PROPOSED CHANGE OF THE YARD, OLD SHIP INN, BECK BANK, GOSBERTON CLOUGH, SPALDING, PE11 4JL.

FLOOD RISK ASSESSMENT

View of site looking north east

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 the change of use of the site at The Yard, Old Ship Inn, Beck Bank, Gosberton Clough. 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 (reference PL/0119/22) has been submitted to Lincolnshire County Council to change the use of the redundant courier/transportation business at The Yard, Old Ship Inn, Beck Bank, Gosberton Clough, PE11 4JL to a car dismantling business.

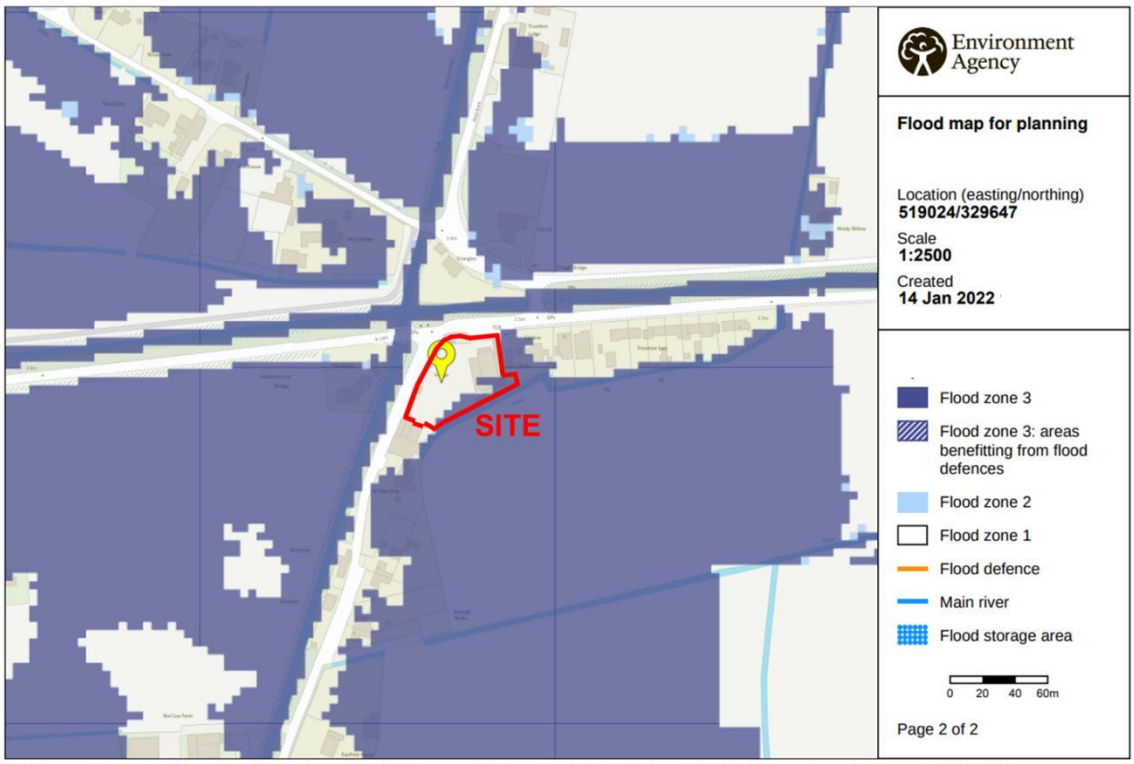
The site is within Flood Zones 1 and 3 as shown on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

The Council have asked for a Flood Risk Assessment to be carried as part of the site is within flood zone 3.

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 Black Sluice 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 and on the site itself.



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It can be seen that 95% of the site is within flood zone1 and a small strip (5% of the total area) on the southern boundary is in flood zone 3.

Application Site

The site is located 5.25 km south west of the village of Gosberton and the National Grid Reference of the site is 519024 329647.

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 and is not in the functional flood plain the parts of the site within flood zone 3 can be designated 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 car dismantling business is classified as “less vulnerable”. Reference to Table 3 (shown below) of the Guidance informs us that less vulnerable development is satisfactory in Flood Zone 3(a).

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	✓*

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 refined 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 the proposed use as a car dismantling business is classified as less vulnerable which is similar to the previous use then the sequential test can be considered to be passed.

Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment (SFRA) written for the South Holland District Council (SHDC) in 2010 provides details of the actual flood risk in the Council's area. This information has not been updated and reference to the maps in this document give the following information for the actual flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

For the present day Depth of flooding … zero
Extent of flooding .. Low or medium flood probability
Peak Velocity ……. Nil

For year 2115 Depth of flooding … zero
Extent of flooding…. Low or medium flood probability
Peak Velocity …… Nil

The maps showing the residual flood hazard were revised in the 2016 update of the South Holland District Council Strategic Flood Risk Assessment which can be found on the website of the South East Lincolnshire Joint Planning Committee. The residual hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

For the present day Depth of flooding …zero
Extent of flooding .. Low or medium flood probability
Hazard…….. None
Peak Velocity .. Nil

For the year 2115 Depth of flooding …zero
Extent of flooding .. Low or medium flood probability
Hazard……. None
Peak Velocity .. Nil

Figure 16 of the maps shows that the site is not within the rapid inundation zone.

Tables in the SFRA show the following details of the defence bank on the east side of the tidal section of the River Welland north of the River Glen outfall sluice, between chainage 15.0km and 16.1km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.99m OD	6.32m OD	7.13m 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 7.50 and 7.70 m OD, apart from one low recorded level of 7.30m OD, the minimum freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1510mm	1180mm	370mm
Peak 1 in 1,000 year freeboard	1180mm	850mm	40mm

Maximum flood level and bank levels in the South Forty Foot Drain

Maximum flood levels in the South Forty Foot Drain south of Kingston Bridge at chainage 26.5 km are shown in the reports as follows:

	Present	2115 (20% climate change allowance)
1 in 100 year	3.37	3.41

The earth bank level is shown to be 4.91m OD at this location, however it is widely known that there are sections of the bank south of Kingston Bridge where levels are no higher than 3.00m OD which will limit the maximum level of this section of the South Forty Foot Drain to 3.00m ODN.

Maximum flood and bank levels in the River Glen

Maximum flood levels in the River Glen at chainage 10.2 km are shown in the reports as follows:

	Present	Including Climate Change
1 in 100 year	4.66	4.93
1 in 1,000 year	4.94	5.16

The defences west of the A151 bridge consist of earth banks with minimum levels of 5.70m OD and some higher levels of up to 6.20m OD.

Information from the Environment Agency

The Environment Agency has provided predicted flood levels for the River Glen. The levels quoted below are approximately 100 metres downstream of the road bridge at West Pinchbeck.

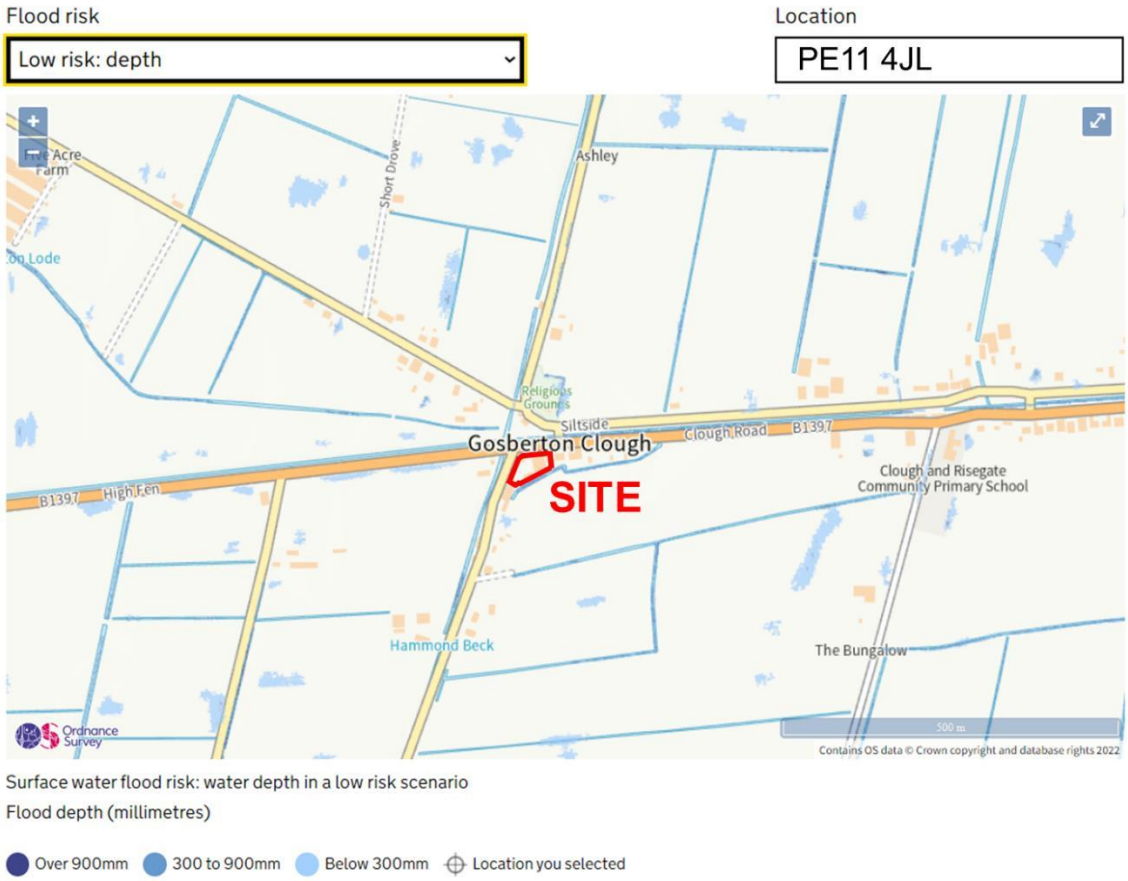
	2007	2115
Peak 1 in 100 year flood level	4.68m OD	5.23m OD
Peak 1 in 1,000 year flood level	4.96m OD	5.49m OD

The Environment Agency has provided the following predicted fluvial flood flows measured in cumecs for the River Glen at the same location.

	2007	2115
Peak 1 in 100 year flow	32.35	39.11
Peak 1 in 1,000 year flow	39.83	49.54

Information on Surface Water Flooding on Environment Agency Website

The map below shows the predicted depths of surface water flooding in Gosberton Clough.



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 no predicted risk of surface water flooding to this site.

Site levels

The level of the Risegate Road at the junction of Beck Bank and Risegate is 3.50m ODN. A topographical survey of the site has been carried out and the levels shown on the plan on page 13 of this report have been taken from that survey. It can be seen that the levels vary between 3.27m and 3.49m ODN 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". 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 site is approximately 2.9 km east of the South Forty Foot Drain, which is main river and maintained by the Environment Agency.

The site is approximately 4.75 km north of the River Glen, which is main river and maintained by the Environment Agency.

The site is approximately 9.2 km west of the tidal River Welland north of Surfleet Seas End, which is main river and maintained by the Environment Agency.

Potential Sources of Flooding

The following sources of flooding have been identified:

1) Failure or overtopping of South Forty Foot Drain
2) Failure or overtopping of tidal defences of the River Welland
3) Failure or overtopping of the River Glen
4) Overtopping of IDB drainage systems.
5) Flooding from local surface water systems.

1) Failure or Overtopping of South Forty Foot Drain

The South Forty Foot Drain is located 2.9km west of the site. This watercourse is maintained by the Environment Agency. The Drain is embanked from the southern end at Black Hole Drove Pumping station to north of Donington. The SFRA states that the maximum predicted water level in the Drain in a 1 in 100 year event in 2115 is 3.41m OD. However later reports by the EA have concluded that the watercourse only has a standard of service between 1 in 25 and 1 in 50 years and overtopping will occur in events larger than these. In practice the water level is unlikely to exceed 3.0m ODN in any event, and flooding will occur with overtopping of the banks of the Drain and the embanked highland watercourses that lead into the Drain from the west.

As the site is 2.9km from the South Forty Foot Drain the from any flooding that were to occur alongside the Drain extending as far as Beck Bank are extremely low.

2) Failure or overtopping of tidal defences of the River Welland

The tidal defences of the River Welland are approximately 9.2 km east of the development site. The SFRA does not predict that flood water from this source will extend as far as the site. The maps indicate that flood water could extend as far as the railway line between Gosberton and Risegate, which is 3.3km from the development site, but is unlikely to extend further westwards.

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

3) Failure or overtopping of the River Glen

The River Glen is approximately 4.75 km south of the site. If a breach occurred in the bank in a 1 in 100 year event in 2115 flood water would flow northwards and flood low land around Northgate and Burtey Fen. The map in the SFRA showing flood depths in a 1 in 100 year residual event in 2115 indicates the flooding would extend into the

low areas of land in Burtey Fen and may extend into the low fen areas of Gosberton Fen west of the site but the flood water would not extend to within 1.0km of the site.

4) Overtopping of IDB Systems

The watercourse on the northern side of Risegate Road is the Risegate Eau, and the watercourse on the southern side of the proposed development is called "Primitive Gait" which flows into Risegate Eau. Both watercourses are drains maintained by Black Sluice IDB.

This section of Risegate Eau flows in a westerly direction and the water level in this drain is controlled at the outfall into the South Forty Foot Drain near Kingston Bridge. Water flows into the South Forty Foot Drain through a gravity sluice when flows are low. As soon as there is normal flow in the Twenty Foot Drain then the water is pumped in the South Forty Foot Drain at Gosberton Fen Pumping Station.

The Black Sluice IDB drains have been designed to a 1 in 10 year standard with a freeboard of between 800mm and 1.0 metres. This generally provides a standard of at least 1 in 50 years for flooding of the lowest land. Much of the land in the catchment is below 3.00m OD and therefore even if the pumps fail to operate for a considerable time during a rainfall event the site of the development is unlikely to flood. The normal water level at Gosberton Pumping Station is -0.30m OD, and the normal water level in Risegate Eau north of the Cockrams Yard is approximately 0.00m ODN.

Black Sluice IDB have carried out computer modelling for the section of Risegate Eau within their District and the predicted levels in Risegate Eau on the east side of Carter's Bridge are:

1 in 100 years	1.69m OD
1 in 100 years + climate change	1.81m OD

The risk of the water level of IDB drains rising above 3.00m ODN and flooding onto the site is extremely low.

5) Flooding from local foul or surface water systems

The Environment Agency surface water risk map does not predict any surface water flooding on the site. Therefore this source of flooding 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 being flooded in the last sixty years.

Probabilities and Trends of Flooding

The probability of this site flooding from Environment Agency main river is very low. However in an extreme event at this location water levels could rise quickly and residents would need to take refuge in the upper floors of the building.

Residual Risk – Extreme Events

The residual risk from extreme events is very low on 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 part of the development is in flood zone 3 and there is no flood hazard reference should be made to Category G7 which shows that the matrix reference for this category is "No Comment".

Summary of Risk of Flooding to the Site

The map in the SFRA (an extract of which is shown below) indicates that no flooding is predicted to take place in a 1 in 100 year fluvial or a 1 in 200 year tidal residual event in 2115.

Therefore it can be concluded that no flooding is predicted to the site in a 1 in 100 year event in 2115, and as the maps for the 1 in 1000 year event in 2115 are very similar to the 1 in 100 year map above it follows there is unlikely to be any flooding in this event.

The greatest flood risk to this site is from high water levels in the South Forty Foot Drain. In an extreme event the pumping station may not be operated for a period of time which could lead to water levels approaching 3.00m ODN in Risegate Eau. However it is unlikely that flooding from this source will cause any flooding to the site.

Conclusions

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.

Recommendations

The flood risk in this area of Gosberton Clough is low and the risk is considered to be satisfactory for the site to be used as a car dismantling business.

Occupiers of these premises 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 any set of circumstances acting together any flooding did to begin to occur, this would happen very slowly and workers on the site would have adequate time to evacuate the area and remain safe.

The occupier of the site should be aware that Black Sluice IDB have a Bye Law that restricts development within 9.0 metres of a Board's drain. This is relevant as the watercourse on the southern boundary is a Board's drain. The Board may on application relax this Bye Law to enable the buildings to be located nearer than 9.0 metres from this watercourse.

S M Hemmings B Sc C Eng MICE MIWEM

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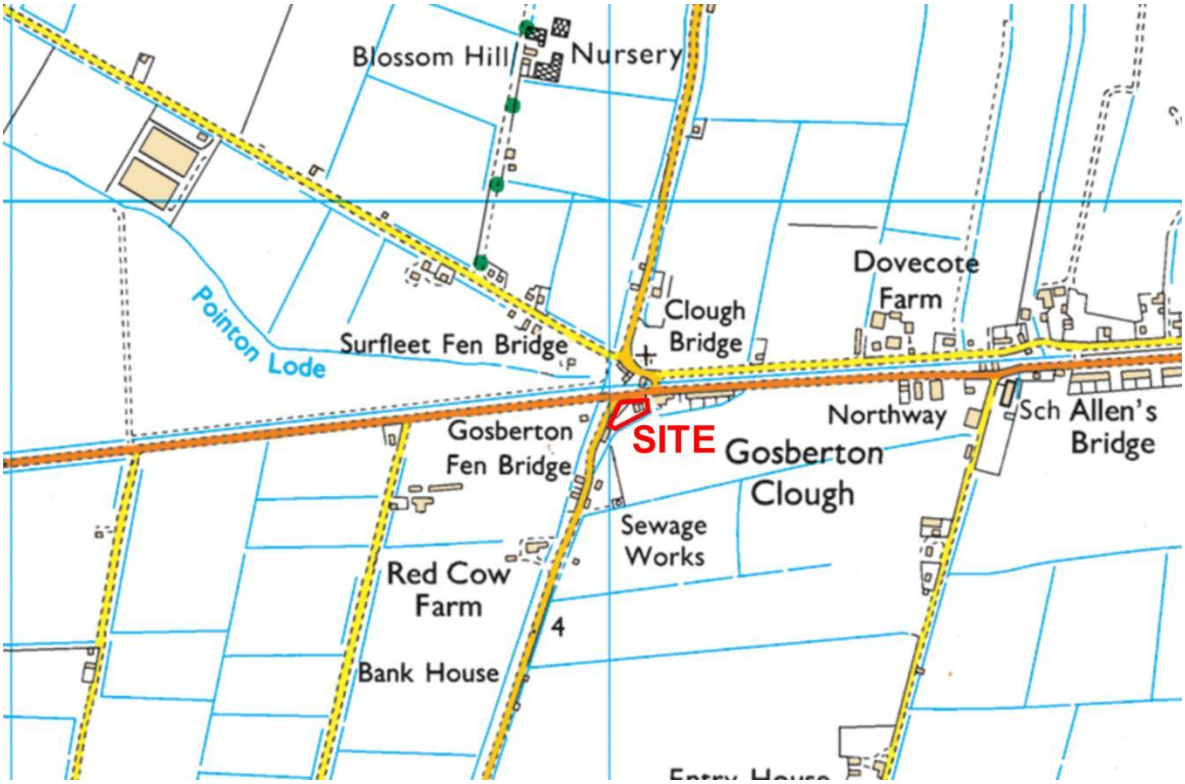
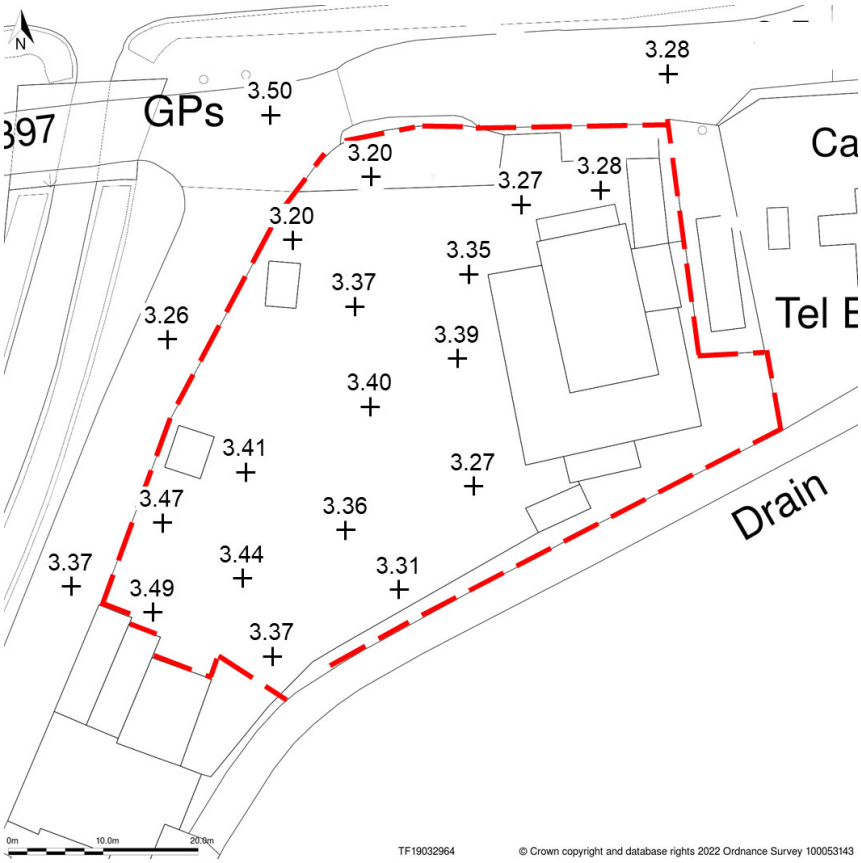
17th November 2022.

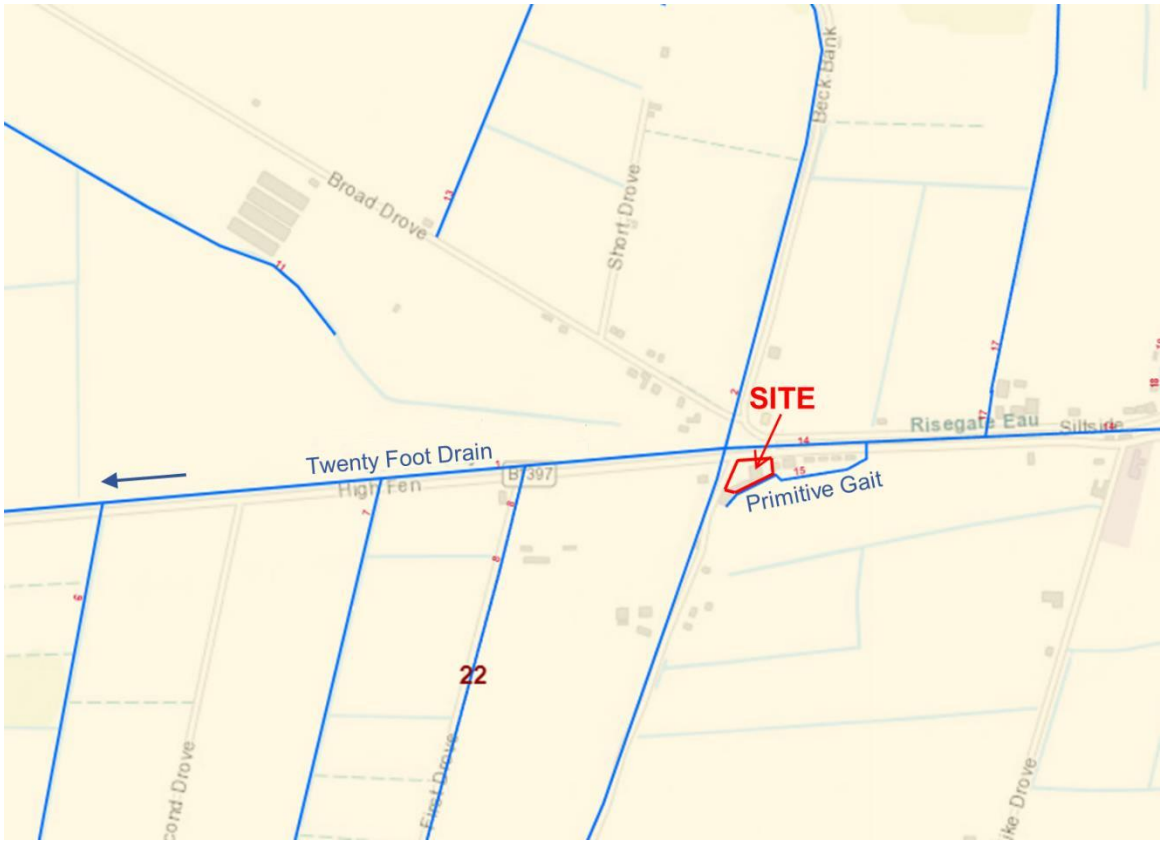
LOCATION PLAN



PLAN OF LEVELS ON THE SITE



PLAN OF IDB DRAINS



PLAN OF PROPOSED USE

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 PPS25[1]. 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

document is out of date

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%	

has been withdrawn (19

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 South Forty Foot Drain and River Glen
3) Flooding from 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 will not have the effect of increasing the maximum flood levels in a 1 in 200 year breach event in 2115 by 100mm or the extent of the flooding. The largest increase in the flood depth will probably be between 10mm and 50mm, and this will be near to the location of the breach. Therefore this small increase will not affect the conclusions and recommendations in the report.

Fluvial Flooding from the River Glen or the South Forty Foot Drain(SFFD).

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 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 Glen or the SFFD. If there are additional flows along this part of the River Glen, or the SFFD, it will lead to overtopping of banks in numerous places on both of these watercourses. This will prevent the water level rising significantly above the predicted levels for the present day and with 20% allowance for climate change.

The upper end allowance predicting a 65% increase in flows above the 1 in 100 year predicted flows now needs to be considered. This level of predicted river flows again will not lead to increased river levels as the river will be overtopping the banks in numerous places.

Effect on IDB Systems

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

Conclusion

It can be concluded that the revised Environment Agency Guidance on Climate Change will not affect the conclusions and recommendations given in this report.