



Quarrington Design Ltd
Building & Structural Engineering

01529 300375

info@quarringtondesignltd.co.uk

Unit A

Holdingham Barns

Lincoln Road

Holdingham

NG34 8NP

Flood Risk Assessment

Client Mr A. Linkauskas

Address Beck Lodge – New Hammond Beck Road - Boston

REVISION TABLE

DATE	DESCRIPTION	Revision	INITIALS
16.11.20	FOR APPROVAL	P1	I.B.
16.02.21	<i>EA Comments</i>	P2	I.B.

NOTES

Flood Risk Assessment to be read in conjunction with all Architect details

CONTENTS

1.

Details of Building Design

1.1 Design of Flood Risk Assessment for Planning Application

DESIGN TEAM DETAILS

Client

Name: Aidas Linkauskas

Address: Beck Lodge – New Hammond Beck Road – Boston PE21 7JD

Architect

Company Name: Misura Architecture

Address: Lindum Business Park - Lincoln

Civil Engineer

Company Name: Quarrington Design Ltd

Address: Unit A Holdingham Barns – Lincoln Road - Holdingham

Telephone: 01522 300375

Fax:

Contact Name: Linda Butler

Email: info@quarringtondesignltd.co.uk

CONTENTS PAGE

1.0 INTRODUCTION

2.0 SITE DESCRIPTION AND DEVELOPMENT PROPOSALS

3.0 FLOOD RISK

4.0 CLIMATE CHANGE

5.0 FLOOD RISK MITIGATION

6.0 SEQUENTIAL AND EXCEPTION TEST

7.0 CONCLUSIONS

APPENDICES

- A Planning Drawings
- B Environment Agency Flood Information
- C Flood Plan Template

1.0 INTRODUCTION

Government Guidance states:

'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.'

To demonstrate the appropriateness of any new development in areas at risk of flooding a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The requirements for flood risk assessments are generally as set out in the National Planning Policy Framework (NPPF) and the National Planning Policy Framework Planning Practice Guidance. The FRA should be commensurate with the risk of flooding to the proposed Development, for example, where the risk of flooding to the site is negligible (e.g. 'low probability' Flood Zone 1), there is little benefit to be gained in assessing the potential risk to life and/or property as a result of fluvial (river) flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding lower than in the catchment.

This assessment has been produced in accordance with "Preparing a Flood Risk Assessment: Standing Guidance" by DEFRA and the Environment Agency.

This Flood Risk Assessment considers the impact of the proposed development in addition to the common ways in which flooding can occur. The conditions that currently exist in the location of the site are described, together with the methods used to identify and assess potential impacts caused from the development proposals.

Instruction has been received to produce a Flood Risk Assessment in support of a planning application for prior approval of a change of use from an office and stores building to a residential dwelling.

This report is for the sole use of the applicant and only in respect of the application for which it was prepared. The report is, in part, based upon information provided by others and on the assumption that all relevant information has been provided by those parties from whom it has been requested. Information obtained from any third party has not been independently verified unless otherwise stated in the report.

2.0 SITE DESCRIPTION

The site is on the north side of New Hammond Beck Road, centred approximately on national grid reference **TF 29516 43039**, approximately 3km west of Boston town centre. It is currently occupied by a single storey office/store building and an unbound gravel access with the surrounding area laid to grass.

There are a number of watercourses in the relatively flat landscape which surrounds Boston.

The River Witham, South Forty Foot Drain and Maud Foster Drain converge at Boston where they become the River Haven. Cowbridge Drain outfalls into the Haven 4km south of the town. The Haven reaches the sea approximately 4km further downstream.

There are a number of becks and ditches in the area which are typical of the flat, fenlands which surround Boston; these are generally maintained by Black Sluice and Witham Fourth Internal Drainage Boards. The New Hammond Beck is the closest watercourse, running easterly on the opposite site of New Hammond Beck Road.

Fig 1 shows site location and identifies the main rivers and New Hammond Beck (most local ordinary watercourse).



Fig.1. Site Location

Topographically the site forms part of a notionally flat landscape and is at approximately 3m AOD. Levels in the area range from 5m AOD in the centre of Boston to 2m in the surrounding fens.

2.1 DEVELOPMENT PROPOSALS

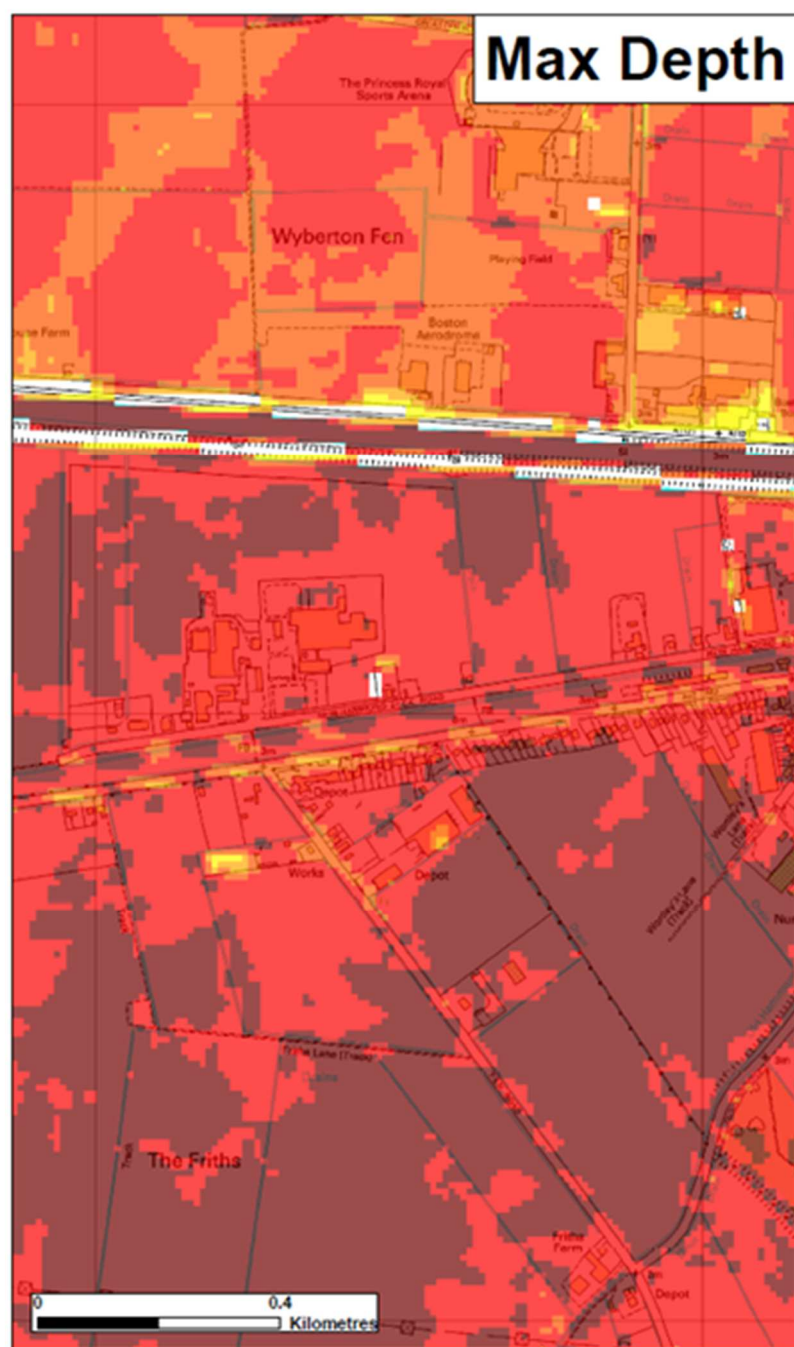
Appended to this document are the existing and proposed site plans by Misura Design.

It is proposed that the existing, single storey office and stores building is altered internally to create a new residential dwelling.

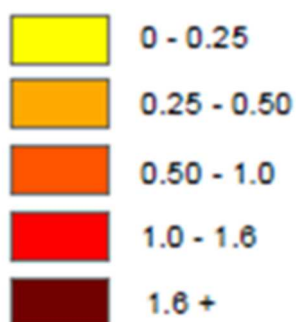
As the development is a change of use to create a new single-storey dwelling, the majority of the living space will be approximately at the existing ground floor level which is 300mm above the ground level

Landscaping proposals are not developed at this stage, but it is understood that any new external finishes will be of porous construction.

The map below is extracted from EA consultation response reference CNN-2020-182970 and shows the flood water depths for the 0.1% 2115 breach scenario. The max flood depth is shown to be between 1.0 and 1.6m at the site with an interpolated estimate of approx. 1.4m.



Max Depth (m)



Since receiving the EA comments we have revisited the scheme and will submit an updated proposal with the bedroom elevated a further 300mmm. This will place the sleeping accommodation at the maximum 1.6m flood level shown on the 0.1% breach map and above the interpolated max level, ensuring that the occupants are protected from the effects of the worst case flood whilst sleeping and at their most vulnerable. The bedroom will also provide safe refuge for the occupants of the dwelling should they need await rescue in the event of a flood.

3.0 FLOOD RISK SUMMARY

Source of Flooding	Description	Significance of risk prior to mitigation			Mitigation Measures	Significance of risk post mitigation		
		L	M	H		L	M	H
Rivers	The site is identified as at high risk from river flooding where defences are not present. The Haven is tidal & provides potential for significant fluvial flooding in extreme events			✓	Raised river embankments in the area reduce the risk of flooding (at the defence) to a 1% (1 in 100) chance of occurring in any year.	✓		
Water Courses	Several Water courses contribute to the IDB system but are not known to affect the site	✓				✓		
Tidal/Coastal	The site is in flood zone 3a and is therefore classified as high-risk tidal flooding. Overtopping of the Haven has been recorded in recent years following tidal surge.			✓	Site is identified as benefitting from improved defences along The Haven, reducing the risk of overtopping.		✓	
Groundwater	BGS identifies the site as being at low risk	✓				✓		

Overland flow (Surface Water)	Gov.uk data shows the site at 'very low risk'	✓				✓		
Ponds/Swales	There are no notable ponds or swales which might affect the site	✓				✓		
Public infrastructure failure	No public sewers are known of in the vicinity of the site	✓				✓		
Private infrastructure failure	The site is adjacent to a large industrial site. It is proposed to make use of the existing drainage systems on the site which are in unknown condition	✓			Building is elevated above adjacent roads. No history of public sewer failure or local flooding. Ensure existing systems are in good repair.	✓		
Pluvial (urban drainage)	There is no proposed increase of impermeable area at the site	✓				✓		
Artificial sources	Several man-made IDB drainage systems converge in Boston and the River Witham is controlled by sluice gates upstream of the site; failure could affect the site		✓		No evidence of flooding from IDB maintained systems or Anglian Water sewers	✓		

--	--	--	--	--	--	--	--	--

3.1 ANALYSIS OF FLOOD RISKS

3.1.1 RIVER FLOODING

Planning policy generally requires development to be designed to accommodate 1 in 100 (1%) annual probability flood events from rivers and pluvial sources and 1 in 200 (0.5%) annual probability flood events from seas. The figure 2 flood map below shows flood risk for rivers and seas during normal pluvial and fluvial events. This is extracted from the Government website and is stated to ignore the presence of flood defences in the area.

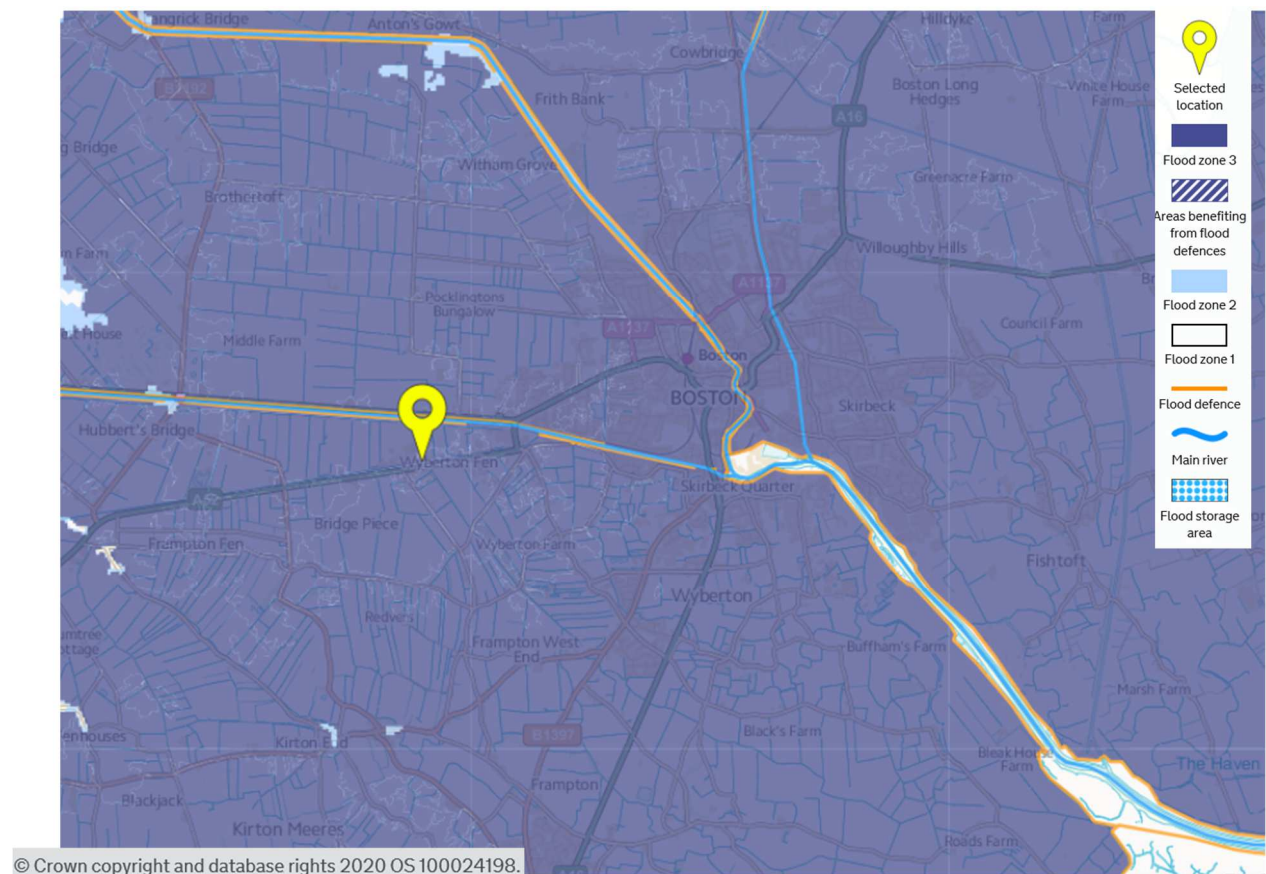


Fig.2: Flood Maps for Rivers and Seas (<https://flood-warning-information.service.gov.uk>)

The Environment Agency (EA) were consulted in preparation of this report. Their response Ref: CCN-2020-182970 is appended to this report, it confirms that the South Forty Foot Drain represents the primary risk of river flooding at the site.

Figures 3 below identifies the most local modelled river node points on the South Forty Foot Drain. Below that, figure 4 shows the modelled flood levels in the river for a range of return periods and using 2016 flood model scenario.

The model indicates that the peak water level during a 1% (1 in 100) annual probability event is 2.75m AOD. The EA have confirmed that the raised embankments on the local rivers provide defence up to a 1% (1 in 100) annual probability, furthermore the existing ground levels at the site are shown on ordnance survey mapping to be approximately 3m AOD. As such, the risk of fluvial flooding at the site is 'low'.

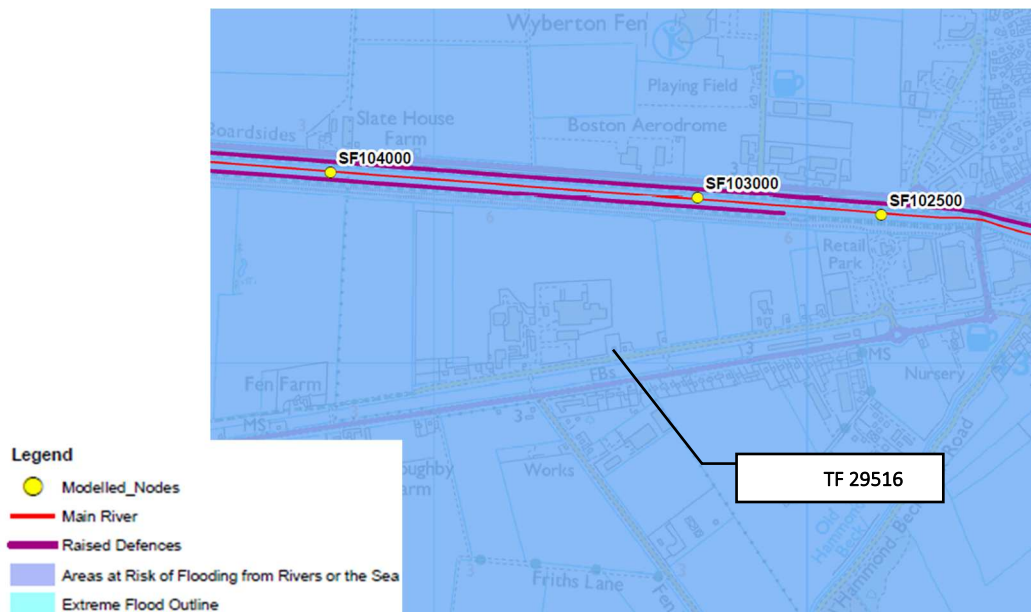


Fig.3: South Forty Foot Fluvial Flooding Model Note Points (Environment Agency October 2020)

Node Label	Easting	Northing	Annual Exceedance Probability - Maximum Water Levels (mODN)										
			50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
SF102500	530198	343397	2.14	2.50	2.62	2.64	2.66	2.71	2.72	2.74	2.74	2.77	2.77
SF103000	529706	343441	2.14	2.50	2.62	2.64	2.67	2.71	2.72	2.75	2.75	2.77	2.78
SF104000	528723	343511	2.15	2.51	2.62	2.64	2.67	2.71	2.73	2.75	2.75	2.77	2.78

Fig.4: South Forty Foot Fluvial Flooding Levels by Node Point (Environment Agency October 2020)

Figure 5 below shows the modelled flood extents for the South Forty Foot Drain for a range of return periods using the 2016 model scenario. The map shows that the site is unaffected for all return periods.

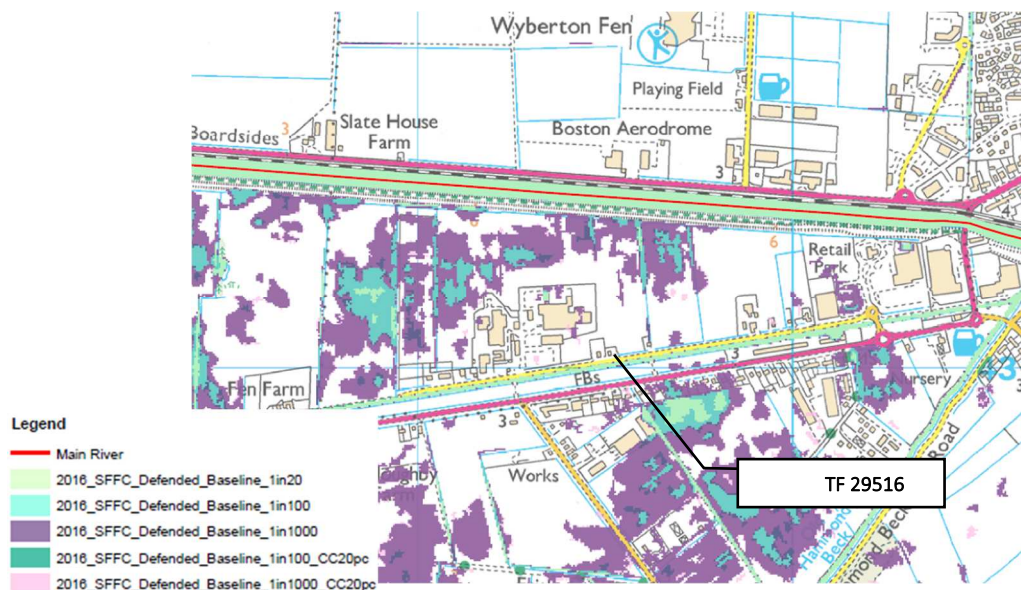


Fig.5: South Forty Foot Fluvial Model Flood Extents (Environment Agency October 2020)

3.1.2 TIDAL FLOOD

It is the tidal influence on the River Haven, as evidenced by the historic flood events in the town, which makes it the most significant risk of flooding for the site. Tides reaching levels in the range of 6.000m AOD to 6.200m AOD will naturally move up the Haven until the lower level defences are reached and overtopped.

Current improvements made along the Haven embankments and the construction of the Boston Barrier are suitable to protect against 0.5% (1 in 200) annual probability events and it is therefore considered extremely unlikely that flooding will occur at the site within the lifetime of the development. The Boston Combine strategy will provide a level of protection against 0.33% (1 in 300) annual probability events when complete in 2021.

The risk of flooding at the site from tidal sources would be in the unlikely event that the coastal or Haven defences are breached or overtopped. Figures 6 and 7 below are excerpts from the flood modelling information supplied by the EA as part of their response Ref: CCN-2020-182970, the maps show the effects of flood water at the site in the event of a breach during a 0.5% (1 in 200) event, based on 2115 model data.

Figure 6 shows a max hazard rating of 'Danger for Most' during this breach scenario.

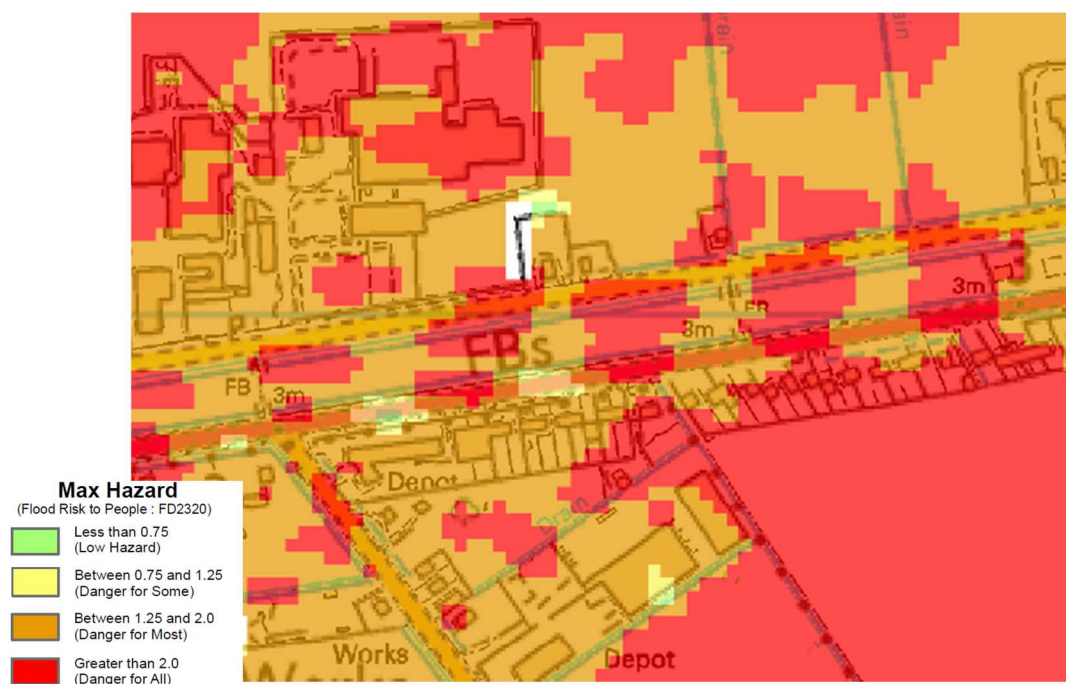


Fig.6: 0.5% Tidal Breach Max Hazard Map 2115 ([Environment Agency October 2020](#))

Figure 7 shows the max depth of water at the site during the 0.5% modelled breach scenario.

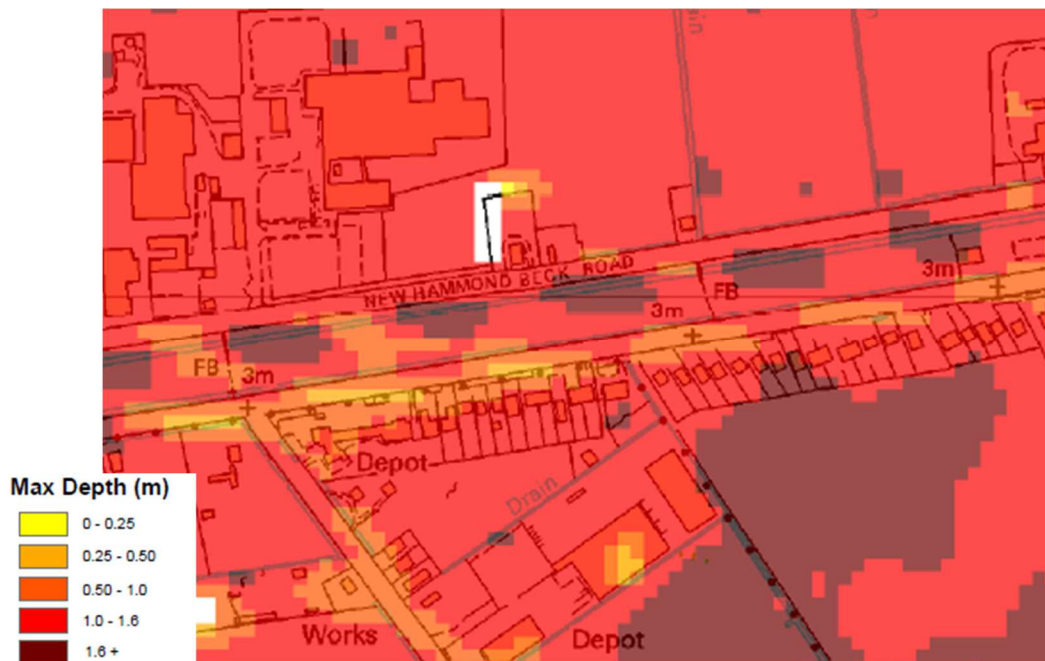


Fig.7: 0.5% Tidal Breach Max Depth Map 2115 ([Environment Agency October 2020](#))

3.1.2 ARTIFICIAL SOURCES

Artificial flooding sources include man made channels and structures which convey, compound or affect flows of water. These include Canals, reservoirs, dams, to name a few. Boston Borough and indeed much of Lincolnshire is low lying fen lands which are drained in carefully managed man made channels which are generally pumped into higher level main rivers and these must be considered.

Detailed studies by Black Sluice IDB and Witham Fourth District IDB summarised in Tables 3 and 4 in the Boston SFRA show that the site is not considered at risk from any IDB maintained assets or from other local artificial sources.

3.2 RESIDUAL FLOOD RISK

The development is proposed within flood zone 3a and EA mapping suggests that tidal water could inundate the ground floor of the building during 1 in 200 (0.5%) annual probability climate change event. Given that the development is a change of use of a single storey building it is not possible for the proposed FFL to be adjusted to be suitably elevated above the flood level.

It is understood that the EA flood mapping for the area is due to be updated in 2021 to take into consideration the increased level of protection afforded by the finalised Boston Combined Strategy. It is anticipated that the depth of water and hazard rating at the site will be significantly reduced as a result of the updated modelling.

Flood resilient construction should be adopted as far as practicable to mitigate flood risk at ground floor level.

An indirect risk to occupants may arise in the event of a significant flood as they attempt to leave the site and gain access to other areas unaffected by flooding. This risk should be mitigated through the implementation of a Flood Warning and Evacuation Plan (FWEP).

Risk of flooding from all other sources is considered to be low without mitigation.

4.0 CLIMATE CHANGE

National Planning Policy Framework (which details government requirements for the management and reduction of flood risk) requires the investigation of climate change on any proposed development. The Environment Agency have produced guidance on the allowances that are to be made to mitigate the future impact of climate change.

Climate change allowances are predictions of anticipated change for:

- peak river flow
- peak rainfall intensity
- sea level rise
- offshore wind speed and extreme wave height

They are based on UK climate change projections. There are different allowances for different epochs or periods of time over the next century.

4.1 SEA LEVEL CHANGE

For more vulnerable development in flood zone 3(a) the higher central and upper end should be used to assess the range of allowances.

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Anglian	Higher central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	1.2

Fig 4: Climate Change Guidance to the National Planning Policy Framework, Table 1 (extract)

These changes in sea level should be anticipated within the lifetime of the development and should be further considered for any future development at the site, alongside the latest flood risk guidance.

4.2 RAINFALL INTENSITY CHANGE

Due to the nature of the development (residential), it is considered that the design life of the development could exceed 100 years and therefore the on-site drainage design and flood risk mitigation measures must ensure climate change of 40% is taken into account in accordance with fig 5, below.

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Fig 5: Climate Change Guidance to the National Planning Policy Framework, Table 2 (extract)

5.0 FLOOD RISK MITIGATION

5.1 FINISHED FLOOR LEVELS

To mitigate risk to occupants, wherever possible, buildings should be designed with floor levels and resilient measures such that occupied areas are not inundated during 1 in 200 probability + climate change events.

Due to the nature of this development, which would alter the internal reconfiguration to change the use of an existing office and stores building to a residential dwelling, it will not be possible to raise the floor levels throughout the dwelling to be above the modelled flood water level.

The appended designs show that the FFL of the new residence would be more than 300mm above the surrounding ground level, as recommended by EA standing flood mitigation guidance, and that the sleeping accommodation is to be raised a further 1m with the window on the rear elevation raised to provide emergency egress in the event of a flood.

5.2 FLOOD WARNING AND EVACUATION PROCEDURE

The site is shown to lie within Flood Zone 3 and in an area at risk of tidal flooding. The proposed use of the premises is such that occupants would be familiar with their surroundings, although they may be asleep at the time of the flooding event; they are therefore potentially vulnerable during such an event.

The residents should sign up to flood warnings using Flood Warning Information service operated by the Government. Using this, they will be provided a warning of high water levels within the catchment, thereby providing advanced warning of flood waters reaching the site. Local flood information is available from the Government Flood Warning Information website or obtained by their 'Quickdial' recorded information service.

It is recommended that a Flood Warning and Evacuation Plan (FWEP) is produced which would inform the occupants of actions to take before, during and after a flood event to ensure their safety, and to ensure their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

The FWEP should include:

1. How flood warning is to be provided, such as:
 - Availability of existing flood warning systems;
 - Where available, rate of onset of flooding and available flood warning time; and
 - How flood warning is received.
2. What will be done to protect the development and contents, such as:
 - How easily damaged items (including parked cars) or valuable items will be relocated;
 - How services can be switched off (gas, electricity, water supplies);

- The use of flood protection products (e.g. flood boards, airbrick covers etc);
- The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc; and
- The time taken to respond to a flood warning.

3. Ensuring safe occupancy and access to and from the development, such as:

- Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate;
- Safe access route to and from the development;
- If necessary, the ability to maintain key services during an event;
- Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and
- Expected time taken to re-establish normal use following a flood event (clean up times, time to re-establish service etc).

The Government provide a Personal Flood Plan template which should be kept up to date by the occupants of the development. Further guidance on the creation of a personal flood plan can be found using the following link:

<https://www.gov.uk/government/publications/personal-flood-plan>

5.3 FLOOD RESILIENT CONSTRUCTION

Flood-resilient buildings are designed to reduce the consequences of flooding and facilitate recovery from the effects of flooding sooner than conventional buildings. This is typically achieved through the use of water-resistant materials for floors, walls and fixtures and the siting of electrical controls, cables and appliances at higher than normal level.

This report advises that it will not be possible to raise the lowest floor above the predicted flood level for the new areas during 0.5% (1 in 200) annual probability events and it is not practical to accommodate more extreme events this way. It is therefore recommended that flood resilient measures are included in the detailed design and construction of the premises. Government guidance recommends key flood resilient measures as follows:

- Replace timber floors with concrete and cover with tiles,
- Replace window frames and doors with flood protective units of man-made materials
- Fit flood defence barriers to existing doorways and openings,
- Install flood protection plates or replace standard air bricks with special flood resistant ones
- Replace chipboard/MDF kitchen and bathroom units with stainless steel or plastic equivalents,
- Replace gypsum plaster with more water-resistant material, such as lime plaster or cement render,
- Route ground floor services from above and locate service meters and electrical points a minimum of 1500mm above floor level,
- Install main parts of the heating and ventilation system, such as a boiler, upstairs or significantly raised above the ground floor

- Put one-way valves into drainage pipes to prevent sewage backing up into the house

This list is not exhaustive and further advice should be sought from an architect or engineer to obtain site specific flood protection information. More comprehensive guidance on the design of flood resilient buildings is also available via the following link:

http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

6.0 SEQUENTIAL AND EXCEPTION TEST

Table 2 of NPPF is shown below and confirms that buildings used for dwelling houses are classified as 'More Vulnerable' in terms of flood risk.

More Vulnerable
<ul style="list-style-type: none"> • Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Fig 6: Technical Guidance to the National Planning Policy Framework, Table 2 (extract)

Table 3 of the Technical Guidance to the NPPF shown below suggests that dwellings (as characterised within table 2) are appropriate for Flood Zone 3 subject to the Sequential and Exceptions Tests being passed.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

Key:

✓ Development is appropriate

x Development should not be permitted.

Fig 7: Technical Guidance to the National Planning Policy Framework, Table 3 (extract)

The aim of the Sequential Test, as set out in the Planning Practice Guidance, is to ensure that a sequential approach is followed to steer new development to areas with the lowest probability of flooding through a review of available sites in the local area and their relative flood risk categorisation.

Once the Sequential Test has been satisfied the development must pass the Exceptions Test, for this it must be demonstrated that:

1. The development provides wider sustainability benefits to the community that outweigh flood risks, informed by the Strategic Flood Risk Assessment; and
2. A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking into account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible will reduce flood risk overall.

Both parts of this test must be satisfied in order for the development to be considered appropriate in terms of flood risk and there must be robust evidence in support of every part of the test.

6.1 SEQUENTIAL TEST

The application seeks prior approval for the change of use of a redundant office to a residential dwelling and it is therefore exempt from the sequential test.

6.2 EXCEPTIONS TEST

As the Sequential Test has been satisfied the development must pass the Exceptions Test.

Part 1 of the exceptions test will be satisfied by the Supporting Planning Statement and through compliance with Boston Borough Council's planning policies.

This FRA indicates that the second part of the Exceptions test is satisfied and that the proposals would provide flood safety for the lifetime of the development (100 years) and not increase flood risk elsewhere.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the work carried out in preparation of this report the following summary, conclusions and recommendations are made:

- 1 From publicly available flood data and in the context of NPPF, the site is classified as lying within Flood Zone 3a and has a high (0.5% or 1 in 200 annually) probability of flooding due to tidal overtopping/breach of the Haven.
- 2 The risk of tidal flooding following completion of the Combined Boston Strategy will be reduced to a 0.33%, 1 in 300 annual probability.
- 3 Risk of flooding from all other sources is considered to be low.
- 4 There is no proposed increase to the impermeable coverage of the site; therefore the development will not increase the risk of flooding for downstream properties.
- 5 NPPF exempts change of use development applications from requiring Sequential testing, and the Exception Test is considered to be passed if the recommendations of this report are adopted. The development is therefore considered appropriate within Flood Zone 3a.
- 6 It is not possible to raise the finished floor levels of the bungalow to provide freeboard above the 1 in 200 (0.5%) annual probability flood event however the sleeping accommodation has been raised as far as practicable within the existing building constraints.
- 7 Flood resilient construction and flood protection measures should be employed as recommended in this report and in accordance with government guidance.
- 8 Occupants should sign up for the government Flood Warning Service.
- 9 It is recommended that a Flood Warning and Evacuation Plan (FWEP) is created for the development.
- 10 The site occupants should develop, and keep up to date, a Personal Flood Plan for the property
- 11 Maintenance should be carried out as detailed within this report and in accordance with all manufacturer recommendations.
- 12 It is recommended that advice is sought from insurers on the insurability of the proposed development.

APPENDIX A: DRAWINGS

Quarrington Design Unit A Holdingham Barns Sleaford Lincs	Project Beck Lodge - New Hammond Beck Road - Boston PE21 7JD				Job Ref. 20.176	
	Description FRA				Sheet no./rev. 23	
	Design By I.B	Date 16/11/2020	Chk'd by	Date	Revision P1	Date 16/11/2020

APPENDIX B: ENVIRONMENT AGENCY FLOOD MAPPING INFORMATION

Quarrington Design Unit A Holdingham Barns Sleaford Lincs	Project Beck Lodge - New Hammond Beck Road - Boston PE21 7JD				Job Ref. 20.176	
	Description FRA				Sheet no./rev. 24	
	Design By I.B	Date 16/11/2020	Chk'd by	Date	Revision P1	Date 16/11/2020

APPENDIX C: PERSONAL FLOOD PLAN TEMPLATE