

**PROPOSED CHANGE OF USE TO RESIDENTIAL AT 90 ACACIA
AVENUE, SPALDING, PE11 2LR**
FLOOD RISK ASSESSMENT



View from east side of site

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

This flood risk assessment has been prepared solely to support the planning application for a change of use at 90 Acacia Avenue, Spalding. 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

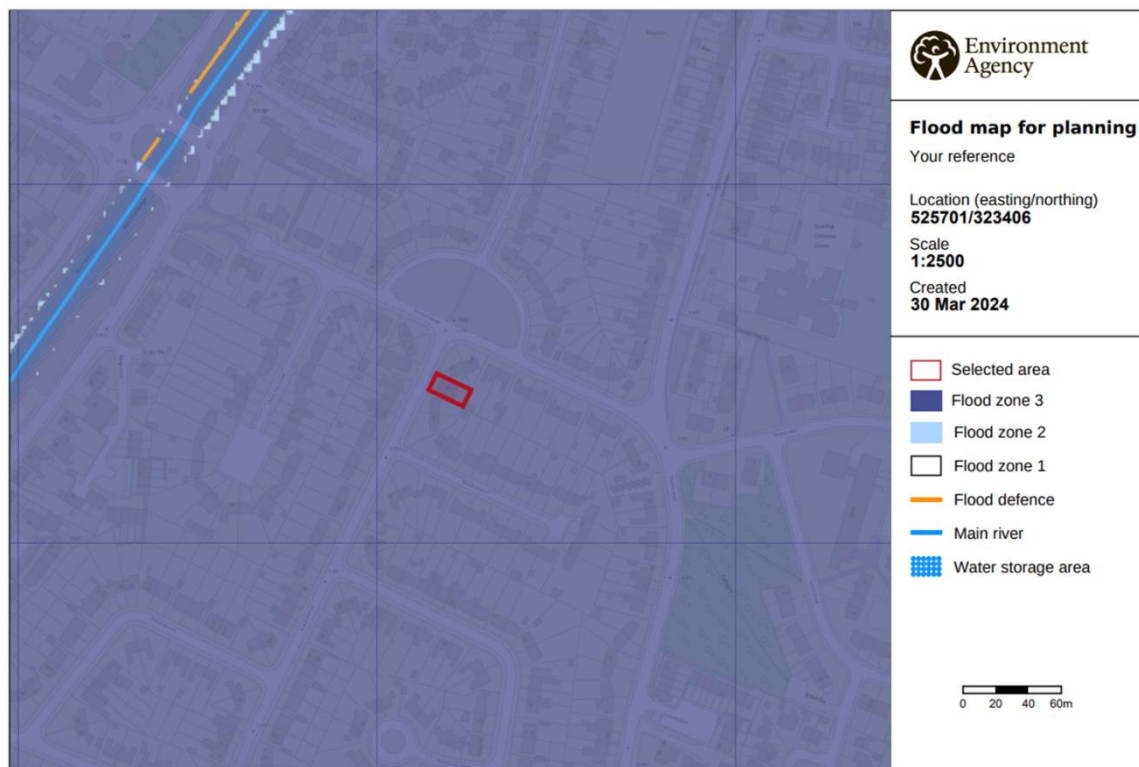
A planning application is due to be submitted to South Holland District Council for permission to change the use at 90 Acacia Avenue, Spalding, PE11 2LR to provide residential accommodation.

The site of the proposed development is within Flood Zone 3 as shown on the Environment Agency's Flood Zone map.

The Planning Application requires a flood risk assessment to be carried out as specified in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. The site is 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 that all of the site is in Flood Zone 3.

Application Site

The National Grid Reference of the site is 525700 323405.

The position and extent 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 considered to be within flood zone 3(a) 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 a dwelling house 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	✓*

From the above table it can be seen that “More Vulnerable” development is only satisfactory within flood zone 3 if the sequential and exception test is passed.

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 this application is for a change of use of an existing building it is not possible to locate this development on an alternative site.

The advice on the Environment Agency website states that a sequential test does not need to be undertaken for an application for change of use.

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 ... 500mm – 1.0metre
	Extent of flooding....High
	Peak Velocity 0 – 0.1m/sec

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 hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

For the present day	Depth of flooding ...1.0 – 2.0 metres
	Extent of flooding .. High
	Hazard rating..... 1.25 – 2.0 (Danger for Most)
	Peak Velocity .. 0 – 0.3m/sec
For the year 2115	Depth of flooding ... Greater than 2.0 metres
	Extent of flooding .. High
	Hazard rating..... Greater than 2.00 (Danger for all)
	Peak velocity 0.3 – 1.0m/sec

The hazards for the 0.1% tidal and fluvial event probability are as follows:

For the year 2115 Depth of flooding ... Greater than 2.0 metres
 Extent of flooding .. High
 Hazard rating..... Greater than 2.00 (Danger for all)
 Peak velocity 0.3 – 1.0m/sec

Figure 16 of the general maps show that the site is within the rapid inundation zone for the present day and 2115.

Maximum flood level and bank levels in the River Welland

Tables in the SFRA show the following details of the defence bank on the east side of the tidal section of the River Welland at chainage 22.0km immediately north of Marsh Road Sluice and 450 metres north of the development site.

	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	6.32m OD	6.65m OD	7.46m OD

With an average defence crest level between 7.80 and 7.90 m OD 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

Tables in the SFRA show the following details for the defence bank on the west side of the Coronation Channel at chainage 0.4 km which is 270 metres east of the site.

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

The bank levels on this section vary between 5.50m OD and 6.0m OD. Therefore it can be seen there is a minimum freeboard of 800mm to the predicted design maximum levels in 2115.

The Wash banks are at least 20.0 km north of the site. The tidal defences are earth banks with an average level of 7.80m OD. The maximum predicted 1 in 200 year tide level in 2115 in the SFRA is 7.11m OD.

Information on Surface Water Flooding on Environment Agency Website

The map below shows areas around the site where there is a low risk of surface water flooding. 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" and is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding due to overtopping or failures of the defences is considered to be very low.

The site is approximately 270 metres east of the River Welland, which is the main river and maintained by the Environment Agency.

The site is approximately 450 metres south of the tidal defences of the River Welland and Coronation Channel.

The area between the River Welland and the Coronation Channel is drained by surface water sewers maintained by Anglian Water, which discharge either into the River Welland or into drainage channels maintained by South Holland Internal Drainage Board. The water levels in the IDB channels are controlled by Clay Lake Pumping Station, which is operated by South Holland IDB, and discharges into the Coronation channel.

Existing Ground Levels

The level of the site is approximately 3.20m ODN and the level of Holbeach Road north of the site is between 3.80m and 4.0m ODN.

Potential Sources of Flooding

The following sources of flooding have been identified:

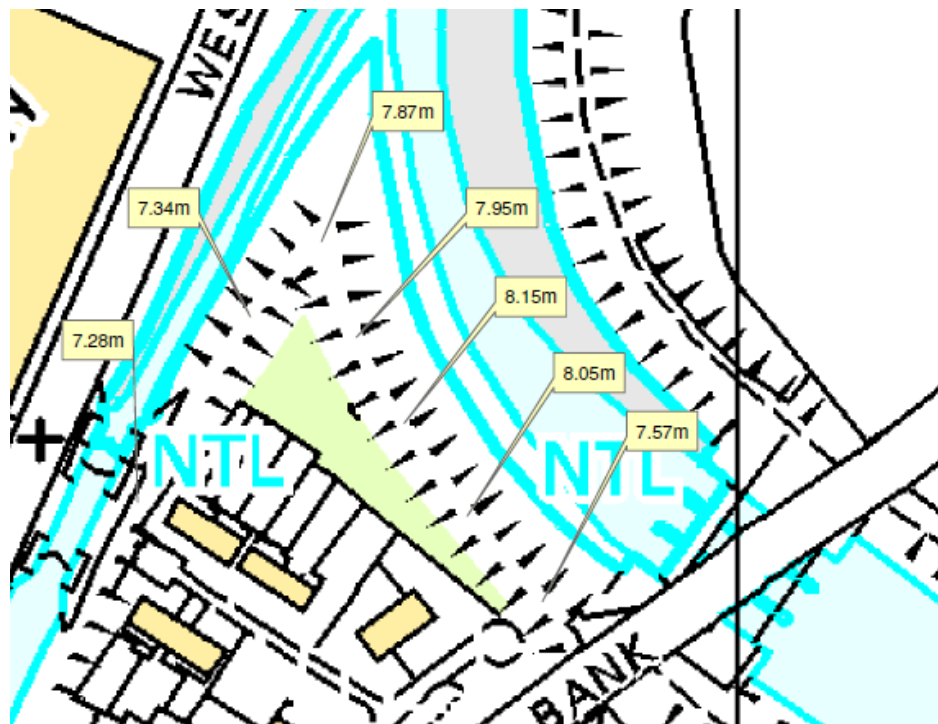
1. Failure or overtopping of the tidal defences.
2. Overtopping of the River Welland.
3. Overtopping or breaching of the Coronation Channel.

4. Failures of Clay Lake Pumping Station (IDB)
5. Flooding from IDB channels and piped drains
6. Blockages in local surface water sewers (highway or Anglian Water)

1. Failure or overtopping of tidal defences.

There is a short length of tidal defences on the Coronation Channel west of Marsh Road Sluice and on the River Welland north of Fulney Lock that defends the area between the River Welland and the Coronation Channel from tidal flooding. The SFRA states that the defences are adequate to withstand a 1 in 200 year (0.5%) probability event for present day but in the future (2115) some of the banks would be overtopped in a 0.5% probability event.

Crest levels of this bank have been surveyed and these are shown below. These levels range from 7.28m OD near Fulney Lock to above 8.00m OD on the main section of bank. The low level of 6.88m OD mentioned in the SFRA was not found. All the surveyed levels are higher than the 1 in 200 year extreme tide level in 2115 of 7.12m OD stated in the SFRA.



These banks are well maintained and have a top width of at least 4.0 metres, and it is reasonable to assume that during the next one hundred years, considering the assets that are protected by this bank, further maintenance and capital works will be carried out on the tidal banks to ensure a continuing minimum defence standard of 1 in 200 years.

If a breach occurred in the tidal bank during a 1 in 200 year event in the year 2115 flood water would flow southwards and start to flood the whole area between the Coronation Channel and the River Welland. The hazards of this will be considered later in the report.

2. Overtopping of the River Welland.

The crest level of the east bank of the River Welland is approximately 5.50m OD west of the development site. The highest predicted fluvial level for a 1 in 100 year event in the fluvial River Welland in 2115 is 4.69m OD. The level of the east bank of the River Welland varies between 5.10 and 5.30m OD through the town of Spalding.

Therefore there is a risk of flooding on the proposed site from this source if a breach occurred in the east bank of the River Welland in a 1 in 100 year event in 2115.

3. Overtopping or Breaching of the Coronation Channel

The area between the River Welland and the Coronation Channel is protected from flooding by banks on the west side of the channel, which are approximately 2.0m to 3.0m above the land. The top level of these banks are at a level of 5.40m OD, which gives a freeboard of at least 700 mm above the 1 in 1,000 year maximum design level in the channel.

If a breach occurred in the channel the maximum water level in the flooded area could reach between 4.0 m and 4.1 m OD for the present day situation and between 4.3m and 4.4 m OD if climate change is allowed for.

Therefore the risk of flooding from this source can be considered to be low, and it is likely that the flood level following a breach would be lower than if the tidal defences were to breach. This source of flooding will be adequately mitigated by raising the floor level of the proposed building above the maximum predicted flood depth in a tidal event.

4. Failure of Clay Lake Pumping Station

The South Holland IDB estimate that the Clay Lake Pumping Station provides a 1 in 50 year standard with a freeboard, which in effect provides a 1 in 100 year protection against flooding. The pumping station is maintained in good condition and should a failure occur the Drainage Board would quickly deploy temporary pumps to alleviate the situation. It is highly unlikely that any flooding from this source would extend as far as this site, as the flood water would need to rise above 3.40m OD, which is higher than the ground levels around the pumping station itself which would flood first.

Therefore flooding from this source can be considered to be adequately mitigated.

5. Flooding from IDB channels and Piped Drains

There are two main drainage channels in the area between the coronation Channel and the River Welland. Exeter Drain flows southwards from Albert Street to Clay Lake Pumping Station. The northern section of this drain as far as Halmer Gate is piped. The upper section of the second drain is piped and flows eastwards from north of the development site as far as the Coronation Channel. The drain then flows southwards as far as Clay Lake Pumping Station as an open channel located behind the bank of the Coronation Channel.

The South Holland IDB has a regular annual maintenance programme and they remove weed growth from channels such as these twice each year. However, any flooding from this channel will not cause any flooding to the development site, as explained in (4) above.

Flooding from this source can be considered to be adequately mitigated.

6. Blockages in local surface water sewers

Both Anglian Water and the Highways Authority maintain surface water drainage systems in this area. The floor level of the proposed development will be raised a significant height above the existing ground level which will provide adequate mitigation against flooding from this source.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties having been flooded in the last 50 years.

Probabilities and Trends of Flooding

The probability of this development being flooded from Environment Agency main river is very low. In an extreme tidal the site would be affected by flood water very soon after a breach occurred, and initially the flood water could be up to 1.0 metre in depth flowing southwards from the breach into the lower areas to the south of the site.

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 this FRA. The effects of these new recommendations are considered in Appendix B of this report (pages 13 to 16). The hazard maps can be found on the South East Lincolnshire Local Plan website. The modelling and mapping note advises that these new maps do not take into account of the new climate change guidance (February 2016) issued by the Environment Agency. The notes in Appendix B conclude 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 map below shows that the predicted flood hazard for this site is greater than 2.00 (danger for all), for both the 1 in 200 year and 1 in 1000 year event in 2115.



As the development is in flood zone 3 and the predicted flood hazard is greater than 2.00 (Danger for all) reference should be made to Category C8 of the South East Lincolnshire Standing Advice Matrix which shows the following advice.

The Environment Agency requires direct consultation on proposals in this hazard zone. 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 document “Improving Flood Performance of New Buildings Flood Resilient Construction (DCLG2007).

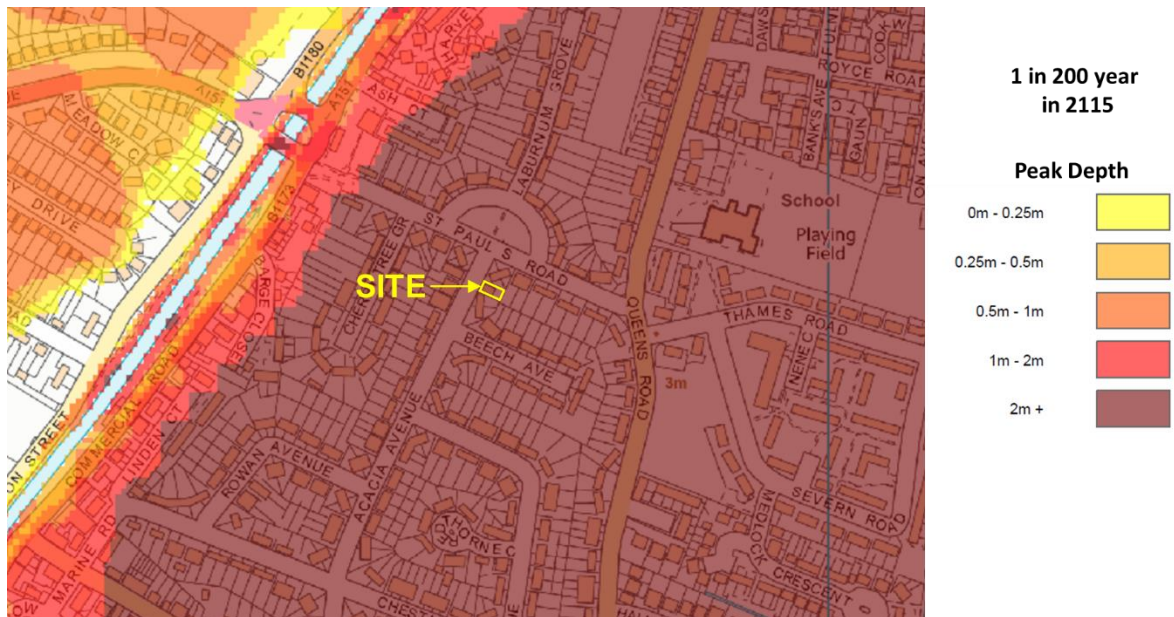
Finished floor levels (FFL) should be informed by the predicted flood depth maps and set as required below (single storey proposals must use the 0.1% event, 2115 scenario, for setting FFLs).

Flood depths of greater than 1.6 metres

It is unlikely that mitigation measures would prevent flood water from entering the building at ground floor level. Therefore proposals should have a minimum of 2 storeys with no ground floor habitable accommodation. The first floor living accommodation must be above the highest predicted flood depth.

Summary of Flood Risk

The Environment Agency plan (shown on the next page) of predicted depths of flooding in a 1 in 200 year fluvial or tidal event in 2115 indicates predicted flood depths of greater than 2.0 metres at this site if a breach were to occur in the tidal bank of the River Welland.



The map shown above indicates the predicted residual flood level in a 1 in 200 year event in 2115 will be higher than 5.20m ODN, as the existing ground level on the site is 3.20m ODN.

However when the flood level reaches 5.00m OD in the area flood water will begin to flow back into the fluvial River Welland west of the development site preventing the flood level increasing above a level of between 5.20m and 5.30m OD.

Therefore it can be concluded that the maximum flood level in a 1 in 200 year event would not exceed 5.40m ODN. This will be below the existing level of the first floor of the building which is estimated to be 5.80m ODN.

Recommendations

Following the advice in the Matrix on the South East Lincolnshire website there should be no habitable accommodation on the ground floor and the new residential development should all be on the first floor of the building.

All of the ground floor of the buildings should be able to withstand flooding for a number of days.

The building should be designed incorporating flood resistant and resilient techniques to allow it to be refurbished after being flooded to a depth of approximately 300mm above the predicted flood depth.

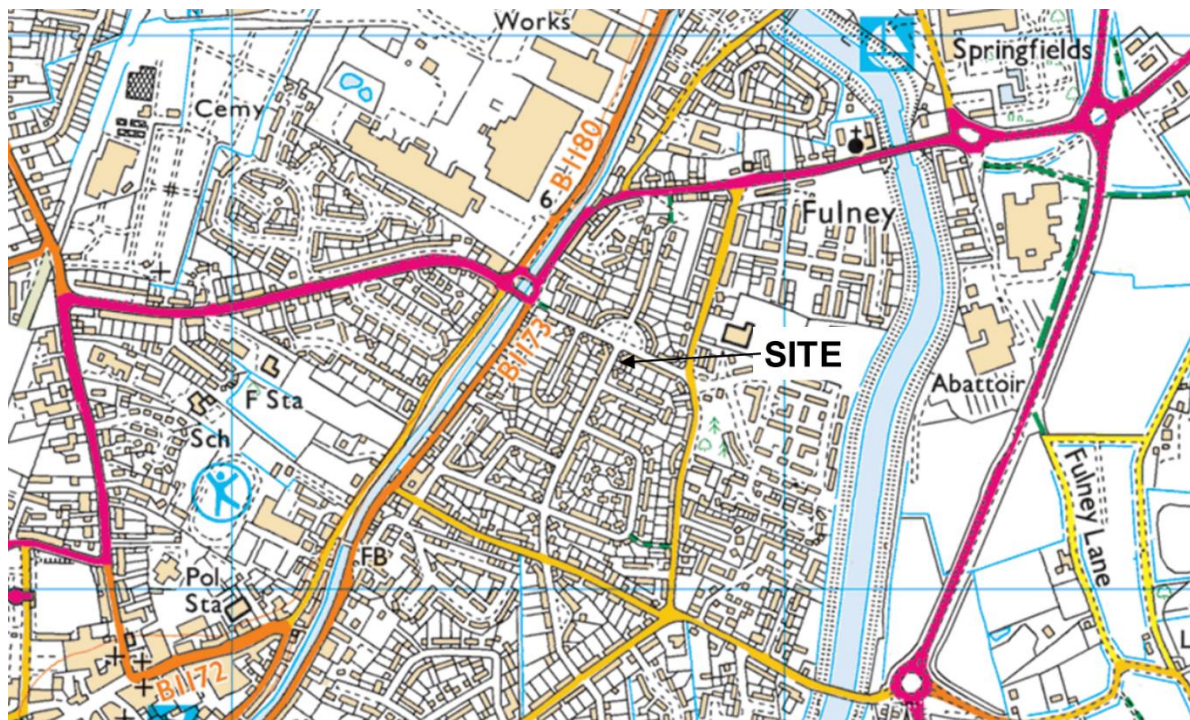
The developer should advise owners and occupiers of the properties to register with the Environment Agency's Floodline Warnings Direct Service.

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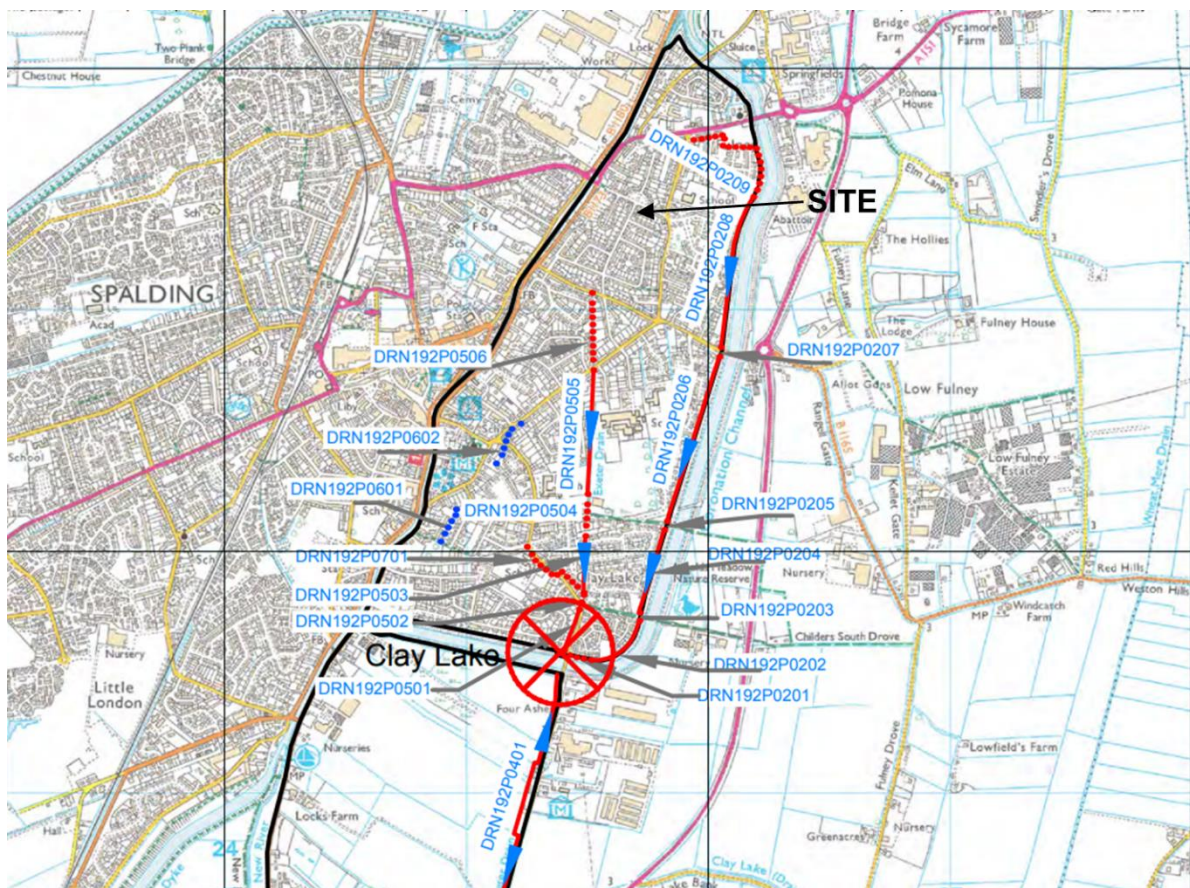
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23rd April 2024

LOCATION PLAN



PLAN OF IDB DRAINS



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 tidal River Welland
- 2) Flooding from the fluvial section of the River Welland, the Coronation Channel or IDB drainage system

1) Flooding from the tidal River Welland

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 may slightly increase the risk of a breach occurring in the tidal bank north of the site. It may also slightly increase the flow of water into the area between the Coronation Channel and the River Welland. However it will not change the conclusions and recommendations in this report.

Fluvial Flooding.

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.

Maximum flood levels in the River Welland and the Coronation Channel will not be increased by the increase in flows projected in the new climate change allowances. If flows increase by 65% in these systems it will have the affect of flooding over the long sections of bank between Spalding and Market Deeping and the maximum levels will not increase significantly.

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.

As the major flood risk to this site is from tidal flooding then any increases in flow from fluvial sources do not need to be considered further.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that all habitable accommodation should be on the first floor of the building is satisfactory.