

**PROPOSED DEVELOPMENT BETWEEN FLEET ROAD AND
LITTLE MARSH LANE, FLEET HARGATE, HOLBEACH,
SPALDING, PE12 8LS.
FLOOD RISK ASSESSMENT**



View of site from Little Marsh Lane looking north

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This flood risk assessment has been prepared solely to support the planning application for the proposed development at Fleet Road, Fleet Hargate, Holbeach. 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

A Planning application is due to be submitted to South Holland District Council to construct 22 new dwellings on a site south of Fleet Road and north west of Little Marsh Lane in the village of Fleet Hargate, Spalding.

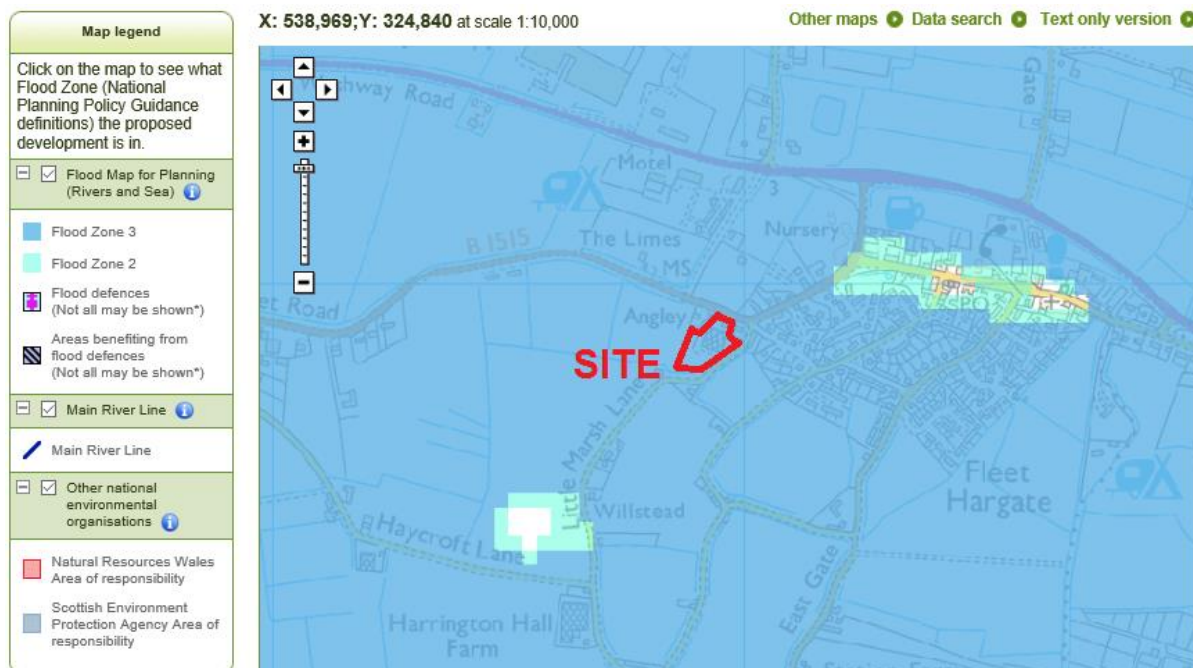
The site is in Flood Zone 3 as shown on the Environment Agency's Flood Zone map. The flood zone maps do not take into account existing flood defences.

For the Planning Application to be valid a flood risk assessment needs to be carried out to conform with the requirements of the Technical Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified in the South Holland District Council's Strategic Flood Risk Assessment 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 a greater part of this area of Fleet Hargate is within Flood Zone 3 (shown dark blue). Land to the east in the centre of the village is higher and classed as flood zone 2 (shown in light blue).



Application Site

The development is located on the west side of the village of Fleet Hargate. The approximate National Grid Reference of the site is 538940 324880.

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

As the area is not within the functional flood plain it can be designated as being within flood zone 3(a). 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.

As can be seen from the map on page 2 of this report the whole of the area around Fleet Hargate with the exception of the small central area of the village is in Flood Zone 3. Therefore it would be difficult to find a similar site for development 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 for the development in the Fleet Hargate area. The safety of the development will be delivered by ensuring the floor levels of the proposed new dwellings are above predicted residual flood levels for this area.

The Design and Access statement confirms that the proposed development is in accordance with the relevant South Holland District Council Core Strategy policies.

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.

South Holland DC SFRA

Report Maps

Map 3 shows that the site is within flood zone 3.

Map 5 shows that the site is at low or medium risk, but reliant on flood defences for this standard.

Map 6 indicates the peak depth is zero for the present day 1% fluvial and 0.5% tidal event probability.

Map 7 indicates the peak velocity is zero for the present day 1% fluvial and 0.5% tidal event probability.

Map 12 indicates the actual risk is low or medium for the year 2055 1% fluvial and 0.5% tidal event probability.

Map 13 indicates the actual risk is low or medium for the year 2115 1% fluvial and 0.5% tidal event probability.

Map 16 shows that the site is not within a rapid inundation zone.

Flood Maps Table D1

The actual flood hazard for the present day and 2115 is as follows:

Depth of flooding..... zero
Extent of flooding..... low or medium, reliant on flood defences
Velocity nil

The residual flood hazard for the present day and 2115 is as follows:

Depth of flooding..... zero
Extent of flooding..... low or medium, reliant on flood defences
Velocity nil

Maximum flood level and bank levels in the River Welland

The maximum levels in the tidal section of the River Welland 8 km west of the site are as follows:

	2007	2115
Peak 1 in 200 year level	5.98	7.12
Peak 1 in 1000 year level	6.27	7.41

The lowest levels of the east bank of the River Welland around chainage 18km are 7.50m OD, with average levels between 7.60m and 7.70m OD.

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 5.2km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.86m OD	6.19m OD	7.00m OD
Peak 1 in 1,000 year extreme tide level	6.20m OD	6.53m OD	7.34m OD

The SFRA states the defence type at this point is “No raised Defence” with a defence crest level of 6.95 m OD and the freeboards are as follows:

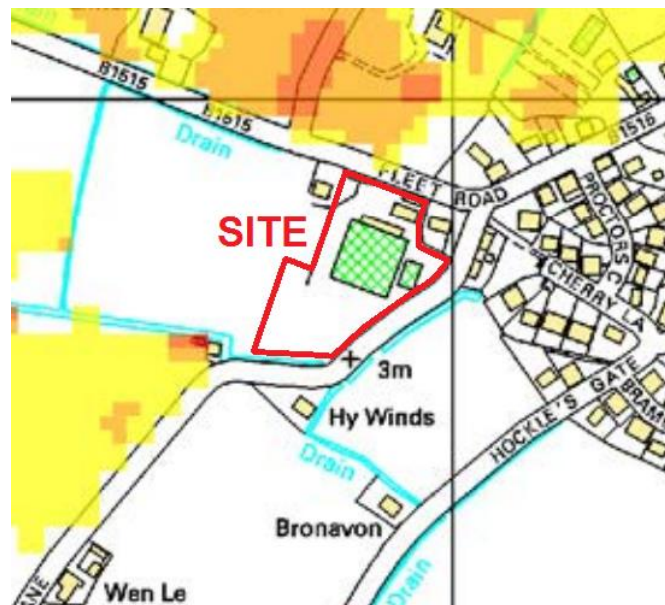
	2007	2055	2115
Peak 1 in 200 year freeboard	1870mm	1540mm	730mm
Peak 1 in 1,000 year freeboard	1580mm	1250mm	440mm

Further south the defence is an earth bank with crest levels between 5.3km and 5.7km (the outfall of the South Holland Main Drain) of 7.07, 7.1, 7.04, 7.15 and 7.07m OD. However there is a low section adjacent to the bridge itself at a level of 5.95m OD. Levels of the defence north of the A17 bridge are approximately 6.30m OD.

Environment Agency Tidal Breach Hazard Mapping

The Environment Agency has published mapping which predicts the depths, velocities and hazard following a breach in the tidal defences for a 1 in 200 and 1 in 1000 year event in 2115. The maps have been produced by modelling breaches along the whole

length of the tidal defences and combining these into one map. The floor levels for two story buildings should be above the 1 in 200 year predicted tidal flood depths in 2115, and the map showing these depths is shown below.



The map does not predict any flooding on the site in a 1 in 200 year tidal year event in 2115.

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 8.2 km from the tidal section of the River Welland near Fosdyke, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located 10.6 km west of the tidal River Nene north of Sutton Bridge which also has a tidal defence bank which is maintained by the Environment Agency.

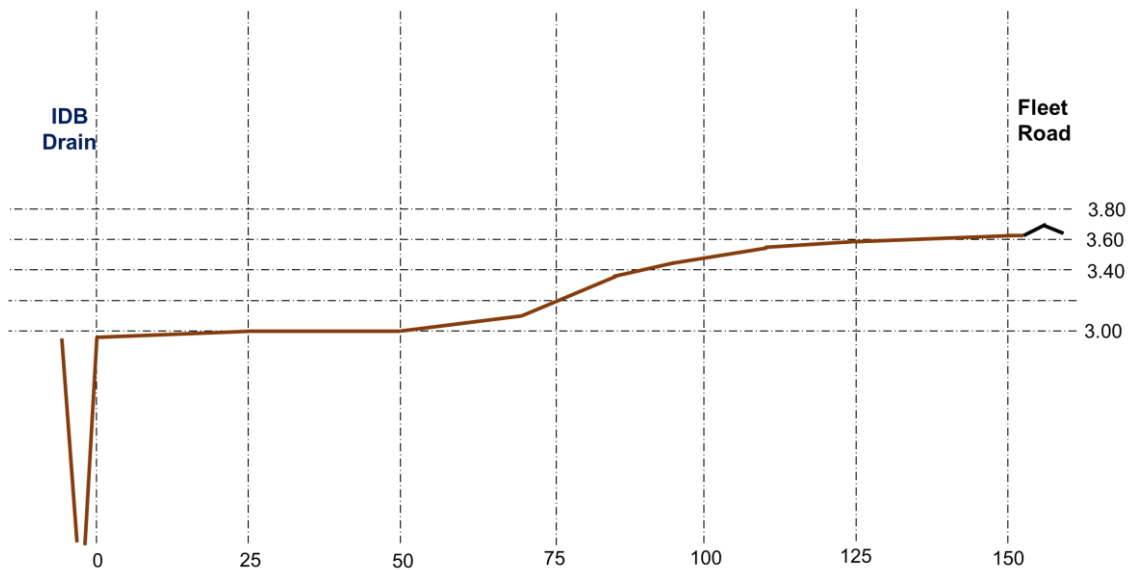
The site is located 10.9 km south of the Wash tidal defences north of Holbeach St Matthew which are maintained by the Environment Agency.

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

Existing Ground Levels

A full topographical survey has been carried out across the site and this drawing will be submitted with the planning application.

The site slopes from a level of 3.65m OD on the northern side adjacent to Fleet Road to approximately 3.00m OD alongside the IDB drain on the southern boundary alongside Little Marsh Drain. A cross section north south is shown below:



Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Nene or the Wash
2. High water levels in IDB drainage channels.
3. Localised flooding in the area.

1. Failure or overtopping of tidal defences of the River Nene, River Welland or the Wash

The site is approximately 8.2 km from the tidal defences of the River Welland south of Fosdyke and east of the A17. The SFRA predicts an extreme tide level of 7.13m OD in a 1 in 200 year event in 2115. The defence levels in this section vary between 7.46m OD and 7.83m OD and therefore could be overtopped in an extreme event allowing for wave action.

The site is approximately 10.6 km from the tidal defences of the River Nene. The predicted levels in the SFRA indicate that the west bank of the River Nene between the A17 road bridge and the South Holland Main Drain Outfall Sluice will not be overtopped unless there is an event greater than 1 in 1000 years at the present time. In 2115 although it will not be overtopped in a 1 in 200 year event, it could be overtopped in a 1 in 1000 year event.

The site is 10.9 km from the Wash banks north of the site near Holbeach St Matthew. The hazard from a breach in these defences in 2115 is unlikely to affect areas south of the A17 road.

The maps in the SFRA do not predict any flooding on the proposed site in a 1 in 200 year event in 2115. The maps produced later by the Environment Agency also do not predict any flooding on the proposed site in a 1 in 200 year event in 2115.

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 areas west of the River Nene.

Therefore it can be concluded that the site will not be affected following a breach in the tidal defences in a 1 in 200 year tidal event in 2115.

2. High Water Levels in IDB drains

Although the whole of this area is below high tide level and levels in the rivers, 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, the Wash and the River Welland and control water levels throughout the South Holland IDB area.

The development site is located on the south side of Fleet Road which is in the Lutton Leam catchment. The watercourse on the southern boundary of the development on the north side of Little Marsh Lane is an IDB maintained drain. This flows eastwards through a piped section and then flows into the Fleet Drain and flows north under the A17. It then flows eastwards and north of Long Sutton flows into Lutton Leam, and the water then discharges through a sluice into the tidal River Nene north of Sutton Bridge.

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. South Holland IDB watercourses generally state that their watercourses provide a standard of 1 in 100 years with a freeboard of 300mm in urban areas. 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.

3. Localised Flooding in the Area of the Development

A surface water system will be constructed to collect the flows from the roadway in the development the flow will be discharged into a dyke on the south east side of Little Marsh Lane. If this system were to fail, or excess surface water collected on the site this would flow into the open section of the IDB drain which would prevent any flooding on the site.

The raising of floor levels by 300mm above ground level will provide adequate mitigation for this source of flooding.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the existing house or garden 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 recommendations for flood depths for this flood risk assessment use information mostly taken from the South Holland DC SFRA which was last updated in 2010. 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 15 to 18).

Conclusions

Both the SFRA and the information from the EA do not predict any flooding on the site in a 1 in 200 year tidal event in 2115. The EA have modelled breaches in banks of all of the tidal rivers and along the frontage of the Wash. The banks are high enough at the present time to prevent overtopping. If a large breach occurred in the bank the SFRA and the EA maps indicate that the flood water would not reach this development site in Fleet Hargate area.

The Environment Agency have stated that their policy is to continue to maintain tidal banks in the future with at least a 1 in 200 year standard of service.

The risk of flooding to the building from IDB drains in a 1 in 100 year event in 2115 can be considered to be remote as the floor levels will be raised by 300mm above ground level.

The IDB have adequate arrangements to bring in contractors and use their own staff if a failure of any part of the sluices occurred. If drains become full any flooding that occurs would happen very slowly and affect land at levels between 2.50m OD and 3.0m OD before the development site. It would be very unlikely to reach a level of 3.30m OD and flood the proposed houses.

The proposed development is not in a functional flood plain as defined by PPS 25.

Any flooding that might occur in a greater event than 1 in 200 years in 2115 would happen very slowly and residents would have adequate time to prepare themselves for the event.

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 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 approximately 300mm above existing ground levels and therefore the minimum floor level for houses with all sleeping accommodation on the first floor should be 3.30m OD

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

Rainwater from the roofs of the houses and garages should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations. Hardstandings around the buildings should be constructed with permeable paving.

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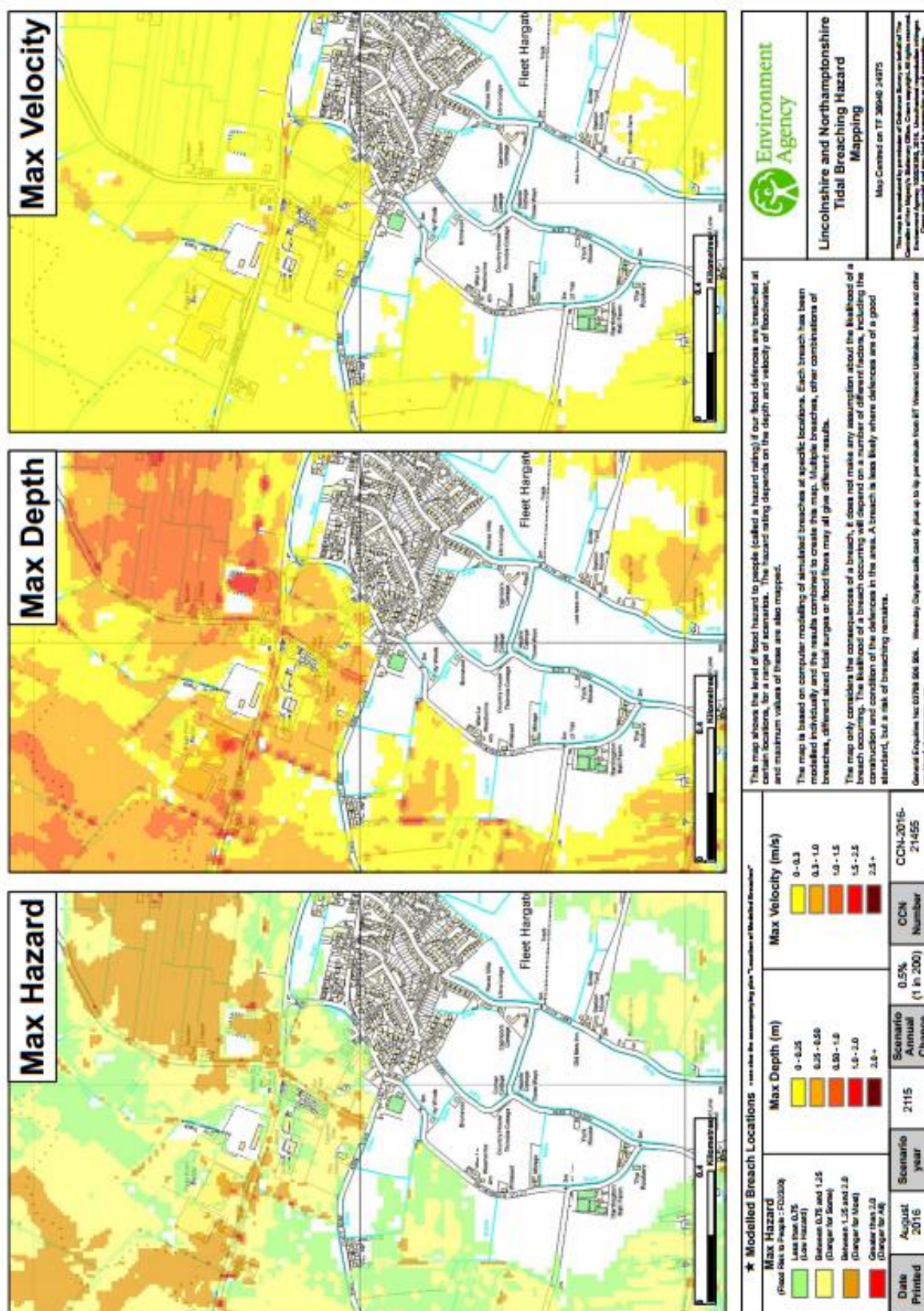
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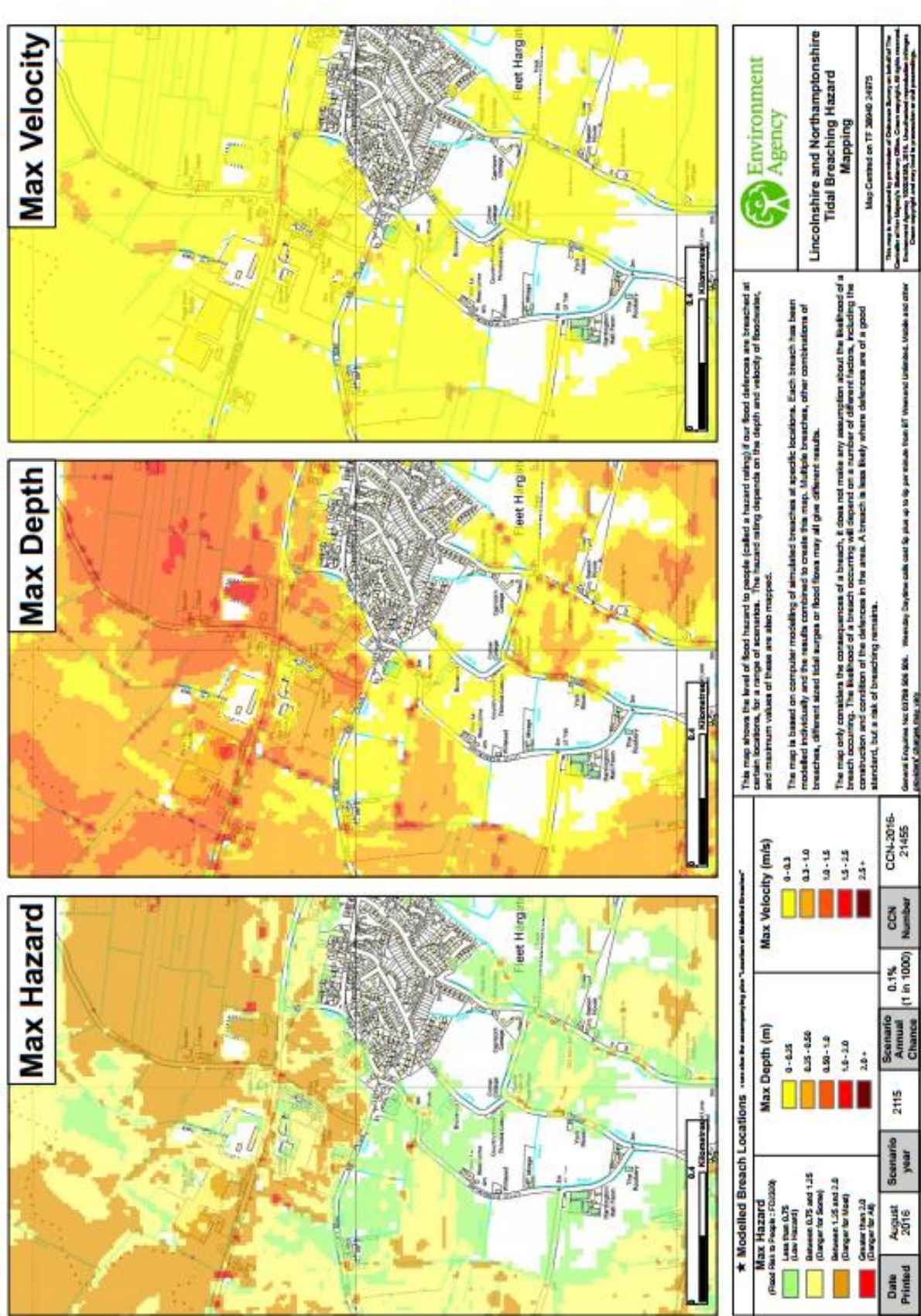
PROPOSED SITE LAYOUT



1 in 200 year in 2115 Breach Hazard Map



1 in 1000 year in 2115 Breach Hazard Map



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 PPS25¹. 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

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%	

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 Wash, tidal River Welland or tidal River Nene
- 2) Flooding from IDB drainage system

1) Flooding from the Wash, tidal River Welland or 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 maximum

flood level at the site in a 1 in 200 year breach event in 2115 by 100mm. It will probably be between 10mm and 50mm. This will not therefore affect the conclusion that flood water from a breach in the tidal defences will not affect the development site.

2) Fluvial Flooding from IDB watercourses

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 at least 300mm above existing ground level with a minimum level of 3.30m OD is satisfactory.