

**PROPOSED CHANGE OF USE OF THE BARN TO RESIDENTIAL
USE AT DERENE AT DAMGATE, HOLBEACH, PE12 8QL.**
FLOOD RISK ASSESSMENT



View of barn

S M Hemmings B Sc C Eng MICE MIWEM,
13 Lea Gardens,
Peterborough,
PE3 6BY.
stuart.hemmings@btinternet.com

This flood risk assessment has been prepared solely to support the planning application for the change of use at Derene, Damgate, 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 purposes other than for which it was originally commissioned.

Introduction

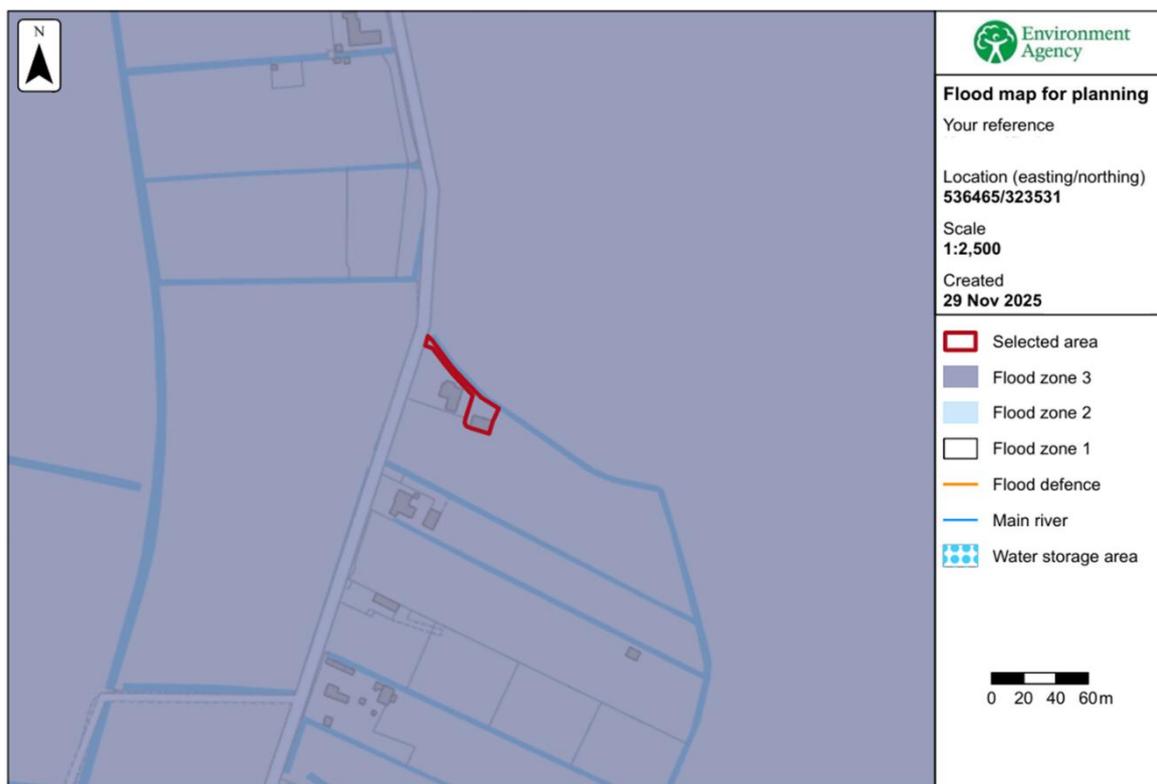
A Planning application is due to be submitted to South Holland District Council (SHDC) to convert an existing barn into a residential building to the rear of a property called Derene on Damgate, Holbeach, PE12 8QL. Previous planning applications in 2017 (reference no H09-0376-17) and in 2020 (reference no H09-0306-20) for prior approval were both approved by SHDC.

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.



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It can be seen that all of this area south of Holbeach is within Flood 3.

Application Site

The development is located 1.5km south of Holbeach. The National Grid Reference of the site is 536465 323530.

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

As the site is within a defended area the proposed development can be designated to be within Flood Zone 3(a) “High Probability” 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, the development of a dwelling house is classified as “more vulnerable”.

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	✓*

Table 3 of the Guidance (see below) states that residential use is only permitted after the sequential and exception test is followed. However as the application is for Class Q approval for a change of use from agricultural use to residential then the sequential and exception tests do not need to be applied to this application.

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 ... 250mm – 500mm
	Extent of flooding .. High
	Hazard..... 0.75 – 1.25 (danger for some)
	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 10.0 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 12.0 km 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 levels of the River Nene north of the outfall sluice of the South Holland Main Drain are between 7.00m and 7.30m OD.

Environment Agency Tidal Breach Hazard Mapping

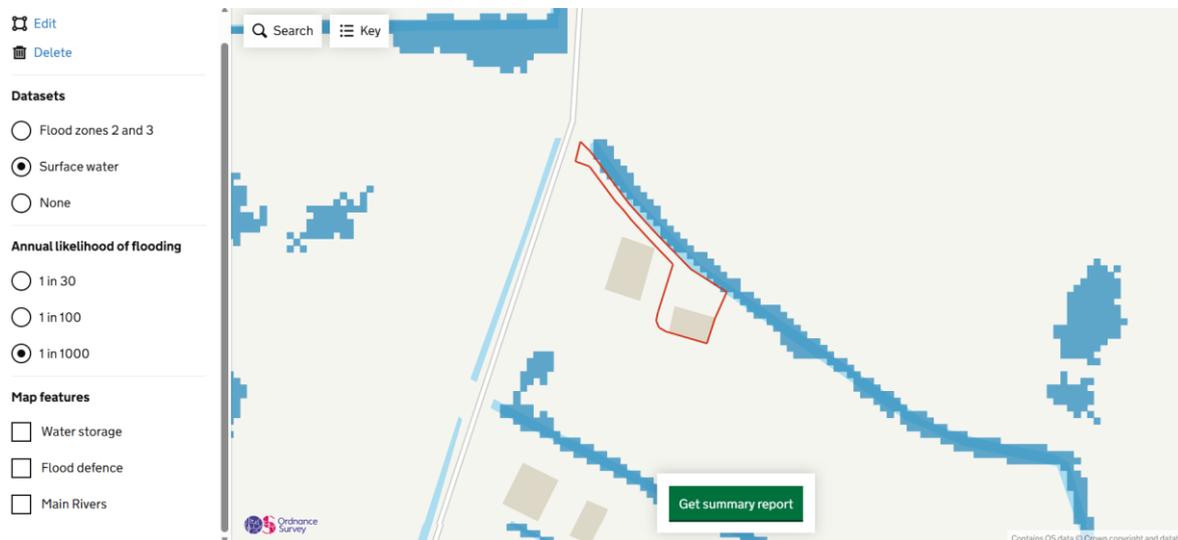
The Environment Agency provided maps which show the predicted flood hazard, flood depth and maximum velocity for both the 1 in 200 year and 1 in 1000 year event in 2115. These predict the following flood hazards

	Hazard	Flood Depth	Maximum velocity
1 in 200 year	0.75 – 1.25	0 – 500mm	0 – 0.3 m/sec
1 in 1000 year	1.25 – 2.0	250mm – 1.0m	0 – 0.3 m/sec

The maps are reproduced on pages 13 and 14 of this report

Information on Surface Water Flooding on Environment Agency Website

The map below shows the annual likelihood of surface water flooding in this area south of Holbeach in a 1 in 1000 year event.



The above map predicts that there could be flooding on the northern side of the site where an open dyke is located. However it does not predict there will be any surface water flooding on the site. Therefore it can be assumed that the above map indicates there would be high water levels in the dyke following a 1 in 1000 year rainfall event.

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 10.0 km from the tidal section of the River Nene, 12.0km from the tidal part of the River Welland and 13.0km 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, and these 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

A topographical study has been carried out on the site and the results are shown on page 11 of this report. The levels around the building vary between 2.45m and 2.65m OD, which is the level of the whole site and the surrounding farmland.

The existing floor level of the barn is 2.70m 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, 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 Welland or the River Nene or the Wash

The maps in the 2010 SFRA indicate that the east bank of the River Welland, which is approximately 10.0 km from the site, provides a 1 in 200 year standard of protection in 2115.

The west bank of the River Nene is approximately 12.0 km east of the site of the proposed development, and the Wash Banks are at 13.0km north of the site at their nearest point.

The predicted levels in the 2010 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. 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.

Maps on the South East Lincs Local Plan website indicate flood depths on the site of between 250mm and 500mm for the 1 in 200 year event in 2115 and between 250mm and 1.0 metre for the 1 in 1000 year event in 2115.

Adequate mitigation of this risk will be provided by raising proposed ground floor levels above the predicted maximum flood level.

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 south of Holbeach which is in the Little Holland catchment area. The Board's drain on the west side of Damgate flows southwards to discharge into the Little South Holland Drain. The level of this watercourse is controlled by the Little Holland Pumping station which is a further 3.0km south east, which lifts the water into the South Holland Main Drain. The South Holland IDB have advised that the maximum 1 in 100 year predicted level at the pumping station is 0.30m OD. and the maximum 1 in 100 year level in IDB drainage channels near the site is not likely to exceed 1.70m OD. 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.

Adequate mitigation of this risk will be provided by raising proposed ground floor levels above the predicted maximum flood level resulting from tidal flooding.

3. Localised Flooding in the area

Although there is a risk that surface water could accumulate on the site, the floor level will be raised in the barn and the risk of flooding from this source is very low.

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

It can be seen that ground levels within the “red” zone where the predicted flood depth is between 500mm and 1.0 metre are 2.70, 2.62, 2.61, 2.49 and 2.45m OD

It can be seen that ground levels within the “orange” zone where the predicted flood depth is between 250mm and 500mm are 2.65, 2.64, 2.70, 2.67, 2.60 and 2.50m OD.

Probably the most relevant are the levels of 2.61m and 2.62m OD on the boundary of the two zones where the predicted flood depth is 500mm. Using these levels a maximum flood level in a 1 in 1000 year event in 2115 of 3.12m OD can be calculated.

The recommended mitigation for a dwelling with sleeping accommodation on the ground floor is that the floor level should be raised to be above the 1 in 1000 year flood level in 2115.

Therefore it is recommended that the floor level should be raised to a minimum level of 3.20m OD which is 500mm above the existing floor level.

The risk of flooding to the building from IDB drains can be considered low, especially with the floor level of the proposed building being approximately 600mm above ground levels on the site.

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 may occur would happen very slowly and affect land at levels below 2.50m OD before the site of the proposed development.

The proposed development is not in a functional flood plain.

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 likely to flood 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.

If any flooding were to occur it 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 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.

However as this proposal is for a change of use of an existing building it is considered satisfactory for sleeping accommodation to be on the ground floor of the building.

The finished floor level of the proposed dwelling should be raised to a minimum level of 3.20m OD which is 500mm above the existing floor level of the barn.

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

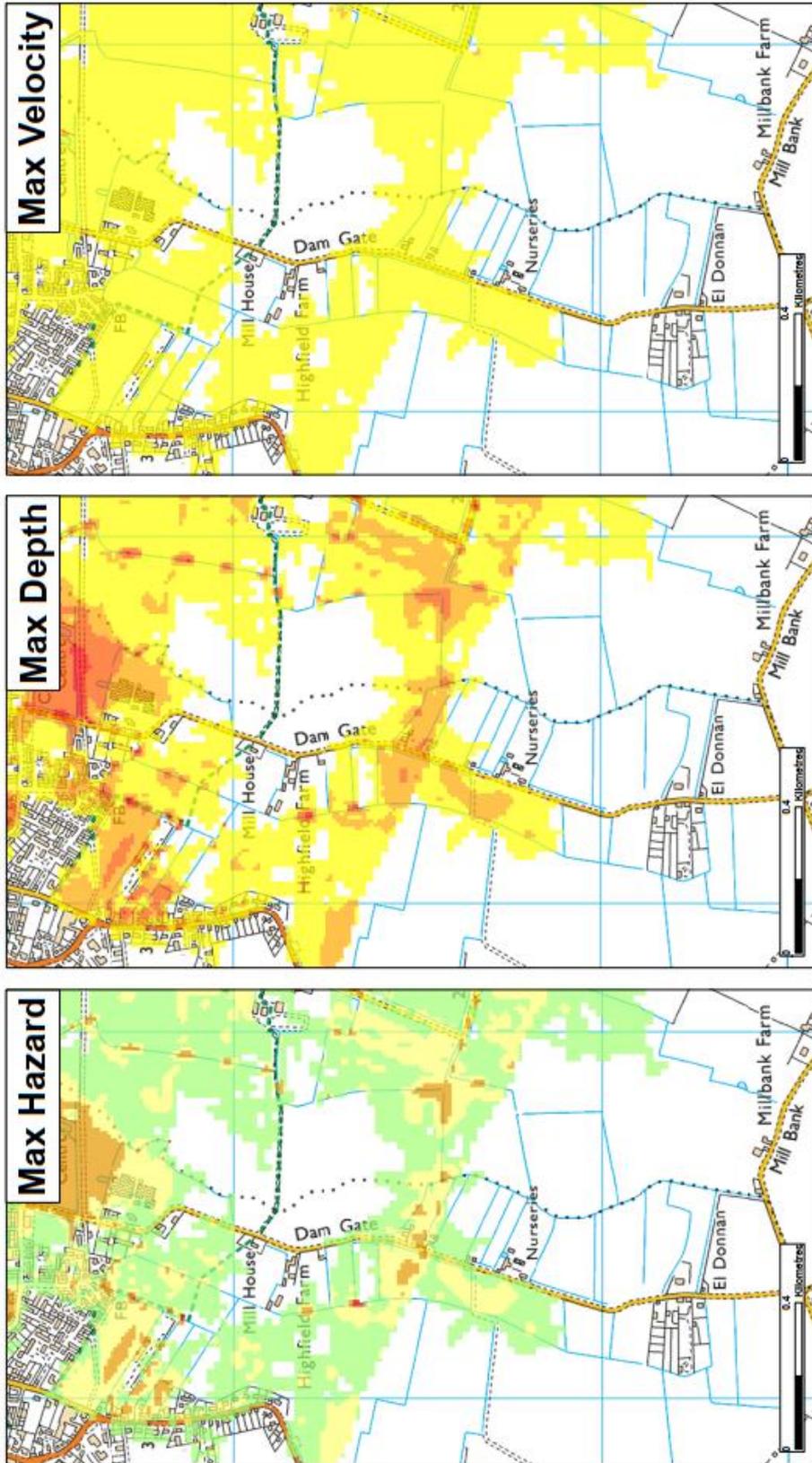
The building should be designed incorporating flood resistant and resilient techniques to allow it to be refurbished after being flooding to a depth of approximately 300mm above the finished ground floor level of the building.

S M HEMMINGS B Sc C Eng MICE MIWEM

stuart.hemmings@btinternet.com

2nd December 2025

ENVIRONMENT AGENCY MAPS OF FLOOD HAZARD IN 1 IN 200 YEAR EVENT



Environment Agency

Lincolnshire and Northamptonshire
Breach Hazard Mapping

Map Created on TF 36470 23516

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences 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.

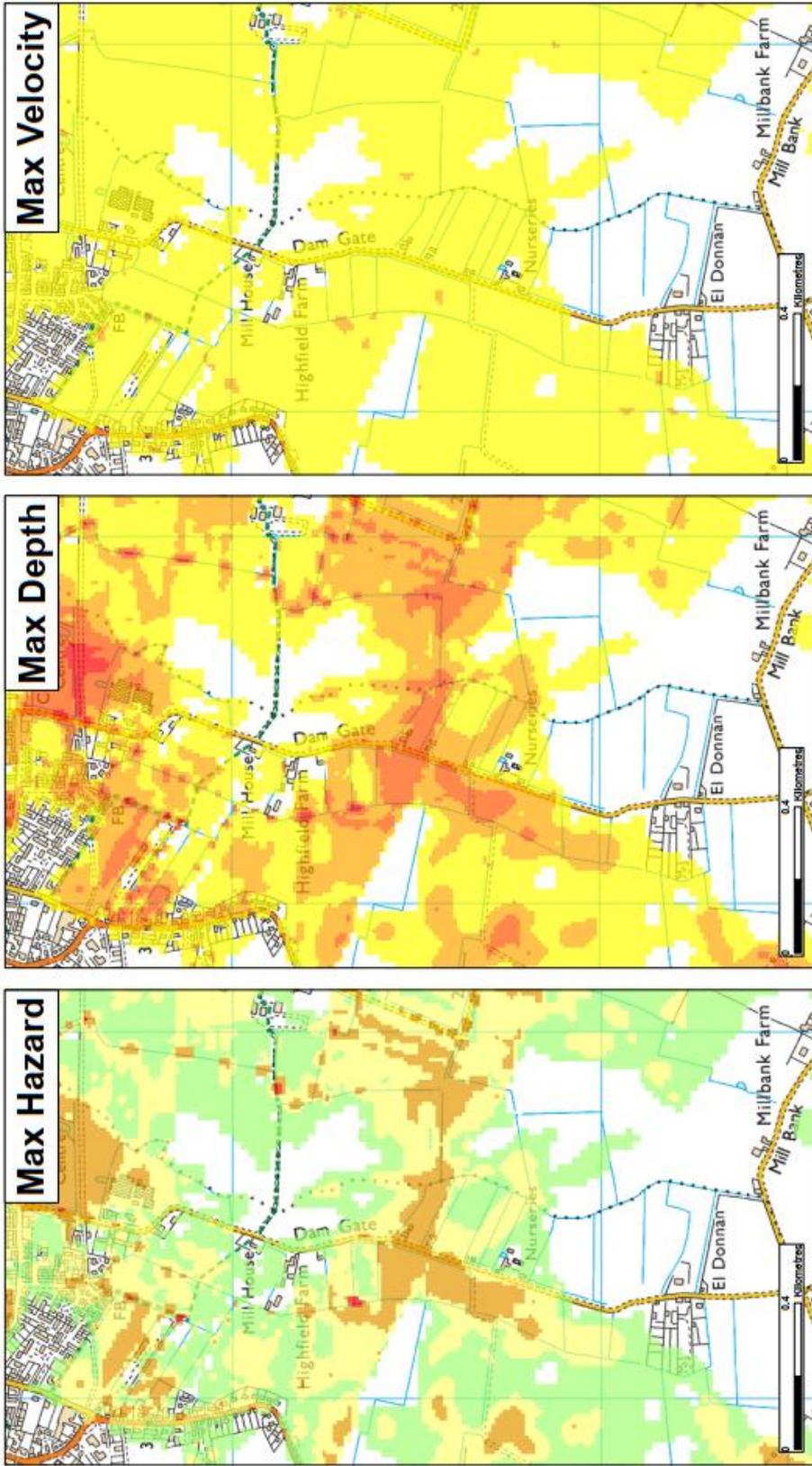
The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

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: 03705 506 506. Westday Daytime calls cost 5p plus up to 6p per minute from BT* Weekend Unlimited. Mobile and other providers' charges may vary.

★ Modelled Breach Locations - see also the accompanying plan "Location of Modelled Breaches"		Max Velocity (m/s)	CCN-2017-46247
Max Hazard (Flood Risk to People: F32209) 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)	0 - 0.25	0 - 0.3	Scenario Annual Chance (1 in 200) 2115 0.5%
	0.25 - 0.50	0.3 - 1.0	
	0.50 - 1.0	1.0 - 1.5	
	1.0 - 1.5	1.5 - 2.5	
	1.5 - 2.5	2.5 +	
Date Printed May 2017	Scenario year 2115	CCN Number 46247	

ENVIRONMENT AGENCY MAPS OF FLOOD HAZARD IN 1 IN 1000 YEAR EVENT



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

Date Printed	May 2017	Scenario year	2115	Scenario Annual Chance (1 in 1000)	0.1%	CCN Number	CCN-2017-46247
Max Hazard (Flood Risk to People - F02500)	Less than 0.75 (Low Hazard)	Between 0.75 and 1.25 (Change for Some)	Between 1.25 and 2.0 (Change for Most)	Greater than 2.0 (Change for All)			
Max Depth (m)	0 - 0.25	0.25 - 0.50	0.50 - 1.0	1.0 - 1.6			
Max Velocity (m/s)	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 defences 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 the map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

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General Enquiries: Tel: 03706 956 956. Weekday Daytime calls cost 5p per minute from BT. Weekend Unlimited. Mobile and other providers charges apply.

Environment Agency

Lincolnshire and Northamptonshire
Breach Hazard mapping

Map Created on TF 36470 23516

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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)

<u>Area of England</u>	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, Nene, 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 Nene 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

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 predicted flood depths on the maps shown in this report are likely to significantly change.

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 should be a minimum level of 3.20m OD, which is approximately 600mm above the existing ground level, is satisfactory.