

PROPOSED RESIDENTIAL DEVELOPMENT AT SOUTH DROVE, SPALDING, PE11 3BE. FLOOD RISK ASSESSMENT



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This flood risk assessment has been prepared solely to support the planning application for the conversion of a development at South Drove, 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

An application is due to be made to South Holland District Council for planning permission to undertake a residential development at South Drove Spalding. The site is at present part of a field south west of South Drove.

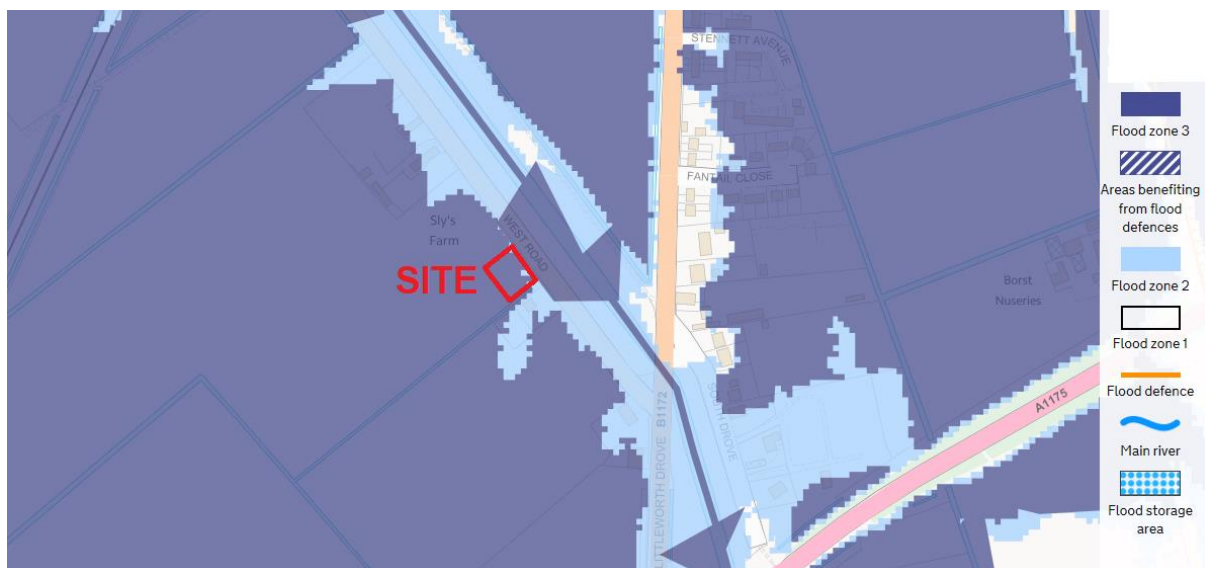
The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

Therefore the Planning Application requires a Flood Risk Assessment to be carried out as required in the Planning Practice Guidance to the National Planning Policy Framework.

The site is shown within the defended area of 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 the area.



It can be seen that this area south west of Spalding is in Flood Zone 3.

Application Site

The development is located on the western side of the North Drove Drain. The National Grid Reference of the site is 523150 319270.

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 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 residential development 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 †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Therefore it can be seen that for “More vulnerable” development the sequential and the exception tests need to be applied to the development.

Sequential Test

The aim of the Sequential Test, as set out in the Planning Practice Guidance, is to ensure that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The flood zones as defined in the Strategic Flood Risk Assessment for the area provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

Although the central area of Spalding is at a slightly higher level, the outskirts of Spalding are all at a similar level and all these areas are within flood zone 3. Therefore it is unlikely that a residential site could be found with a lower flood risk that has not already been developed.

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.

The Design and Access statement will confirm that the proposed development is in accordance with the relevant South Holland District Council Core Strategy policies.

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

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.

The maps illustrate the actual flood hazard for the 1% fluvial event and 0.5% tidal event, and for the 0.1% 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 hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

For the present day	Depth of flooding ... 500mm – 1.0 metre
	Extent of flooding .. High
	Hazard rating..... 1.25 – 2.0 (Danger for most)
	Peak Velocity .. 0 – 0.3 metres/second
For the year 2115	Depth of flooding ... 500mm – 1.0 metre
	Extent of flooding .. High
	Hazard rating..... 1.25 – 2.0 (Danger for most)
	Peak Velocity .. 0 – 0.3 metres/second

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

The maximum levels in the River Welland east of the site are as follows:

	2007	2115
Peak 1 in 100 year level	4.50	4.67
Peak 1 in 1000 year level	4.51	4.67

The defence level (top of left bank) is between 5.85m OD and 6.0m OD at this location.

Site Levels

The level of South Drove on the north eastern boundary of the site varies from 2.33m to 2.58m OD.

The land levels on the site are between 1.60m and 1.80m OD with higher levels adjacent to South Drove.

A plan showing all these levels is shown on page 11 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". The area 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 to the River Welland is very low.

The edge of the site is 25 metres from the top of the bank of the South Drove Drain. The water level in South Drove Drain is controlled by Pode Hole Pumping Station, which is maintained by Welland and Deepings IDB.

The site is approximately 600 metres west of the River Welland, which is main river and maintained by the Environment Agency.

Potential Sources of Flooding

The following sources of flooding have been identified:

- 1) Due to high water levels in South Drove Drain.

- 2) Failure or overtopping of the west bank of the River Welland.
- 3) Failure or overtopping of tidal defences of the River Welland
- 4) Overtopping of IDB drainage systems.
- 5) Flooding from local surface water systems.

1. High Levels in South Drove Drain

The water level in South Drove Drain, which is maintained by Welland and Deepings IDB (W & D IDB) is controlled by Pote Hole Pumping Station. There are both electrically operated and diesel powered pumps which are operated at this location to control water levels. W & D IDB have stated that the normal pumping level is -1.20m OD and the maximum design water level in a 1 in 100 year event would be 0.18m OD. With climate change this could increase to around 0.7m OD.

However you would expect Welland and Deepings IDB to carry out improvements to their system to ensure that the present standard of service does not reduce due to climate change over the next one hundred years.

Although the likelihood of water levels rising to 2.00m OD in South Drove Drain is remote, if this happened low land around Deeping St Nicholas would start to flood and so the level in the Drain would be unlikely to increase further.

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

2. Failure or Overtopping of the west bank of the River Welland

The River Welland is located 600 metres east of the site.

The maximum 1 in 1000 design level in the River Welland is 4.67m OD. The minimum level of the west bank of the River Welland at this location is 5.85m OD. Therefore as long as the bank does not fail there is no danger of this bank overtopping, and causing flooding to the proposed development.

If the west bank breached at a location due east of the site water would first flow westwards from the River Welland and would flood the houses on the east side of the B1172. There would be at least 1.0 metre depth of flood water when it would then flow over the B1172 road and start to flow into the South Drove Drain, and the level of both South Drove and North Drove Drain would start to rapidly increase. Although W & D IDB would operate as much of their pumping capacity as possible in this situation to alleviate the situation, water levels would rise to 2.0m OD in a short time. The land around Deeping St Nicholas would then begin to flood and there would not be a further rapid increase in water levels in the Drain.

The flood maps in the SFRA indicate flood water would start to flood South Drove and the area of land west of this road in a 1 in 100 year event in 2115.

As the Environment Agency maintains the banks of the in good condition and the risk of the bank failing is very low, then the possibility of water levels rising to above 3.00m OD and flooding the proposed dwelling must be very low, and very much below 0.1% probability.

Therefore the floor levels of the proposed houses will be raised above the predicted level of this flood water.

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

The tidal defences are 8 km north east of the site, to the north of Spalding. It is most unlikely that a breach of these defences would spread this distance inland, and therefore the possibility of flooding from this source can be considered to be remote.

4. Overtopping of IDB Systems

Drainage channels maintained by the Welland and Deeping IDB generally have a 1 in 10 year standard with up to 1.0 metre of freeboard, which generally provides between 1 in 50 and 1 in 100 year standard against flooding. It is almost inconceivable that the South Drove Drain, which has a normal water level of -1.2m OD and a maximum design level of 0.18m OD would reach a level of 3.0m OD and cause flooding to the development site.

5. Flooding from local foul or surface water systems

It is assumed that the foul water from the proposed development will be discharged into a treatment plant which will discharge into the dyke on the southern boundary of the site.

Surface water from the proposed buildings will be discharged into soakaways.

As the floor levels of the proposed houses will be raised at least 500mm above ground level the risk of flooding from the dyke on the southern boundary or from surface water draining off South Drove can be considered to be adequately mitigated.

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.

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 A of this report (pages 12 to 15). Updated SFRA maps were issued on the South East Lincolnshire Local Plan website in March 2017. The modelling and mapping note advises that the 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.

As the development is in flood zone 3 and the flood hazard is “Danger for Most” (1.25 - 2.0) reference should be made to Category D8 which states for a predicted flood depth of between 500mm and 1.0 metre:

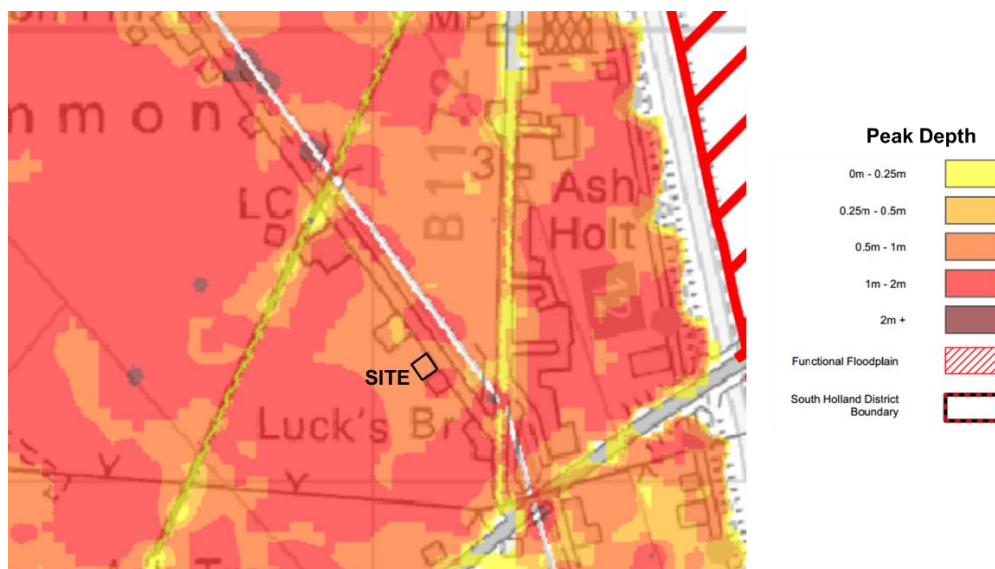
Finished Floor Levels must be set 1.0 metre above ground level, with flood resilient construction to a height of 300mm above the predicted flood depth.

The conclusions set out below will consider the ground levels on the site and additional information from previous FRA's carried out in this area and this will enable a more accurate assessment of the flood level to be made, and a recommended level for the finished floor level of the building.

Summary of Risk of Flooding to the Site

The main risk of flooding to the site is if a breach or overtopping were to occur in the west bank of the River Welland. The risk of this happening along this section of bank can be considered to be low. The bank has a wide top and bank slopes are not steep.

The relevant part of the map in the updated SFRA showing the predicted peak depths in this area if a breach occurred in the bank of the River Welland in a 1% fluvial and 0.5% tidal event probability in 2115 is shown below



The map above predicts flood depths of between 500mm and 1.0 metre over the whole of the site, and for most of the length of the road in front of the site.

The land levels on the site vary between 1.53m and about 2.0m OD. There is a higher level of 2.26m OD in the northern corner of the site. The levels of the road are higher at between 2.33m and 2.58m OD.

Therefore there seems to be a 1.0 metre range of levels where the flood depth is predicted to be between 500mm and 1.0 metre in depth.

The flood depths predicted on the site will be the result of a breach of the western bank of the River Welland. Flood water will flow westwards and flow in to the South Drove Drain, which is a significant size. Although there will be efforts by the IDB to stop water levels in the Drain from rising it will soon reach very high levels with water flowing south westwards and flooding onto lower land south of Deeping St Nicholas.

At some stage the computer modelling seems to show that in a 1 in 100 year event in 2115 the flood water will overflow the south west bank of the South Drove Drain and start to flow over the South Drove and flood water will flow south westwards.

It is therefore concluded that the maximum flood level on the site should be considered to be 1.53m OD + 1.0 metre = 2.53m OD. Therefore all buildings should have a minimum finished floor level of 2.60m OD.

Conclusions

The following conclusions can be made:

The proposed development is not in a functional flood plain as defined by PPS25.

The risk of the site flooding from any Environment Agency watercourse is very low.

The risk of flooding from IDB watercourses is also extremely low.

Velocities, and therefore the hazard of any flood water in the area would be low.

Recommendations

In an area where there is a flood risk it is recommended that all new dwellings should be of two story construction designed with all sleeping accommodation located on the first floor.

The ground floor level of the proposed two storey buildings should be at a minimum level of 2.60m OD.

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

Occupiers of the all of the new properties should register with the Environment Agency's Floodline Warnings Direct Service to receive automated early warnings of potential flooding.

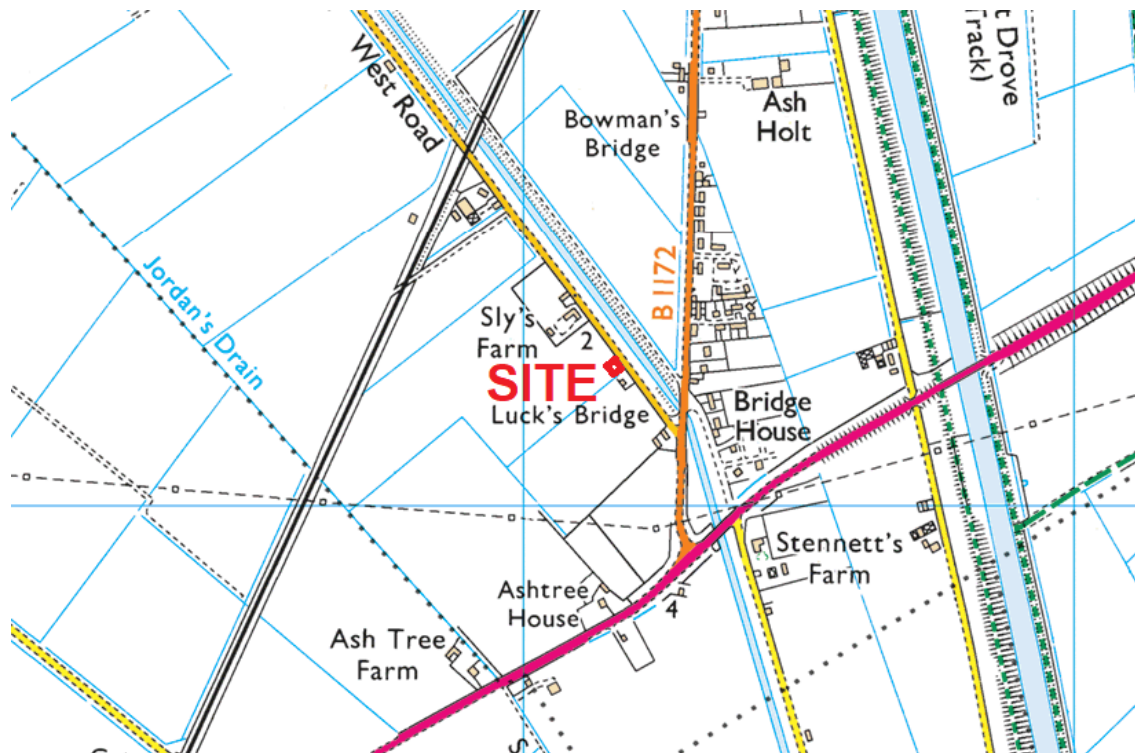
Although the risk of flooding is extremely low, if through a set of circumstances acting together any flooding were to begin to occur, residents would have adequate time to evacuate the area and remain safe.

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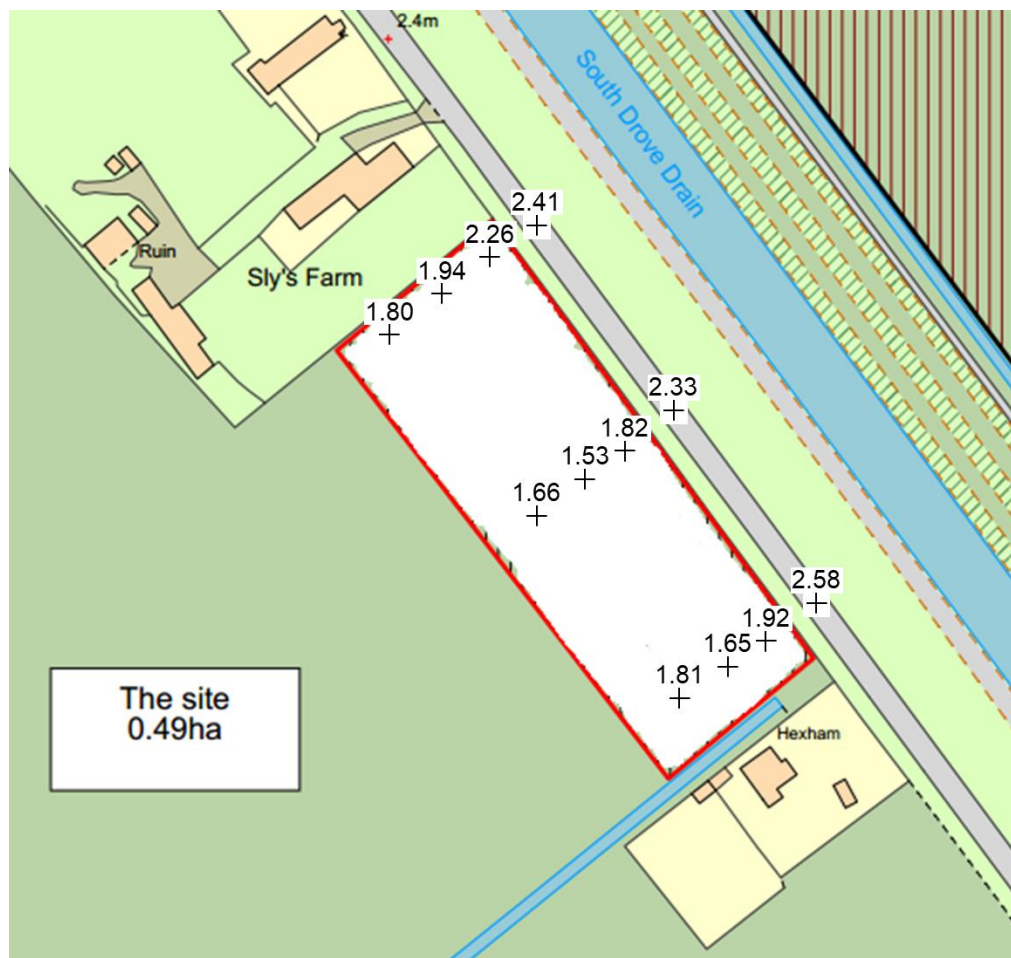
Stuart.hemmings@btinternet.com

2nd September 2018

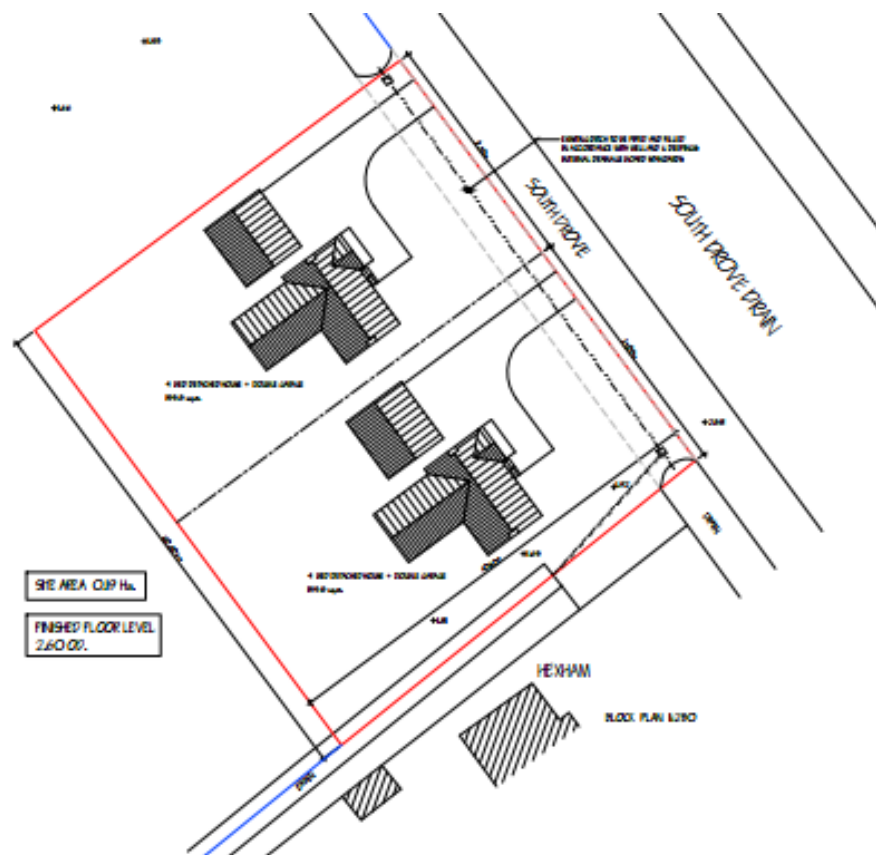
LOCATION PLAN



PLAN OF SITE LEVELS



PLAN OF PROPOSED DEVELOPMENT



PLAN OF IDB DRAINAGE NETWORK



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

Fluvial Flooding from River Welland.

As the development is in flood zone 3 and is classed as more vulnerable, the upper end climate change allowance, which is 35%, should first 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.

The EA have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. The SHDC SFRA also has used this figure of 20%. The increase to 35% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the River Welland. If there are additional flows along this part of the River Welland it will lead to the storage systems of the Cowbit and Crowland Washes operating and additional overtopping over lower banks rather than any significant increase in levels in the river.

The upper end allowance predicting a 65% increase in flows above the 1 in 100 year predicted flows now needs to be considered. The River Welland is an embanked

watercourse between Spalding and Market Deeping. There are flood reservoirs on the east side of the River called the Cowbit and the Crowland Washes. Excess water would flow into these Washes through two large syphons. In this scenario the Washes would fill up and also water would be flooding over lower banks of the River. The increases in rainfall leading to this would also lead to significant flooding in the upper part of the River Welland Catchment. It is unlikely that there will be any significant increase in the water level in the River. Therefore the consequence will not be significantly different to the maps produced in the SFRA.

Effect on IDB Systems

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 are necessary 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 level of the proposed dwellings should be a minimum level of 2.60m OD is satisfactory.