

PROPOSED RESIDENTIAL DEVELOPMENT SOUTH OF 154
PINCHBECK ROAD, SPALDING, PE11 1QN
FLOOD RISK ASSESSMENT



View from Pinchbeck Road

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 development south of 154 Pinchbeck Road, 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

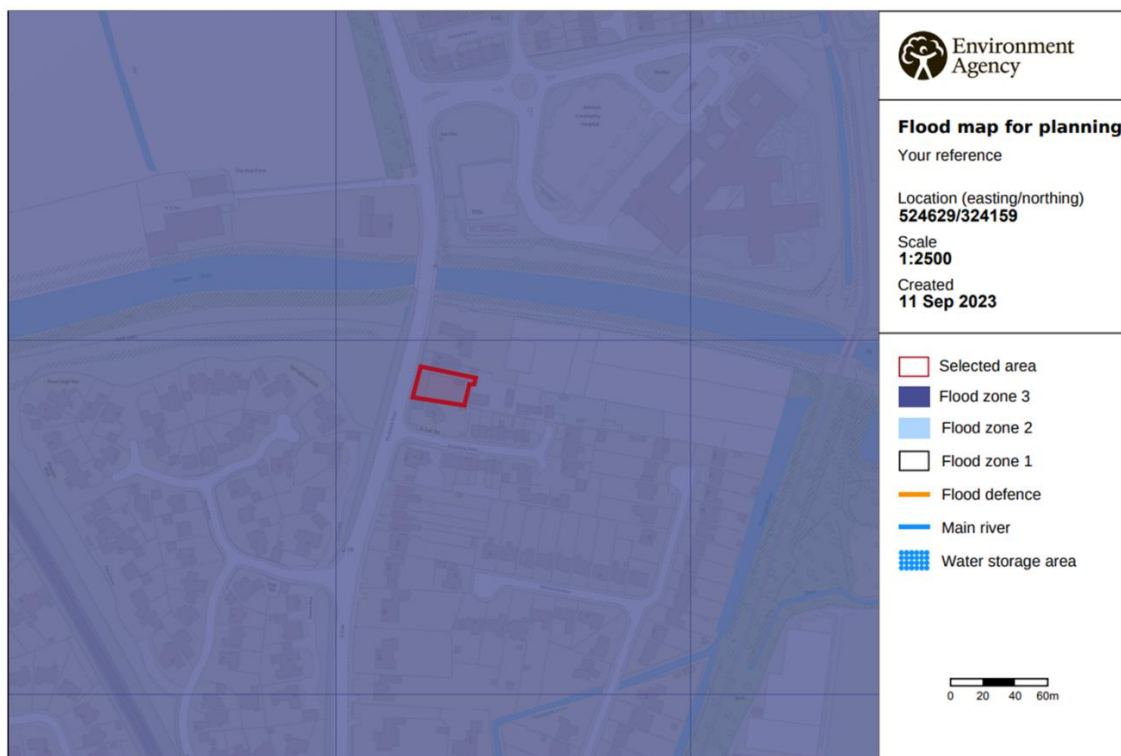
A planning application is due to be submitted to South Holland District Council for permission to carry out a development of one dwelling on the south side of No 154 Pinchbeck Road, Spalding, PE11 1QN. The planning application will also include for the demolition of the existing properties 154 and 156 Pinchbeck Road.

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 Welland and Deepings 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 524629 324159.

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.

Most of the town of Spalding is within flood zone 3(a) and therefore it would be difficult to find a suitable site for development within a lower flood zone,

The site of this proposed development is within the town boundary and the South East Lincolnshire Local Plan adopted in March 2019 recognises in paragraph 5.3.5 that infill and speculative applications will come forward within the South Holland District Council area. It states that there will be numerous opportunities for infill developments which it is not practical to identify, and the plan encourages these types of developments provided that the material considerations of the Local Plan and particular sites are met.

The safety of the development will be delivered by ensuring the floor level of the proposed new dwelling is above the predicted residual flood levels for this area in a 1 in 200 year fluvial or tidal event in 2115.

Therefore I consider that the sequential test has been passed.

Exception Test

The Sequential Test has demonstrated that it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding. Therefore the Exception Test must be applied and for this to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risks, informed by the Strategic Flood Risk Assessment; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking into account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible will reduce flood risk overall.

Both parts of this test must be satisfied in order for the development to be considered appropriate in terms of flood risk. There must be robust evidence in support of every part of the test.

The first section will be demonstrated by the Supporting Planning Statement and compliance with South Holland District Council's planning policies.

This flood risk assessment will demonstrate that the development will be safe for its lifetime and it will not increase flood risk elsewhere.

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
	Flood Hazard..... Nil
	Peak Velocity Nil
For year 2115	Depth of flooding ... 0 - 500mm
	Extent of flooding....High
	Flood Hazard..... Moderate
	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 ...0 – 250mm
	Extent of flooding .. High
	Hazard rating..... 0.75 – 1.25 (Danger for Some)
	Peak Velocity .. 0 – 0.3m/sec
For the year 2115	Depth of flooding ... 250 – 500mm
	Extent of flooding .. High
	Hazard rating..... 0.75 – 1.25 (Danger for Some)
	Peak velocity 0 – 0.3m/sec

Figure 16 of the general maps show that the site is not 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 6.97 and 7.04 m OD (average 7.00m OD) between chainages 21.5 and 21.9km the freeboards are as follows:

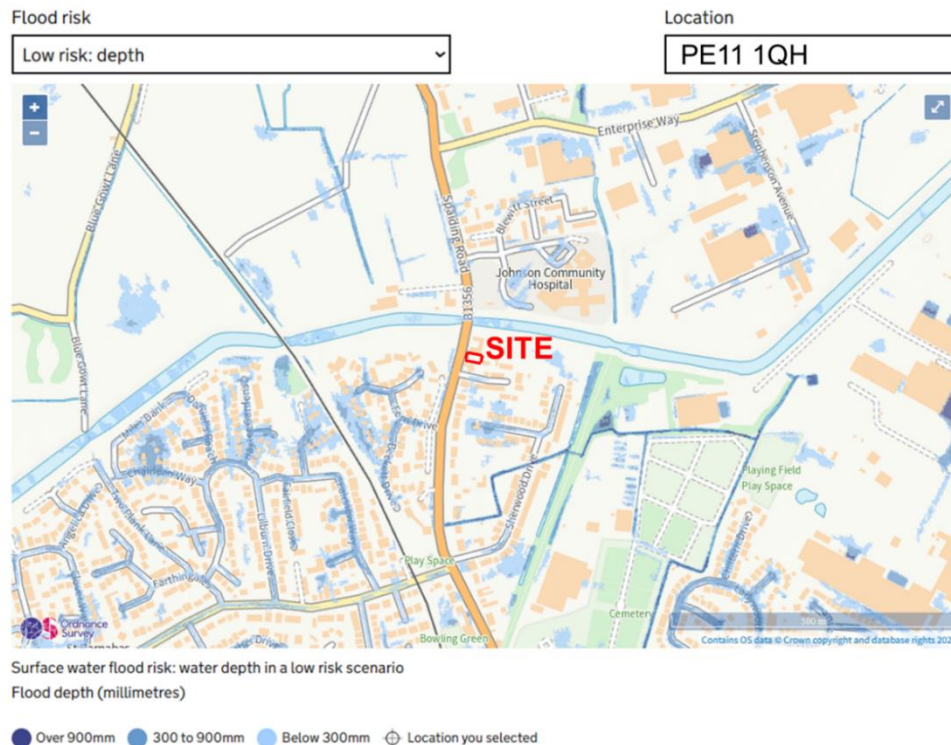
	2007	2055	2115
Peak 1 in 200 year freeboard	1002mm	690mm	-120mm
Peak 1 in 1,000 year freeboard	680mm	350mm	-460mm

Maximum water level in Vernatts Drain

The maximum water level in Vernatts Drain is shown in the SFRA to be 3.79m OD for both the 1 in 100 year and 1 in 1000 year event for the present day and for 2115. The defence level is shown to be 4.30m ODN.

Information on Surface Water Flooding on Environment Agency Website

The map on the next page 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 70 metres south of Vernatts Drain which is a large watercourse maintained by Welland and Deepings IDB.

The site is approximately 1.25 km west of the tidal defences of the River Welland, which are maintained by the Environment Agency.

The site is approximately 1.1 km metres west of the fluvial section of the River Welland, which is the main river and maintained by the Environment Agency.

There are additional smaller watercourses in the area that are maintained by Welland and Deepings IDB.

Existing Ground Levels

Levels have been taken across the north side of the site and these are shown on a plan on page 13 of this report.

The level across the north of the site is approximately 2.96m OD and the levels rise on west side near the road where the footpath level is 3.19m OD and the road level is 3.28m OD.

The ground floor level of the existing house (154 Pinchbeck Road) is 3.11m OD

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. Flooding from Vernatts Drain
4. Flooding from IDB channels and piped drains
5. Blockages in local surface water sewers (highway or Anglian Water)

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

The west bank of the tidal section of the River Welland is approximately 1.1km east of the site. The hazard from a breach in this bank will be considered to be the major flood risk to the site.

The flood risk maps shown on the South East Lincolnshire website predict flood depths of between 250mm and 500mm on the site in a 1 in 200 year event in 2115.

The predicted flood levels and the defence crest levels in the 2010 SHDC SFRA (see page 5 of this report) indicate that there could be overtopping of the west bank in a 1 in 200 year event in 2115.

It is reasonable to presume that within the next one hundred years works would be undertaken on this section of the bank to ensure that there will be a 1 in 200 year standard of defence continuing into the future, especially considering the value of the industrial and residential properties protected by these defences.

Adequate mitigation will be provided against the hazard by raising floor levels to above the predicted flood level on the site.

2. Overtopping of the River Welland.

The west bank of the River Welland is at a level of 5.20m O.D. east of West Marsh Road and Albion Street. This is not a raised defence at this point. The average level of these roads and footpaths is 5.25m OD. The predicted level in the fluvial River Welland in a 1 in 1000 year event in 2115 is 4.68m OD. If this level increases siphons are activated to spill water onto Cowbit and Crowland Washes. Also water will begin to flood over lower banks around Crowland. Therefore, the risk of flooding from this source reaching the proposed development on Pinchbeck Road can be considered to be lower than the risk from tidal flooding.

Therefore the 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 can be considered to be adequately mitigated.

3. Flooding from Vernatts Drain

The highest predicted water levels in IDB drainage channels in the area are in Vernatts Drain which are indicated to be 3.79m OD in the 2010 SHDC SFRA. If the south bank of the Drain were to breach when the level of the Drain is at its maximum level then flood water could flow towards the site. However Welland and Deepings would take

action to reduce the output of Pode Hole Pumping Station and to reduce levels in Vernatts Drain to prevent significant flooding.

With a proposed floor level of the new building of 3.50m OD this source of flooding can be considered to be adequately mitigated.

4. Flooding from IDB channels and Piped Drains

Welland and Deepings IDB maintain an open drainage channel called the Cemetery Drain which is located approximately 250 metres south of the site of the proposed development. This drain conveys surface water and land drainage from the area around Sherwood Drive and Pinchbeck Road westwards through piped drainage channels and then open drainage channels under IDB jurisdiction. The water level in these channels is controlled by Pode Hole Pumping Station which lifts the water into Vernatts Drain.

Maximum predicted water levels in the IDB catchment controlled by Pode Hole Pumping Station in a 1 in 100 year event in 2115 are below 1.00m OD which is at least 2.5 metres below the proposed ground floor level for the new building of 3.50m ODN.

The Welland and Deepings 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.

Therefore the risk of flooding from the above IDB channels can be considered to be adequately mitigated.

5. 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 and the level of Pinchbeck Road 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

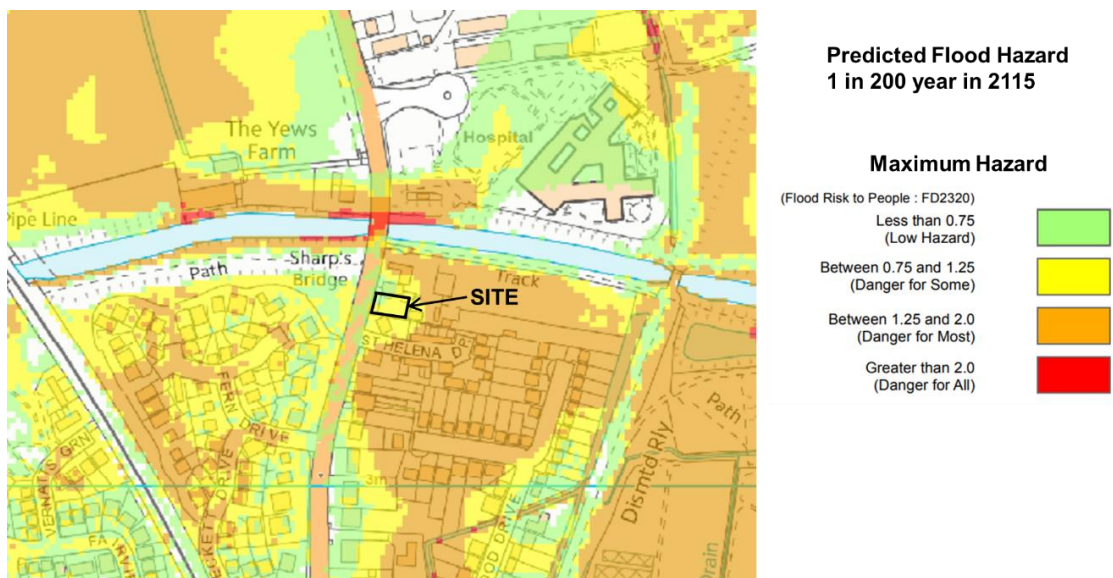
The recommendations for flood depths for this flood risk assessment use information mostly taken from the South Holland DC SFRA which was last updated in 2010. The EA have issued new guidance on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which from 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 14 to 17). 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 A 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 the 1 in 200 year event in 2115.



As the development is in flood zone 3 and the predicted flood hazard across most of the site is between 0.75 and 1.25 (danger for some) reference should be made to Category E8 which shows the following advice.

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 (refer to the relevant 2115 1% fluvial or 0.5% tidal maximum depth map) and set as required below (single storey proposals must use the 0.1% event, 2115 scenario, for setting FFLs).

For flood depths of 250mm – 500mm, FFL should be set 500mm above ground level with flood resilient construction to a height of 300mm above the predicted flood depth.

For flood depths of 0 – 250mm, FFL must be set 300mm above ground level.

Summary of Flood Risk

The extract from the Environment Agency plan (shown below) of predicted depths of flooding in a 1 in 100 year fluvial or 1 in 200 year tidal event in 2115 indicates predicted flood depths of between 250mm and 500mm over most of the site if a breach were to occur in the tidal bank of the River Welland.



The average level of the site is 2.95m ODN with the level of the footpath and road being 3.19m and 3.28m ODN. Therefore the predicted flood level in a 1 in 100 year fluvial or 1 in 200 year tidal event in 2115 can be estimated to be 3.45m ODN.

There is a risk that the bank of Vernatts Drain could break and flood water could flow towards the site. However Welland and Deepings could control the situation and this would reduce the risk of flooding to the site.

Recommendations

In any area at risk of flooding all 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 new dwelling should be raised by approximately 500mm above the existing ground level, to a level of 3.50m ODN.

Flood resilient construction should be carried out to a height of 300mm above the predicted flood depth.

The owner and occupier of the property should register to receive flood warnings with the Environment Agency's Floodline Warnings Direct Service.

Rainwater from the roof of the proposed building should be discharged if possible into soakaways and these should be designed to BRE Digest 365 and approved under

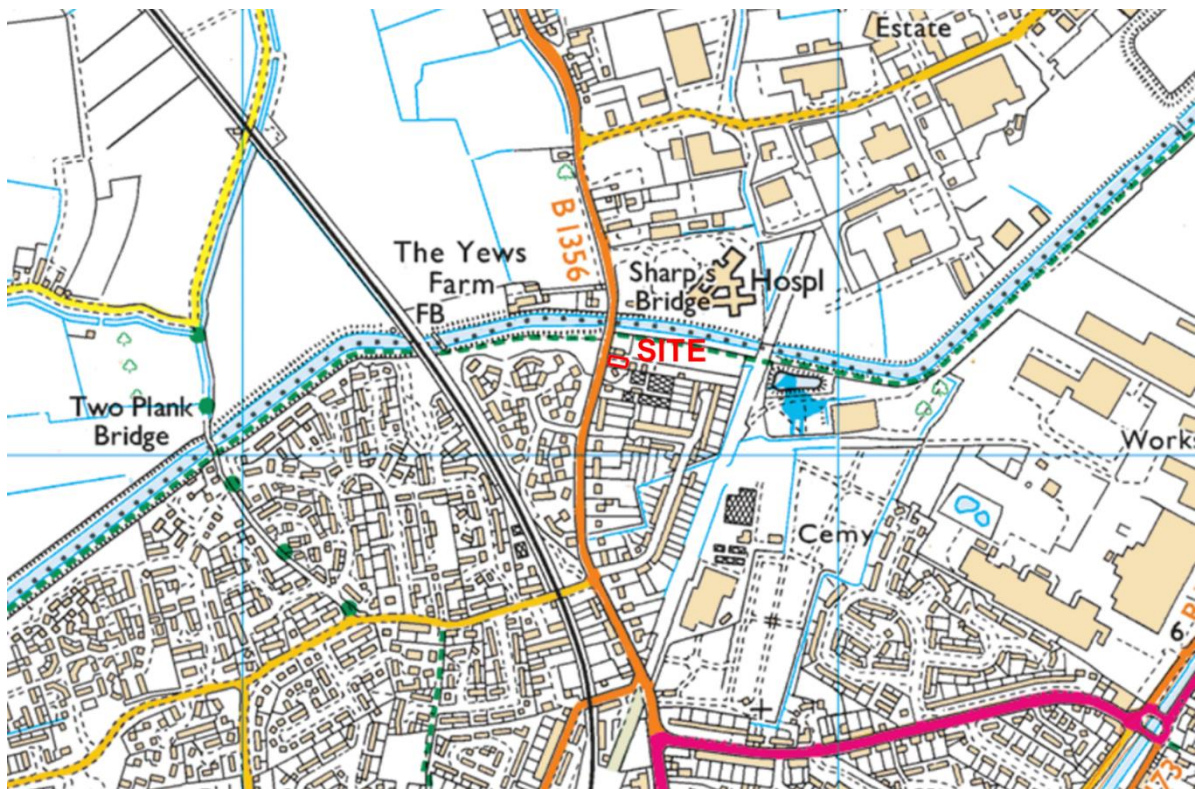
Building regulations. Hardstandings around the building should be constructed with permeable paving.

S M HEMMINGS B Sc C Eng MICE MIWEM

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21st September 2023

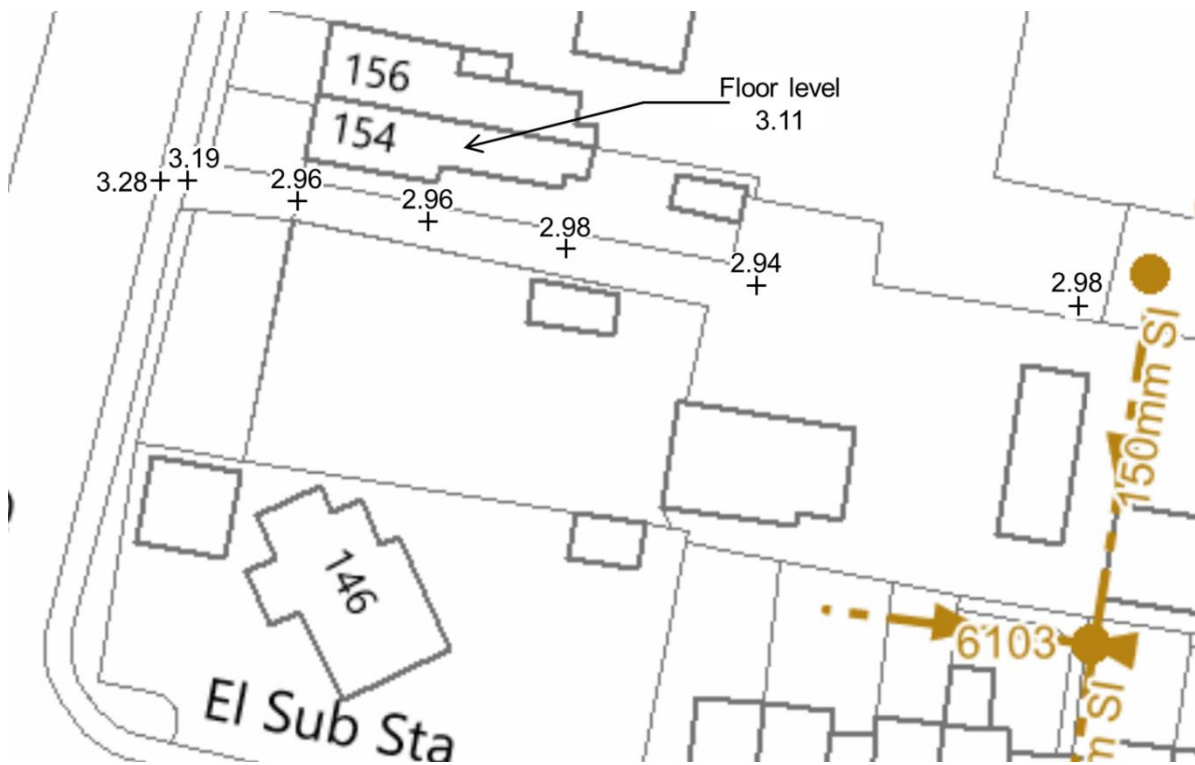
LOCATION PLAN



PLAN OF IDB DRAINS



LEVELS OF THE SITE



BLOCK PLAN



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 east 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 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.

Welland and Deepings 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 Welland and Deepings IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that the Board continues to provide the same standard of service as the present day.

Therefore 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 the ground floor levels should be a minimum level of 3.50m OD is satisfactory.