PROPOSED DEVELOPMENT AT
WHARF STREET, SUTTON BRIDGE, SPALDING, PE12 9UF
FLOOD RISK ASSESSMENT



View from Road

S M Hemmings B Sc C Eng MICE MIWEM,
69 Charlotte Way,
Peterborough,
PE3 9ER

This flood risk assessment has been prepared solely to support the planning application for a development at Wharf Street, Sutton Bridge. 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.

Introduction

An application is due to be made to South Holland District Council for Planning Permission to construct a single dwelling on a vacant plot of land at the western end of Wharf Street, Sutton Bridge, PE12 9UF directly east of the bungalow called “Monette”.

The site is within Flood Zone 3 as shown on the Environment Agency’s Flood Zone Map. These 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 shown within the defended area of the South Holland District Council’s Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the South Holland Internal Drainage Board district.

Environment Agency (EA) Flood Zones

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



It can be seen that the whole area of Sutton Bridge, except for a small area on the north east side of the town, is in Flood Zone 3.

Application Site

The development is located on the western side of the River Nene. The National Grid Reference of the site is 547830 321305.

The location of the site is shown on the plan at the end of this document.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a development consisting of dwelling houses 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 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.

The greater part of the area around Sutton Bridge, 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 development within the village boundary that is in a lower flood zone.

Taking into account the guidance, it can be seen that it is extremely unlikely that an alternative site with a lower flood risk could be found in the village of Sutton Bridge for this development. The safety of the development will be delivered by ensuring the floor level of the proposed new dwellings is above predicted residual flood levels for this area.

The South Holland District Council Core Strategy states that there is a limited number of sites outside the town of Spalding available for residential development. Therefore there is a requirement for further land to be brought forward and used for residential development.

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 South Holland District 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 South Holland District Council (SHDC). This document provides details of the flood risk in the Council's area. Reference to the maps in this document give the following information for the flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

The maps illustrate the actual flood hazard which is as follows:

For the present day	Depth of flooding … zero
	Extent of flooding .. Low or medium
	Hazard……..zero
	Velocity ……. Nil
For year 2115	Depth of flooding … Greater than 1.5m
	Extent of flooding .. High

Hazard…….....Significant

Peak Velocity …… Greater than 0.25m/sec.

The maps also illustrate the residual flood hazard which is as follows:-

For the present day Depth of flooding … 0 - 500mm

Extent of flooding .. High

Hazard…….....Low

Peak Velocity .. 0 – 0.1m/sec

For the year 2115 Depth of flooding …1.0m – 1.5m

Extent of flooding .. High

Hazard…….....Significant

Peak Velocity ……. Greater than 0.25m/sec.

Figure 16 of the general maps shows that the site is not within the rapid inundation zonefor the present day, but if no improvements are carried out it will be within the rapid inundation zone in 2115.

Tables in the SFRA show the following details of the defence bank on the west side of the tidal section of the River Nene south of the A17 road bridge, at chainage 3.3km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.92m OD	6.25m OD	7.06m OD
Peak 1 in 1,000 year extreme tide level	6.26m OD	6.59m OD	7.40m OD

The SFRA states the defence type at this point is an earth bank with a defence crest level between 6.94m and 7.25m OD and the average freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1140mm	810mm	0mm
Peak 1 in 1,000 year freeboard	800mm	470mm	-340mm

Information from Environment Agency

The Environment Agency has produced mapping which shows the maximum hazard, depth and velocity predicted following breaching of the tidal defences of the tidal River Nene east of the site. The EA have stated that the site would not be affected by overtopping of the defences.

The maps of breaching show the following predictions for hazard, maximum depth and maximum velocity at the development site:

	Maximum Hazard	Maximum Depth	Maximum Velocity
1 in 200 year in 2006	zero	zero	zero
1 in 200 year in 2115	zero	zero	zero
1 in 1000 year in 2006	Greater than 2	1.0m to 2.0m	0.3 to 1.0 m/sec
1 in 1000 year in 2115	Greater than 2	1.0m to 2.0m	0.3 to 1.0 m/sec

The maps supplied by the Environment Agency are reproduced on pages 13 to 16 of this report.

Existing 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 likelihood of flooding occurring due to overtopping or failures of the defences is considered to be very low.

The site is located approximately 430 metres from the tidal section of the River Nene, which is maintained by the Environment Agency.

There are watercourses in the area that are maintained by South Holland IDB.

Existing Ground Levels

The existing ground levels on the site are shown on page 09 of this report.

It can be seen that levels on the proposed development site vary from 3.78m OD to 3.98m OD. The level of Wharf Street north of the site is approximately 3.75m OD.

The ground floor level of the adjacent bungalow called "Monette" is approximately 3.9m OD.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Nene.
2. High water levels in IDB drainage channels.
3. Localised flooding due to failure of highway drainage

1. Failure or overtopping of tidal defences of the River Nene

The west bank of the River Nene is approximately 430 metres east of the site of the proposed development, and the Wash Banks are 10km north of the site at their nearest point. The hazard from the River Nene east of the development site if a breach occurred in the west bank will be considered to be the major risk to the site.

The predicted levels in the SFRA indicate that the west bank of the River Nene will not be overtopped unless there is an event greater than 1 in 1000 years at the present

time. However in 2115 although it will not be overtopped in a 1 in 200 year event, it will be overtopped in a 1 in 1000 year event.

The maps in the SFRA indicate that the predicted residual depth of flooding in a 1 in 200 year event in 2115 will be between 1.0 metres and 1.5 metres, and the breach mapping undertaken by the EA predicts similar flood depths to the site.

The EA breach mapping assumes no attempt is made to immediately repair the breach. It is also likely that the EA will undertake further bank raising within the next 100 years to ensure that there is a continuing 1 in 200 year defence to the Sutton Bridge area.

2. **High Water Levels in IDB drains**

Although the whole of this area is below high tide level in the Wash and the River Nene, the retained water levels in the drainage channels ensure that the risk of flooding is extremely low. South Holland IDB maintains a system of sluices, pumping stations, and drainage channels which convey surface water into the River Nene and the wash and control water levels throughout the South Holland IDB area.

This area of Sutton Bridge is within the Westmere Catchment and surface water and drainage discharges into watercourses which flow to Westmere Sluice, which is located approximately 1km north of the site on the banks of the River Nene. The surface water drainage of Wharf Road itself may not discharge into this system and is more likely to be collected in Anglian Water sewers and discharged directly into the River Nene or into the combined drainage system.

The channels maintained by South Holland IDB in urban areas are classified as high priority watercourses and as such receive a higher maintenance priority.

There are possibilities of failure of outfall sluices, but these are mitigated by the high level of maintenance given to these structures by the IDB. If a failure did occur the IDB would immediately be warned of the problem by their telemetry system and take action to repair the fault or to bring in temporary pumps to reduce the risk of any flooding in the area. Similarly any failures of culverts or other blockages would be dealt with immediately.

IDB systems are designed to provide a freeboard of between 600mm and 1000mm to all land in a 1 in 10 year return period rainfall event. This normally provides a standard of service of between 1 in 50 years and 1 in 100 years against flooding. In an extreme event water levels will rise but this will be a slow process and it would be at least 24 hours before levels were high enough to begin to flood low land in the area, and after this the level of the flood water would need to rise another 1.0 metre before the development site would be affected.

Therefore the risk of flooding from IDB drainage channels can be considered to be extremely low, and can be discounted as the floor levels of the proposed property will be raised significantly

3. **Localised Flooding due to failure of highway drainage**

There seems to be an adequate highway drainage system in Wharf Street in the area of the development site. However if for some reason there was a blockage in this system there is a possibility that some flooding could occur in low areas in adjoining properties. The recommended floor levels of the proposed property will be sufficiently high to ensure the risk from of flooding from this source can be discounted.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties having been flooded in the past.

Probabilities and Trends of Flooding

The probability of this development flooding from Environment Agency main river is very low. In an extreme event any effect on this location would not be sudden and there would be time for residents to take precautionary measures to limit the impact of any flooding that may occur.

Residual Risk – Extreme Events

The residual risk from extreme events is very low on this site. The major risk to the site is from a breach or overtopping of the tidal defences

The risk of this happening in this case is low and the hazard from any flooding is also low.

Climate Change

The predictions of 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 level 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 15 to 18). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Conclusions

The risk of flooding caused by bank breaches in EA rivers has been considered and shown to be remote. However both the SFRA and the EA mapping predicts that if a breach occurred in the bank of the River Nene east of the development site flooding will occur at this location.

The relevant parts of the EA maps showing predicted depths in a 1 in 200 year event in 2115 are shown below:



It can be seen from the map above that although the predicted levels on the site are between 1.0 and 2.0 metres, the predicted levels of flooding on the northern side of wharf Street are between 500mm and 1.0 metre. There is significant difference in the levels on each side of the road at the western end of Wharf Street, so it can be concluded that the predicted maximum flood depth following a breach of the west bank in a 1 in 200 year event in 2115 would be approximately 1.0 metre.

Recommendations

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

The ground floor level of the proposed houses should be a minimum of 4.80m OD which is approximately 1000mm above the existing ground level.

Flood resilient construction should be incorporated to a minimum height of 1000mm above the predicted flood level, and all of the electrical installation should be a similar height above finished floor level.

Demountable defences to a height of 600mm should be installed on ground floor doorways.

Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service. If a very high tide is predicted (greater than 6.50m OD) then the occupiers are advised that they should make preparations to monitor the situation and evacuate the building for the duration of the very high tide. They should drive to the central area of Sutton Bridge or be advised of a safer place to go.

On site surface water drainage should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations. As an alternative the surface water should be discharged into the Anglian Water surface water sewer in Wharf Street.

All future owners and occupiers of the building should be given a copy of the Flood Risk Assessment so that they are fully aware of the risk of flooding in this area.

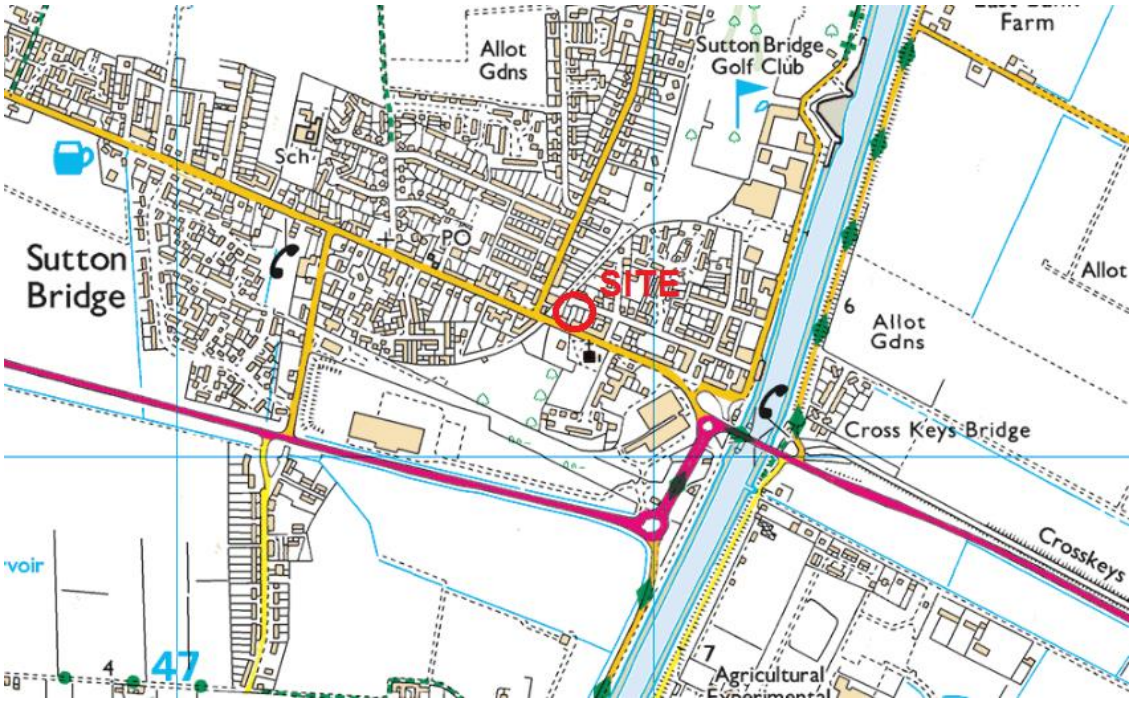
A flood evacuation plan should be prepared and the developer should inform the future occupiers of the property of this flood risk assessment and the risk of flooding if the west bank of the River Nene breached.

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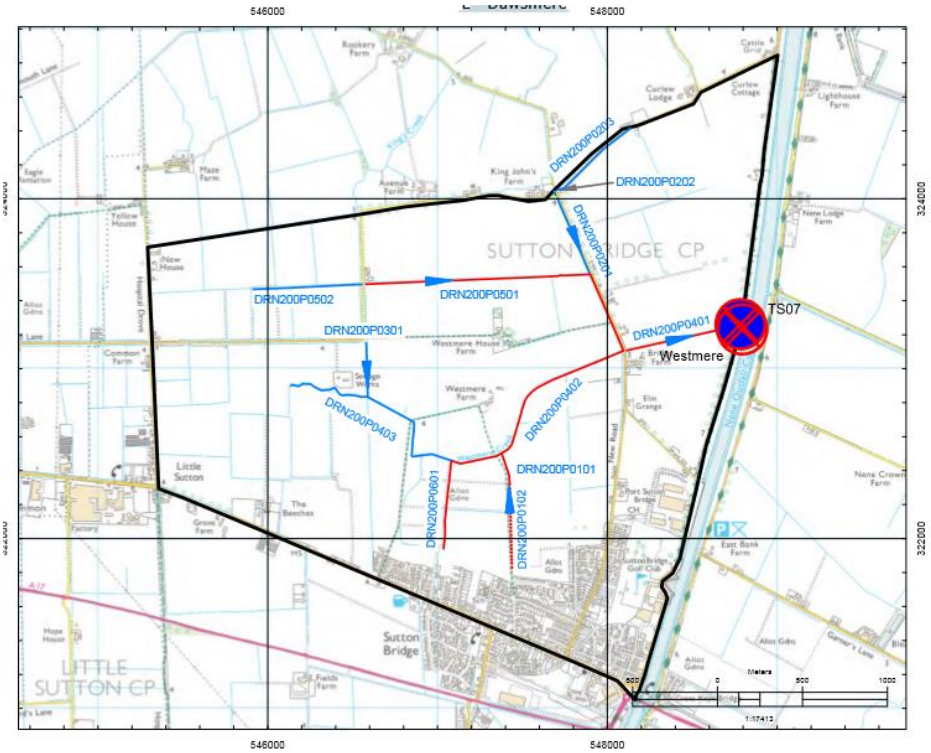
stuart.hemmings@btinternet.com

5th October 2016

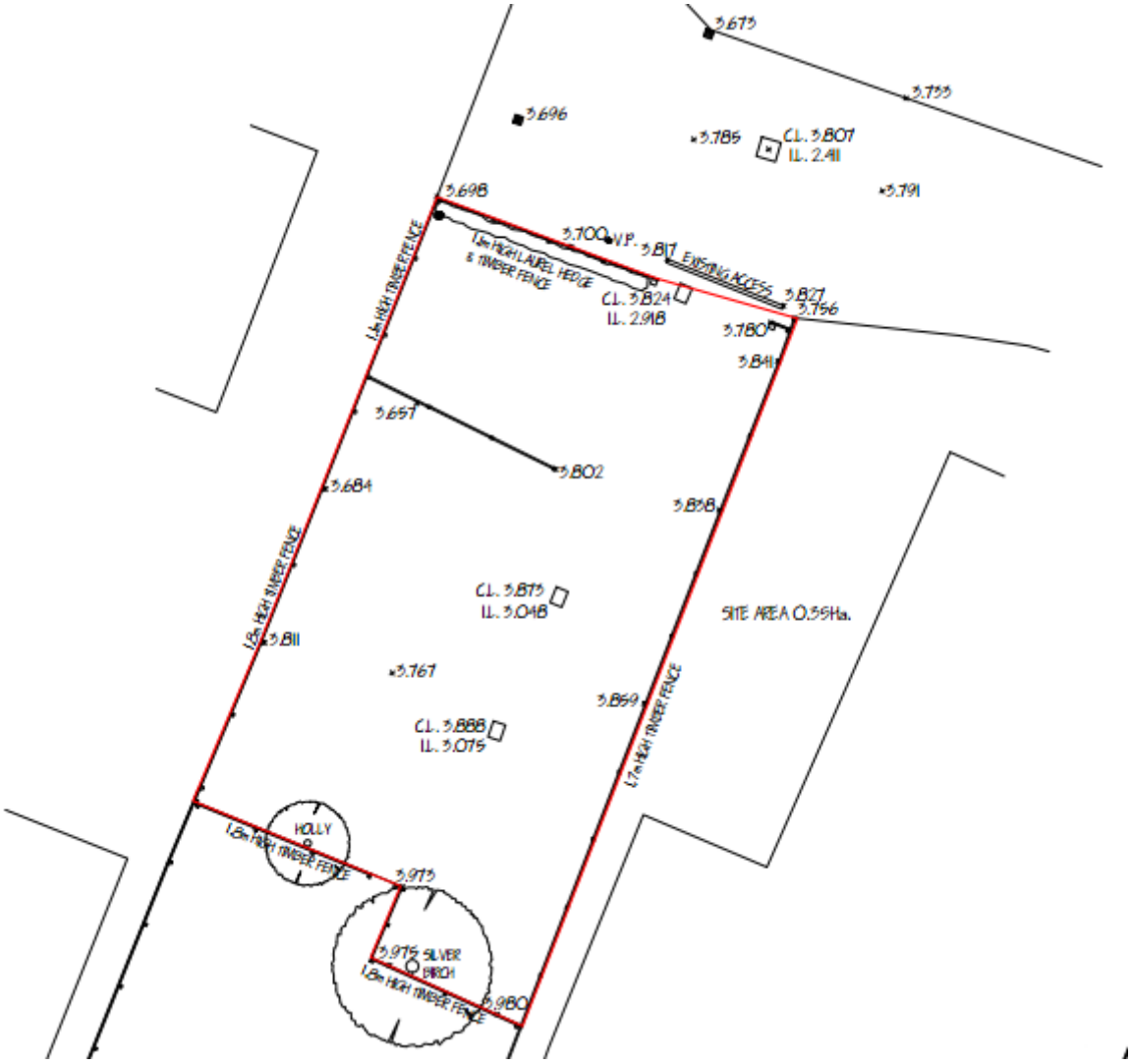
LOCATION PLAN



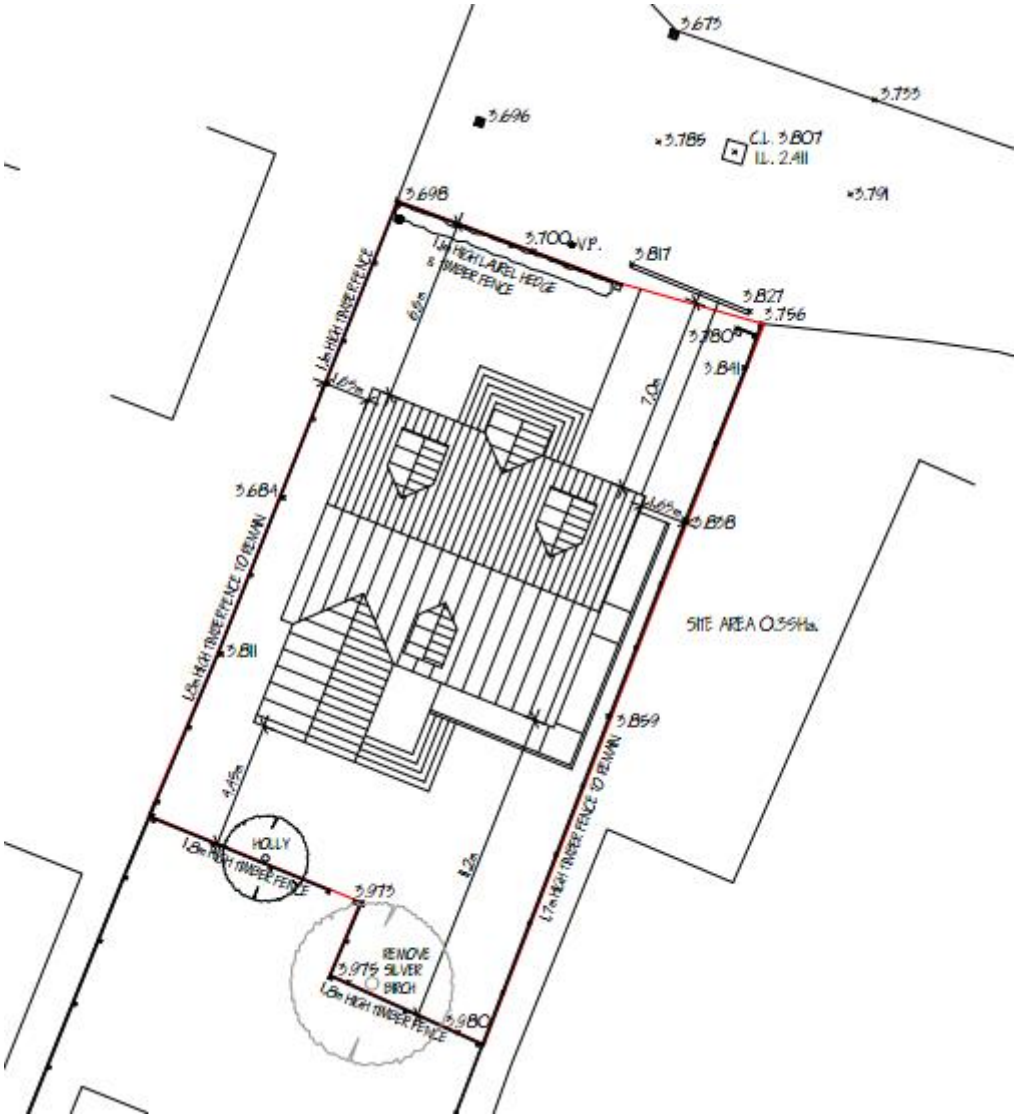
PLAN OF IDB DRAINS



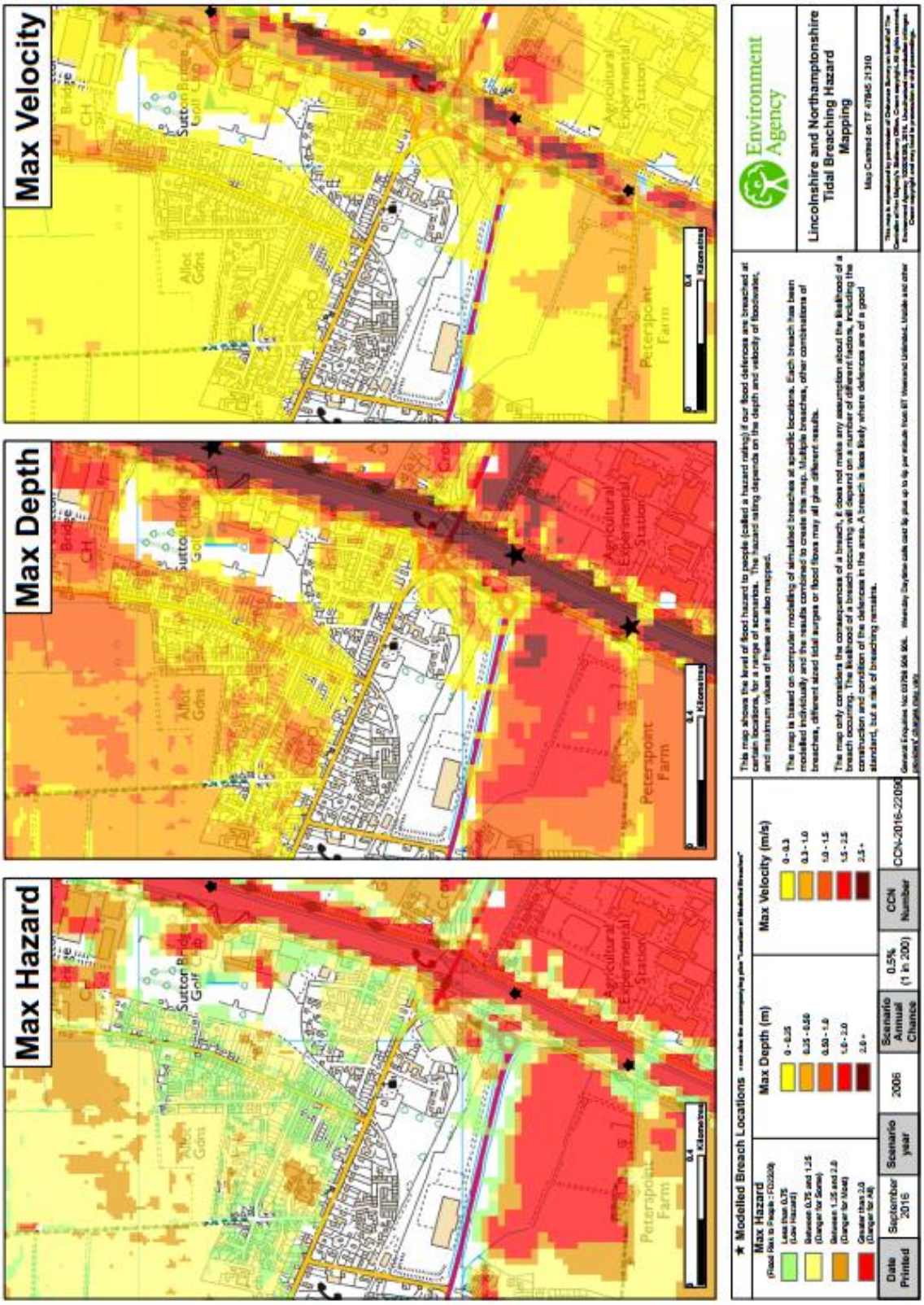
PLAN SHOWING SITE LEVELS



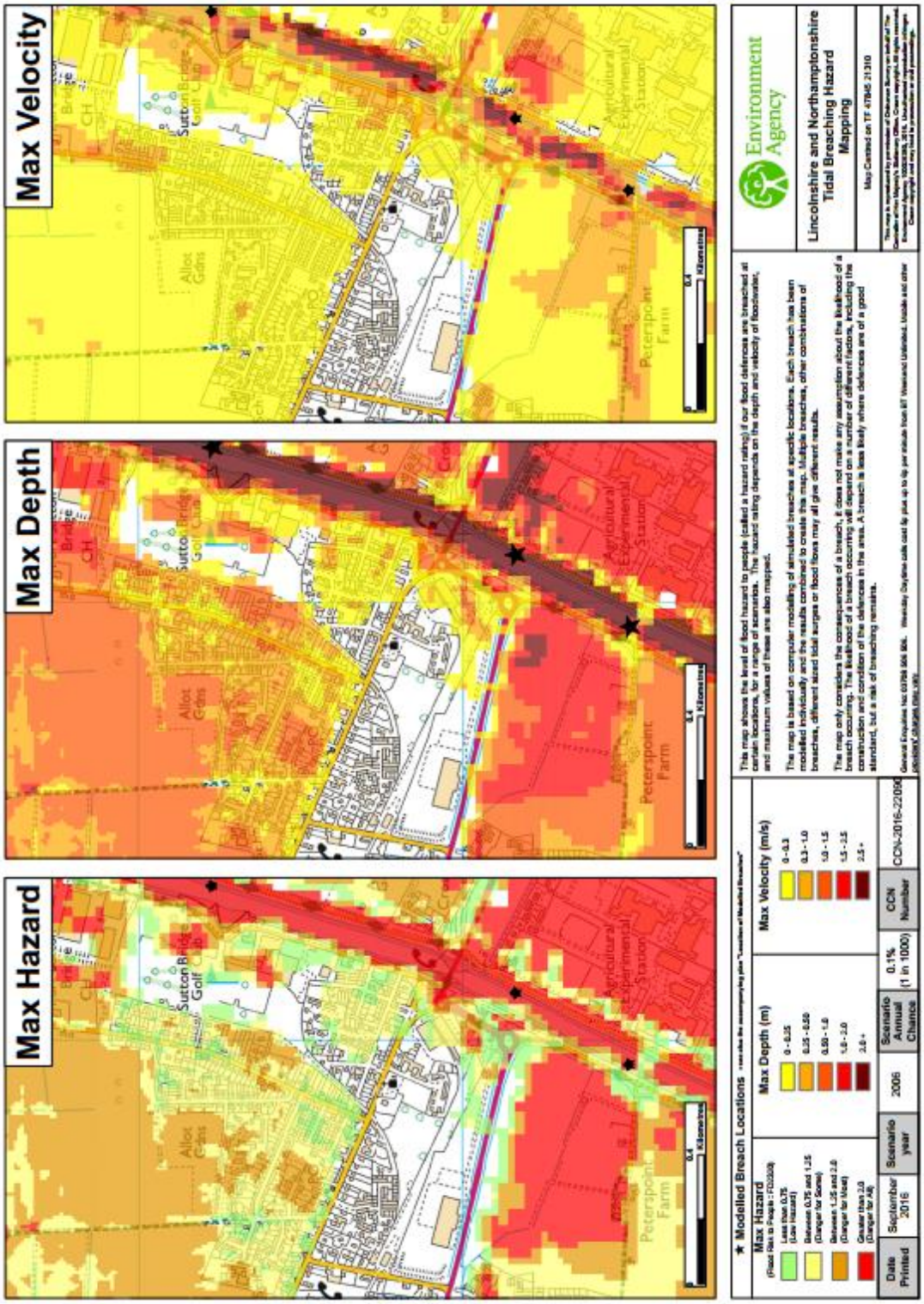
PLAN OF PROPOSED DEVELOPMENT



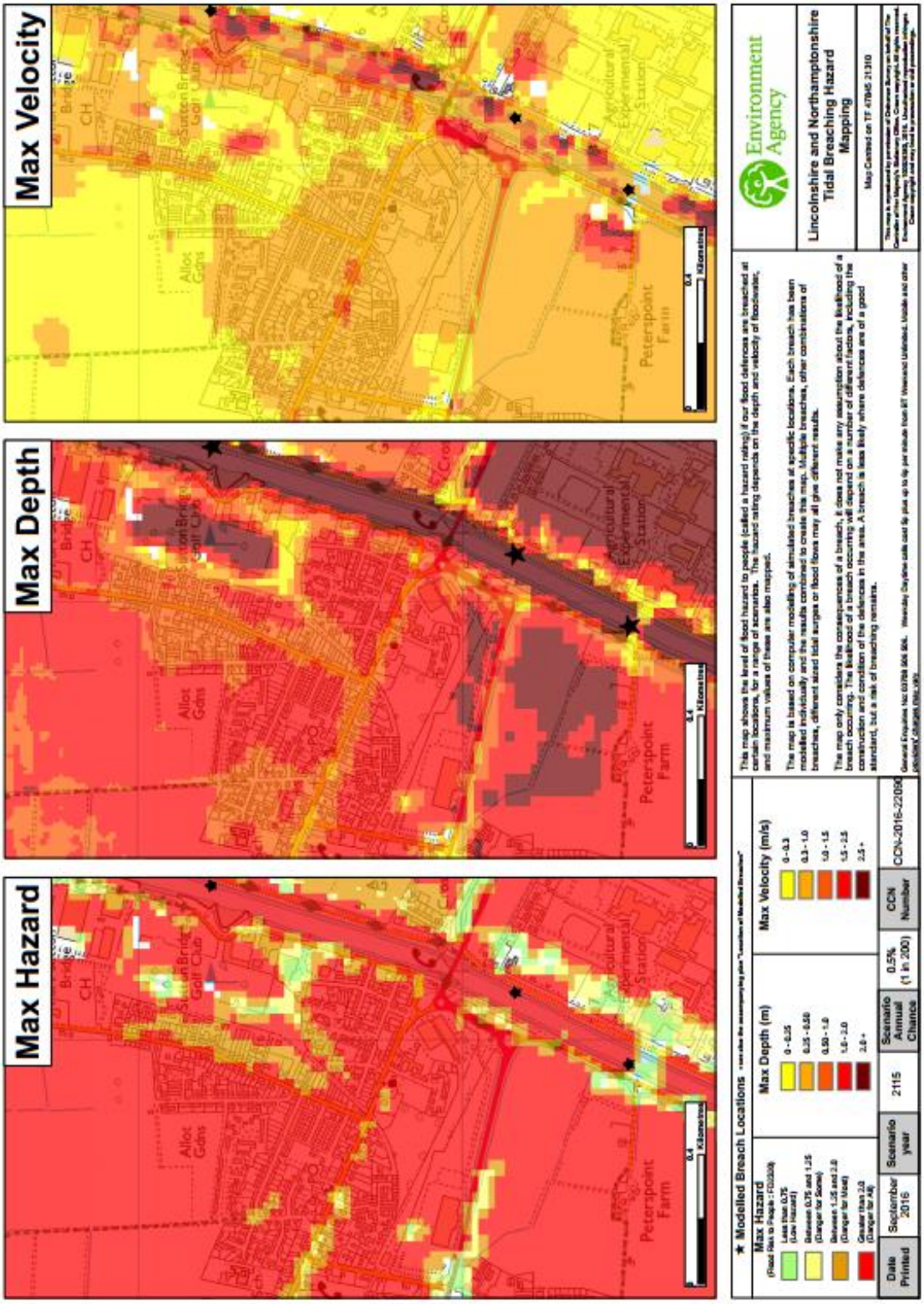
EA MAP SHOWING TIDAL BREACHING HAZARDS IN 1 in 200 YEAR EVENT IN 2006



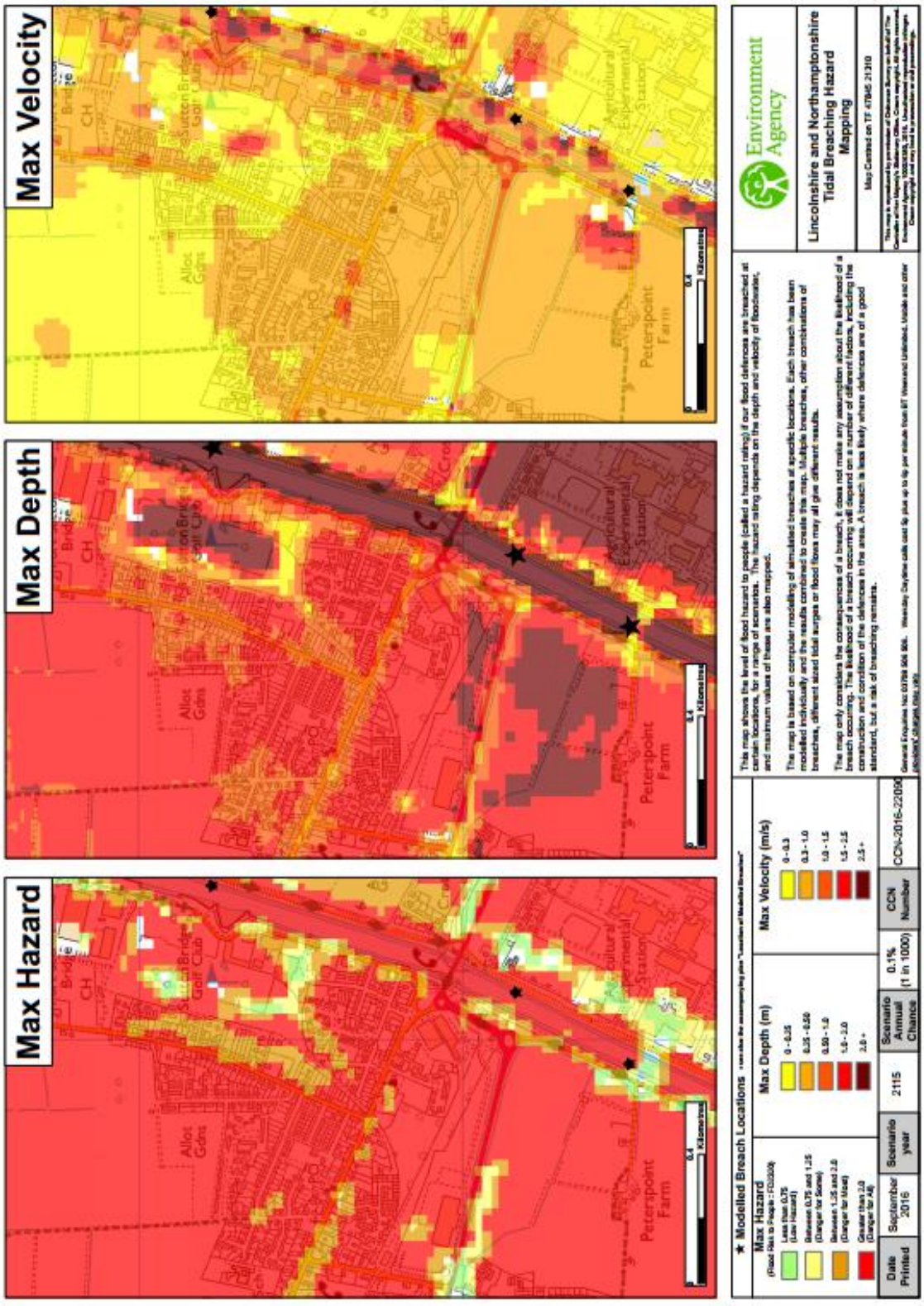
EA MAP SHOWING TIDAL BREACHING HAZARDS IN 1 in 1000 YEAR EVENT IN 2006



EA MAP SHOWING TIDAL BREACHING HAZARDS IN 1 in 200 YEAR EVENT IN 2115



EA MAP SHOWING TIDAL BREACHING HAZARDS IN 1 in 1000 YEAR EVENT 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.

Listed below are the climate change allowances in three documents:

- South Holland SFRA
- EA guidance (2013)
- Revised EA guidance

The recommendations in each document are shown below.

2010 South Holland DC SFRA

The SHDC SFRA states that the the following allowances have been made for climate change:

4.4 Climate Change

Scenarios for the years 2055 and 2115 include for climate change contingency allowances to the amount suggested by PPS25[1]. These allowances are expressed in *Table 2*. Percentage increases are relative to the present-day.

Table 2 – Adopted Climate change contingency allowances

Parameter	Year 2055	Year 2115
Sea level rise (m)	+ 0.33	+ 1.14
Extreme wave height	+ 10%	+ 10%
Peak river flow and volume	+ 20%	+ 20%
Peak rainfall intensity	+ 20%	+30%

Where flows arise from pumping rather than natural run-off, notably in the Vernatt's Drain and for the Fenland subcatchments of the South Forty Foot Drain, peak flow rates for future eras have been taken as equal to current rates since this SFRA assumes all flood risk management measures will remain in their current state.

2013 Guidance to Planners

Guidance to planners was issued by EA in September 2013

Table 1: Recommended contingency allowances for net sea level rises (Net sea level rise (mm per year) relative to 1990)

	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

document is out of date

Table 2: Recommended national precautionary sensitivity ranges for peak rainfall intensity, peak river flow, offshore wind speed and wave height

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

s been withdrawn (19

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 the main source of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site is flooding from the tidal River Nene

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	SFRA	2013 guidance	Revised 2016 guidance
2055	0.33	0.395	0.412
2115	1.14	1.205	1.24

Therefore it can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. This will not have the effect of increasing the predicted flood level at the site in a 1 in 200 year breach event in 2115 by the maximum of 100mm, but it will probably be only between 10mm and 50mm. It is unlikely that this increase will significantly change the maps at present issued by the Environment Agency.

Flooding from IDB drainage system

As the development is in flood zone 3 and is classed as more vulnerable, the advice from the Environment Agency is that the higher central climate change allowance, which is 35%, should be considered. After considering the effects of this increase the upper end allowance, which is 65%, should be considered to assess the effect of this.

IDB's have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. Generally IDB's are happy that their systems provide a 1 in 100 year standard to most urban areas at the present time.

South Holland 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 South Holland 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 the 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 floor levels should be a minimum level of 4.80m OD is satisfactory.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the floor levels should be a minimum level of 3.75m OD is satisfactory.