PROPOSED DEVELOPMENT AT
CAMPAINS LANE, DEEPING ST NICHOLAS, SPALDING PE11 3EX

FLOOD RISK ASSESSMENT



View from Road

S M Hemmings B Sc C Eng MICE MIWEM,
69 Charlotte Way,
Peterborough,
PE3 9ER

This flood risk assessment has been prepared solely to support the planning application for the proposed development at Campains Lane, Deeping St Nicholas, 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.

Introduction

An application is due to be submitted to South Holland District Council for Planning Permission to construct a development of a number of houses on land on the south west side of Campains Lane, Deeping St Nicholas, Spalding, PE11 3EX. The area is at present part of an agricultural field.

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 Technical Guidance to the National Planning Policy Framework Development and Flood Risk states that if a development lies within Flood Zone 3 a Flood Risk Assessment should be carried out to accompany any Planning Application.

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.

Application Site

The development is located north of the A16 road at Deeping St Nicholas. The National Grid Reference of the site is 521700 316450.

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

The proposed development is within Flood Zone 3 "High Probability" as detailed on the Environment Agency's flood zone maps without defences, as defined in Table 1 of the Technical Guidance. As the site is within a defended area as specified in the SFRA the site is within flood zone 3(a).

Applying the flood risk vulnerability classification in Table 2 of the Guidance, the development of a dwelling house is classified as "more vulnerable" and Table 3 of the Guidance states that residential use is only permitted after the sequential and exception test is followed.

Sequential Test

As the proposed development is located in Flood Zone 3(a) the NPPF requires the sequential test to be applied to determine if there are any reasonably available and suitable alternative sites in a lower flood risk zone for this type of development. This development can be classed as a windfall site within the village of Deeping St Nicholas. The development complies with the South Holland District Council's policy on these types of sites. All of the area west of Spalding is classified by the Environment Agency as being in Flood Zone 3(a) and therefore it is unlikely that an area for development can be found and located within Flood zone 2. Although the central area of Spalding is at a slightly higher level, the whole of this area is at a similar level to other areas outside the central area and all these areas are within flood zone

3. Therefore it is unlikely that a residential site would be found with a lower flood risk that has not already been developed.

Therefore it can be considered that the sequential test is 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 following information about the flood risk to the proposed development has been gained from the maps produced for the South Holland District Council Strategic Flood Risk Assessment:

1. Report Maps

- Map 5 indicates the site to be low or medium risk and protected by flood defences.
- Map 6 indicates the peak depth is zero for the present day 1% fluvial / 0.5% tidal event probability.
- Map 7 indicates the peak velocity is zero for the present day 1% fluvial / 0.5% tidal event probability.
- Map 12 indicates the actual risk extent is zero.
- Map 13 indicates the 1% fluvial / 0.5% tidal event probability for 2115 for the site is low.

- Map 16 indicates the site is not within the rapid inundation zone for both the present day and 2115.

2. Flood Maps Table D1

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

- The maps also illustrate the residual flood hazard which is as follows:-

For the present day	Depth of flooding … Zero
	Extent of flooding .. Low or medium flood probability
	Velocity …….. Nil
• For the year 2115	Depth of flooding … 0.0m – 500mm
	Extent of flooding .. High
	Velocity .. 0 – 0.1m/sec

3. The maximum flood levels in the fluvial section of the Spalding Welland is shown in the reports as follows:

	Peak 1 in 100 year		Peak 1 in 1000 year	
Year	2007	2115	2007	2115
Level	4.54	4.67	4.55	4.67

The chainage of the River Welland east of the development site is 4.0km. All of the bank levels between chainage 3 km and 5 km vary between 5.75m OD and 6.15m OD.

Site Levels

The levels on the site vary between 1.18m OD in a low area in the eastern corner to 2.01m OD on the north western boundary. There are two lower areas adjacent to the IDB drain alongside Campains Lane but most of the site is at a level of 1.50m and above. The level of Campains Lane varies between 2.10 and 2.30m OD. The floor

levels of the existing houses on the north eastern side of the road are approximately 1.80m OD.

A full topographical study has been carried out and a plan with levels of the site 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" 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 2.8 km from the River Welland, which is main river and maintained by the Environment Agency.

This area south west of Spalding is drained by watercourses maintained by Welland and Deepings Internal Drainage Board. The water levels in the IDB channels are controlled by the water level in North and South Drove Drain which also is operated by Welland and Deepings IDB.

Potential Sources of Flooding

The following sources of flooding have been identified:

1. Due to high water levels in the IDB Drainage system
2. Failure or overtopping of the west bank of the River Welland.
3. Failure or overtopping of the tidal defences of the River Welland.
4. Blockages in local surface water systems

1. High Levels in the IDB Drainage System.

North and South Drove Drains are the main IDB watercourses in this area and these are maintained by Welland and Deepings IDB (W & D IDB). The water levels in these drains is controlled by the electrically operated and diesel powered pumps at Pode Hole Pumping Station. W & D IDB have stated that the normal water level at Pode Hole Pumping Station is -1.20m OD and the design level in a 1 in 100 year event is 0.18m OD.

W & D IDB have a policy of reviewing standards of protection at regular intervals and would carry out improvements over the next 100 years to ensure that all agricultural land and properties in this catchment would continue to have a satisfactory standard, and therefore it can be assumed that the maximum design level in 2115 will be 0.18m OD.

W & D IDB have a policy of continual maintenance to all the pumps at Pode Hole to ensure that they will operate satisfactorily in a high rainfall event. The Board have contingency plans to operate the pumps if electricity supplies were compromised and have sufficient sources to repair plant and machinery if a breakdown occurred.

Drainage channels maintained by W & D IDB generally have a 1 in 10 year standard with up to 1.0 metre of freeboard, which provides between 1 in 50 year and 1 in 100 year standard against flooding. The risk of water levels in the drains north and south of Campains Lane in a 1 in 100 year event both now and in 2115 is extremely low.

Therefore the risk of flooding from this source in a 1 in 100 year event both now and in 2115 is extremely low.

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

The River Welland is located 2.8 km 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 risk of overtopping of the bank and therefore no risk of flooding to the proposed development.

If the west bank of the River Welland breached at a location due east of the site the flood water would initially flow into the South Drove Drain, which would then rapidly increase levels in the South Drove and the North Drove Drain. Although W & D IDB would operate the pumps at Pode Hole to try to alleviate the situation water levels would rise to 1.5m OD and start to flood onto lower agricultural land. Flooding would then start to take place on lower land north east of the development site and the maps in the SFRA predict that the depth of flooding would be between 0mm and 500mm deep on the development site.

An estimation of the maximum level of the flood water at this location is shown on page 7 of this report.

3. Failure or Overtopping of the 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 flood water from a breach of these defences would flow as far as Deeping St Nicholas. Therefore this source of flooding can be discounted.

4. Blockages in local surface water drainage systems

There are no surface water sewers or highway drainage systems along Campains Lane that could cause any significant flooding to the development site. As floor levels are to be significantly raised above ground level this source of flooding can be discounted.

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.

Probabilities and Trends of Flooding

The probability of this development 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.

There are no records of the area around Campains Lane having been flooded in the last 60 years.

Estimation of Maximum Flood Level on the Site.

The major flood risk to the site is if a breach were to occur in the southern bank of the River Welland, which is 3km from the site. Flood water would firstly discharge into South Drove Drain which would as well as quickly filling to bank level would flow southwards and northwards spreading the water over a larger area. Other IDB channels would react in the same way.

The map shown in the SFRA showing peak residual flood depths in 2115 for the 1% fluvial and 0.5% tidal event probability is reproduced on page 11 and predicts between 0 and 500mm depths of flooding to Campains Lane and across the whole site. No flooding is predicted to the area of the field south west of the site where ground levels are between approximately 1.50m and 2.00m OD.

The topographical survey carried out shows levels between 2.10m and 2.30m OD on Campains Lane and between 1.18m OD and 2.01m OD across the site itself. This range of land levels is predicted to suffer flooding of between 0 and 500mm, according to the map in the SFRA. If we assume that the LIDAR levels used to produce the SFRA maps have not picked up the low levels in the two low areas we can assume the land levels used to produce the this map are between 1.5m and 2.0m OD. As we can also assume the flood water is flowing south westwards from the River Welland it can be assumed to flow over Campains Lane and only flow into the part of the field alongside Campains Lane. From this we can estimate a maximum flood level on the site to be 2.0m OD.

Therefore to provide adequate mitigation for flooding to the site it is recommended that the minimum ground level of the house should be 2.20m OD.

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).

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 very low.

There is a residual risk of flooding to the site, which is the risk caused by a breach in the west bank of the River Welland, and the maximum flood level in 2115 is estimated to be 2.00m OD.

The risk of the site becoming flooded from any other source is extremely low.

In a flood risk area there is always a risk of an event occurring of greater magnitude than has been considered in this flood risk assessment.

Recommendations

In any area at risk of flooding it is preferable that 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 River Welland, and ensure there is no danger to residents when they are asleep

The ground floor level of the proposed buildings should be at a minimum level of 2.20m OD.

If any flooding started to occur residents would be able to escape to the higher level of Littleworth Drove (A16 road) before flood water rose to the level of the Campains Lane, or in an extreme event shelter on the first floor of the building.

Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service.

In this location it is recommended that the developer should consider designing the building to be flood resilient. This type of design would accept that water from a flood would enter the building, but would ensure the structural integrity of the building would be maintained and the building could be easily dried out and cleaned after a flood.

The design of the building should follow the guidance in "Improving the Flood performance of New Buildings" produced in 2007 and available on the Government website. Some details are given in Appendix A on page 11.

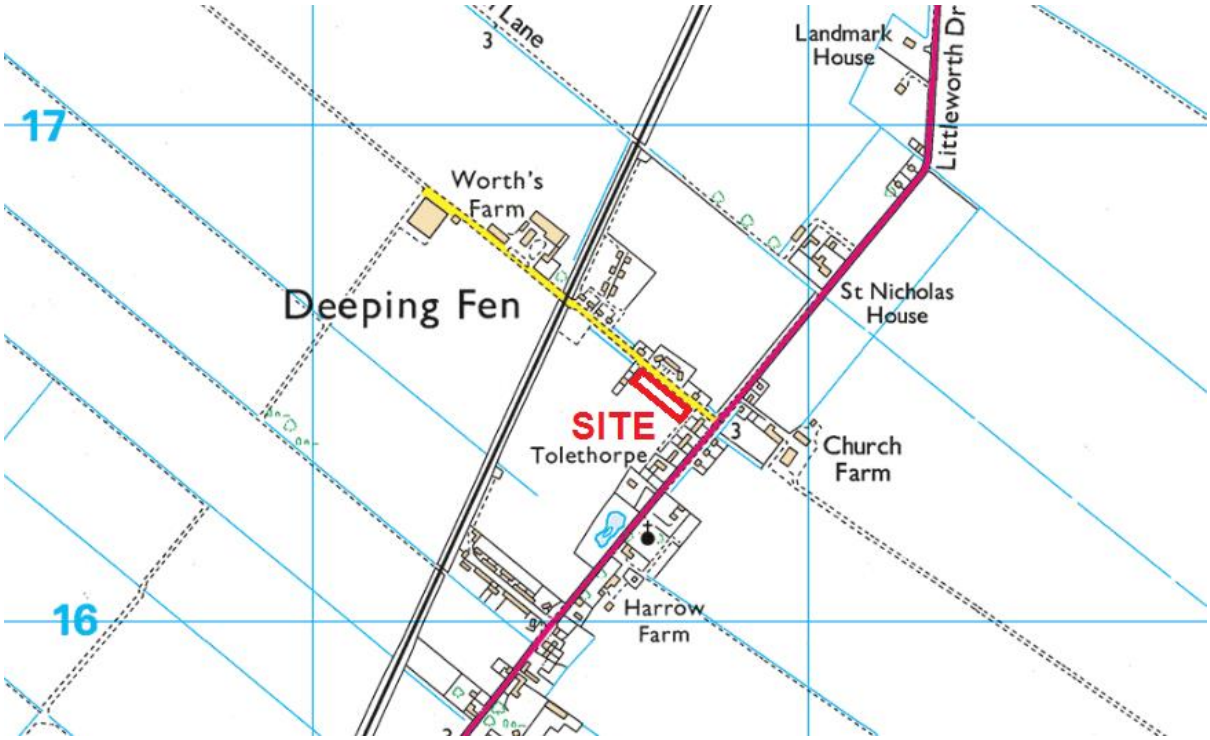
On site surface water drainage should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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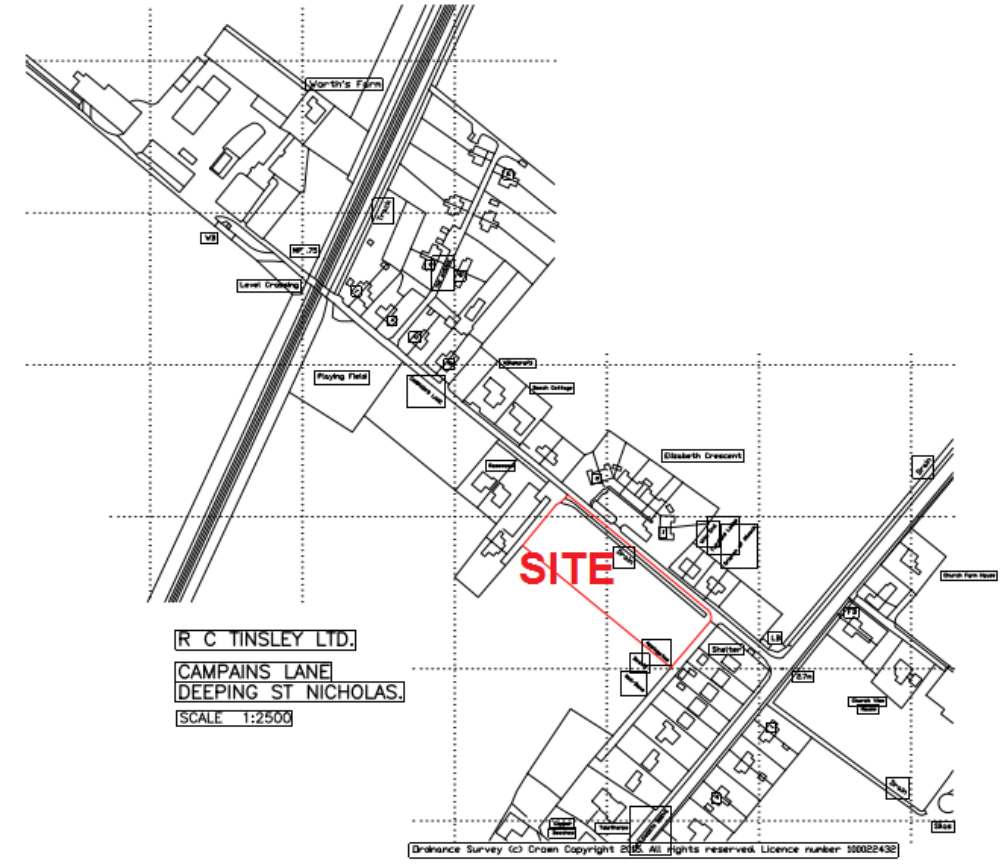
stuart.hemmings@btinternet.com

10th September 2016

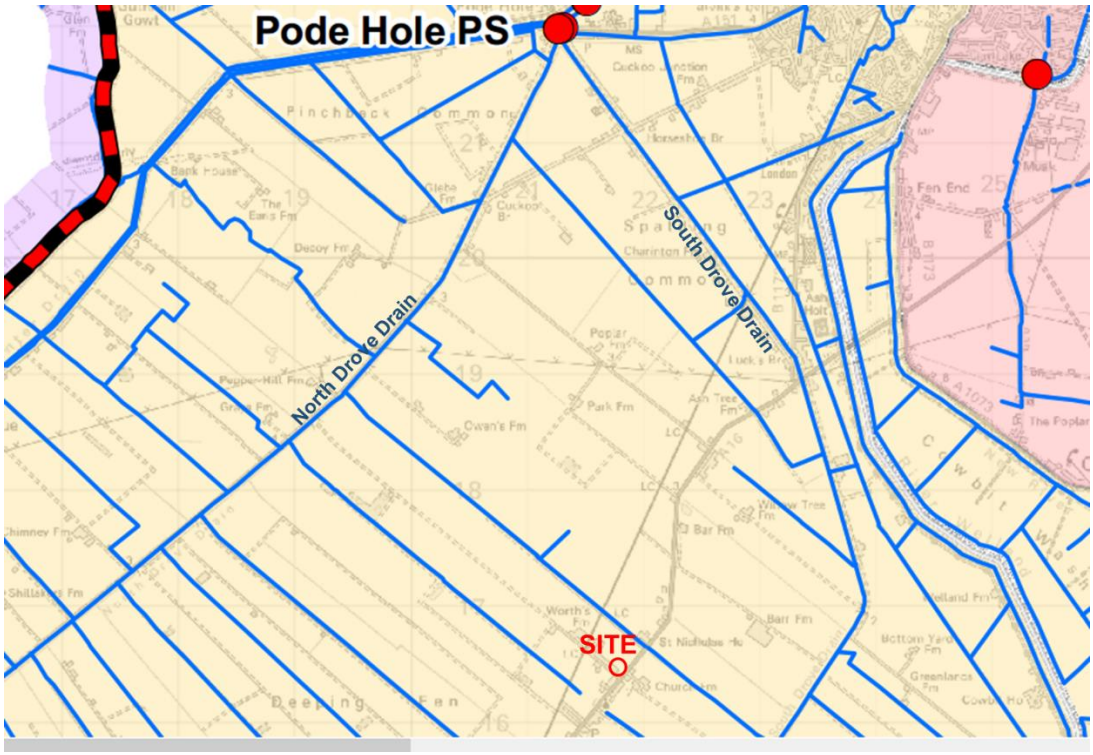
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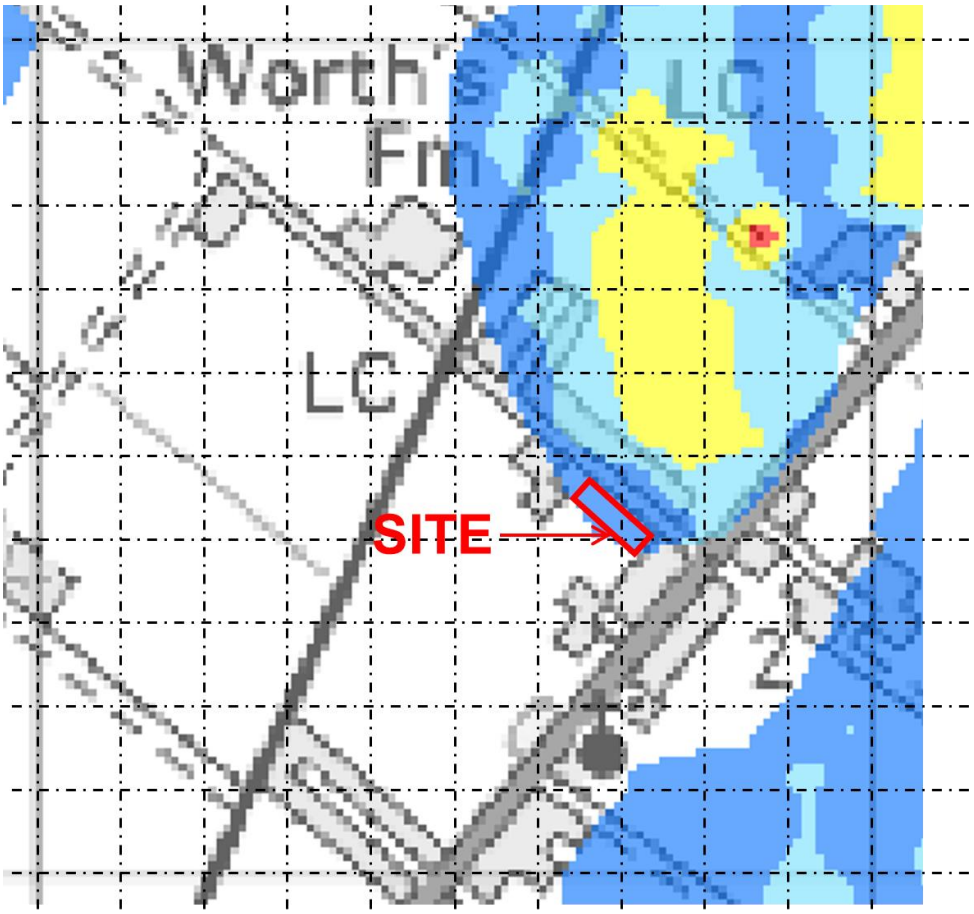
PLAN OF SITE



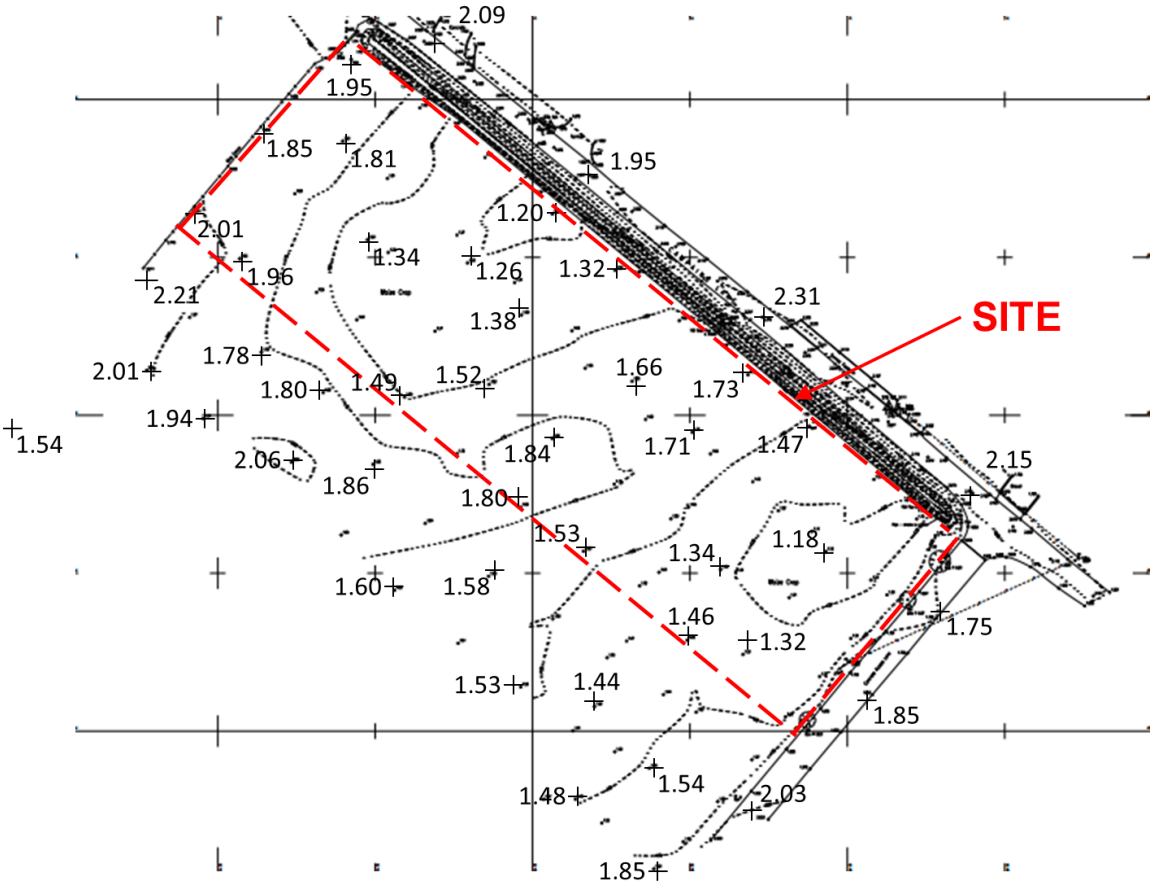
PLAN OF IDB DRAINS



1 in 200 YEAR IN 2115 RESIDUAL FLOOD DEPTHS



LEVELS OF SITE



APPENDIX A

RECOMMENDATIONS ON LIMITING FLOOD DAMAGE TO BUILDING

Walls:	Construction to first floor level should be carried out with good quality brickwork. Specification for blockwork should be checked and only blockwork that does not absorb water should be used. If possible brickwork should be used instead of blockwork to first floor level. Construction below DPC should be carried out with engineering brickwork.
Ground Floor:	Either precast concrete beams with concrete infill, or concrete above made up ground should be used. Dense concrete screeds should be used. The floors should be tiled and non absorbent skirting boards should be fitted in all ground floor areas.
Insulation:	Cellular insulation which has very low water absorption characteristics should be used in floors and cavity walls.
Doors:	Doors should be solid construction, or plastic should be considered. Butt hinges should be fitted to allow internal doors to be removed and placed in a dry area prior to any flooding.
Electrical Services:	Place all of electrical wiring at first floor level and drop wiring down to sockets in the ground floor storage rooms at least 1.5 metre above ground level.
Central Heating:	All distribution pipes should be placed at first floor level.
Sewer connections:	The developer should consider not installing a WC or washing facilities on the ground floor.

APPENDIX B 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'a

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%	

s 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

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 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 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 levels should be a minimum level of 2.20m OD is satisfactory.