PROPOSED DEVELOPMENT AT SOUTH DROVE, NEAR LUCKS BRIDGE, SPALDING, PE11 3ED

FLOOD RISK ASSESSMENT

View from eastern boundary of the site

Revision A 21st July 2017 Flood depths from South East Lincs SFRA added and conclusions and recommendations amended.

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This flood risk assessment has been prepared solely to support the planning application for the proposed development east of Lucks Bridge, 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 submitted to South Holland District Council for Planning Permission to carry out a residential development of ten dwellings at South Drove, near Lucks Bridge, Spalding, PE11 3ED.

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 on the western side of the River Welland. The National Grid Reference of the site is 523410 319190.

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

The proposed development is within Flood Zone 3(a) "High Probability" 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, the development of a dwelling houses 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

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 in the Spalding Common area are 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.

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

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 8 indicates the risk extent is zero for the present day 1% fluvial / 0.5% tidal event probability.
- Map 10 indicates the actual risk extent for the 0.1% event probability is zero.
- 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 zero.
- Map 14 indicates the actual risk extent for the year 2115 for the 0.1% event probability is zero.
- Map 16 indicates the site is 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
	Hazard …. Nil
	Velocity … Nil
For year 2115	Depth of flooding … zero
	Extent of flooding .. Low
	Hazard … Nil
	Velocity .. Nil

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

For the present day	Depth of flooding … 500mm – 1.0m (east side) 1.0m -1.5m (west side)
	Extent of flooding .. High
	Hazard … Significant
	Velocity .. 0.1 – 0.25m/sec
For the year 2115	Depth of flooding … 500mm – 1.0m (east side) 1.0m -1.5m (west side
	Extent of flooding .. High
	Hazard … Significant
	Velocity .. 0.1 – 0.25m/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	4.49	4.67	4.50	4.68

The chainage of the River Welland directly east of the development site is 2.0km. All of the bank levels between chainage 0.2km at Little London and 2.1km are above 6.0m OD. Further upstream top of bank levels vary between 5.80m OD and 6.00m OD.

4. **The extreme tide levels in the section of the River Welland north of Fulney Lock is shown in the report 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

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The lowest bank level occurs 200 metres north of Fulney Lock, where a section 300 metres long has a minimum level of 6.98m OD.

Strategic Flood Risk Assessment (2017)

Updated information about the flood risk at the location of the proposed development has been sourced from the maps issued in March 2017 and reproduced on the South East Lincolnshire Joint Strategic Planning Committee Website.

These updated maps indicate that the predicted flood depth on the site will be between 1.0 metre and 2.0 metres depth across the site. The map is reproduced on page 10 of this report.

Information from the Environment Agency

The Environment Agency has provided predicted flood levels for the River Welland which are taken from the Welland Catchment Model produced in 2007.

	2007	2115
Peak 1 in 100 year flood level	4.42m OD	4.68m OD
Peak 1 in 1,000 year flood level	4.43m OD	4.68m OD

The Environment Agency has provided the following predicted fluvial flood flows measured in cumecs for the River Welland which are taken from the Welland Catchment Model produced in 2007.

	2007	2115
Peak 1 in 100 year flow	90.87	90.7
Peak 1 in 1,000 year flow	91.44	91.34

Site Levels

Land levels have been measured across the site and these are shown on page 12 of this report.

The land levels generally vary between 1.99m OD and 1.60m OD, but there is a lower area in the north western corner of the site where levels are lower than 1.60m OD, and the lowest level found in the survey was 1.39m OD.

The road level (South Drove) immediately west of the proposed entrance to the site is 2.06m OD. The existing houses along South Drove seemed to be above the road level at approximately 2.25m OD.

The water level in the IDB Drain on the 17th January 2017 was 0.0m OD, and the level in South Drove Drain was -0.53m OD.

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 375 metres from the River Welland, which is main river and maintained by the Environment Agency.

This area south of the centre of Spalding is drained by drainage channels maintained by Welland and Deepings Internal Drainage Board. The water levels in the IDB channels are controlled by the water level in 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. Failure or overtopping of the tidal defences.
2. Overtopping of the River Welland.
3. Flooding from IDB drainage channels
4. Flooding from accumulation of surface water on the site.

1. Failure or overtopping of tidal defences.

The River Welland is tidal north of Fulney Lock, which is more than 5.0km north 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 could be overtopped with a 0.5% probability event. However one would expect that during the next one hundred years defences will be raised to maintain a 1 in 200 year standard of defence.

If overtopping or a breach allowed water to flow south westwards from the tidal Welland lower land to the west of the River Welland would be flooded and the central area of Spalding would remain unaffected. Therefore if flood water from this source were to affect the development site it would have to flow south westwards towards Pode Hole then south eastwards towards Spalding Common. The railway line to the west of Spalding Common would be a final barrier to any substantial amount of flood water reaching the site.

Therefore flooding from this source can be discounted for all foreseeable events.

2. **Failure or Overtopping of the River Welland.**

The west bank of the River Welland is at a level of above 6.00m O.D. directly west of the development site. If a breach were to occur in the west bank of the River Welland when the river is at its maximum 2115 level of 4.68m OD then water would flood into the area between the river and Spalding Common.

It is assumed that it is this scenario that will cause the predicted residual flood depths which are shown on the maps in the SFRA. The flood water from a breach would flow across the development site (east to west) and flow into the South Drove Drain. This would limit the increase in depth of the flooding, but eventually water levels in the South Drove Drain would increase possibly to the top of the banks. Further west it would be flooding onto lower land south of Deeping St Nicholas.

The risk of breaching is considered low as the banks of the River Welland do not have steep slopes, and any overtopping, which is the main cause of breaching, is more likely to occur in upstream lengths of this River.

3. **Flooding from IDB watercourses**

This area east of South Drove and Spalding Common is drained by Fantail Mill Drain which is located on the eastern boundary of the proposed development site. Fantail Mill Drain is maintained by Welland and Deepings IDB (W & D IDB) and flows into South Drove Drain.

The water level in North and South Drove Drain, which is maintained by W & D IDB is controlled by Pode 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 the IDB to continue to provide between a 1 in 50 year and a 1 in 100 year standard of protection to keep pace with climate change over the next one hundred years.

Although the likelihood of water levels rising to 2.00m OD in North 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 discounted.

4. Flooding due to Accumulation of Surface Water on the Site

A suitable soakaway system will be constructed designed to BRE365 which will allow for the adequate disposal of the surface water from the roofs of the proposed buildings. Hardstandings will also be designed to allow adequate percolation of water into the sub strata. Therefore no surface water will flow off the site and affect any of the adjoining properties or agricultural land.

If percolation tests indicate that soakaways will not work adequately then the surface water will be discharged into a storage lagoon or an alternative storage facility and the discharged at a low rate of flow into the IDB drain on the eastern side of the development, subject to the prior approval from Welland and Deepings IDB.

As the new buildings will need to be raised a significant height above the existing ground level to mitigate the flood risk from the River Welland the risk of flooding from this source can be considered remote.

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. In an extreme event the effect on this location would not be sudden. Residents would be warned by the EA that river levels were rising to a critical level and they would be advised 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. In an extreme event the River Welland would start to flood onto the Washes before any floodwater overtopped the banks and flowed over the west bank.

There are no records of the Spalding Common area having been flooded in the last 60 years.

Climate Change

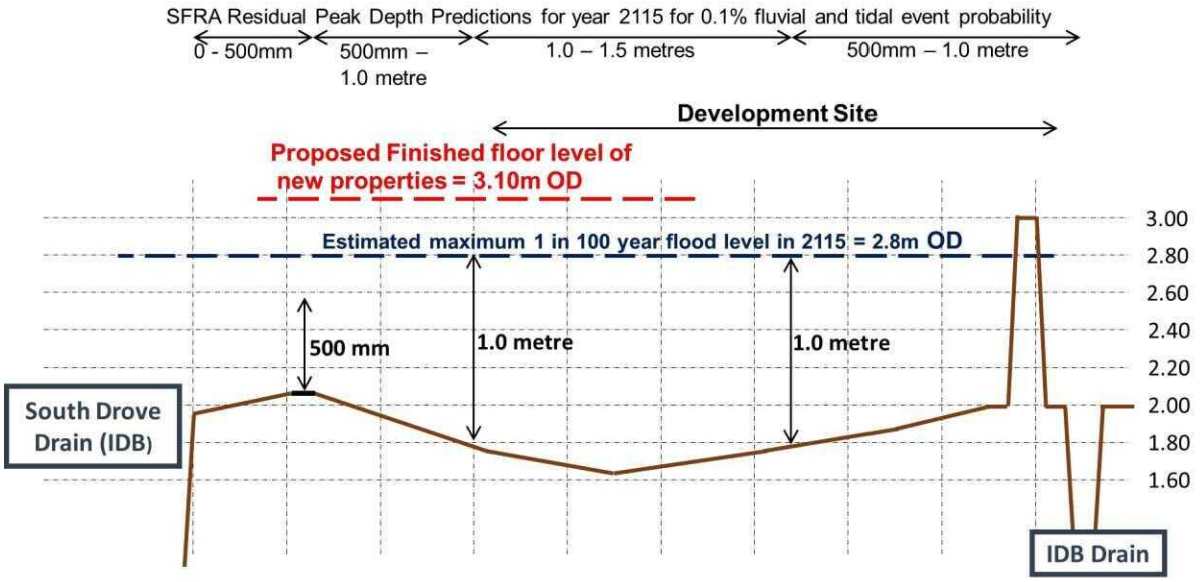
The predictions of flood depths for this flood risk assessment use information in the SHDC SFRA which was produced in 2010. The EA have issued new guidance on recommended contingency allowances for predicted sea level rises, fluvial flows and rainfall intensities which from 19th February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 16 to 19). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Summary of Risk of Flooding to the Site as predicted in the 2010 SFRA

The main risk to the site is if a breach 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 very low. The bank has a wide top and bank slopes are not steep.

However the hazard if the bank breached is considered as significant at the site as shown on the residual flood hazard maps for 2115 in the 2010 SFRA. It is predicted that depths of flooding in both the 1 in 100 year and 1 in 1000 year events in 2115 would be between 500mm and 1.0 metres on the eastern third of the site and between 1.0 metres and 1.5 metres on the western two thirds of the site. Part of the residual flood hazard maps for 2115 for a 1 in 1000 year event is reproduced below.

A section has been drawn which is shown below details the existing ground levels with these predictions on flood depths indicated.



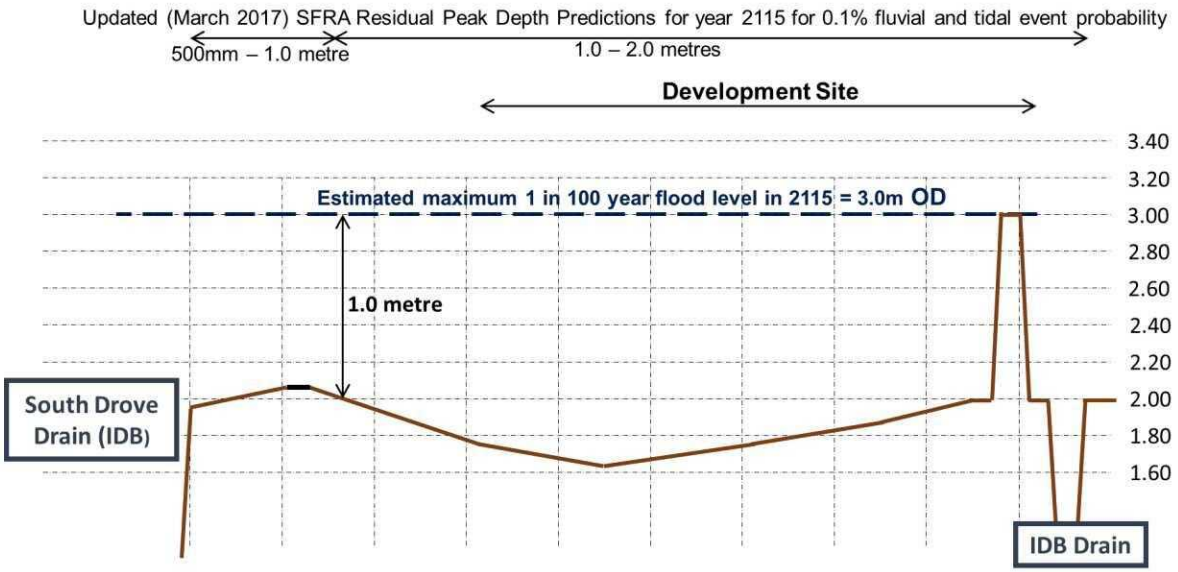
The estimated predicted flood level of 2.80m OD has been calculated by using the boundary between the blue (flood depths 0.5m – 1.0m) and yellow (flood depths 1.0m – 1.5m) as a flood depth of 1.0m.

Reference to the Updated Strategic Flood Risk Assessment (2017)

The relevant part of the map in the updated SFRA issued in March 2017 on the South East Lincolnshire Joint Strategic Planning Committee Website showing the residual peak depths for Spalding in 2115 in a 1% fluvial and 0.5% tidal event probability is shown on the next page

This shows most of the site coloured red (between 1.0 and 2.0 metre depth) and South Drove coloured orange (between 500mm and 1.0 metre depth).

Using the above levels and the results from the map of updated residual flood depths the following cross section has been produced.



The dimension of 1.0 metre shown on the cross section is the line between the red and the orange shading on the map. Therefore using this cross section the estimated maximum flood level would be 3.00m OD.

Conclusions

The following conclusions can be made:

- 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, and the updated SFRA maps predict that if a breach occurs in the bank of the River Welland the flooding would be between 1.0m and 2.0m deep across the site.
- Following the predictions on the updated maps the maximum flood level if a breach occured in a 1 in 100 year event in 2115 is 3.00m OD, which is 1.04 metres above the road level of South Drove at the entrance to the site.
- The risk of the site becoming flooded from any 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 an area of flood risk it is recommended that the proposed dwellings should be constructed with two stories with all sleeping accommodation on the first floor. This would ensure that no residents would be at risk whilst they were asleep and provide a refuge on the first floor.
- If the buildings are built with two stories with all of the sleeping accommodation on the first floor then the minimum finished ground floor level should be 3.10m OD.
- If any flooding started to occur residents should escape along Spalding Common before flood water rose to the level of the road, 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.
- The building should be designed incorporating flood resistant and resilient techniques to allow it to be refurbished after being flooding to a depth of approximately 300mm above the floor level of the new building. Consideration should be given to the electrics and heating pipes being distributed at ceiling level rather than at floor level. Materials used for the floor and walls should be able to withstand flooding for a period of a few days. Further details are given in Appendix A on page 12.

- On site surface water drainage will be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations. If percolation tests indicate that soakaways will not work satisfactorily then the surface water from the roofs and any excess from the roads should be discharged into a lagoon or a suitable storage facility and discharged at a low rate into the IDB drain on the eastern side of the site, subject to the approval of the Welland and Deepings IDB.

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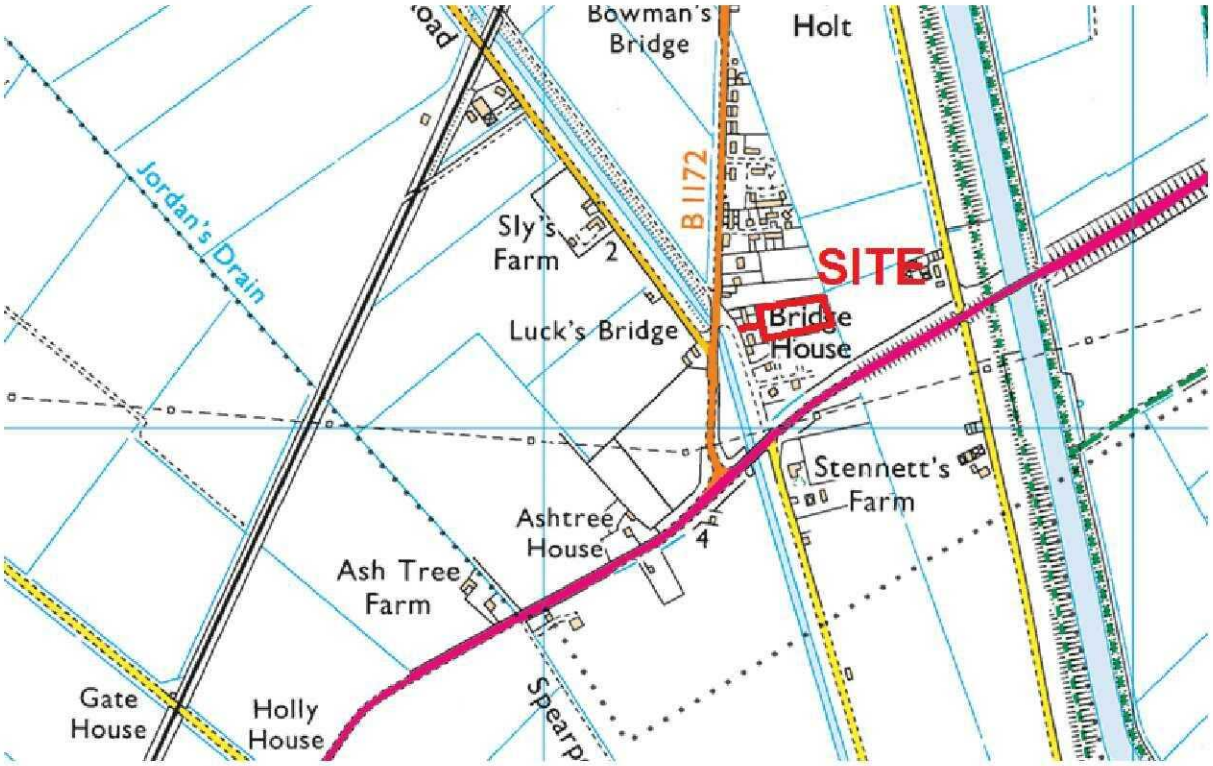
9th February 2017

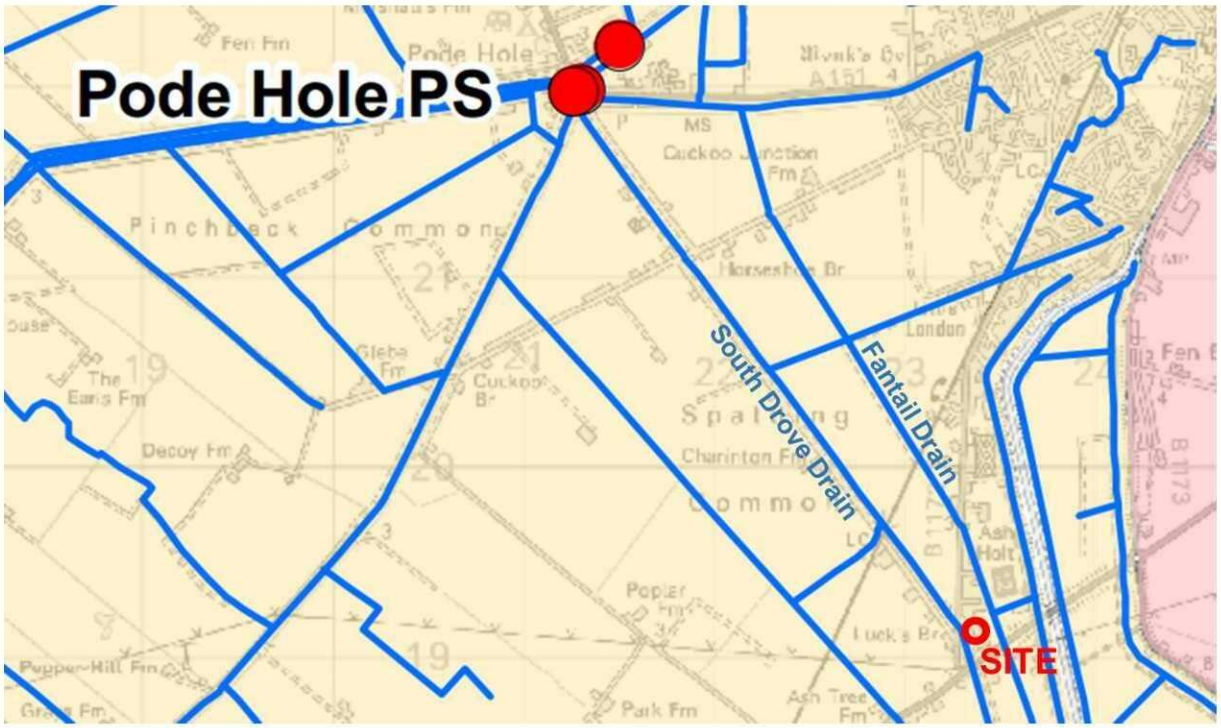
Revision A 21st July 2017 Flood depths from South East Lincs SFRA added and conclusions and recommendations amended.

LOCATION PLAN

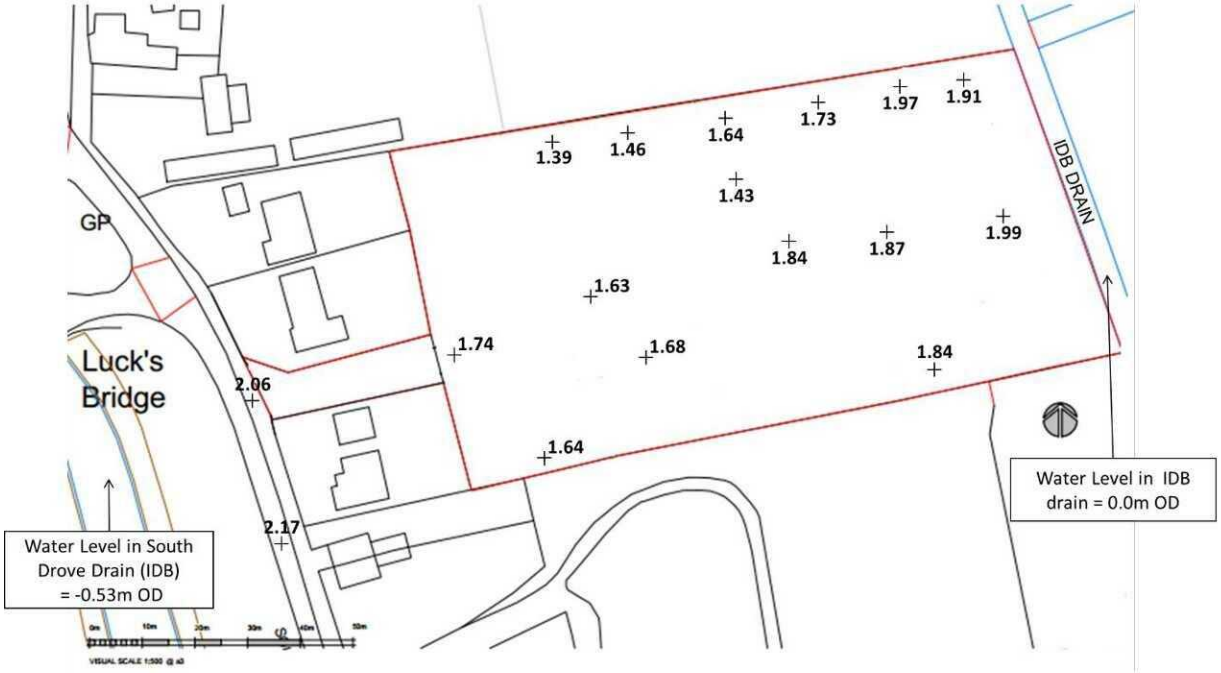


PLAN OF PROPOSED DEVELOPMENT

PLAN OF IDB DRAINS



PLAN OF SITE LEVELS



APPENDIX A

RECOMMENDATIONS ON LIMITING FLOOD DAMAGE TO BUILDINGS

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. StormMeister Flood protection doors, or similar, which provide a seal against flood water, should be considered for the external doors.
Kitchens:	Install plastic base feet and if possible other plastic items to reduce damage from low level flooding. Raise fitted ovens as high as possible.
Electrical Services:	Place all of electrical wiring at first floor level and drop wiring down to sockets at least 1.0 metre above ground level.
Central Heating:	All distribution pipes should be placed at first floor level and drop down to radiators on the ground floor.
Sewer connections:	Water will flow back through any toilets and other waste water pipes unless non return valves are fitted. The developer should consider not installing a WC on the ground floor and separately fitting non return valves on smaller waste water pipes.

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

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 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 3.10m OD is satisfactory.