

**PROPOSED REPLACEMENT STABLES AT MIDDLEDENE, SURFLEET
ROAD, PINCHBECK, SPALDING, PE11 4AG.
FLOOD RISK ASSESSMENT**



View of site looking south east

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This flood risk assessment has been prepared solely to support the planning application for the new stables at Middledene, Surfleet Road, Pinchbeck, 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

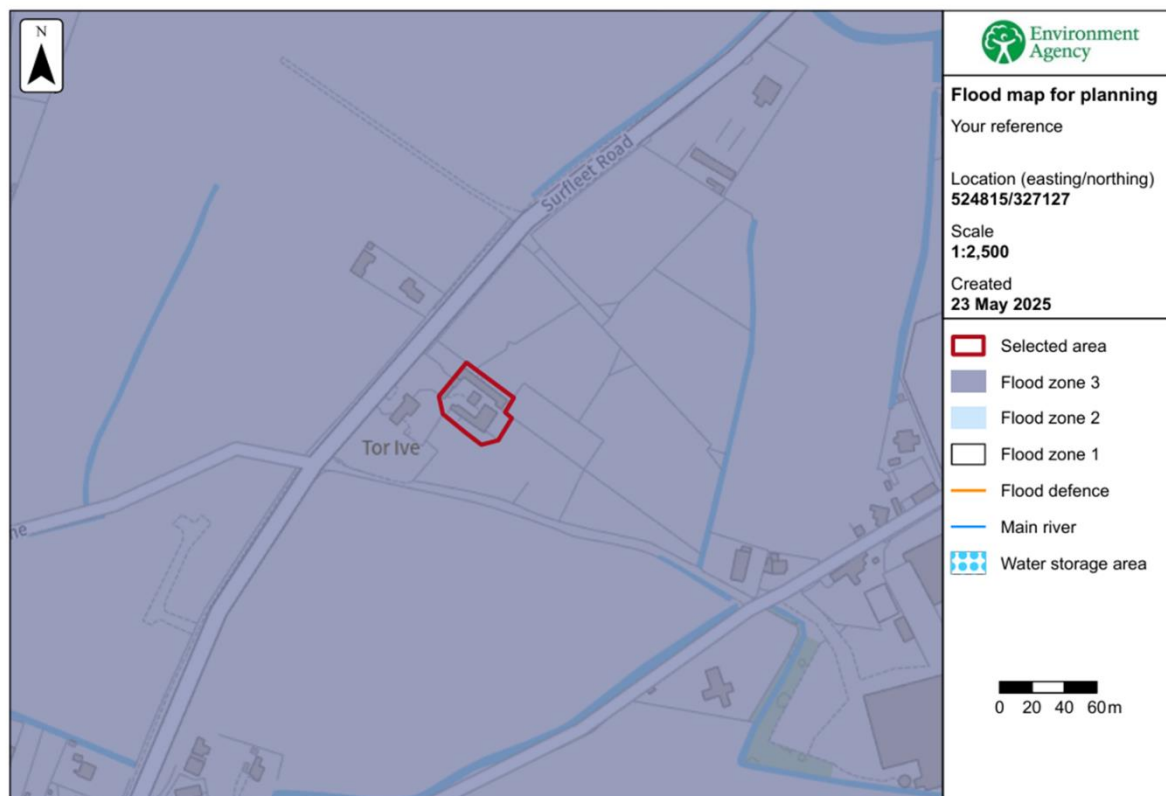
A planning application is due to be submitted to South Holland District Council for permission to replace the existing stables with new stables at Middledene in Surfleet Road, Pinchbeck, PE11 4AG. The proposed development will include the replacement of the concrete floors at a higher level and the installation of roof drainage into soakaways.

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.

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 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.



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It can be seen that the whole of this area between Surfleet and Pinchbeck is in Flood Zone 3.

Application Site

The development is located on the western side of the River Welland. The National Grid Reference of the site is 524815 327125.

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

As the site of the proposed development is within a defended area it can be considered to be within Flood Zone 3(a) “High Probability”, as defined in Table 1 of the Technical Guidance.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a development which will be used as an equestrian centre with stable block and a school area, is classified as “Less Vulnerable”.

Table 3 of the Guidance is shown below:

<u>Flood Zones</u>	<u>Flood Risk Vulnerability Classification</u>				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

Therefore it can be seen that “less vulnerable” development is appropriate in flood zone 3(a).

Strategic Flood Risk Assessment

A Strategic Flood Risk Assessment (SFRA) was produced for the South Holland District Council (SHDC) in 2010. This document provides details of the flood risk in the Council's area.

The maps in this document illustrate the actual flood hazard which is as follows:

For the present day	Depth of flooding ... Zero
	Extent of flooding .. Low or medium flood probability
	Flood Hazard.....Zero
	Peak Velocity Nil
For year 2115	Depth of flooding ... Zero
	Extent of flooding....Low or medium flood probability
	Flood Hazard.....Zero

Peak Velocity Nil

The maps showing the residual flood hazards 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 for the 1% fluvial or 0.5% tidal event probability are as follows:

For the present day	Depth of flooding.... Zero
	Extent of flooding ...Low or Medium
	Hazard Zero
	Velocity Nil
For the year 2115	Depth of flooding 0 – 250mm
	Extent of flooding ...High
	Hazard 0 – 0.75 (Low hazard)
	Velocity 0 – 0.3 m/sec

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

For the year 2115	Depth of flooding 0 – 250mm
	Extent of flooding ...High
	Hazard 0 – 0.75 (Low hazard)
	Velocity 0 – 0.3 m/sec

Figure 16 of the general maps in the 2010 SFRA show that the site is not within the rapid inundation zone for the present day and in 2115.

The extreme tide levels in the section of the River Welland north of Fulney Lock is shown in the 2010 SFRA as follows:

	2007	2055	2115
1 in 100 year	5.98	6.31	7.12
1 in 1,000 year	6.32	6.65	7.46

The bank levels for the 600 metres north of Fulney Lock are approximately 7.00m OD but further north the bank levels are between 7.60m and 7.80m OD.

The maximum flood levels in the River Glen at chainage 4.7km are shown in the 2010 SFRA as follows:

	Present	Present + Climate Change
1 in 100 year	4.29	4.65
1 in 1,000 year	4.43	4.68

The bank levels around chainage 4.7km are between 4.40m and 4.60m OD.

Maximum flood levels in the Vernatt's Drain are shown in the reports as follows:

	Present	Present + Climate Change
1 in 100 year	3.77	3.77
1 in 1,000 year	3.77	3.77

The bank level at this location is 4.25m OD

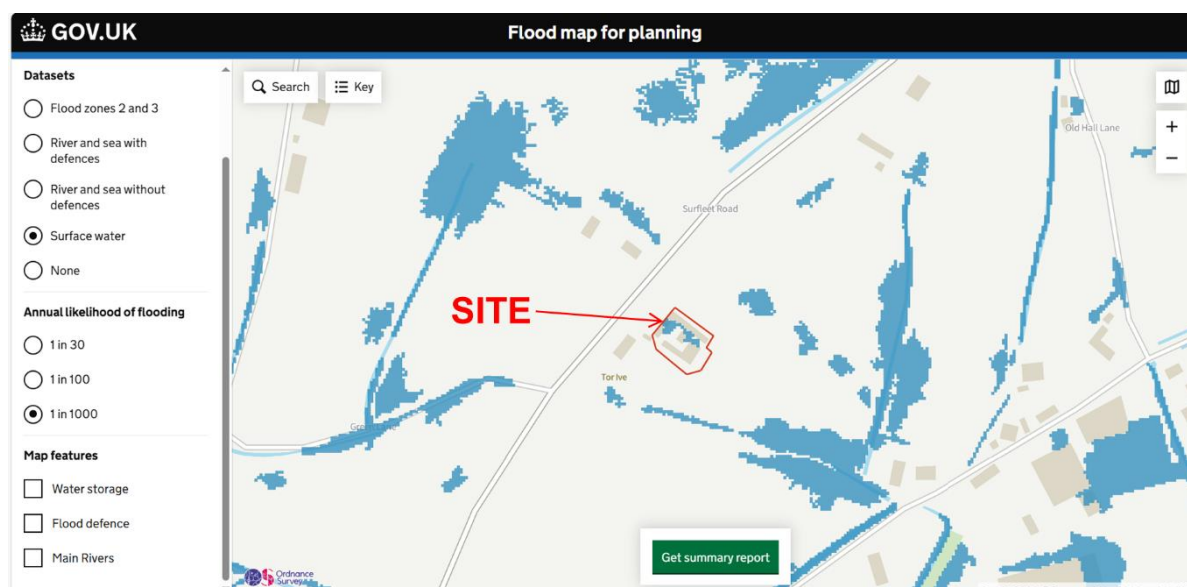
Information from the Environment Agency

The Environment Agency has provided predicted flood levels for the River Glen which are taken from the Welland Catchment Model (2016). The reference of this information is CCN-2017-46642.

	2007	2007+ Climate Change
Peak 1 in 100 year flood level	4.31m OD	4.79m OD
Peak 1 in 1,000 year flood level	4.44m OD	4.84m OD

Information on Surface Water Flooding on Environment Agency Website

The following map shows areas of the site which are predicted to experience surface water flooding in a 1 in 1000 year event.



The areas coloured blue indicate the areas where there could surface water flooding in a 1 in 1000 year event. This area is not shaded blue for the 1 in 100 year event, indicating there is not a risk of surface water flooding in a 1 in 100 year event.

The map indicates there may be a risk of flooding to the proposed area where the new stables are proposed in an extreme 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" 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 590 metres east of the fluvial section of the River Glen, which is main river and maintained by the Environment Agency.

The site is approximately 1.8km west of Vernatts Drain which is maintained by Welland and Deepings IDB.

The site is approximately 2.2 km west of the tidal section of the River Welland to the east, which is main river and maintained by the Environment Agency.

There are open drainage channels and piped drains in the Pinchbeck area which are maintained by Welland and Deepings Internal Drainage Board.

Site Levels

The level of Surfleet Road immediately north west of the location of the new building is 3.90m OD. The level around the existing stables block is approximately 400mm below the level of the road.

Potential Sources of Flooding

The following sources of flooding will be considered:

1. Failure or overtopping of the tidal defences.
2. Overtopping of the River Glen.
3. Flooding from Vernatts Drain
4. Flooding from IDB watercourses
5. Flooding from a failure of IDB Pumping Stations
6. Surface water flooding

1. Failure or overtopping of tidal defences.

The River Welland is tidal north of Fulney Lock, which is approximately 2.2km south east of the site. The SFRA states that the defences are adequate to withstand a 1 in 200 year (0.5%) probability event for present day. In the future in 2115 some of the banks would be overtopped with a 0.5% probability event. It is more likely that a breach would occur in the 600 metres length alongside West Marsh Road immediately north of Fulney Lock than the higher bank north of this section of bank. However if overtopping or a breach occurred water would flow westwards from the tidal Welland and would flood into Vernatts Drain which would reduce the impact of this flood.

It is reasonable to presume that within the next one hundred years works will be undertaken on this lower 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.

It is considered that there is adequate mitigation against the risk of flooding following a failure of the tidal defences.

2. Overtopping of the River Glen.

The predicted maximum 1 in 100 year water level at the present time is 4.31m OD and the predicted 1 in 1000 year water level at the present time is 4.44m OD. The 1 in 1000 year predicted levels (taken from Welland Catchment model) are higher than the defence levels on this section of the bank of the River Glen some of which are lower than 4.40m OD as shown in the 2010 SFRA.

Predicted water levels with 20% climate change are 4.79m OD for the 1 in 100 year event and 4.84 OD for the 1 in 1000 year event. Therefore some flooding is possible in a 1 in 100 year event in 2115.

Although the actual risk is extremely low there is a residual risk if the defences were to fail. The River Glen does not have a 1 in 100 year standard of service at the present time, and the flood risk will increase in the future unless work is carried out by the EA to raise banks. The most common reason for breaches is overtopping of earth banks. This type of failure is more likely to happen at locations to the west of Pinchbeck where the earth banks are lower.

This source of flooding is the greatest risk to the site, and the hazards will be reviewed later in this report.

It is considered that there is adequate mitigation against the risk of flooding following a failure of the bank of the River Glen.

3. Flooding due to high water levels in Vernatt's Drain

The SFRA states that the maximum water level in Vernatt's Drain is 3.77m OD. This is 450mm below the bank levels on the east side of 4.25m OD.

It is considered that there is adequate mitigation against the risk of flooding from Vernatts Drain.

4. Flooding from IDB watercourses

Surface water from this area north of Pinchbeck drains into the Old Pinchbeck Drain which is located south east of this site. This drain flows northwards and discharges into the Old Sea Drain which flows eastwards and then southwards alongside West Marsh Road as far as Pinchbeck Marsh Pumping Station. This pumping station, which is 1.7km south east of the site, pumps excess water into the Blue Gowt Drain which flows northwards and discharges into the River Glen 300 metres west of the outfall sluice on the river.

If a failure occurred in any part of the IDB system water levels would rise in the drainage channels and eventually lower agricultural land outside the Pinchbeck area could start to flood.

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.

The risk of water levels rising to above 3.00m OD in the IDB drain are remote but as the average land levels in the area are lower than 3.00m OD a large area of land would be flooded before the proposed development was affected.

It is considered that there is adequate mitigation against the risk of flooding following a high water levels in the IDB system.

5. Flooding from Failures of IDB Pumping Stations

The water in the Old Sea Drain flows to Pinchbeck Marsh Pumping station. The original pumps at Pinchbeck Marsh had a capacity of 1.5 cumecs, and the new part of the pumping station built approximately ten years ago added a further 1.5 cumecs of capacity. The catchment area that the pumps serve is 850 hectares.

Maximum predicted water levels in the IDB catchment controlled by Pinchbeck Marsh Pumping Station in a 1 in 100 year event in 2115 are below 1.00m OD and therefore this source of flooding can be considered to be adequately mitigated.

6. Surface Water Flooding

The existing level of the stables is lower than the level of the Surfleet Road west of the site of the existing stables.

The Environment Agency surface water flood map predicts some low level surface water flooding could occur in the 1 in 1000 year event but not in the 1 in 100 year event.

Therefore there is a risk of low level flooding (approximately 100mm maximum depth) in the existing and proposed area of the stables following an extreme rainfall event.

It is proposed to construct new concrete floors which will be higher than existing. It is also planned to construct roof drainage which will be disposed of into soakaways. This will reduce the risk of surface water flooding to the new stables.

Extent of known Flooding

The owner of the stables has confirmed that there has been no flooding to the stables in the last 23 years.

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 bank of the River Glen.

The risk of this happening in this case is low but a breach would cause flooding to much of this area north of Pinchbeck.

Although this site is within Flood Zone 3 because of the current standards of drainage and flood risk in this area between Pinchbeck and Surfleet there is a very low risk of flooding to this site.

Climate Change

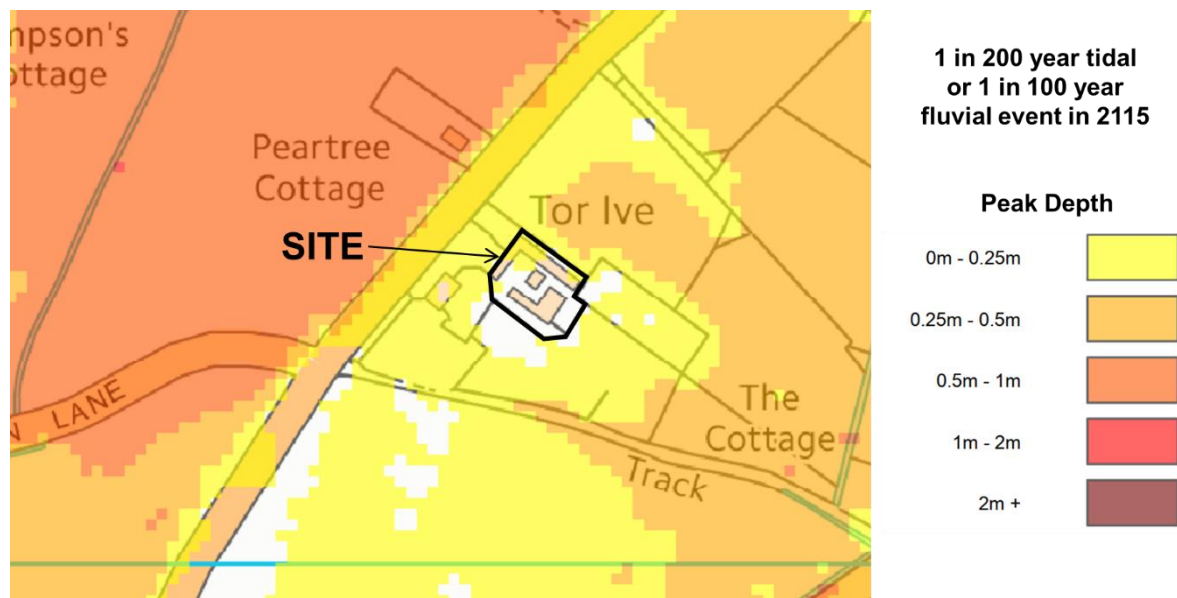
The recommendations for flood depths for this flood risk assessment use information mostly taken from the South Holland DC SFRA which was last updated in 2010. The EA have issued new guidance on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which from 19th February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 13 to 16). It is concluded 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 0 – 0.75 (Low hazard) reference should be made to Category F4 which states that the standing advice is “No Comment”

Summary of Risk of Flooding to the Site

Part of the map which can be found on the South East Lincolnshire Planning website which shows the residual peak depth in 2115 for the 0.5% (1 in 200 year) tidal and 1% (1 in 100 year) fluvial event probability is shown below.



It can be seen that this map predicts that there is a risk of up to 250mm of flooding if overtopping or a breach were to occur in the nearby River Glen in a 1 in 100 year event in 2115, or if there is a breach in the tidal defences of the River Welland east of the site.

Conclusions

The proposed development is not in a functional flood plain as defined by the Technical Guidance.

Although the site is in flood zone 3, the actual risk of the site flooding from any Environment Agency watercourse is extremely low.

Although the report considers the flood risk in the next 100 years the life of these timber stables is unlikely to exceed 40 – 50 years.

The above maps show that the maximum predicted depth of flooding in a 1 in 100 year event in 2115 is 250mm.

The risk of flooding if there is a breach in the tidal defences has been shown to be extremely low.

There is a low risk of surface water flooding to the existing stables. The development includes for new concrete floors at a higher level and a disposal system for the rainwater from the roofs. This will reduce the risk of surface water flooding and flooding from external sources.

This development will not increase flood levels elsewhere in this area.

Recommendations

The management of this facility should register with the Environment Agency's Floodline Warnings Direct Service to receive automatic telephone flood warnings.

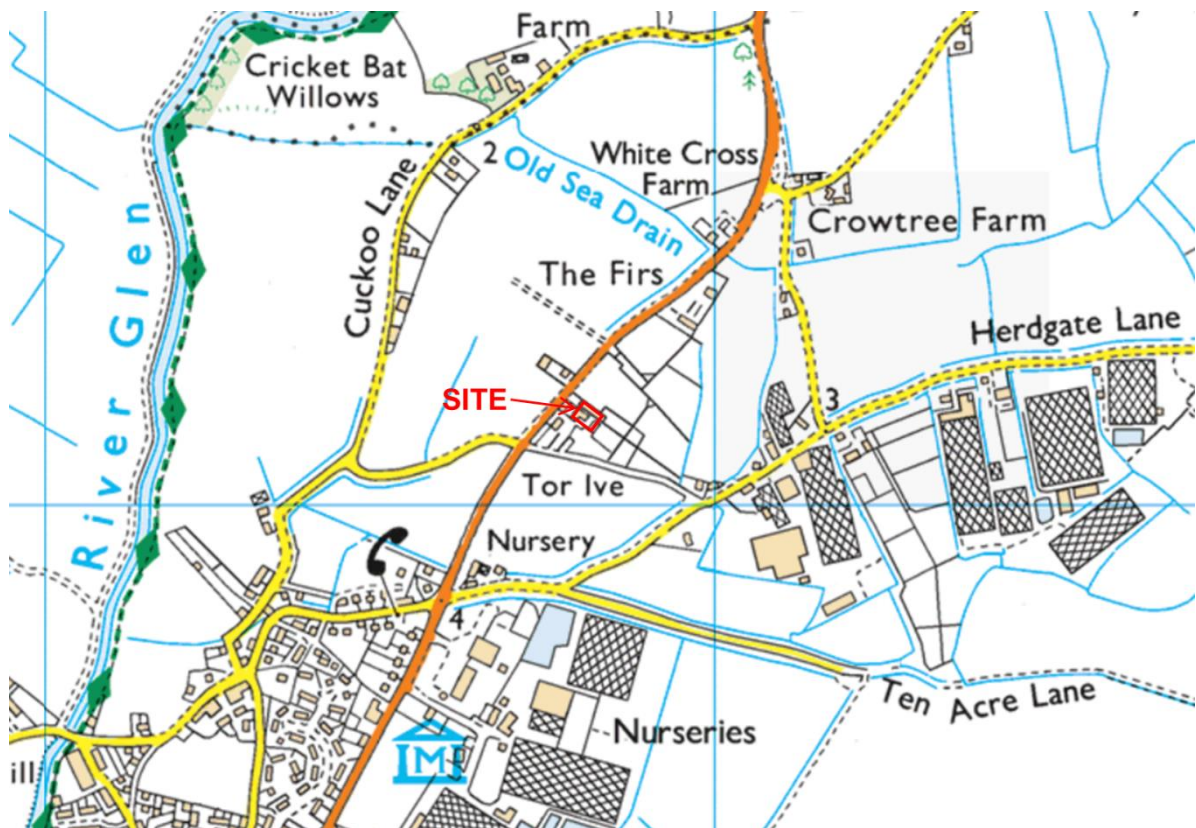
The surface water from the roofs of the proposed stables should if possible be discharged into soakaways. These should be designed to comply with the recommendations of BRE 365 and approved under the Building Regulations.

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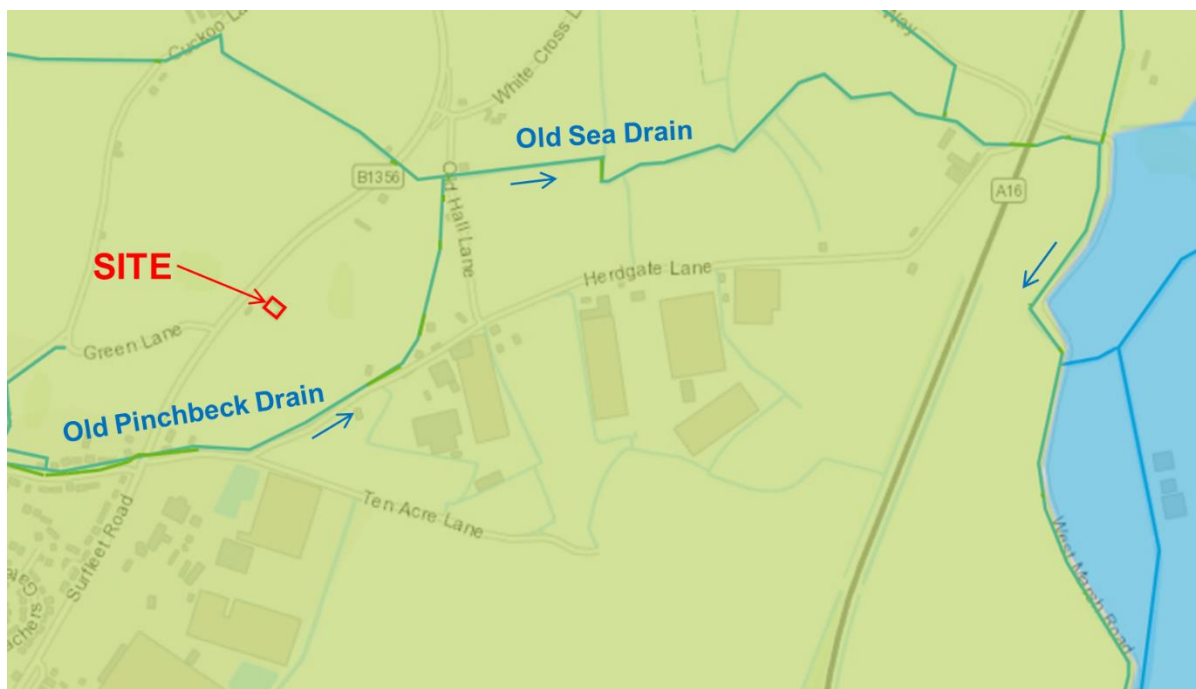
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27th May 2025.

LOCATION PLAN



PLAN SHOWING IDB DRAINAGE CHANNELS



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 less vulnerable development in flood zone 3(a) the central and higher central 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 Glen or the 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 west of the tidal 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 central climate change allowance, which is 25%, should be considered. After considering the effects of this increase the upper end allowance, which is 35%, should be considered to assess the effect of this.

Maximum flood levels in the River Glen will not be increased by the increase in flows projected in the new climate change allowances. If flows increase by 35% in these systems it will have the effect of flooding over the long sections of bank between Bourne and Surfleet 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.

It is considered that the mitigation proposed new stables is satisfactory.