NRW Historic Flood Outlines

4.4 FLUVIAL FLOOD RISK – RIVER DEE

As detailed in **Section 3.3**, the River Dee is located approximately 65 m west of the site and flows in a northerly direction.

4.4.1 Flood Defences

Flood Defences are present along the River Dee (**Figure 6**). Within the vicinity of the site, these comprise a clay embankment, with a crest level ranging between 15.54 and 16.94 m AOD. Reinforced concrete walls, with a crest level of 16.65 m AOD are also located south of the site, either side of the Bangor Bridge.

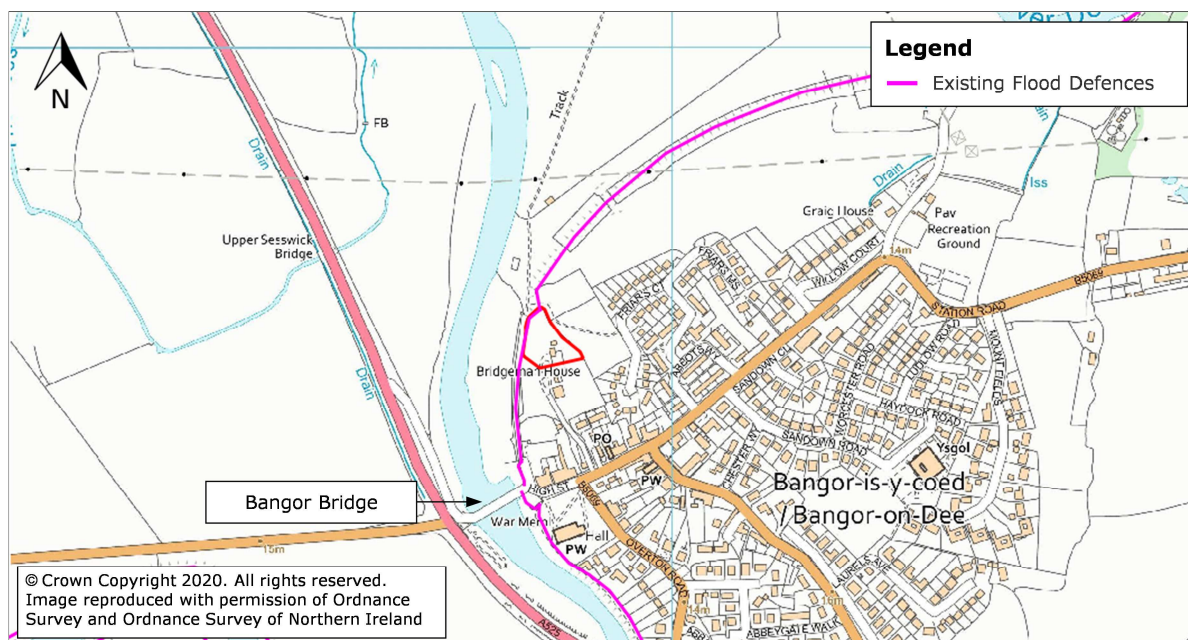


Figure 6: Existing River Dee Flood Defences

4.4.2 Modelled Flood Extents

Modelled defended flood extents for the River Dee have been provided by NRW for the 1:100, 1:100 plus 20% climate change (+CC) and 1:1,000 annual probability events as taken from the 'River Dee at Bangor-on-Dee Flood Risk Mapping Study' (May 2012). These are presented in **Figure 7** and indicate that the site and private access road are expected to remain dry in all of the aforementioned events.

Station Road is also expected to remain dry in the 1:100 and 1:100 +CC (20%) annual probability flooding event. Some flooding may be expected over a section of the road to the east of the site during the 1:1,000 annual probability event; however, based upon an interrogation of the modelled outputs provided by NRW, flood depths would not be expected to exceed 0.26 m.

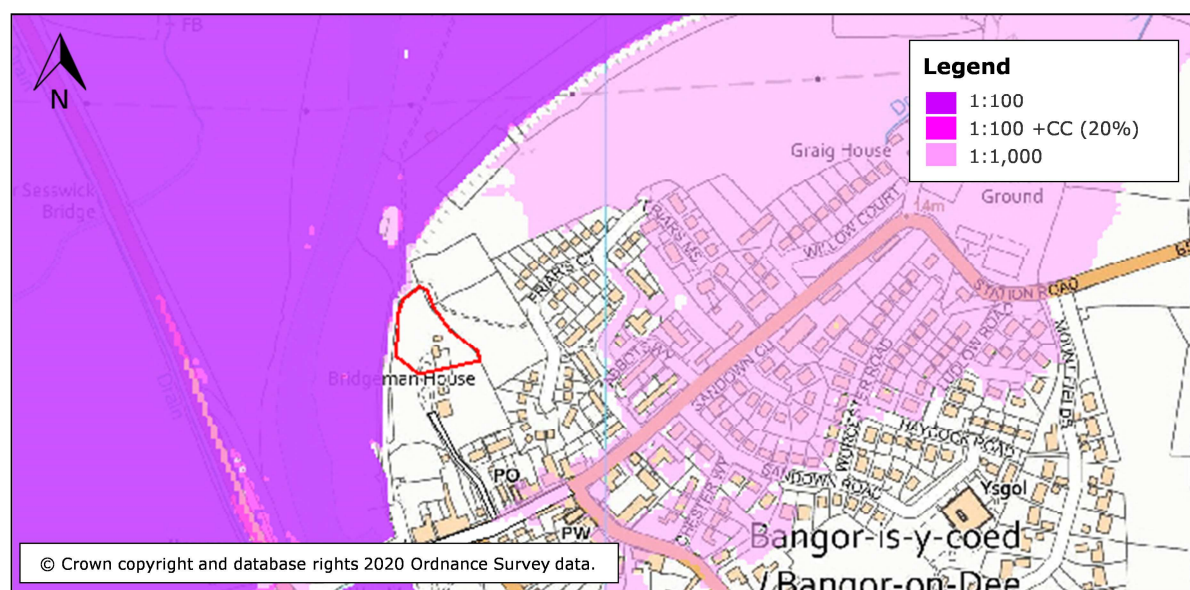


Figure 7: Modelled Flood Extents – Defended
(Source: River Dee at Bangor-on-Dee Flood Risk Mapping Study, May 2012)

4.4.2.1 Breach

A breach of the existing flood defences has also been assessed by NRW as part of the 'River Dee at Bangor-on-Dee Flood Risk Mapping Study' (May 2012) for the 1:100 annual probability event.

The breach location⁹ and the modelled outputs are provided in **Figure 8**.

Table 1 summarises the depth of floodwaters that may be expected during the aforementioned breach scenario.

The private access road is expected to remain dry during the 1:100 annual probability breach event.

Table 1: Flood Information - Breach (Baseline)
(Source: River Dee at Bangor-on-Dee Flood Risk Mapping Study, May 2012)

Location	Depth (m)
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⁹ Location B2

	Highest	Mean
Site	1.31	0.62
Station Road	1.42	1.12

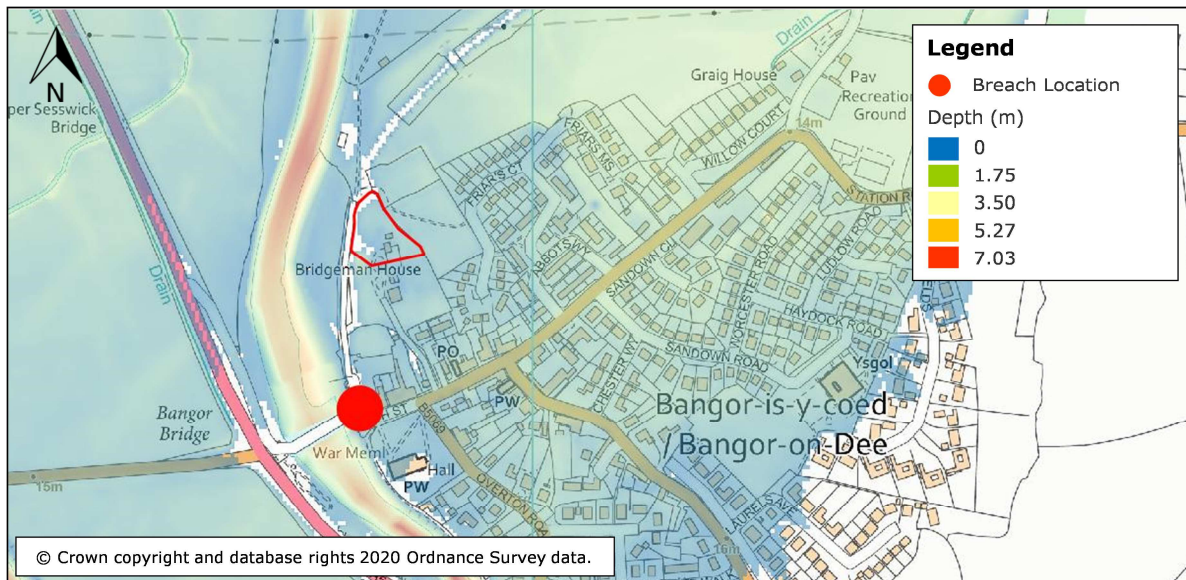


Figure 8: Modelled Flood Depth - Breach
(Source: River Dee at Bangor-on-Dee Flood Risk Mapping Study, May 2012)

4.4.2.2 Blockage

A blockage assessment of the Old Dee Bridge was undertaken as part of the 'River Dee at Bangor-on-Dee Flood Risk Mapping Study' (May 2012) for the 1:100, 1:100 +CC (20%) and 1:1,000 annual probability events. The modelled outputs indicate that there is very little change to the predicted extents of flooding; as such the site and the private access road are expected to remain dry during all scenarios.

4.5 FLUVIAL FLOOD RISK - RIVER FOSS

As detailed in **Section 3.3**, the River Foss is located approximately 213 m north-west of the site and flows in a northerly direction, outfalling into the River Dee approximately 530 m downstream of the site.

No modelled data is available for the River Foss. However, given the intervening infrastructure between the site and the watercourse, most notably the River Dee and its associated defences, this is not expected to pose a risk to the proposed development.

This is further reiterated by the Surface Water Flood Risk map (**Figure 9**), which indicates that there is no anticipated flood risk from this source in up to a 1:1,000 annual probability event.

4.6 FLOOD RISK FROM SURFACE WATER

The Surface Water Flood Risk map (**Figure 9**) indicates the majority of the site is at 'very low' risk, with an area along the eastern boundary at 'low' risk. Potential depths and velocities within the low risk area are expected to remain below 0.3 m and 0.25 m/s respectively.

A 'medium' risk of surface water flooding is shown along the access via Station Road to the east of the site. Depths and velocities are shown to remain less than 0.3 m but exceed 0.25 m/s.

Dŵr Cymru Welsh Water (DCWW) has as advised¹⁰ that it does not hold any records of sewer flooding at the site or within the surrounding area.

WCBC has been contacted¹¹ to determine whether it holds any records of highways flooding at the site or within the surrounding area. At the time of writing a response is awaited.

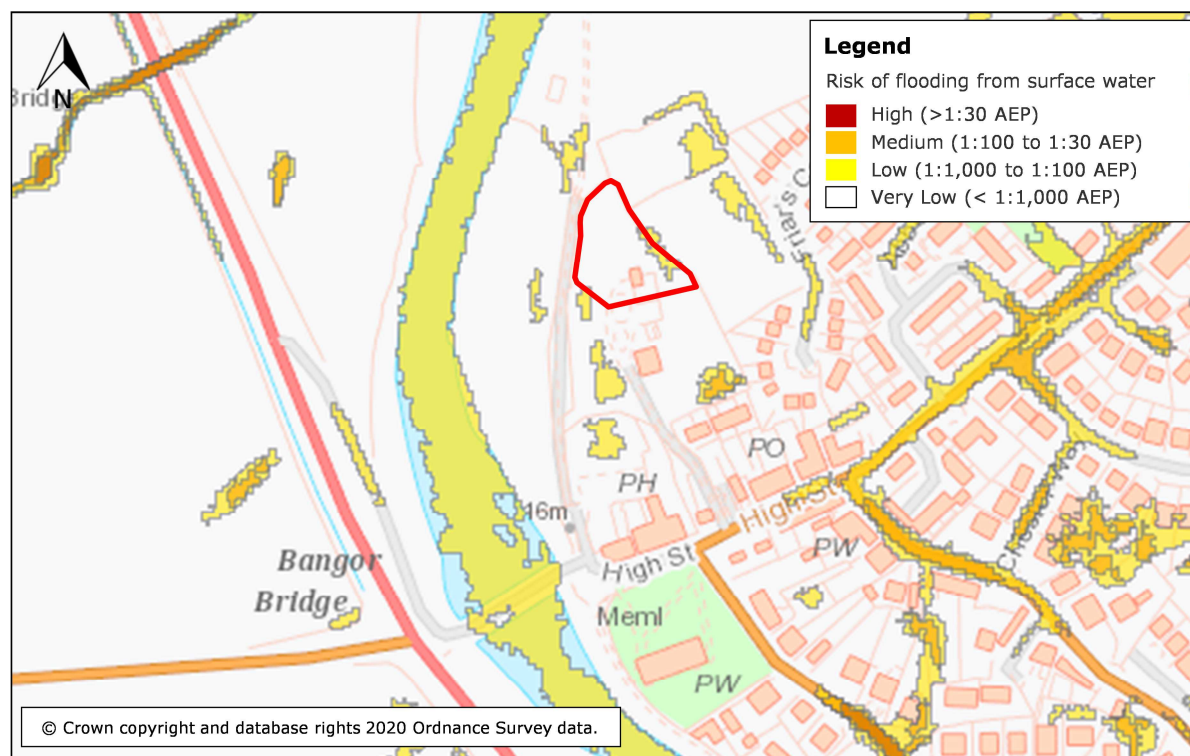


Figure 9: Surface Water Flood Risk
(Source: NRW website)

4.7 FLOOD RISK FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

The Reservoir Flood Risk map (**Figure 10**) indicates that the site is at risk associated with the River Dee. This risk has been assessed in **Section 4.4**.

The site is not shown to be at risk from canals or reservoirs.

¹⁰ Email from DCWW to Weetwood dated 17 January 2020

¹¹ Email from Weetwood to WCBC dated 9 January 2020

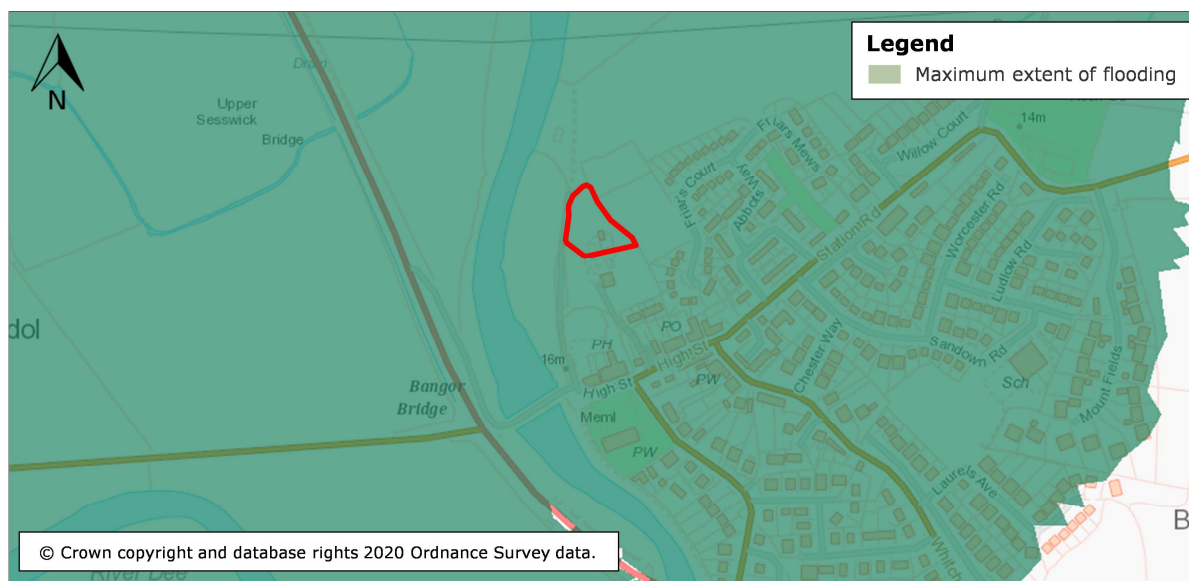


Figure 10: Reservoir Flood Risk
(Source: NRW website)

4.8 FLOOD RISK FROM GROUNDWATER

As detailed in **Section 3.4** ground conditions at the site and within the surrounding area are described as freely draining slightly acidic loamy soils. There may therefore be the propensity for some groundwater flooding.

According to the BGS Groundwater Flooding Hazard map (**Figure 11**) the susceptibility to groundwater flooding is significant.

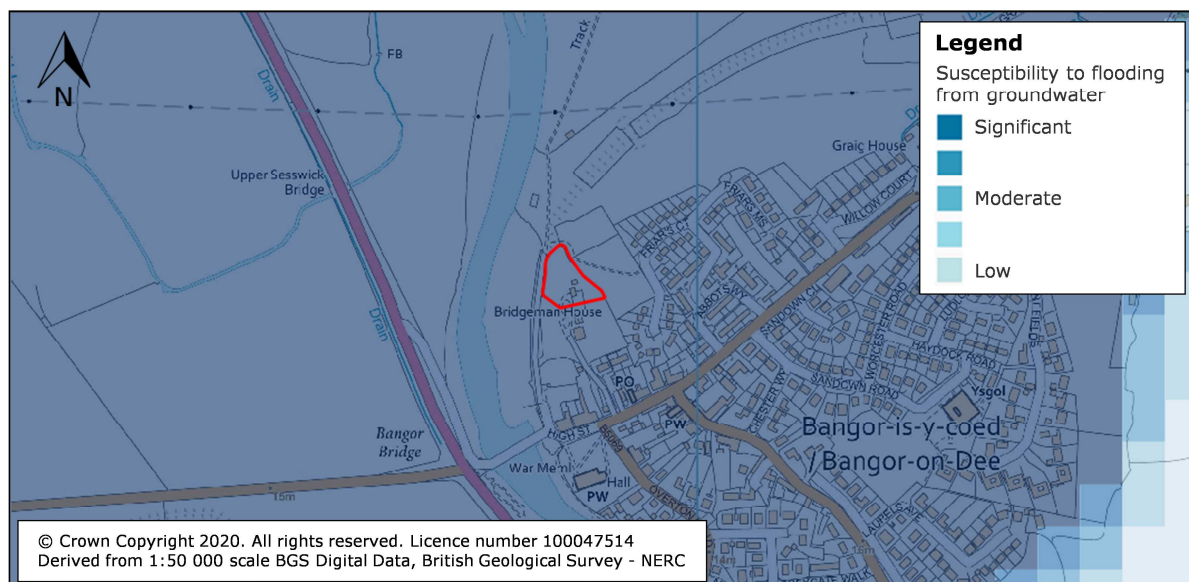


Figure 11: Groundwater Flooding Hazard Map
(Source: Findmaps)

5 FLOOD RISK MITIGATION MEASURES

The flood risk to the site from a breach of the River Dee defences and any residual risk associated with surface water and groundwater will be mitigated through the implementation of the measures proposed within the following section of this report.

5.1 FINISHED FLOOR LEVELS

As detailed in **Section 3.2** the planning application relates to the proposed link between the existing dwelling and garage conversion. As such, it is not possible for the finished floor level to be raised. This should therefore be set no lower than the existing ground floor finished flood level of the existing buildings.

5.2 FLOOD RESISTANT AND RESILIENT CONSTRUCTION

Flood resistant and resilient construction techniques should be incorporated into the design of the proposed extension and, where feasible, should also be retrofitted to the existing buildings up to a minimum of 1.61 m above existing ground level. This is accounts for the 1:100 annual probability breach event including 0.3 m for any uncertainties with the 1:1,000 annual probability breach event.

Flood resistant features, such as the use of flood barriers on external doors should be incorporated to a height of 0.6 m to minimise the entry of water into the building during a breach event. Flood resilient construction techniques should be utilised to reduce the damage in the event of the development being inundated.

5.3 FLOOD RISK ELSEWHERE

Any proposal to modify ground levels should demonstrate that there is no increase in flood risk to the development itself, or to any existing buildings which are known to, or are likely to flood.

In accordance with A1.2 of TAN15 the consequences of the development on flood risk elsewhere should be assessed for up to the 1:1,000 annual probability event. It is understood that NRW seek to ensure that, where necessary, climate change and breach and blockage scenarios are considered for assessing the impact on flood risk elsewhere.

No flooding of the site is expected as a result of overtopping of the River Dee flood defences in up to a 1:1,000 annual probability event. Flooding of the site may be expected from a breach of the flood defences; however, the site benefits from extant planning permission and given the scale of the amendments (36 m²), any potential impact on flood risk elsewhere would be considered negligible.

5.4 ACCESS AND EGRESS

Dry access and egress can be provided via Station Road in up the 1:100 +CC (20%) annual probability River Dee overtopping event. Some flooding may be expected over a section of Station Road to the east of the site during the 1:1,000 annual probability overtopping event; however, flood depths would not be expected to exceed 0.26 m.

Flooding of the access and egress route would also be expected during a 1:100 annual probability River Dee breach event.

A 'medium' risk of surface water flooding is shown along the access via Station Road to the east of the site. Depths and velocities are shown to remain less than 0.3 m but exceed 0.25 m/s.

5.5 FLOOD PLAN

It is recommended that a Flood Plan is prepared in consultation with WCBC emergency planning team.

The objectives of the plan would be to:

- Ensure all residents are aware of the potential risk of flooding and the procedures that should be implemented in the event that flooding is expected or has occurred
- Reduce the risk to property and life
- Reduce the likelihood of anyone entering flood waters
- Reduce the likelihood of a disorganised response to potential or actual flooding

This would be achieved by setting out the measures that would need to be taken in the event that potential flooding is forecast, during flooding and following an 'all-clear' notification. The plan would achieve this by:

- Summarising the roles and responsibilities for flood response and management
- Describing how flood warnings are issued, flood warning codes and what they mean, and other sources of flood information
- Setting out how to respond safely in the event that flooding is forecast or occurs

The site is included in an NRW flood alert and warning area (**Figure 12**). This provides the opportunity for the relevant response procedures set out in the Flood Plan to be invoked in response to receipt of a flood warning from NRW.

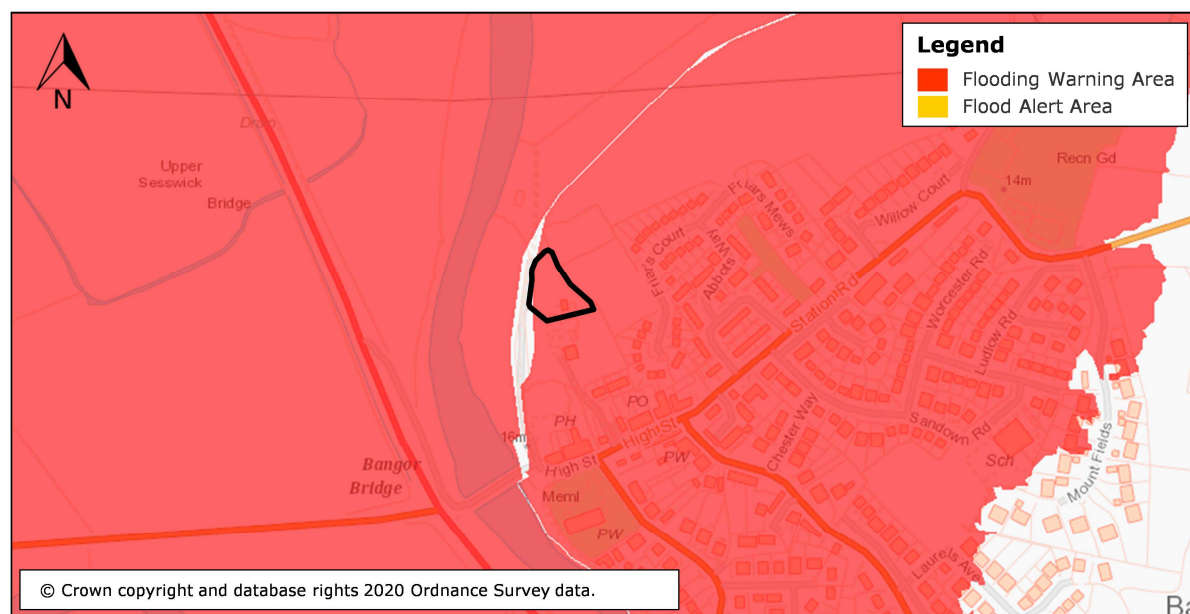


Figure 12: Flood Warning Areas
(Source: NRW website)

6 SURFACE WATER MANAGEMENT

Given the nature of the proposals (i.e. a 36 m² link between the existing dwelling and garage conversion) this should not affect the current surface water drainage arrangement at the site.

7 SUMMARY

This report has been prepared on behalf of Mr J Cox and relates to the proposed development at Bridgeman House, Bangor-on-Dee.

The site benefits from an extant planning permission for the conversion of an existing outbuilding, which has been implemented. The planning application now submitted, therefore relates only to amendments to the design of the conversion and extension.

According to the Flood Risk Map (Rivers and Sea) the proposed development is located within the defended 1:100 fluvial annual probability flood outline and is therefore defined by TAN15 as being situated within Zone C1.

The site currently benefits from an extant planning permission. It is therefore assumed that the planning requirements of the justification test have already been met. This report aims to address point iv of the justification test.

The River Dee is located approximately 65 m west of the site. No flooding of the site is expected from this source in up to a 1:1,000 annual probability overtopping event. Some flooding of the site may be expected during the 1:100 annual probability breach event, with maximum flood depths on site reaching 1.31 m.

The Surface Water Flood Risk map indicates that the majority of the site is at 'very low' risk, with a small portion of the eastern boundary at 'low' risk.

There may be some susceptibility to groundwater flooding at the site.

The finished floor level should be set no lower than the existing buildings, given that proposals are for a link between two existing buildings on site.

Flood resistance and resilience construction techniques should be incorporated into the design of the proposed link and, where feasible, retrofitted to the existing buildings up to a minimum of 1. m above existing ground level.

The proposal is not expected to impact flood risk elsewhere.

Dry access and egress may be provided via Station Road in up to 1:100 +CC (20%) annual probability overtopping event.

A Flood Plan should be prepared in consultation with WCBC emergency planning team.

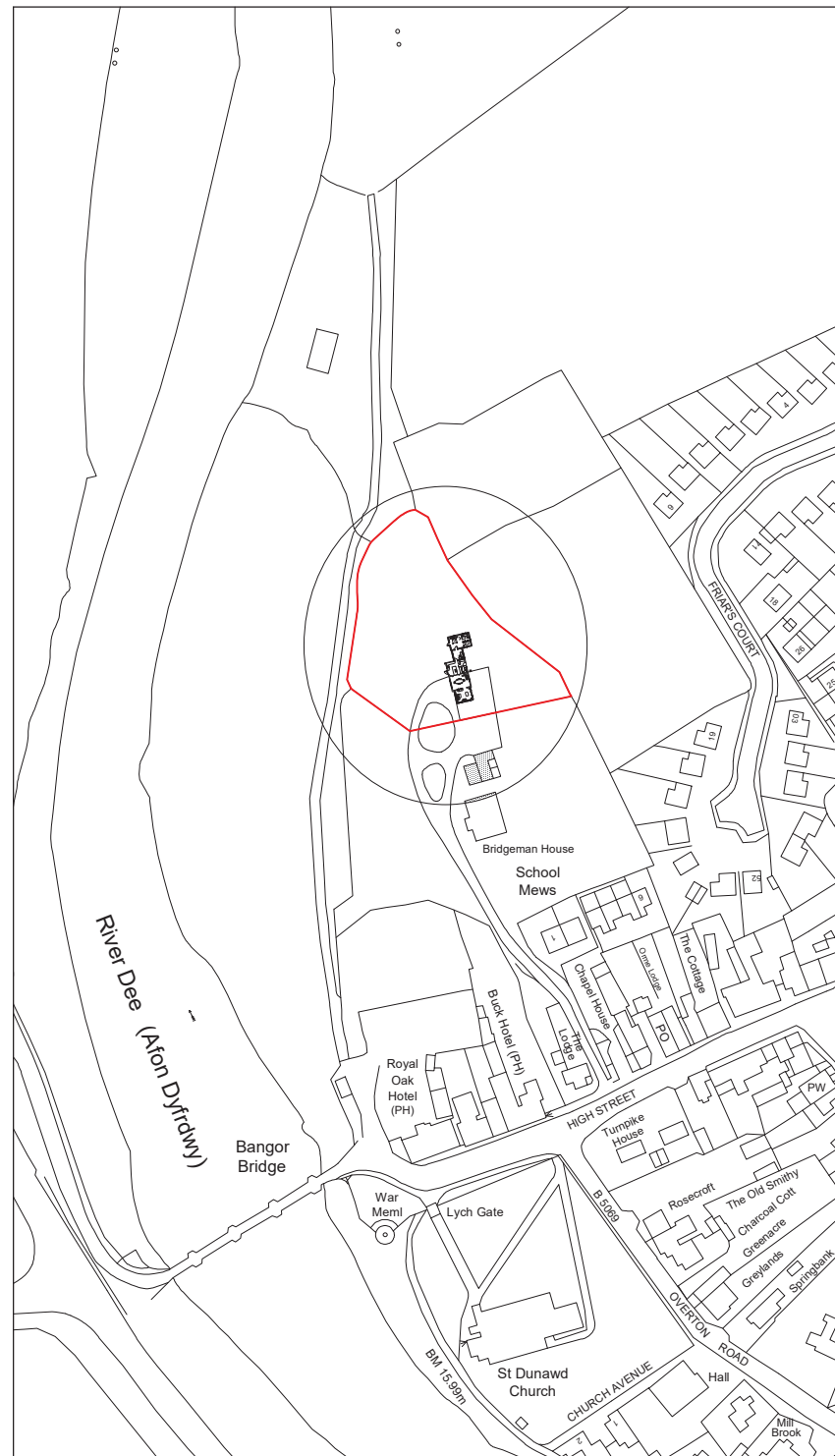
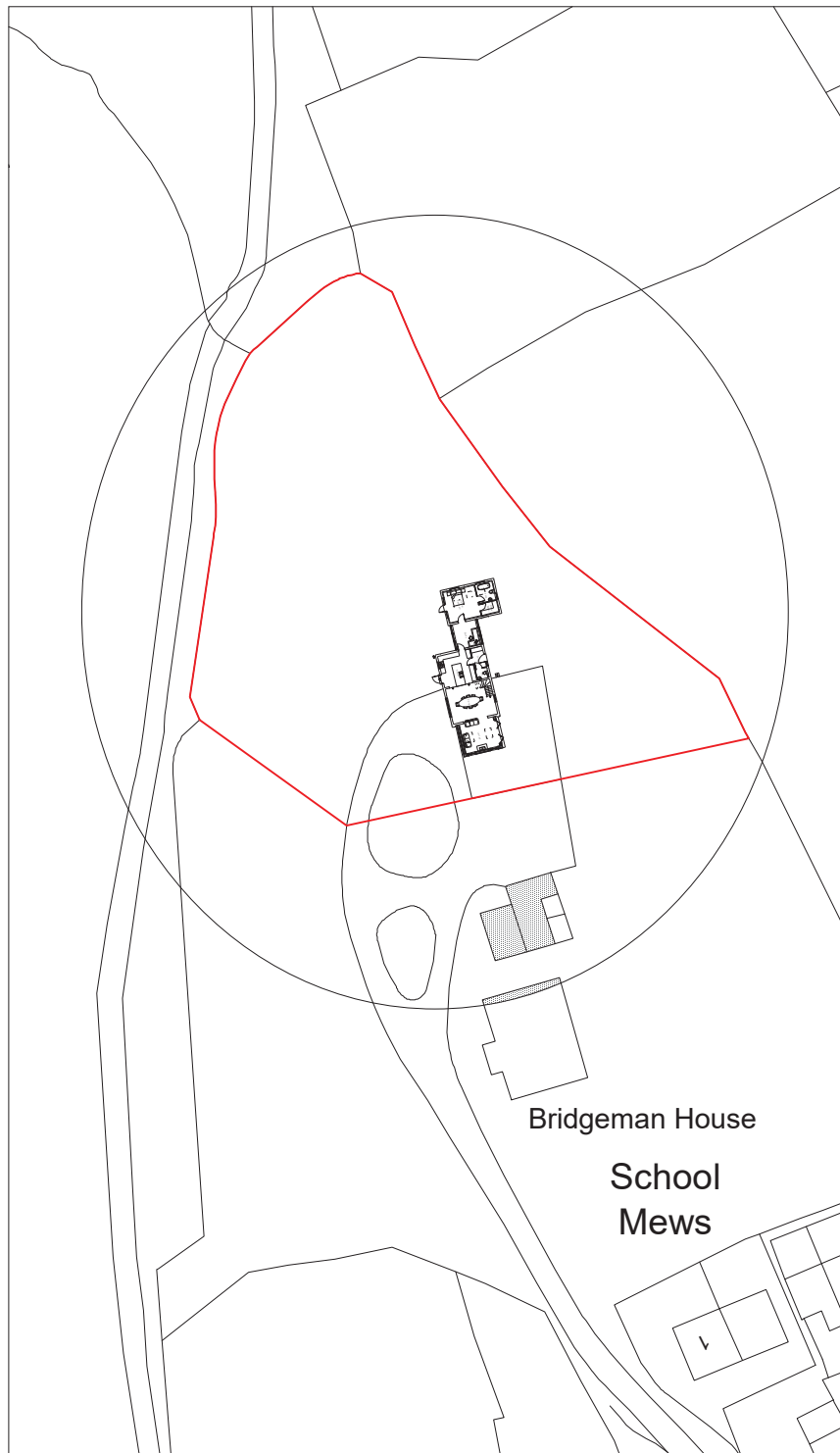
8 RECOMMENDATIONS

This report has demonstrated that the proposed development may be completed subject to the following:

- Finished flood levels should be set no lower than the finished floor levels of the existing buildings.
- The latest best practice flood resistant and resilient construction techniques to be incorporated into the design of the extension and link and retrofitted to the existing buildings where feasible.
- Flood Plan to be developed in consultation with WCBC Council

APPENDIX A:

Development Proposals



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