

PROPOSED DEVELOPMENT AT
SEAS END ROAD, MOULTON SEAS END, SPALDING, PE12 6RA
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 Seas End Road, Moulton Seas End. 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

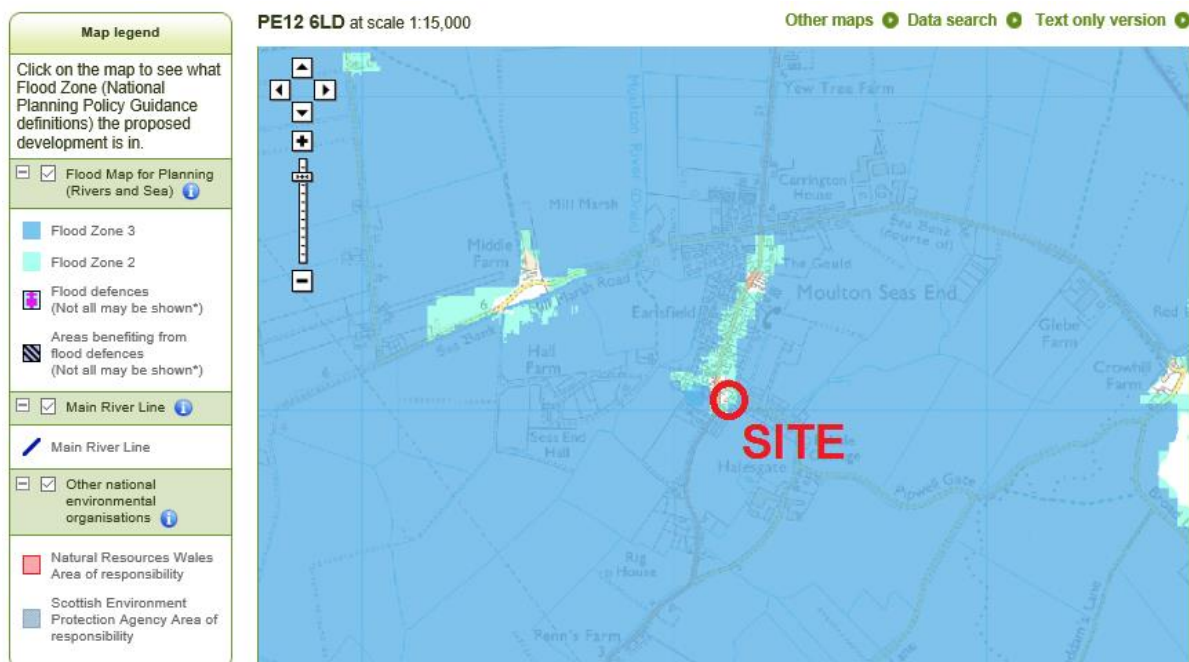
This Flood Risk Assessment has been prepared to accompany a planning application for the construction of a house on a redundant site off Seas End Road, Moulton Seas End, which is approximately 7.5km north east of Spalding.

The site is within Flood Zone 1 or 2 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 required in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified on 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 this area.



It can be seen that the site is in Flood Zone 1 or 2.

Application Site

The site is located 2.2 km from the tidal section of the River Welland. The National Grid Reference of the site is 532160 327010.

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

The proposed development is within Flood Zone 1 or 2 as detailed on the Environment Agency's flood zone maps without defences, as defined in Table 1 of the Technical Guidance.

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:

<u>Flood Zones</u>	<u>Flood Risk Vulnerability Classification</u>				
	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	✓*

The Table shows that in flood zones 1 and 2 for "More vulnerable" development is acceptable.

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 Moulton is within Flood Zone 3. The development site in Seas End Road is within a strip of higher land which is classified as flood zones 1 and 2. Therefore it satisfies the sequential test as being located in the safest location with regard to flooding in Moulton Seas End.

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. This site can be classed as brownfield development and as such is considered acceptable for development within the village envelope. The Council need new sites such as this to be brought forward for development to meet the RSS and Structure Plan requirement for 2021.

Therefore I consider that the sequential test has been passed.

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

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

For the present day	Depth of flooding ... zero
	Extent of flooding .. Low or medium flood probability
	Peak Velocity .. zero
For the year 2115	Depth of flooding ... 0 – 500mm
	Extent of flooding .. High
	Peak Velocity .. 0 – 0.1 m/sec

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

Tables in the SFRA show the following details of the defence bank on the east side of the tidal section of the River Welland north of the A16 road bridge, between chainage 16.0km and 18.0km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.98m OD	6.31m OD	7.12m OD
Peak 1 in 1,000 year extreme tide level	6.27m OD	6.60m OD	7.41m OD

With an average defence crest level between 7.60 and 7.90 m OD the minimum freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1620mm	1290mm	480mm
Peak 1 in 1,000 year freeboard	1330mm	1000mm	190mm

Tables in the SFRA show the following details for the defence bank on the east side of the Coronation Channel between chainage 0 km and 2.0 km.

	2007	2115
Peak 1 in 100 year extreme tide level	4.32m OD	4.69m OD
Peak 1 in 1,000 year extreme tide level	4.34m OD	4.69m OD

The bank levels on this section vary between 5.35m OD and 6.0m OD. Therefore it can be seen there is a minimum freeboard of 650mm to the predicted design maximum levels in 2115.

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	zero	zero	zero
1 in 1000 year event in 2115	zero	zero	zero

The maps for the 1 in 200 year and 1 in 1000 year event in 2115 are shown on pages 12 and 13 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 4.5 km from the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located approximately 7.0 km from the Coronation Channel which also has a defence bank and 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 11 of this report.

It can be seen that levels vary from 4.00m OD alongside Seas End Road on the west side of the site to approximately 3.50m OD at the rear of the site on the eastern boundary. The bungalow on the west side of the site has a floor level of approximately 3.70m OD.

It is recommended that the new house should be built 100mm above the level of Seas End Road with a ground floor level of 4.10m OD.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Welland
2. Overtopping or breach in the Coronation Channel
3. Failure of Lords Drain Pumping Station or Outfall Sluice (IDB)
4. Blockages in IDB drains or culverts
5. Blockages or problems in local surface water systems

1. Failure or overtopping of tidal defences

As shown above, the east bank of the River Welland, which is approximately 4.5 km from the site, has at least a 1 in 200 year standard of protection. If the eastern bank of the tidal section of the River Welland breached then the maps in the SFRA predict that there could be between 0 and 500mm of flooding in a 1 in 200 event in 2115 if a breach occurred in the east bank of the River Welland.

However the latest Environment Agency maps indicate that there would not be any flooding in a 1 in 200 year or a 1 in 1000 year event in 2115.

If a breach occurred in the east bank of the tidal River Welland lower land surrounding Moulton Seas End would flood to a depth of approximately 1.0 metre before the site of the development was affected.

Therefore the risk of flooding to the development from the tidal defences can be considered very low.

2. Overtopping of Breach in the Coronation Channel

The SFRA states that the maximum design water level in the Coronation Channel is 4.69m OD. The minimum crest level of the east bank of the Channel is 5.14m OD, which gives a minimum freeboard of 450mm. However, generally there is a freeboard of 600 mm along this bank of the Channel.

If the Channel were to breach water would flow north eastwards towards the site. However, it would be retained for a short time by the A16 which is higher than the surrounding land.

With the site being at least 7.5 km from the Coronation Channel the risk of flooding from this source can be considered to be remote.

3. Failure of Lords Drain Pumping Station and Outfall Sluice

The water level in the internal dykes and drains in this area is controlled by the level of water in Lords Drain which outfalls into the tidal section of the River Welland which is 5.5 km north west of the development site.

If levels in the system exceeded 2.5m OD low land south of Moulton Seas End would start to flood and this would prevent levels rising and it follows that the possibility of levels rising to above 4.00m OD and above and causing flooding to the proposed site in Moulton Seas End are remote.

4. Blockages in IDB drains and culverts

The nearest IDB drainage channel, called Ugly Bridges Drain, is located 200 metres east of the site. This drain will provide an outfall for the land drainage and surface water from the area of the site. The maximum water level in this drain is approximately 2.30m OD, which is possibly for a 1 in 10 year event. This will possibly increase by approximately 500mm in a 1 in 100 year event in 2115, but this will still be at least 1.0 metres below the recommended ground floor level for the new building.

Ugly Bridges Drain flows in a southerly then a westerly direction and these drain discharge into Lords Drain, which flows northwards to the outfall which is approximately 4 km north west of the proposed site.

The South Holland IDB have a regular maintenance programme which ensures that drains and culverts are regularly inspected and any blockages in the system are quickly rectified. The risk of a large blockage in the system causing very high water levels which would flood the proposed houses is extremely low.

Therefore the risk of flooding from this source can be considered to be remote.

5. Blockages or problems in local surface water systems.

It has been recommended that the ground floor level of the proposed house should be 100mm above the level of Seas End Road on the western boundary of the site. Therefore any accumulation of surface water in the road or on the site will not cause any flooding to the house.

Therefore this source of flooding can be discounted.

Extent of known Flooding

During the preparation of this assessment, no evidence of the site or any of the adjoining properties being flooded at any time in the past.

During early July 1968 the Spalding area experienced rainfall in excess of 75mm during a 24 hour period and this caused significant problems throughout this part of the IDB district. This event initiated major drainage improvements to IDB channels in the area.

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 14 to 17). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Conclusions

There is a risk of flooding to lower land in this area if a breach occurred in the east bank of the tidal River Welland north of Spalding. The maps in the SFRA predict this flooding will affect the site in a 1 in 200 year event in 2115, but the Environment Agency maps do not predict any flooding in the 1 in 1000 year event in 2115.

The risk of flood water reaching the site if a breach occurred in the east bank of the Coronation Channel is extremely low, and as such can be considered remote.

The risk of flooding to the site from IDB drains can be considered extremely low. If the pumping stations were to fail then the IDB have adequate arrangements to operate pumps with alternative motive power, or to bring in mobile pumps. It can be assumed that the IDB will continue to monitor predicted water levels in the drain and carry out improvements to the system over the next 100 years as and when required to retain the present standard of protection to the village of Moulton Seas End.

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

The site is in flood zone 1 or 2, and the actual and residual risk of the site flooding from any Environment Agency or IDB watercourse is very low.

If any flooding that were to occur it would happen very slowly and it would require a catastrophic event for flood water from either a breach in the bank of the River Welland or a failure of the IDB system to affect the proposed house with a floor level of 4.10m OD.

Recommendations

In an area where there is a flood risk, however small, it is preferable that all the new dwellings should be two story houses designed with all sleeping accommodation located on the first floor.

The ground floor level of the proposed building should be at a minimum level of 4.10m OD. This is 100mm above the level of Seas End Road on the western boundary of the site.

All future occupiers of the properties should register with the Environment Agency's Floodline Warnings Direct Service.

Percolation tests should be carried out as set out in BRE Digest 365 to enable the soakaways for the houses to be designed.

S M HEMMINGS B Sc C Eng MICE MIWEM

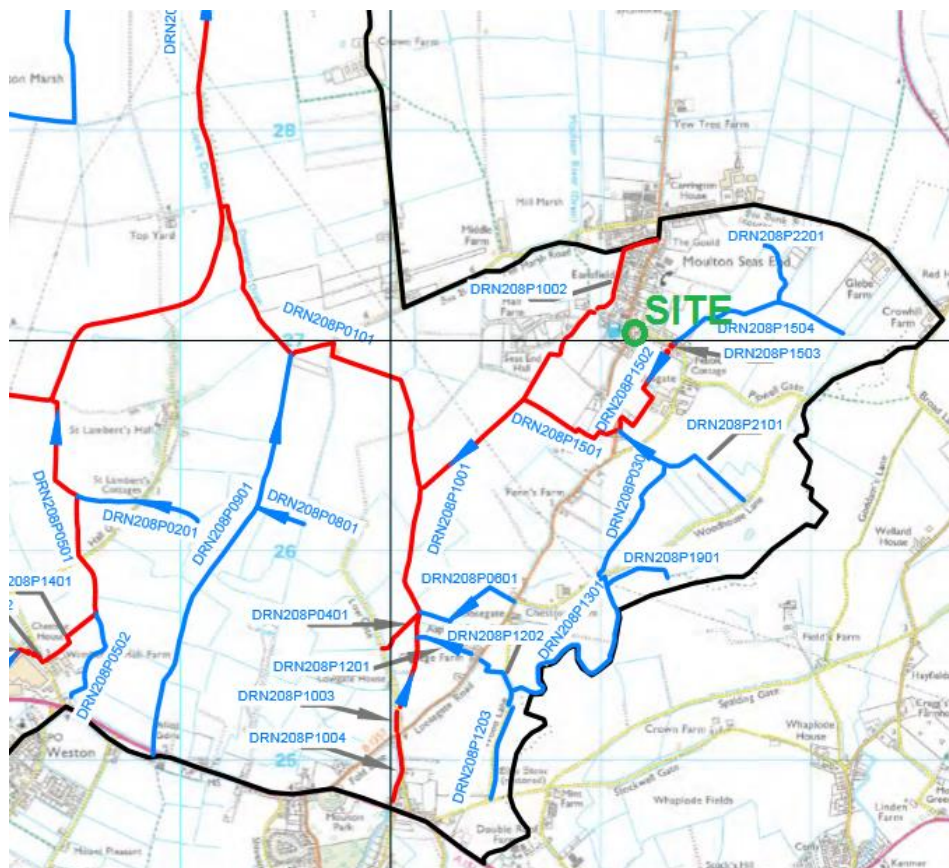
stuart.hemmings@btinternet.com

10th June 2016

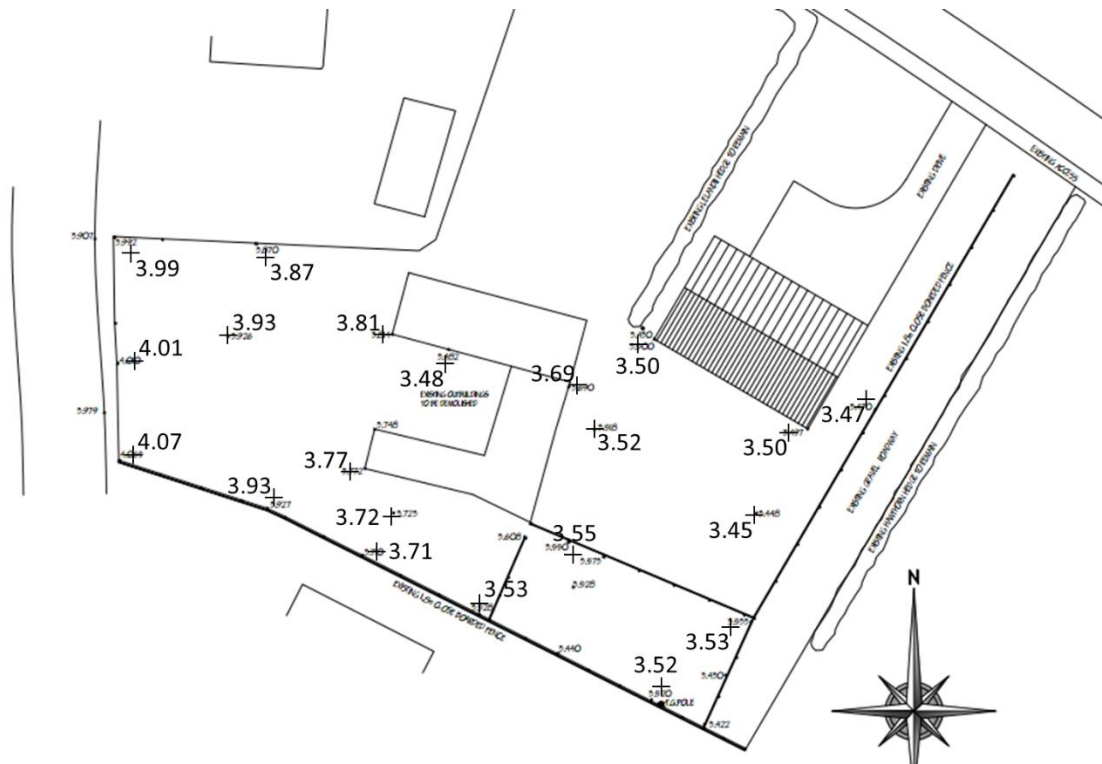
LOCATION PLAN



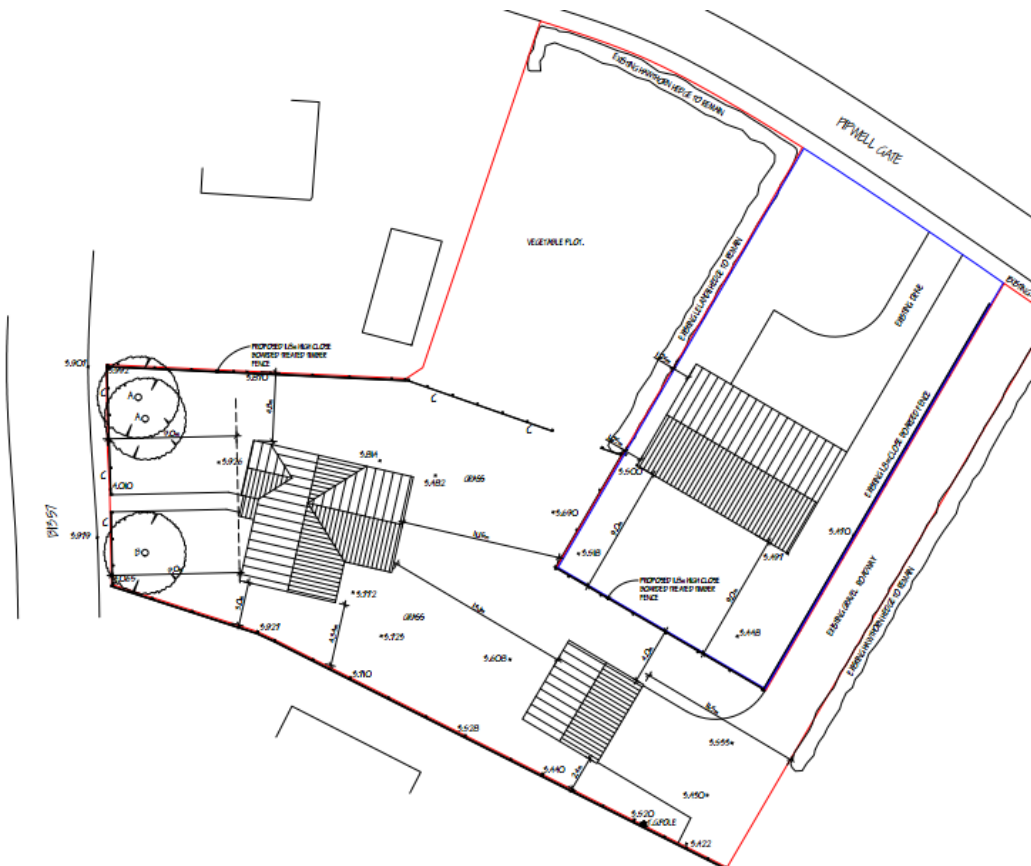
PLAN OF IDB DRAINS

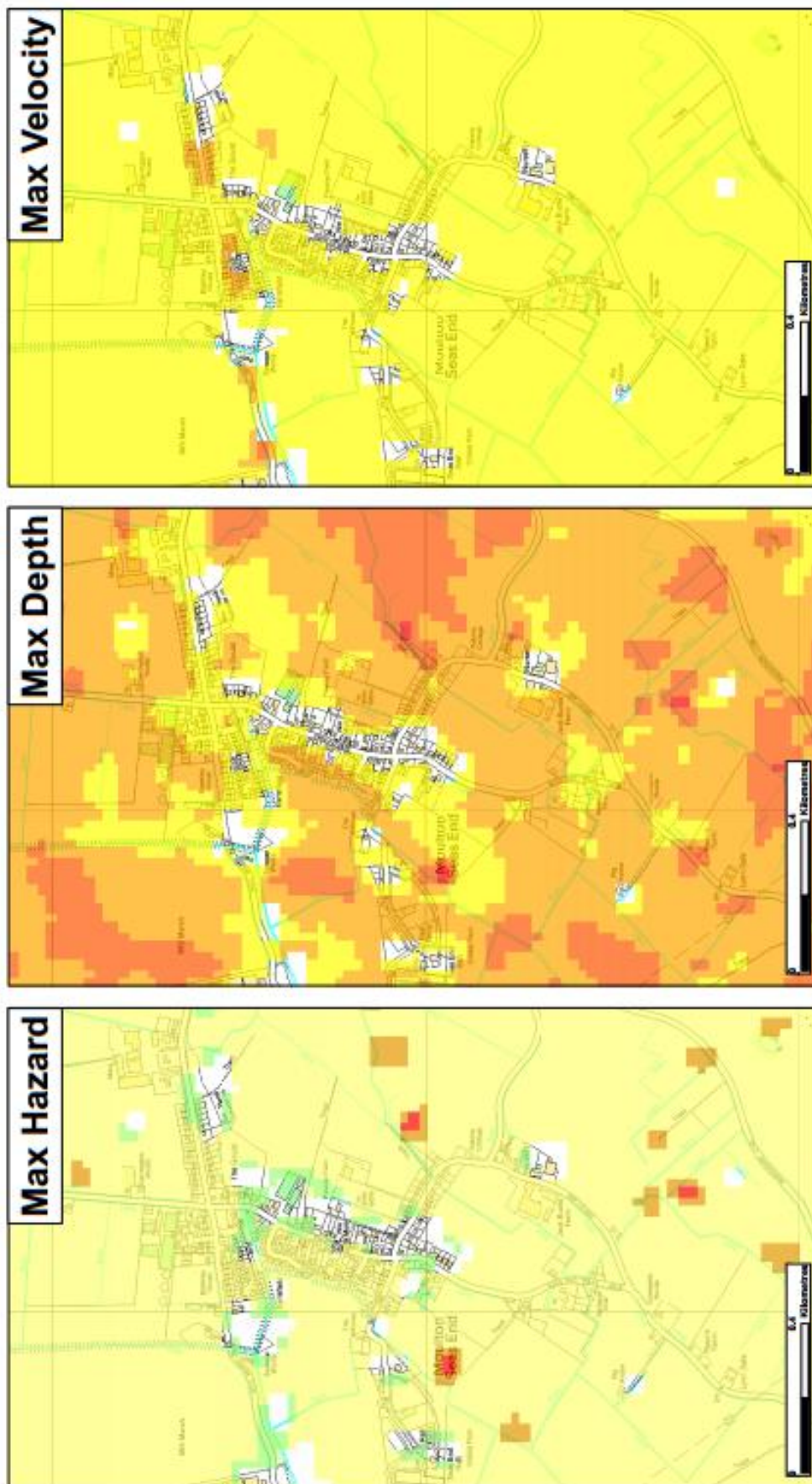


PLAN SHOWING SITE LEVELS



PROPOSED PLAN





★ Modelled Breach Locations - see also the accompanying plan "Location of Modelled Breaches"

Max Hazard (Flood Risk to People - FID3309)	Max Depth (m)	Max Velocity (m/s)
Less than 0.75 (Low Hazard)	0 - 0.25	0 - 0.3
Between 0.75 and 1.25 (Danger for Some)	0.25 - 0.50	0.3 - 1.0
Between 1.25 and 2.0 (Danger for Most)	0.50 - 1.0	1.0 - 1.5
Greater than 2.0 (Danger for All)	1.0 - 2.0	1.5 - 2.5
	2.0 +	2.5 +

Environment Agency

Lincolnshire and Northamptonshire

Tidal Breaching Hazard Mapping

Map Created on 11/10/2016 27025

This map is produced by permission of the Environment Agency on behalf of the Lincolnshire and Northamptonshire Local Authorities. It is not to be used for any purpose other than that for which it was produced. The Environment Agency and Lincolnshire and Northamptonshire Local Authorities accept no liability for any loss or damage caused by the use of this map.

Date Printed

May 2016

Scenario year

2115

Scenario Annual Chance

0.5% (1 in 200)

CCN Number

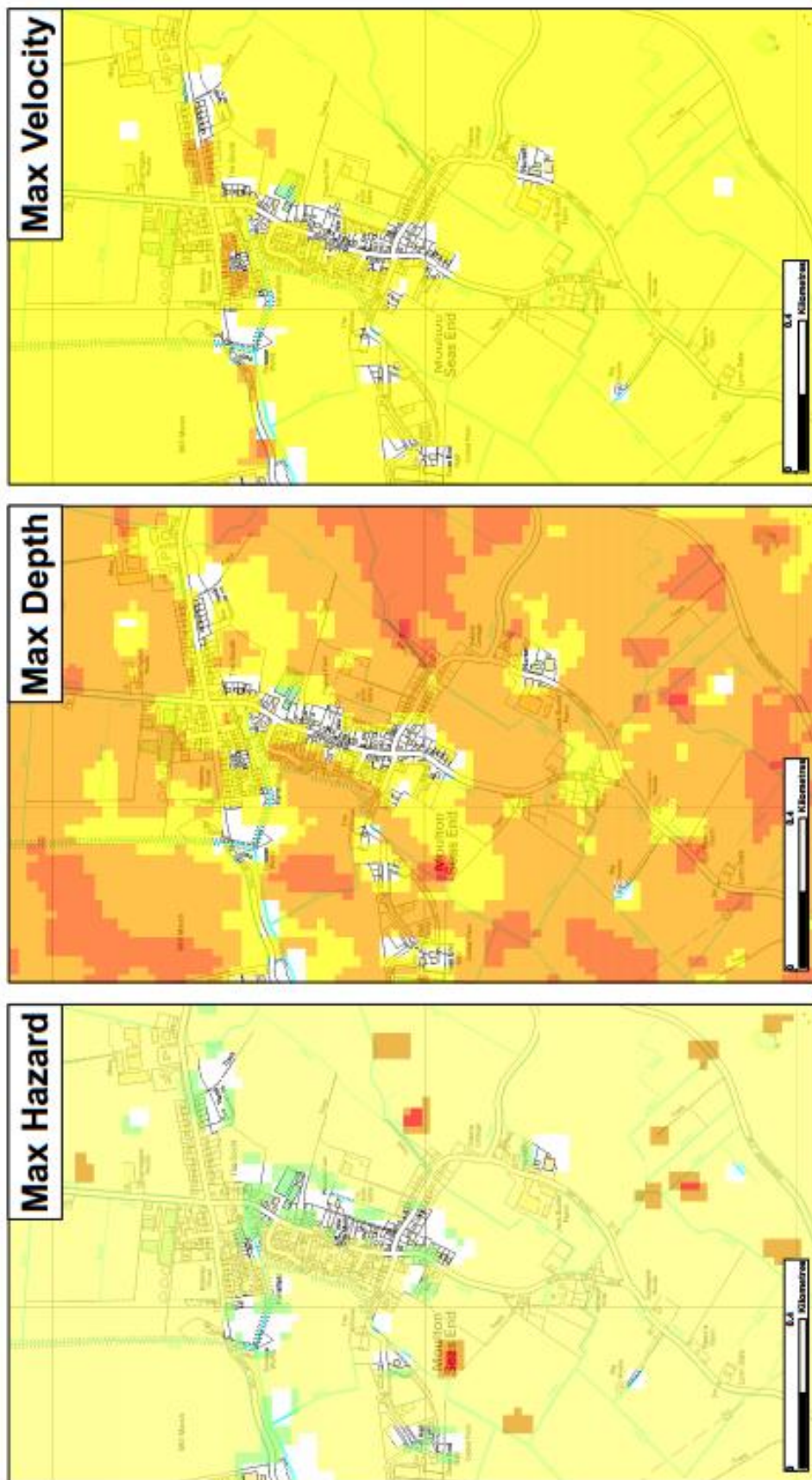
CCN-2016-12416

CCN

CCN

CCN

CCN



★ Modelled Breach Locations – see also the accompanying plot “Location of Modelled Breaches”						
Date Printed	May 2016	Scenario year	2115	Scenario Annual Chance (1 in 1000)	CCN Number	CCN-2016-12418
Max Hazard (Peak Risk to People + Property) Less than 0.75 (Low Hazard) Between 0.75 and 1.25 (Danger for Some) Between 1.25 and 2.0 (Danger for Most) Greater than 2.0 (Danger for All)						
Max Depth (m)				Max Velocity (m/s)		
0 - 0.25 0.25 - 0.50 0.50 - 1.0 1.0 - 2.0 2.0 +				0 - 0.3 0.3 - 1.0 1.0 - 1.5 1.5 - 2.5 2.5 +		

This map shows the level of flood hazard to people (called a hazard rating) if our flood defenses are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

The map only considers the consequences of a breach; it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.

General Enquiries Tel: 01798 526 506. Please say the show calls cost £6 plus up to 1p per minute from BT Network Unlimited. Mobile and other networks' charges may vary.

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 that the major 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 Welland.

It has been concluded that the maps produced by the Environment Agency give a more accurate prediction of the flood risk than the maps in the SFRA which were produced earlier. The contingency climate change allowance in metres for the years 2055 and 2115 using 1990 as a baseline in the SFRA and EA maps compared with the new guidelines is as follows

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

It can be seen that there will be an increase of 100mm in maximum predicted levels in the tidal River Welland in 2115 due to the new guidelines. This may increase the

predicted level of any floodwater that reaches Moulton Seas End by between 25mm and 50mm, but this will not cause any flooding to the proposed house.

The new guidelines also significantly increase the allowance required for peak river flows and peak rainfall intensities.

Using the higher central allowance the increase in flowrates for fluvial flows for 2115 to be allowed for is 86%. However if the upper end allowance is used the 2115 figure increases to 178% over the 1990 figures.

These figures seem to be very high for use in fenland rivers with a percentage of pumped inflows from IDB systems and IDB systems with mostly pumped outfalls, and at first it could be concluded that the overall impact on river systems such as the fluvial River Welland could be very large.

In practice what would happen in the River Welland and the Coronation Channel if there were large increases in flow would be that Cowbit and Crowland Washes would be brought into action more regularly, and overtopping of banks between Spalding and Market Deeping would be extensive. There may be a small increase in predicted river levels in the Coronation Channel through Spalding, but this would not be large enough to cause flooding from this source to the site of the development.

South Holland IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations and drainage channels. Pumping stations only have a 30 year life and will need to be refurbished or rebuilt within this timespan. When the Board plan for these refurbishments adequate arrangements will be made to incorporate the latest climate change projections.