PROPOSED RESIDENTIAL DEVELOPMENT AT HOLBEACH MANOR, FLEET ROAD, HOLBEACH, SPALDING, PE12 7AX.

FLOOD RISK ASSESSMENT

View of site from south end

S M Hemmings B Sc C Eng MICE MIWEM,
13 Lea Gardens,
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PE3 6BY

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This flood risk assessment has been prepared solely to support the planning application for the residential development at Holbeach Manor, Fleet Road, 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 residential development is proposed east of Holbeach Manor at Fleet Road, Holbeach, Spalding. The land is at present part of the extensive gardens to the property.

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 all of this area east of Holbeach is within Flood Zone 3. There is a small area in the centre of Holbeach which is higher and is within flood zones 1 and 2.

Application Site

The development is located on the eastern side of Holbeach. The National Grid Reference of the site is 536760 324680.

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	✓*

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 all of the area on the east side of Holbeach is in Flood Zone 3. Therefore it would be difficult to find a similar site for the development in Holbeach that is in a lower flood risk zone. Most of the areas within Holbeach and Fleet which have been allocated for development and are included within the South East Lincolnshire Local Plan (SELLP) adopted in March 2019 are within flood zone 3(a). A list of the allocated sites in the Holbeach and Fleet area is shown on pages 200 – 203 of the local plan document. The flood hazard and predicted maximum flood depths of these allocated sites are listed on the next page. This information has been taken from the Holbeach section of the South East Lincolnshire Strategic Housing land Availability Assessment.

Site	Area (ha)	Flood Hazard	Flood Depth
Hob004	5.85	Danger for Some	250mm – 500mm
Hob010	0.79	No Hazard	No depth
Hob032	6.27	No Hazard	No depth
Hob048	42.2	Low Hazard	250mm – 500mm

The assessment for the site at Holbeach Manor is as follows

Site	Area (ha)	Flood Hazard	Flood Depth
-	-	Low Hazard	0 – 250mm

There are 2 allocated sites with a lower flood hazard than the site at Holbeach Manor and 2 sites that have been allocated with a greater hazard than the site at Holbeach Manor. Sequentially the proposal site has a better predicted flood depth than two of the sites allocated within the latest Local Plan.

Site Hob045 situated immediately south of the proposed development site was not allocated in the plan. A planning application for this site (reference H09-0332-16) was approved in 2017. The flood hazard for this site was specified as “danger for most” and the predicted flood depth was between 500mm and 1.0 metre. It can be seen that the hazard and the predicted flood depth is greater than the proposed development site.

The safety of the development will be delivered by ensuring the floor levels of the proposed new houses are above the predicted residual flood levels in a 1 in 200 year event in 2115 for this area.

The South Holland District Council Core Strategy states that there is a limited number of sites in the South Holland DC area available for residential development. Some further sites will need to be identified to enable the Council to meet the RSS and Structure Plan requirement for 2021. Therefore there is a requirement for further sites to be brought forward and used for residential development.

Therefore taking into account the above I consider that the sequential test for this site 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

The Strategic Flood Risk Assessment (SFRA) written for the South Holland District Council (SHDC) in 2010 provides details of the actual flood risk in the Council's area. This information has not been updated and reference to the maps in this document give the following information for the actual flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

For the present day	Depth of flooding … zero
	Extent of flooding .. Low or medium flood probability
	Peak Velocity ……. Nil
For year 2115	Depth of flooding … zero
	Extent of flooding…. Low or medium flood probability
	Peak Velocity …… Nil

The maps showing the residual flood hazard were revised in the 2016 update of the South Holland District Council Strategic Flood Risk Assessment which can be found on the website of the South East Lincolnshire Joint Planning Committee. The residual hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

For the present day	Depth of flooding …zero
	Extent of flooding .. Low or medium flood probability
	Hazard…….. None
	Peak Velocity .. Nil
For the year 2115	Depth of flooding …0 – 500mm
	Extent of flooding .. High
	Hazard……. Low Hazard
	Peak Velocity .. 0 – 0.3m/sec

Figure 16 of the general maps shows that the site is not within the rapid inundation zone.

Maximum flood level and bank levels in the River Welland

The maximum levels in this tidal section of the River Welland 9.2 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.

Maximum flood level and bank levels in the River Nene

The maximum levels in this tidal section of the River Nene 12.5km east of the site are as follows:

	2007	2115
Peak 1 in 200 year level	5.79m OD	6.93m OD
Peak 1 in 1000 year level	6.13m OD	7.27m OD

The defence level (top of left bank) at chainage between the South Holland Main Drain and the North level Main Drain is between 7.00m and 7.30mOD.

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.

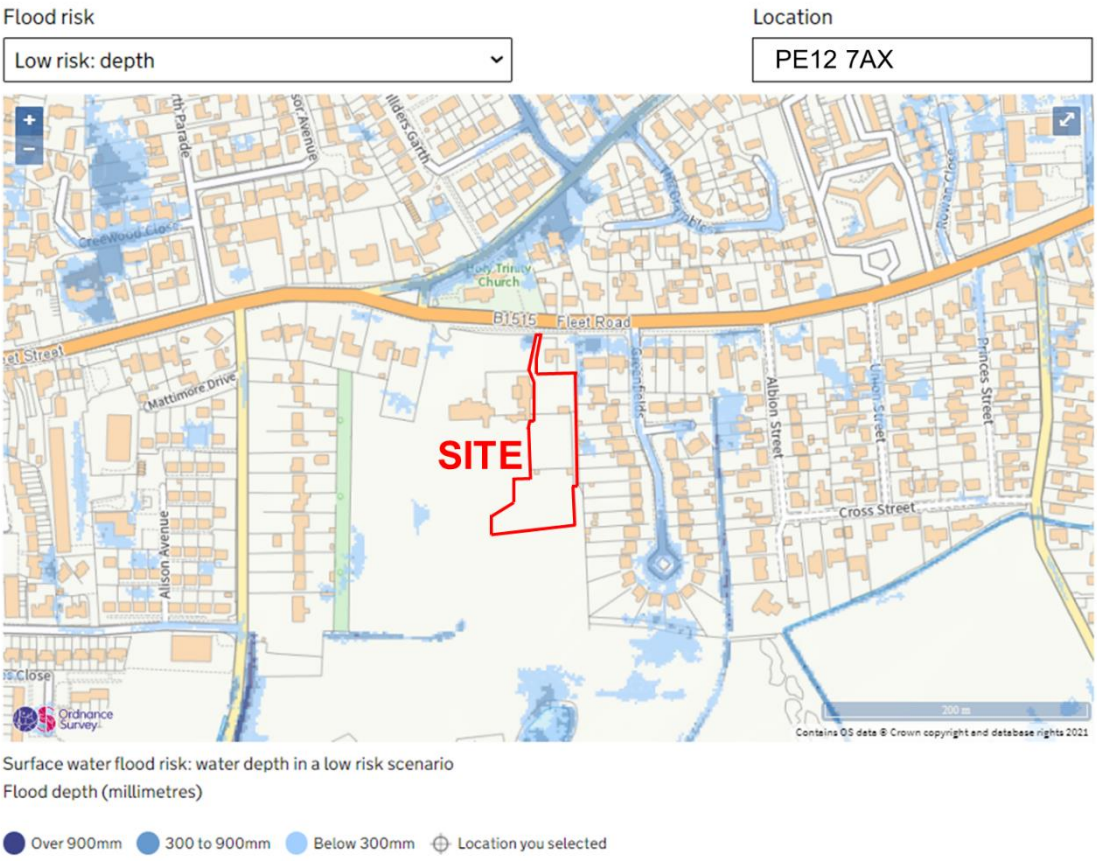
The maps indicate that there is no predicted flooding for the present day 1 in 200 year and 1 in 1000 year events.

The tidal breach map for the 1 in 200 year event in 2115 predicts 0 – 250mm of flooding across the northern 70% of the site and between 250mm and 500mm on the southern part of the site.

The tidal breach map for the 1 in 1000 year event in 2115 predicts similar depths of flooding but slightly larger areas of between 250mm and 500mm of flooding.

Information on Surface Water Flooding on Environment Agency Website

The map on the next page shows the predicted depths of surface water flooding in this area of Holbeach. The light blue areas indicate the low risk of up to 300mm of surface water flooding, and the darker blue areas indicate that between 300mm and 900mm of surface water flooding could occur.



It can be seen there is a no predicted risk of surface water flooding on the site.

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 9.2 km from the tidal section of the River Welland, 12.5km from the tidal part of the River Nene and 11.0km from the Wash defences to the north at the nearest point. The tidal defence banks to all of these are maintained by the Environment Agency.

The major watercourses in the area are maintained by South Holland IDB, which has carried out improvement schemes so that IDB watercourses generally provide a standard of 1 in 100 years with a freeboard of 300mm in urban areas.

Existing Ground Levels and Proposed Levels of Buildings

The site is the eastern part of the grounds of Holbeach Manor. The large building towards the western side is the Manor, and the building to the east is the office building of Seagate Homes. The proposed development site is east of the offices.

The level of Fleet Road north of the site at the entrance to the site is 3.37m ODN. The area immediately east of the office building is approximately the same as the level of Fleet Road, having levels between 3.25m and 3.42m ODN.

There is a brick wall approximately 2.0 metres high between the above area and a small field where levels are lower at between 2.84m and 2.97m ODN. There is also a brick wall on the eastern side of this field and the strip of land east of the wall is at levels of between 3.21m and 3.32m ODN.

South of this field is a disused tennis court with a surface level of 2.75m ODN.

No levels are shown on the topographical survey on the area south of tennis courts but levels on the boundary are similar at between 2.64m and 2.83m ODN.

A sample of the levels from the topographical survey level is shown on the plan on page 15 of this report.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

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

The east bank of the River Welland north of Fosdyke Bridge is approximately 9.2 km west of the site of the proposed development, and the Wash Banks are approximately 11.0km north of the site at their nearest point. The hazard from the River Welland north of Fosdyke Bridge will be considered to be the major risk to the site. If the Wash banks breached the flood water could reach the site but the resulting flood depths should not be as high as if a breach occurred in the banks directly west of the site.

The predicted levels in the SFRA indicate that the east bank of the River Welland will not be overtopped unless there is an event greater than 1 in 1000 years at the present time and 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 supplied by the Environment Agency indicate that the maximum predicted residual depth of flooding in both the 1 in 200 year and the 1 in 1000 year event in 2115 in a greater part of the area will be between 0 and 250mm, and between 250mm and 500mm near the southern boundary of 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 areas east of the River Welland.

Mitigation against flooding of the proposed properties will be mitigated by raising the finished floor levels above the 1 in 200 year predicted flood level in 2115 for two storey

properties and above the 1 in 1000 year predicted flood level in 2115 for single storey properties with bedrooms on the ground floor.

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 east side of Holbeach and is on the north west boundary of the “Free Discharge” catchment which discharges directly into the South Holland Main Drain. There is a open dyke behind the properties on the eastern side of Greenfields which provides a drainage outlet for dykes draining the development site. There is also a drainage channel on the western side of Damgate west of the site which is within the Little Holland Catchment. Both watercourses flow southwards through a series of drainage channels and discharge into the South Holland Main Drain which is approximately 6.3 km south of the site.

The water level in the South Holland Main Drain is controlled by the sluice alongside Nene Way 1.5km south of Sutton Bridge, where the water discharges into the tidal River Nene at low tide.

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 adequately mitigated.

3. Localised Flooding in the area

The risk of surface water flooding will be mitigated as the floor levels of all the properties will be raised by at least 300mm above the existing ground level to mitigate

against tidal flooding. In addition a surface water drainage system will be designed to ensure that surface water from the proposed buildings and roadways is adequately disposed of.

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 19 to 22). 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.

The development is in flood zone 3 and the flood hazard is “low hazard” (less than 0.75) across most of the site and “danger for some” (0.75 – 1.25) reference should be made to Category E8 which shows that the matrix reference for this category is as follows:

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

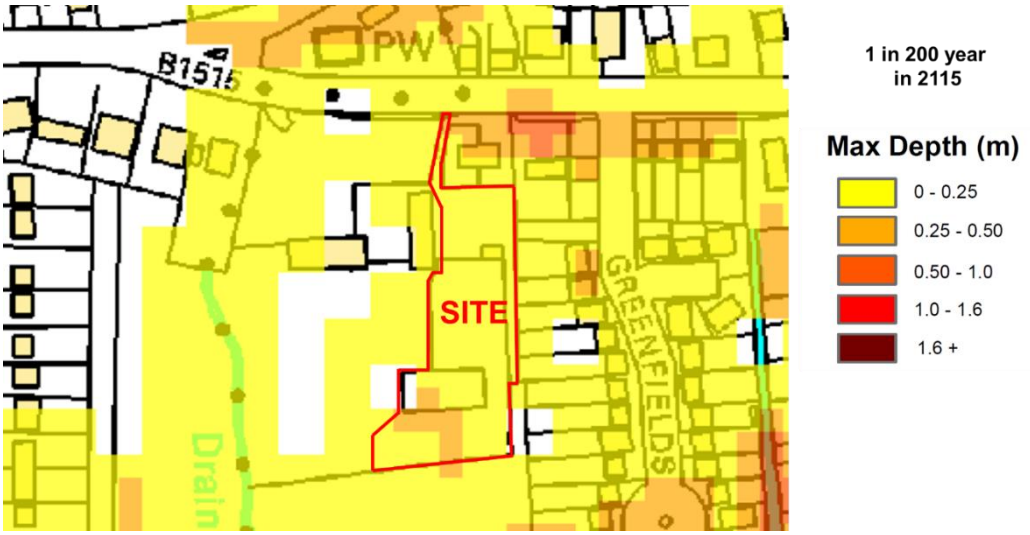
The applicant is advised to refer to the following document for information on flood resilience and resistance techniques to be included “Improving Flood Performance of New Buildings – Flood resilient Construction” (DCLG 2007).

Finished floor levels FFL should be informed by the predicted flood depth maps and reference should be made to the 2115 1% fluvial and 0.5% tidal maximum depth map and set as required below (single storey proposals must use the 0.1% event in 2115 scenario for setting FFL.

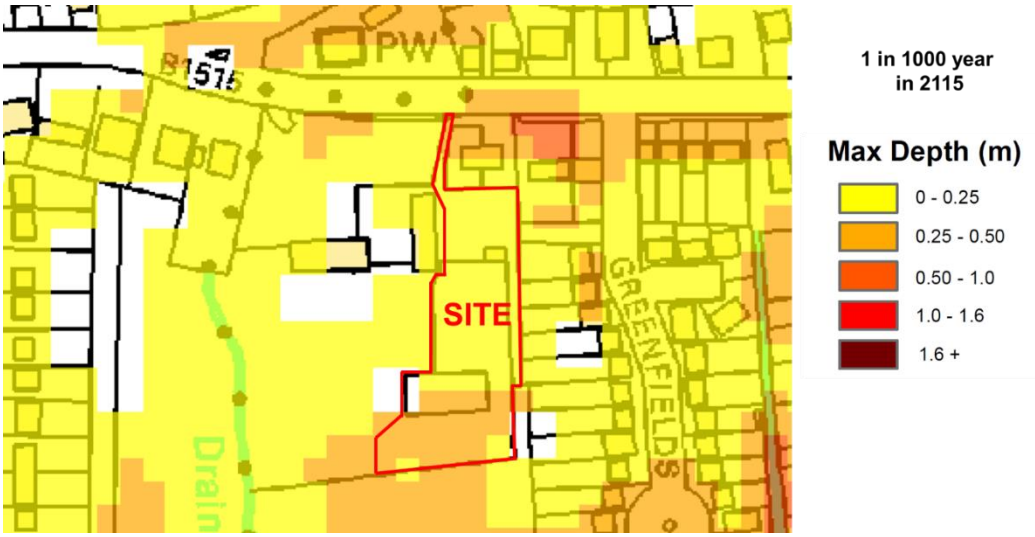
Depths 250mm – 500mm	*FFL must be set 500mm above ground level with flood resilient construction to 300mm above the predicted flood depth.*
Depths 0 – 250mm	*FFL must be set 300mm above existing ground level for two storey proposals. Single storey proposals must set FFL's above the 0.1% event breach depth in the 2115 scenario.*

Conclusions

The Environment Agency map showing the predicted depth of flooding in a 1 in 200 year event in 2115 is shown below.

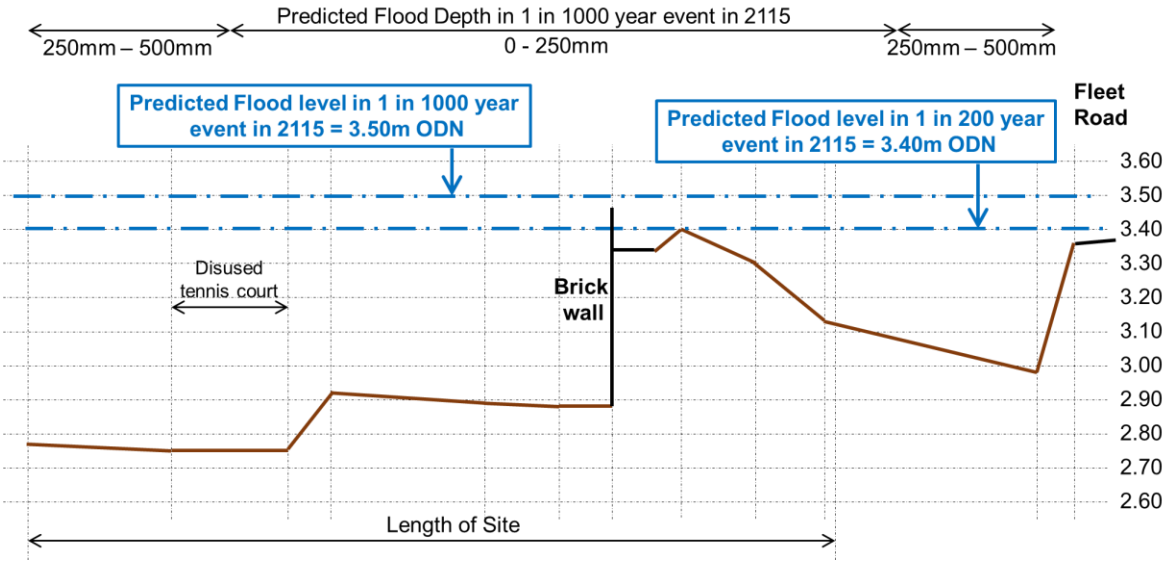


The Environment Agency map showing the predicted depth of flooding in a 1 in 1000 year event in 2115 is shown on the next page.



It can be seen that up to 250mm depth of flooding is predicted on the northern section of the development site and a smaller area including half of the tennis court and the area between the court and the southern boundary of the site has predicted depths of between 250mm and 500mm of flooding.

A section has been drawn south to north across the site showing the levels in the topographical survey and predicted flood levels in a 1 in 200 year and 1 in 1000 year event in 2115.



It can be seen that the following flood levels are predicted:

1 in 200 year in 2115	3.40m ODN
1 in 1000 year in 2115	3.50m ODN

The predicted flood levels have been estimated in the following way:

1) Inspection of levels on the topographical survey along the frontage of the property. These were found to vary from 3.32m ODN at the east to 3.45m ODN midway between the two entrances. On the 1 in 200 year plan of predicted flood depths an area with no predicted flooding coincides with the level of 3.45m ODN. This area is shown flooded (shaded yellow) on the 1 in 1000 year plan.
2) Inspection of levels in the parking area for the Seagate offices show levels between 3.34m and 3.52m ODN. Part of this area is shown yellow (up to 250mm of flooding) and part is shown uncoloured (no flooding) again indicating the estimated flood levels above.
3) Reference to the development site immediately south of the proposed site (planning application no H09-0332-16) indicates a predicted flood level of 3.40m ODN in a 1 in 200 year event.

The cross section above indicates that the flood depth in sections of the site will be greater than the predicted flood depths on the EA flood maps. The predicted flood levels are similar to other sites in Holbeach and therefore should be used to ensure the proposed properties are above the predicted flood level.

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 can be considered low, especially with the floor levels of the proposed buildings in the lower areas being raised at least 500mm above the existing 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 lower than 3.00m ODN before the development site. It would be very unlikely to reach a level of above 3.00m ODN and put the proposed house at risk of flooding.

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

Although the site is in flood zone 3, and the actual risk of the site flooding from any Environment Agency or IDB watercourse is very low. The site is only at risk of flooding if a breach occurs in the east bank of the River Welland or the west bank of the River Nene during a 1 in 1000 year high tide in 2115. No flooding would be likely to occur if a breach did not occur.

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 finished ground floor level of the proposed houses should be at a minimum level of 3.45m ODN which is between 500mm and 600mm above the existing ground level on the southern area of the site.

The developer has indicated that some bungalows may be preferred on this site. If these are proposed then the finished ground floor level of these bungalows should be raised to a minimum level of 3.55m ODN.

The occupiers of these properties should register with the Environment Agency's Floodline Warnings Direct Service to receive automated early warnings of potential flooding.

Rainwater from the roofs of the proposed houses, bungalows and garages should if possible be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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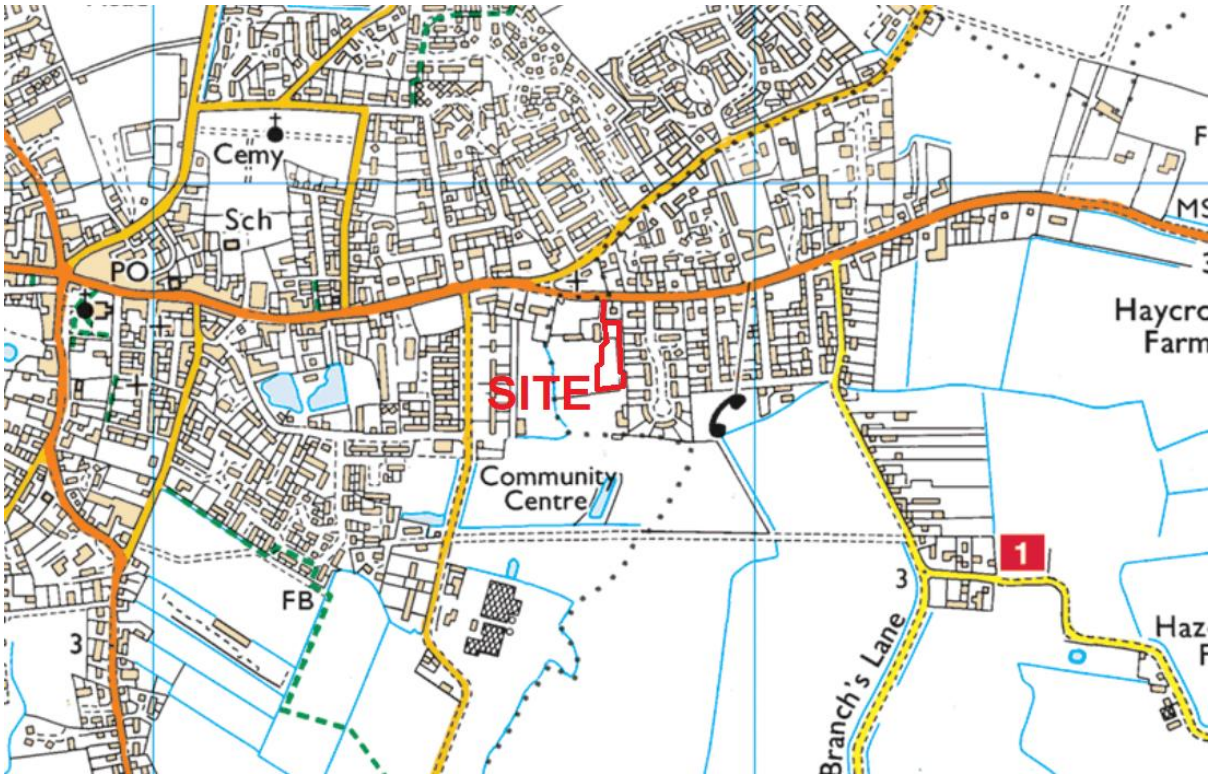
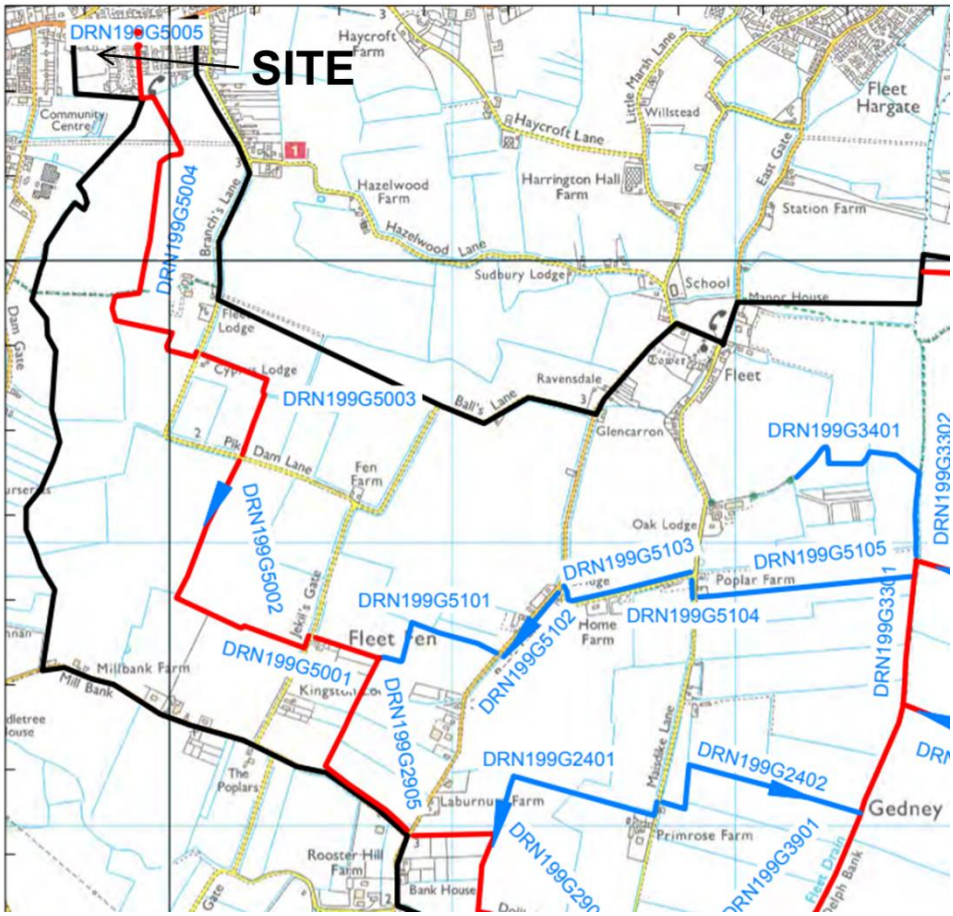
21st May 2021

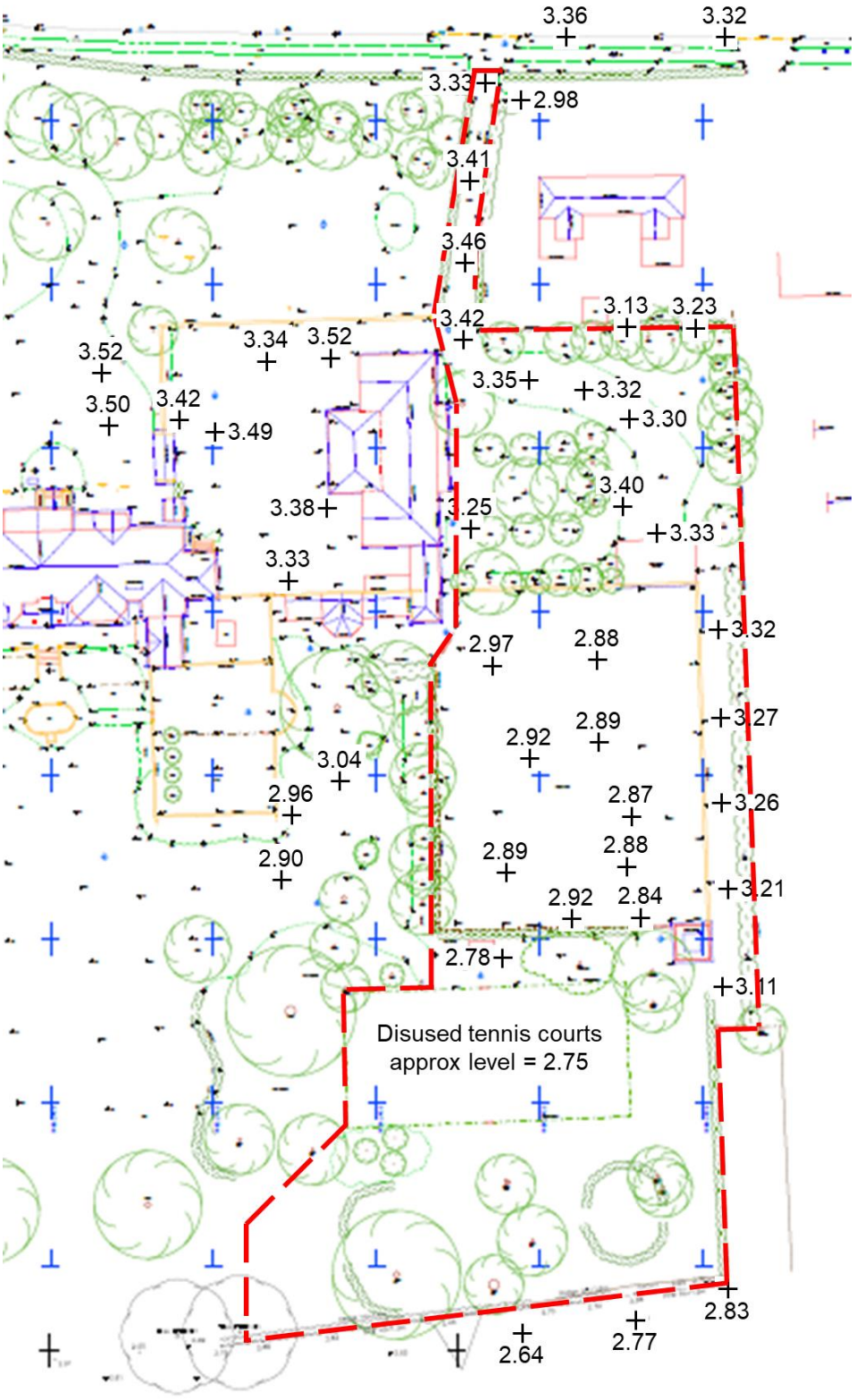
LOCATION PLAN



PLAN OF AREA SHOWING IDB WATERCOURSES



SITE PLAN WITH EXISTING LEVELS



BLOCK PLAN


PROPOSED BRICK WALL TO REAR OF EXISTING GARAGE BLOCK.
FLEET ROAD.
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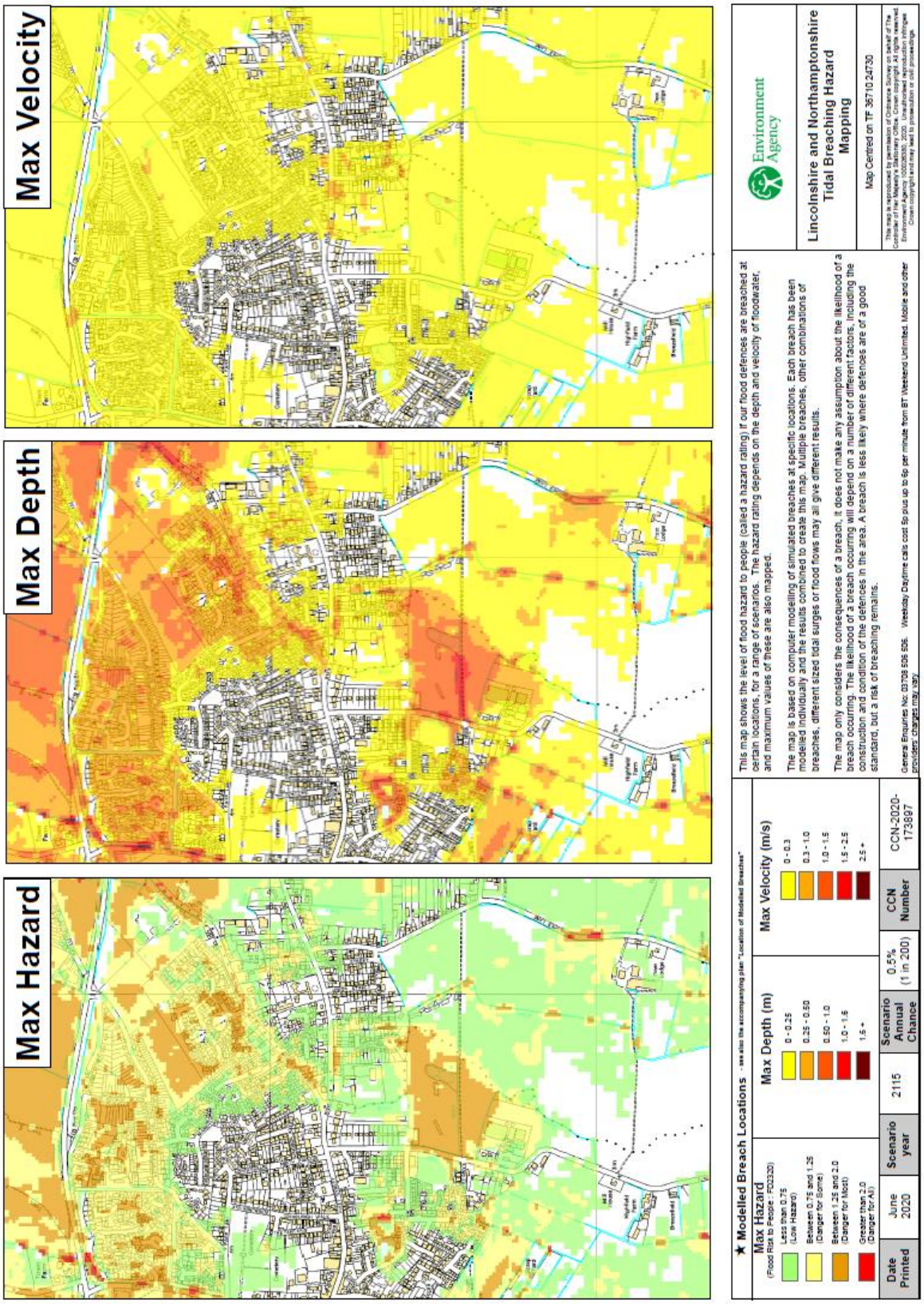
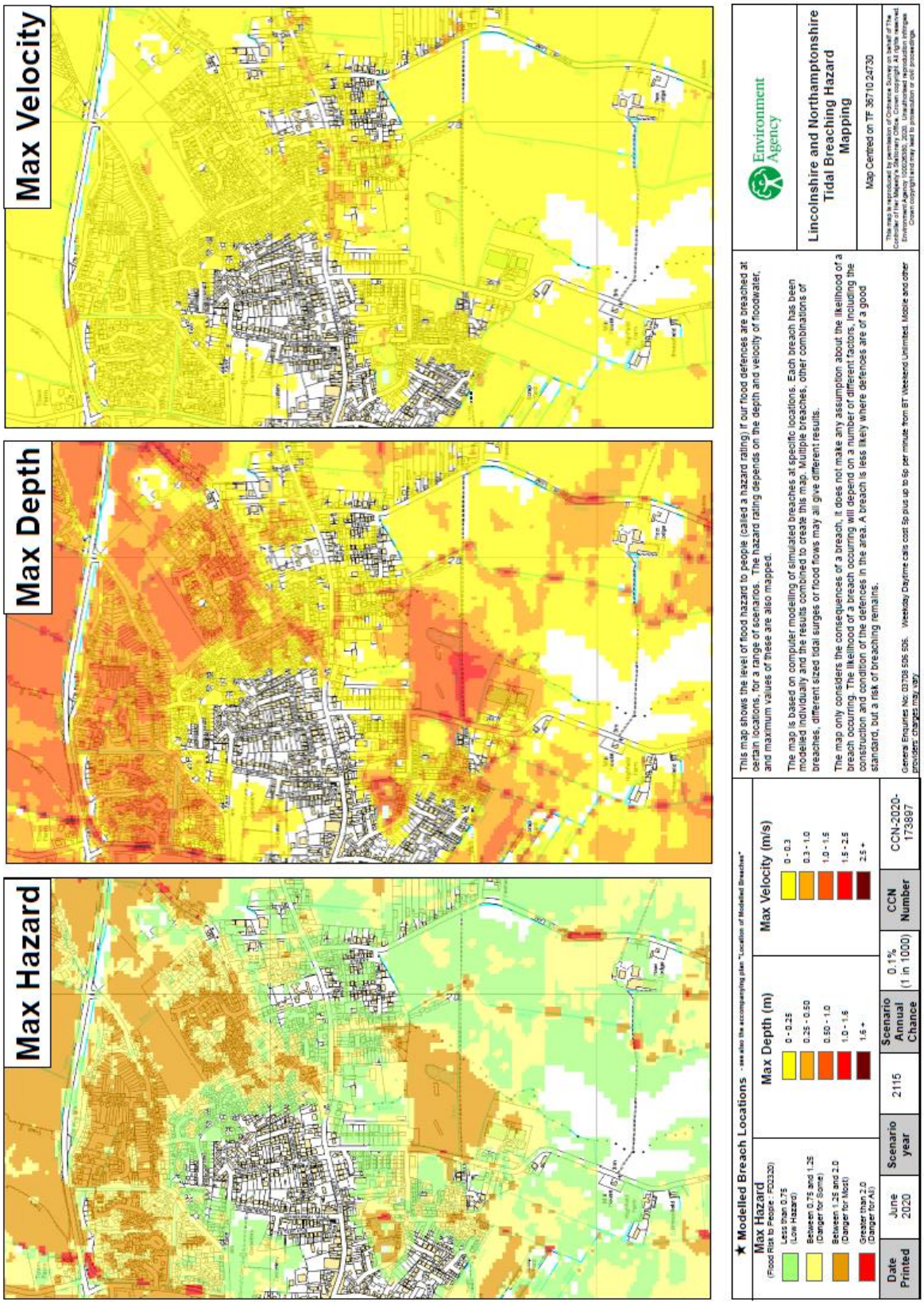
EA MAP SHOWING TIDAL BREACHING HAZARDS IN 1 in 200 YEAR EVENT IN 2115



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

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 tidal River Welland or the Wash,.
2) Flooding from IDB drainage system.

1) Flooding from a breach in the tidal banks.

The FRA has identified the main source of flooding to be from the tidal River Welland or the Wash. The new climate change recommendations could affect the predictions of flood levels in 2115 at the development site:

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 the new guidance increases the maximum predicted sea level in 2115 by 100mm compared with the allowance made in the SFRA, and presumably in the subsequent maps produced by the Environment Agency.

A 100mm increase of maximum tide levels is unlikely to increase flood depths on the site by as much as 100mm. When the flood maps are revised it is unlikely that flood depths are likely to significantly change.

2) 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 generally 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 the allowance provides a 1 in 100 year standard to most urban areas.

to ensure that they have adequate plans to comply with the latest recommendations on climate change.

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 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 of two storey properties should be a minimum level of 3.45m OD, and floor levels of single storey properties should be a minimum level of 3.55m OD, is satisfactory.