PROPOSED RESIDENTIAL DEVELOPMENT AT
2 FISHMERE END ROAD, SUTTERTON, BOSTON, PE20 2HX
FLOOD RISK ASSESSMENT

View of rear garden

S M Hemmings B Sc C Eng MICE MIWEM,

13 Lea Gardens

Peterborough

PE3 6BY

This flood risk assessment has been prepared solely to support the planning application for a residential development at Fishmere End Road Sutterton. The author has made every effort to provide an accurate assessment of the flood risk but accepts no liability should the information be found to be incorrect or incomplete, or if it is used for any other purposes other than for which it was originally commissioned.

Introduction

An application is due to be made to Boston Borough Council for planning permission to construct a single storey annex at the rear of 2 Fishmere End Road, Sutterton, Boston.

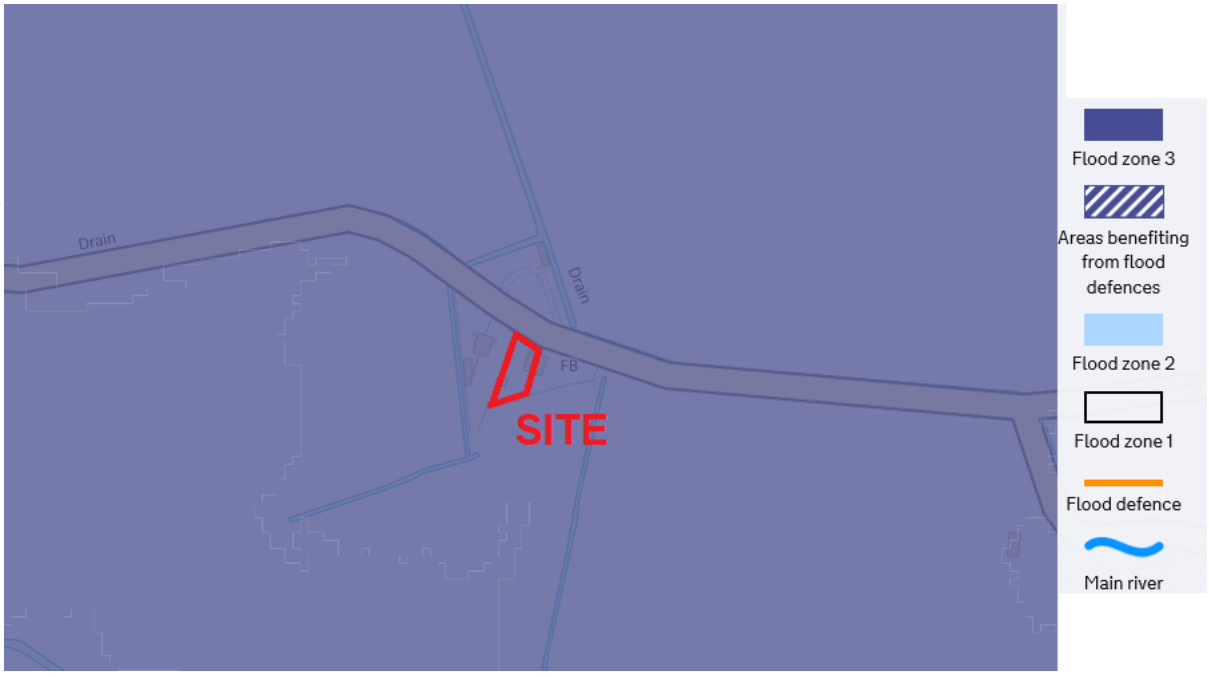
The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone map. The flood zone maps do not take into account existing flood defences.

The Planning Application requires a flood risk assessment to be carried out as specified in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified in the Boston Borough Council's Strategic Flood Risk Assessment (BBC SFRA) map and is located in the Black Sluice Internal Drainage Board District.

The main flood risk to this site is overtopping and possible breaching of the tidal defences.

Environment Agency (EA) Flood Zones

The map below is taken from the Environment agency website and shows the flood zones in this area.



It can be seen that the whole of this area is in Flood Zone 3.

Application Site

The site is located 7.7 km south west of Boston. The National Grid Reference of the site is 528475 337515.

The position and extent of the site is shown on the plan at the end of this document.

As the site is within a defended area the proposed development can be considered to be within Flood Zone 3(a) as defined in Table 1 of the Technical Guidance.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a residential development is classified as “more vulnerable”.

Table 3 of the Guidance is shown below:

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 †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Therefore it can be seen that for “More vulnerable” development in flood zone 3(a) the sequential and the exception tests need to be applied to the development.

Sequential Test

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. The flood zones as defined in the Strategic Flood Risk Assessment for the area provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

Most of the area south west of Kirton, as can be seen from the map on page 2 of this report, is in Flood Zone 3. Therefore it would be difficult to find a similar site for a residential development in this area that is in a lower flood zone.

As the proposed annex is for an elderly member of the family who lives at 2 Fishmere End Road, then the building needs to be located close to the rest of the family who are his carers.

The safety of the development will be delivered by ensuring the floor level of the proposed new dwelling is above the predicted residual flood level for this area.

Therefore I consider that the sequential test has been passed.

Exception Test

The Sequential Test has demonstrated that it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding. Therefore the Exception Test must be applied and for this to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risks, informed by the Strategic Flood Risk Assessment; and
- 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. There must be robust evidence in support of every part of the test.

The first section will be demonstrated by the Supporting Planning Statement and compliance with Boston Borough Council's planning policies.

This flood risk assessment will demonstrate that the development will be safe for its lifetime and it will not increase flood risk elsewhere.

Strategic Flood Risk Assessment

Consultants have produced a Strategic Flood Risk Assessment (SFRA) for the Boston Borough Council (BBC). This document provides details of the flood risk in the Council's area.

This SFRA was updated as part of the South East Lincolnshire Plan which shows the predicted hazard from flooding. These maps show that the greatest hazard in the Kirton area of Boston is flooding following a breach in the tidal defences.

Information Supplied by the Environment Agency

The Environment Agency have provided maps showing the maximum hazard, depth of flooding and velocity for the 1 in 200 year and 1 in 1000 year events in 2006 and 2115, and the results of these are shown below.

	Hazard	Flood Depth	Velocity
1 in 200 year event in 2006	zero	zero	zero
1 in 1000 year event in 2006	zero	zero	zero
1 in 200 year event in 2115	0.75 – 1.25	250 – 500mm	0 – 0.3m/sec
1 in 1000 year event in 2115	1.25 – 2.0	250 – 500mm	0 – 0.3m/sec

The maps of the flood risk supplied by the Environment Agency are reproduced on pages 12 – 15 of this report.

Existing and Proposed Flood Alleviation Measures

The site is within a defended flood plain, as defined in Appendix 1 of the Environment Agency's "Policy and Practice for the Protection of Flood Plains", which is considered to be passive until such time that a flood greater than the defences can withstand occurs.

The site is located approximately 6.8 km south west of the bank of the Haven which is maintained by the Environment Agency.

The site is located approximately 6.5 km north west of the bank of the tidal part of the River Welland north east of Fosdyke Bridge which is maintained by the Environment Agency.

The site is located approximately 6.1 km south of the South Forty Foot Drain which is maintained by the Environment Agency.

There are piped and open watercourses in this area that are maintained by Black Sluice IDB.

Levels of the Site

The level of Fishmere End Road outside the property is approximately 2.90m ODN. The site itself is level and the ground floor level of the house is approximately 200mm above the level of the road.

Potential Sources of Flooding

The following sources of flooding have been identified:

1) Tidal Flooding due to overtopping or breaching of the south east bank of the Haven
2) Tidal Flooding due to overtopping or breaching of the west bank of the River Welland
3) Fluvial flooding from the South Forty Foot Drain
4) Flooding from IDB drainage system
5) Flooding from local surface water systems.

1. Tidal Flooding due to overtopping or breaching of the south east bank of the Haven

The south east bank of the Haven is 6.8km north of the site. The Environment Agency have stated that the predicted tide levels at the Boston Barrier in a 0.5% (1 in 200 year) event, using the 50% confidence figures from the 2018 Coastal Flood Boundary Extreme Sea levels, is 6.09m ODN and in a 0.1% (1 in 1000 year) event is 6.26m ODN.

The SFRA states that an allowance should be made for a sea level rise of 1.201 metres by 2115. The climate change guidance issued in February 2016 by the Environment Agency increased this allowance by an additional 100mm by 2115.

The breach hazard mapping produced by the Environment Agency predicts that flood depths would be a maximum of 500mm in the lower areas of the development site if a breach occured in a 1 in 200 year event and a maximum of 1.0 metre in the lower areas in a 1 in 1000 year event in 2115.

The Environment Agency have agreed a one hundred year strategy for the length of the Haven from Tabs Head as far as Grand Sluice. This involves the construction of a Barrier to prevent flooding upstream of Black Sluice Pumping Station, and the raising of bank levels along the Haven as predicted tide levels increase with climate change to ensure that there is always a 1 in 200 year standard of defence along both banks of the Haven.

Mitigation against this flood risk will be provided by raising the ground floor levels above the predicted flood level.

2. **Tidal Flooding due to overtopping or breaching of the north west bank of the River Welland**

The tidal bank of the River Welland protecting Kirton is 6.5km south east of the site. The Environment Agency have stated that the predicted tide levels at Fosdyke Bridge in a 0.5% (1 in 200 year) event, using the 50% confidence figures from the 2018 Coastal Flood Boundary Extreme Sea levels, is 5.98m ODN and in a 0.1% (1 in 1000 year) event is 6.29m ODN.

The SFRA states that an allowance should be made for a sea level rise of 1.201 metres by 2115. The climate change guidance issued in February 2016 by the Environment Agency increased this allowance by an additional 100mm by 2115.

The breach hazard mapping produced by the Environment Agency predicts that flood depths would be a maximum of 500mm in the lower areas of the development site if a breach occured in a 1 in 200 year event and a maximum of 1.0 metre in the lower areas in a 1 in 1000 year event in 2115.

Mitigation against this flood risk will be provided by raising the ground floor levels above the predicted flood level.

3. **Fluvial Flooding from South Forty Foot Drain**

The site is 5km south of the South Forty Foot Drain, which is the main arterial watercourse which conveys drainage water from the whole of the Black Sluice area to the Haven. The flows are controlled by two large sluices at Black Sluice Pumping Station which allow the water to discharge into the Haven when the tide is low. There are five large pumps at Black Sluice Pumping Station which used to be operated when flows were high. However recent studies have shown that an adequate water level can be maintained inn the South Forty Foot Drain by discharging only through the sluices when tide levels allow and the BSIDB and the EA have agreed that the pumps are not required in the future.

The maximum possible water level in the South Forty Foot Drain is 3.00m ODN at the southern end of the Drain and probably 200mm lower than this at the outfall. Both of these levels are 500mm below the proposed ground floor levels for the new buildings.

Therefore it is concluded this will provide satisfactory mitigation against flooding from the South Forty Foot Drain.

4. **Flooding from IDB Drainage system**

The site is within the Kirton and Frampton Catchment of the Black Sluice IDB area. The water levels in this catchment area are controlled by Chain Bridge Pumping Station which is located on the south bank of the South Forty Foot Drain 5.0km north of the development site.

There are 3 No electrically driven pumps at the pumping station and the total capacity of the pumping station is 3.7 cumecs. In an emergency one pump can be operated with a tractor through a PTO and there is also the facility to operate the all of the pumps with a generator if the electricity supply fails.

The Black Sluice IDB has modelled the catchment and the results demonstrate there is no predicted flooding to any properties in the catchment in a 1 in 100 year event.

Mitigation against this flood risk will be provided as the ground floor level of the proposed building will be raised approximately 750mm above the predicted flood level in the IDB drainage system north of the site.

5. Surface Water Flooding

As the finished floor level of the proposed annex will be raised 600mm above the existing ground level this will provide adequate mitigation against the risk of surface water flooding.

Extent of known Flooding

There was significant flooding to many areas of the east coast in 1953, but there was no flooding to the village of Kirton. Sixty years later a significant high tide event occurred on 5th December 2013 and a large area of central Boston was flooded. A short section of sea bank also failed at Slippery Gowt and some flooding and damage occurred in this area. The flood water flowed into the IDB drains and the Kirton area was not affected.

Climate Change

The recommendations for flood depths for this flood risk assessment use information provided by the Environment Agency which was produced in 2006. The EA have issued new guidance on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which from 19th February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 16 to 18). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

South East Lincs Advice Matrix

Advice can be found on the recommended mitigation required by referring to a spreadsheet on the South East Lincolnshire website. As the development is in flood zone 3 and the maximum flood hazard for a 1 in 1000 year event is "danger for all" (1.25 – 2.0) reference should be made to Category D8 which states:

The NPPF requires that proposals are accompanied by a Flood Risk Assessment which contains evidence that appropriate mitigation measures/flood resilience techniques have been incorporated into the development.

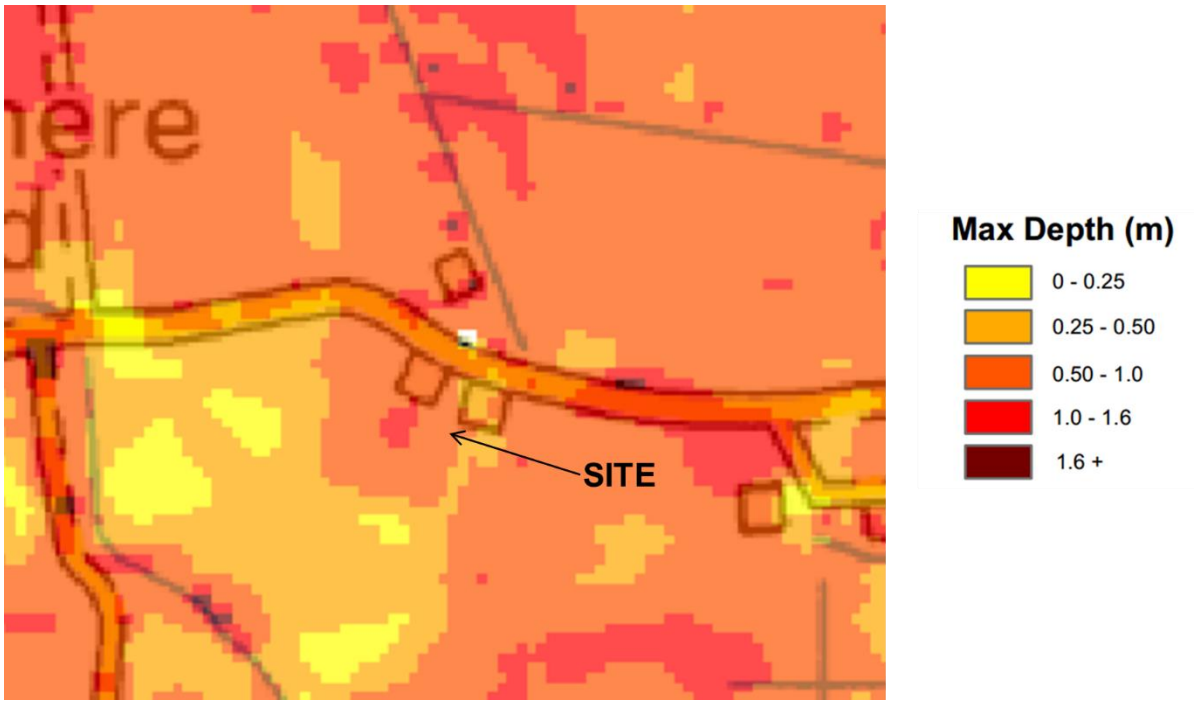
Finished floor levels (FFL) should be informed by the predicted flood depth maps and set as required below (single storey proposals must use the 0.1% event, 2115 scenario for setting FFL's).

Depths of 0.25m – 0.5m:

FFL must be set 500mm above grounds level with flood resilient construction to a height 300mm above the predicted flood depth.

Conclusions

The plan (shown below) of predicted depths of flooding in a 1 in 1000 year event in 2115 in the updated SFRA shows that the predicted flood depth on the site is between 250mm and 500mm on the eastern half of the site and 500mm and 1.0 metre on the western half of the site.



The site (as shown in the photograph on the first page of this report) is level. However the above plan of predicted flood depths shows varying depths on the site. The predicted depth on the western side of the existing house is in the lower band (250mm to 500mm). Therefore it is recommended that the finished ground floor level of the

proposed annex should be a minimum of 500mm above the level of the gravel hardstanding on the western side of the house, which may be about 600mm above the ground level on the site itself. The 1 in 1000 predicted flood level will be at a level of approximately 3.40m OD which is similar to the predicted flood level on sites in this area.

Information from the Black Sluice IDB indicates that the highest predicted water level in IDB drains in this area will be no higher than 2.75m OD. As the predicted levels from this source of flooding are 650mm lower than the predicted maximum flood level resulting from tidal inundation then the floor level will be raised at least 750mm above the predicted maximum level in the IDB drains.

Recommendations

In any area at risk of flooding it is preferable that new dwellings should be of two story construction with all bedrooms at first floor level. This is to provide a refuge for residents if the buildings were to become flooded after a major breach of the tidal bank, and ensure there is no danger to residents when they are asleep.

However as the future use of this annex needs to have the bedroom on the ground floor then the finished ground floor level should be at least 500mm above the level of the gravel hardstanding on the western side of the main building. This will then be above the predicted flood level in a 1 in 1000 year event in 2115.

Flood resilient construction should be included to a height of 300mm above the predicted flood depth.

The developer should advise owners and occupiers of the properties to register with the Environment Agency's Floodline Warnings Direct Service.

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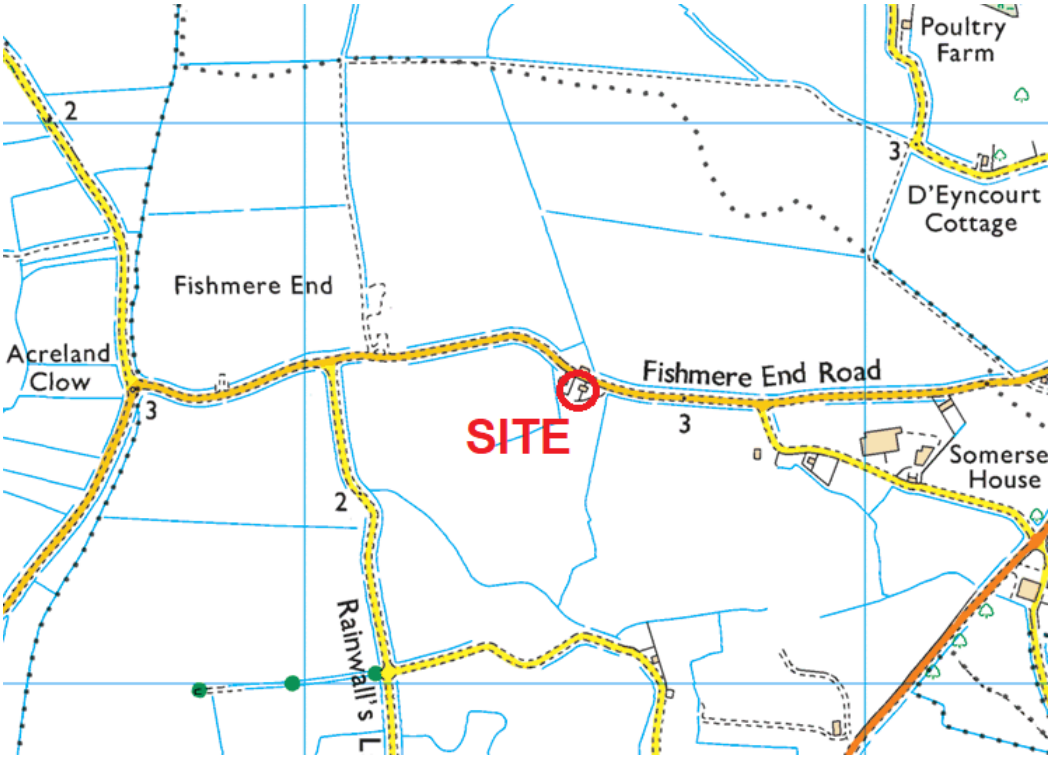
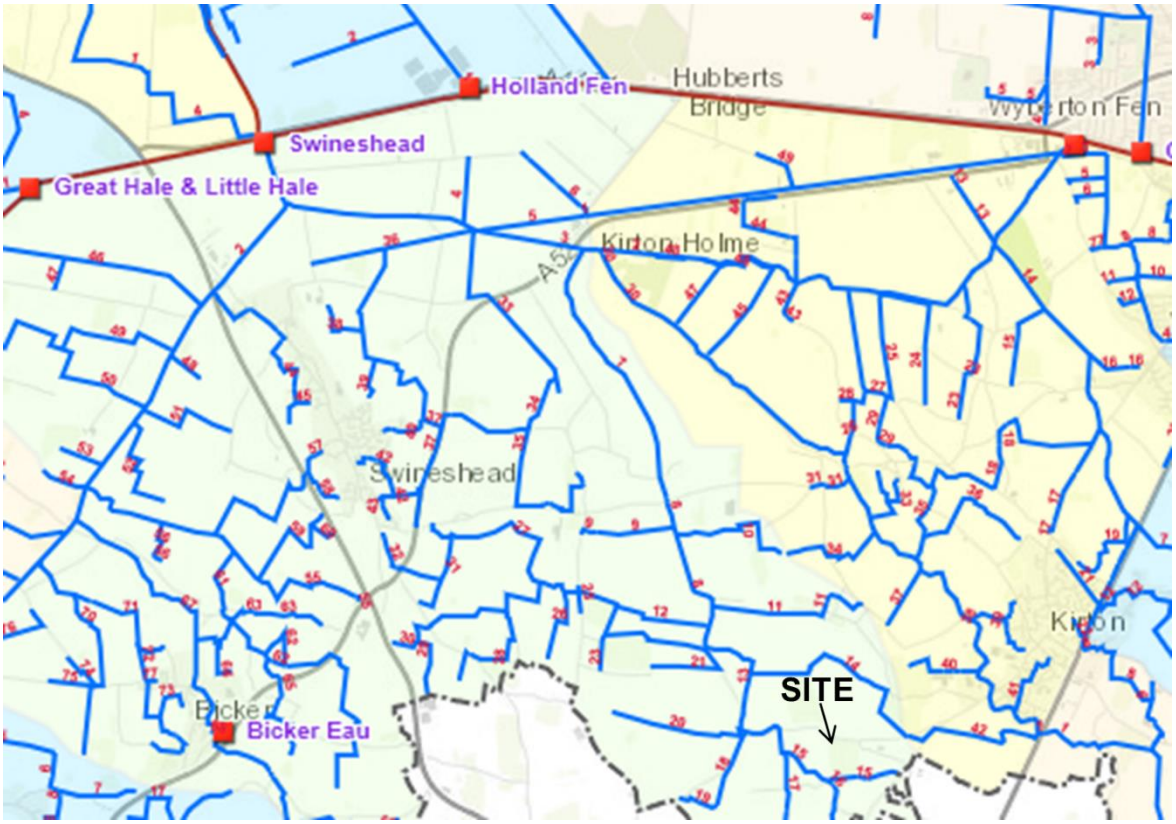
[redacted]

10th August 2020

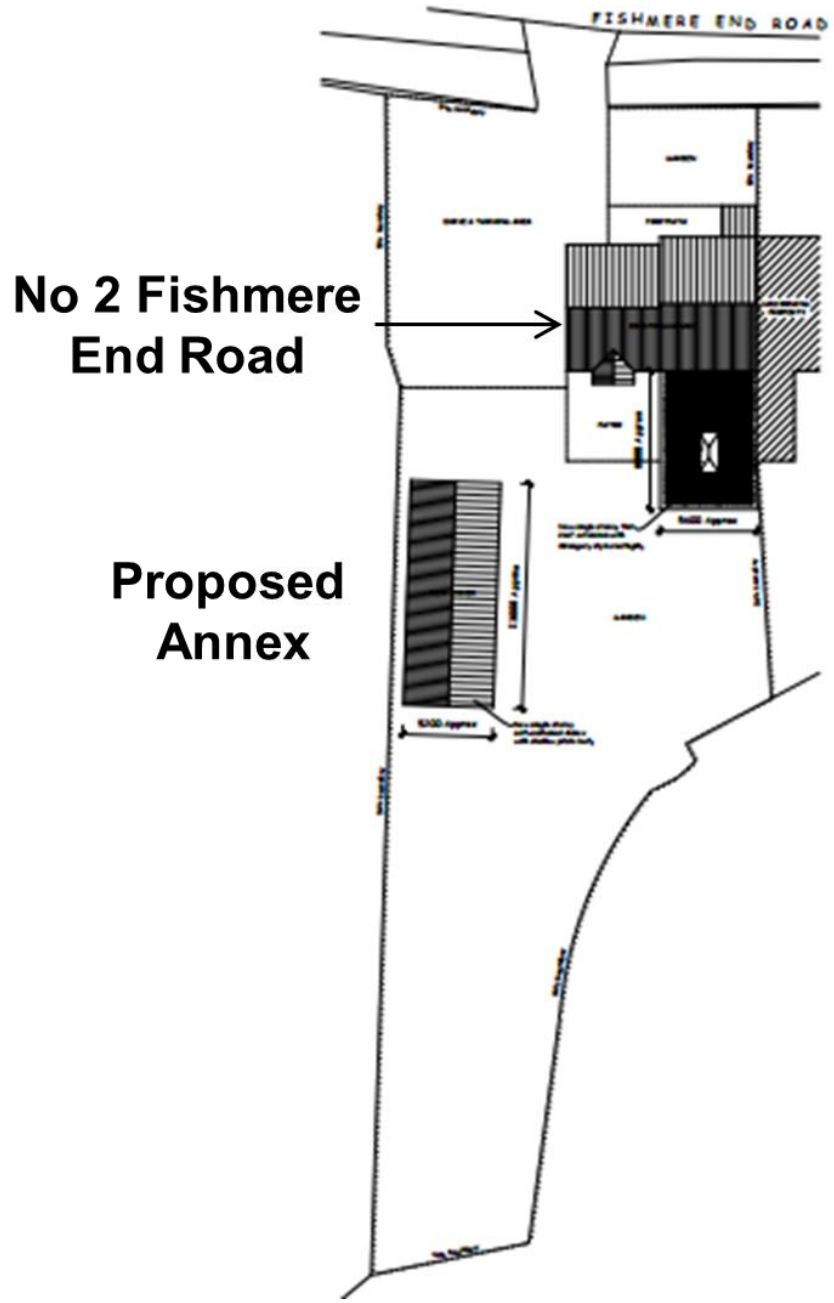
LOCATION PLAN



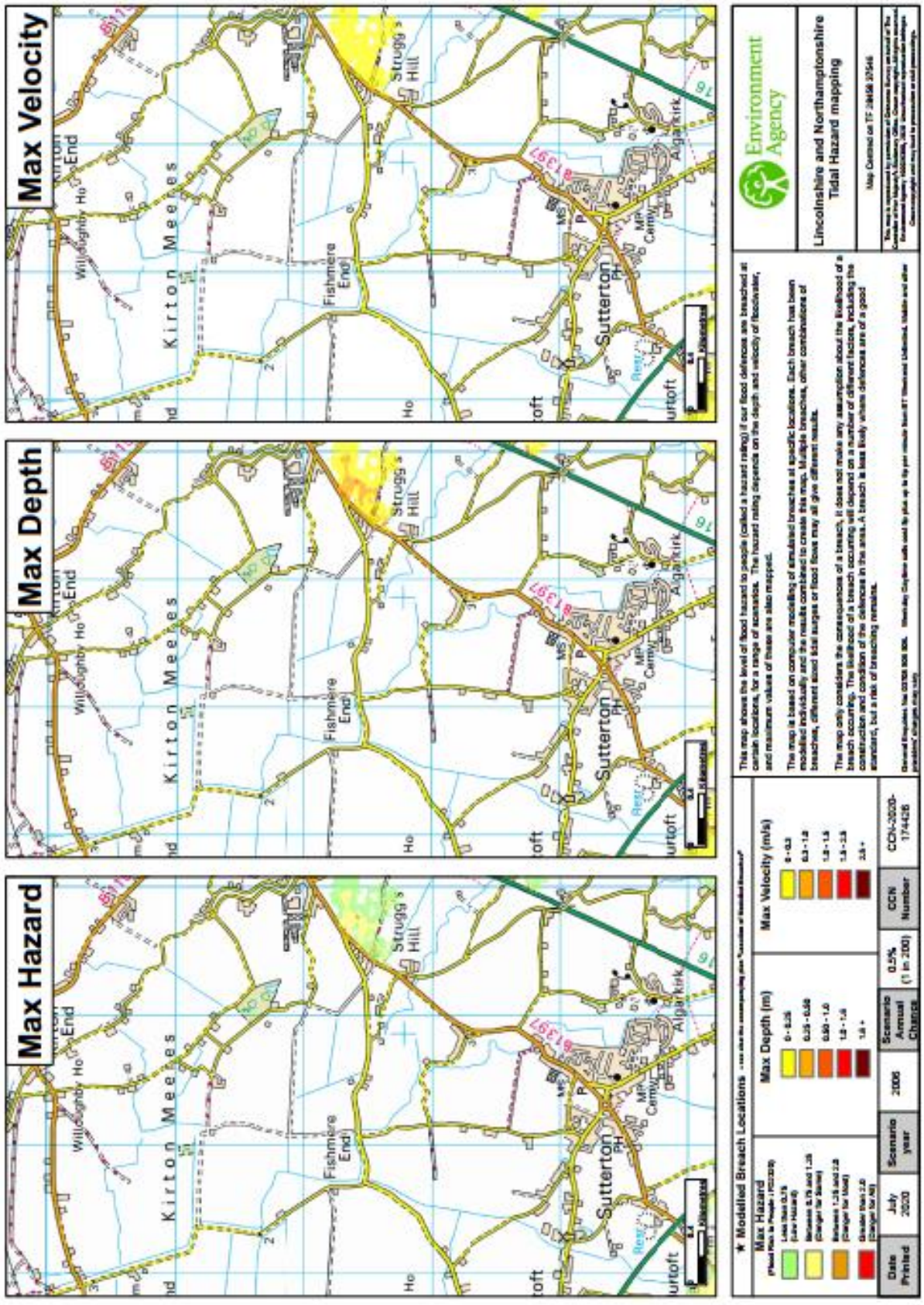
PLAN OF BLACK SLUICE IDB DRAINAGE NETWORK



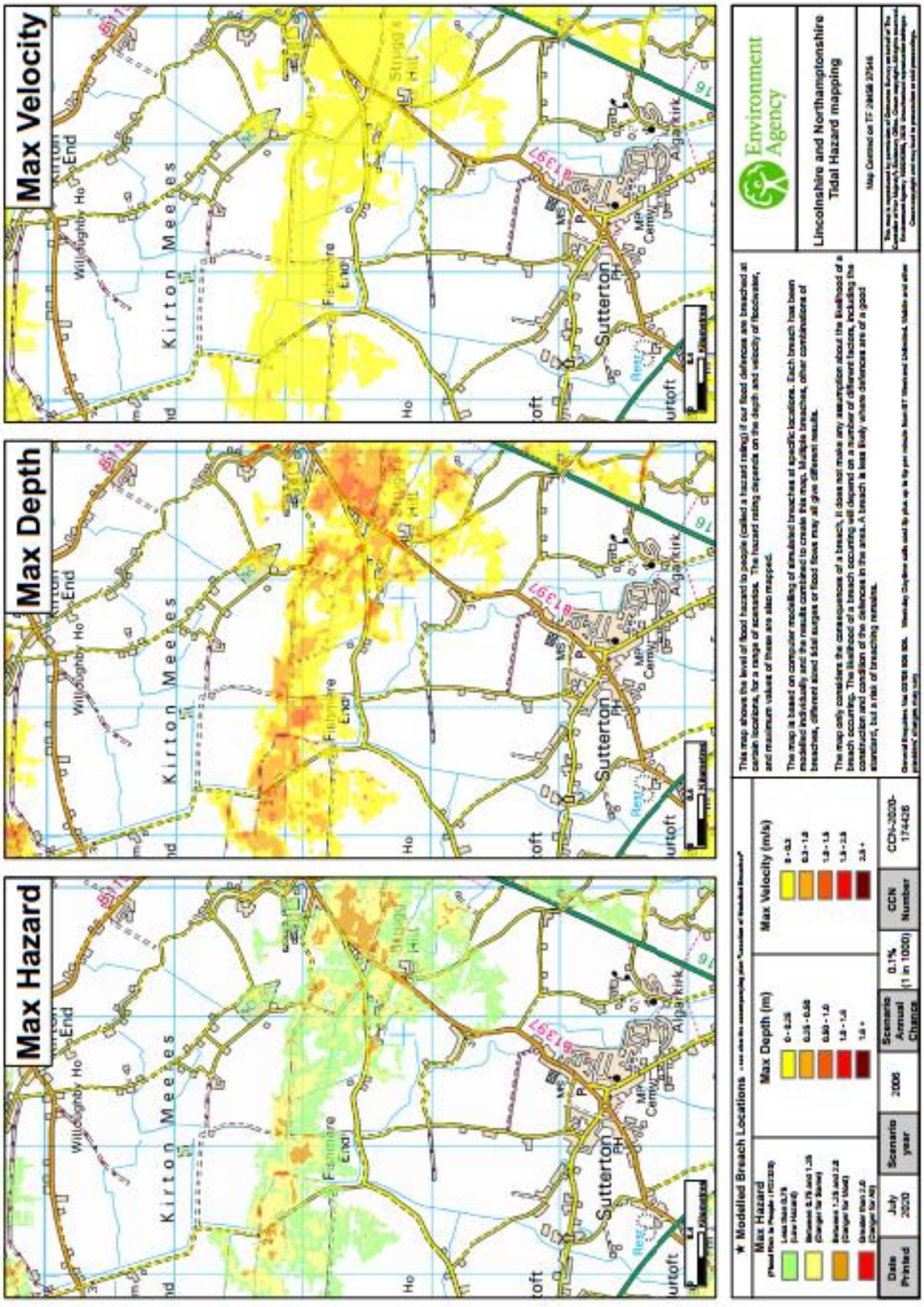
PLAN OF PROPOSED DEVELOPMENT



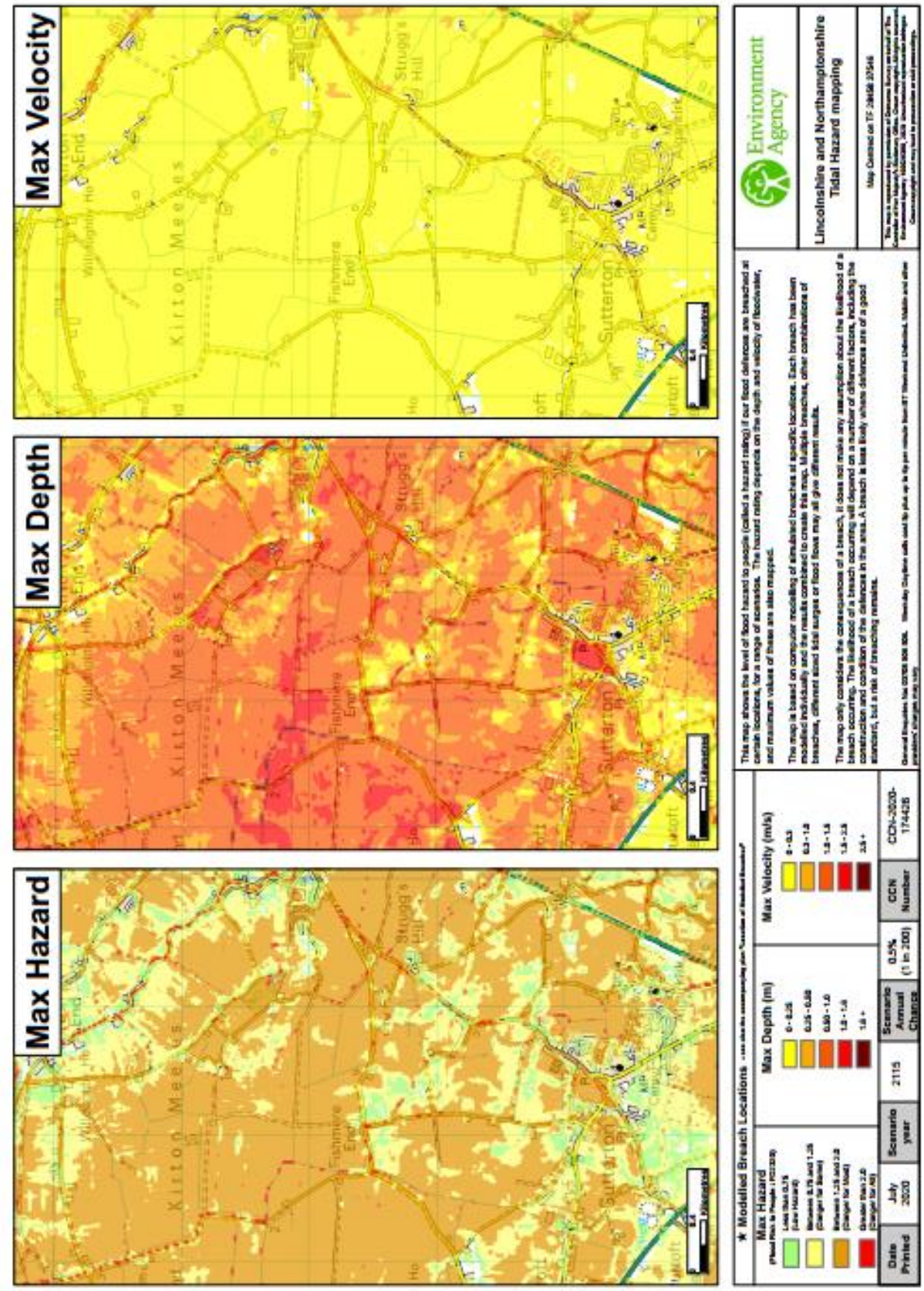
1 in 200 year Flood Risk from Breaching in 2006



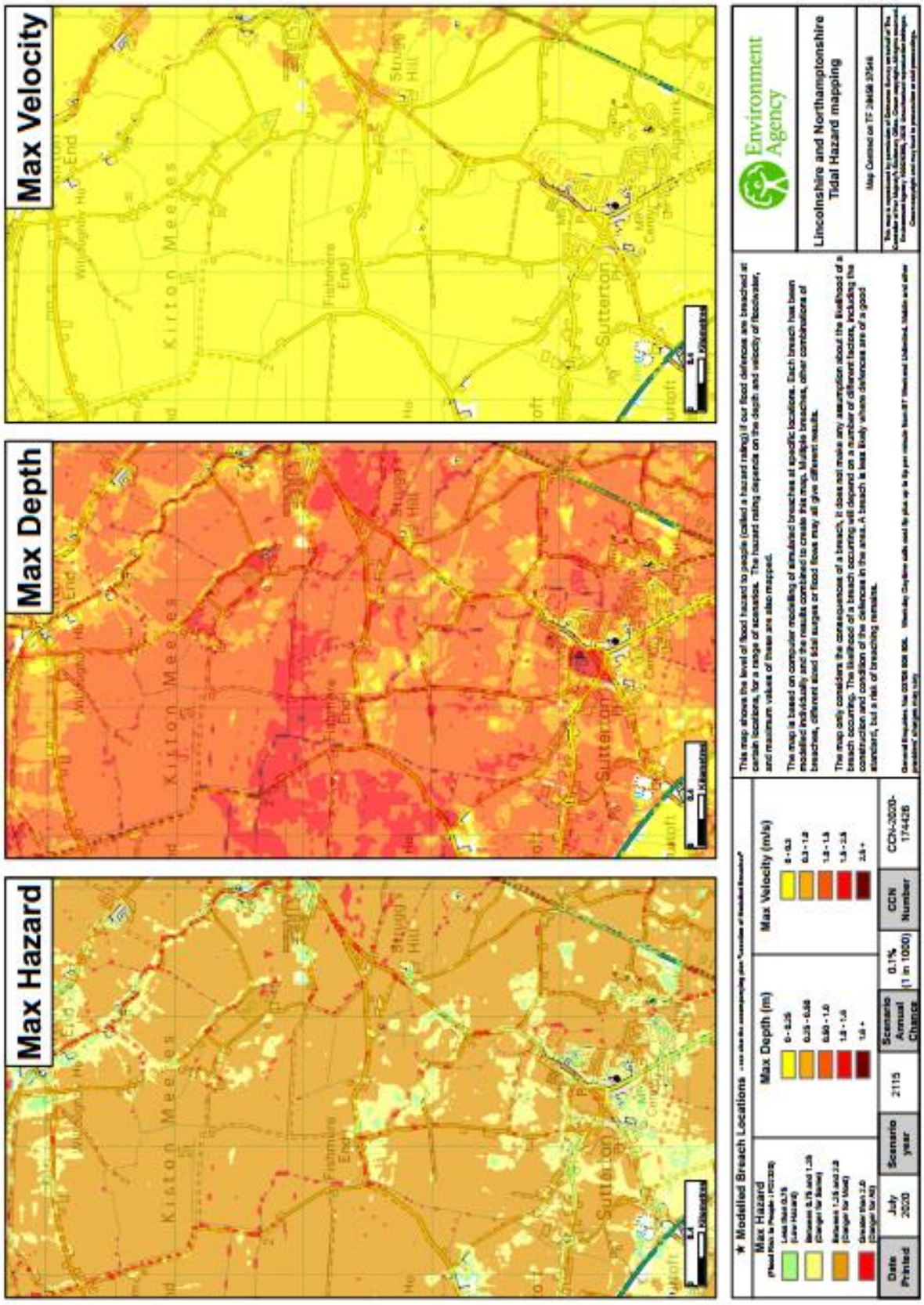
1 in 1000 year Flood Risk from Breaching in 2006



1 in 200 year Flood Risk from Breaching in 2115



1 in 1000 year Flood Risk from Breaching in 2115



APPENDIX A CLIMATE CHANGE

The Environment Agency has issued revised guidance on climate change and have now stated that the new predictions should be considered and incorporated into all flood risk assessments produced after 19th February 2016.

The maps issued by the EA were produced in 2006 and used the climate change impacts published by Defra in October 2006 which are reproduced below.

Table 1: Regional net sea level rise allowances

Administrative or Devolved Region	*Assumed Vertical Land Movement (mm/yr)*	*Net Sea-Level Rise (mm/yr)*				*Previous allowances*
		1990-2025	*2025-2055*	*2055-2085*	*2085-2115*	
East of England, East Midlands, London, SE England (south of Flamborough Head)	-0.8	4.0	8.5	12.0	15.0	6mm/yr* constant

Table 2: Indicative Sensitivity Ranges

Parameter	*1990-2025*	*2025-2055*	*2055-2085*	*2085-2115*
Peak rainfall intensity (preferably for small catchments)	*+5%*	**+10%**	*+20%*	*+30%*
Peak river flow (preferably for larger catchments)	+10%	**+20%**		
Offshore wind speed	*+5%*		**+10%**	*+10%*
Extreme wave height	*+5%*		**+10%**	*+10%*

Revised 2016 EA Guidance

Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%

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

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Table 3 sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)

Area of England	1990 to 2025	2026 to 2050	2051 to 2080	2081 to 2115	Cumulative rise 1990 to 2115 / metres (m)
East, east midlands, London, south east	4 (140 mm)	8.5 (212.5 mm)	12 (360 mm)	15 (525 mm)	1.24 m

Table 4 offshore wind speed and extreme wave height allowance (use 1990 baseline)

Applies around all the English coast	1990 to 2050	2051 to 2115
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

Effects on Predictions of Flood Risk in FRA

The FRA has identified two sources of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site:

1) Flooding from the tidal Haven or the tidal part of the River Welland.
2) Flooding from IDB drains.

1) Flooding from the tidal Haven or the tidal part of the River Welland

The contingency allowance in metres for the years 2055 and 2115 using 1990 as a baseline in the SFRA compared with the guidelines is as follows

Year	2006 guidance	Revised 2016 guidance
2055	0.395	0.412
2115	1.205	1.24

It is unlikely that an increase of 35mm in maximum levels in the Wash will have a significant impact on the predicted flood levels for the development site. The average depth of flooding on the site is 500mm, and a very small increase in the maximum flood level in the Wash is not going to change this prediction significantly.

2) Effect on IDB Systems

Black Sluice IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations, sluices and drainage channels. Pumping stations and sluices only have a 30 year life and will need to be refurbished or rebuilt within this timespan. It is assumed that Black Sluice IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that Board continues to provide the same standard of service as the present day.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the finished ground floor level of the proposed building should be raised by approximately 600mm above the existing ground level is satisfactory.