PROPOSED RESIDENTIAL DEVELOPMENT ADJACENT TO THE GABLES, WESTON HILLS ROADS, LOW FULNEY, SPALDING, PE12 6NE

FLOOD RISK ASSESSMENT



View from Weston Hills Road

S M Hemmings B Sc C Eng MICE MIWEM,

40 Celta Road

Peterborough

PE2 9JD

Revision A 7th December 2018 FRA rewritten

This flood risk assessment has been prepared solely to support the planning application for a development alongside The Gables, Weston Hills Road, Low Fulney. 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 residential development is proposed west of the existing bungalow called “The Gables” on the north side of Weston Hills Road, Low Fulney, Spalding which is 2 km east of the centre of Spalding.

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

The Planning Application requires a flood risk assessment to be carried out as required in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified on the South Holland District Council’s Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the South Holland 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.



It can be seen that all of the site is in Flood Zone 3.

Application Site

The site is located 1.4km from the Coronation Channel and 2.8 km from the tidal section of the River Welland. The National Grid Reference of the site is 527250 321880.

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

As the site is within a defended area the proposed development can be considered to be within Flood Zone 3(a) as detailed on the Environment Agency's flood zone maps without defences, as defined in Table 1 of the Technical Guidance.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a development of a dwelling house is classified as "more vulnerable".

Table 3 of the Guidance is shown below:

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

It can be seen that "More vulnerable" development is only appropriate in Flood Zone 3 after the sequential and the exception test have been applied.

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.

It is unlikely that a site with a lower flood risk can be identified in the Fulney area. The plan showing the flood risk zones on the previous page shows that all of the Fulney area is within flood zone 3 and no alternative sites are available in this area with a lower flood risk.

The South Holland District Council Core Strategy states that there is a limited number of sites outside the town of Spalding available for residential development. Some greenfield land will need to be identified to enable the Council to meet the RSS and Structure Plan requirement for 2021. Therefore there is a requirement for further land to be brought forward and used for residential development.

Therefore I consider that the sequential test has been passed.

Exception Test

The Sequential Test has demonstrated that it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding. Therefore the Exception Test must be applied and for this to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risks, informed by the Strategic Flood Risk Assessment; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking into account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible will reduce flood risk overall.

Both parts of this test must be satisfied in order for the development to be considered appropriate in terms of flood risk. There must be robust evidence in support of every part of the test.

The first section will be demonstrated by the Supporting Planning Statement and compliance with South Holland District Council's planning policies.

This flood risk assessment will demonstrate that the development will be safe for its lifetime and it will not increase flood risk elsewhere.

Strategic Flood Risk Assessment

Consultants have produced a Strategic Flood Risk Assessment (SFRA) for the South Holland District Council (SHDC). This document provides details of the flood risk in the Council's area. Reference to the maps in this document give the following information for the flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

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
	Peak Velocity ……. Nil
For year 2115	Depth of flooding … 0 – 500mm
	Extent of flooding…. High flood probability

Peak Velocity …… 0 – 0.1 m/sec

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

For the present day
Depth of flooding … 0 – 250mm
Extent of flooding .. High
Hazard……..... Less than 0.75 (Low hazard)
Peak Velocity .. 0 – 0.3 m/sec

For the year 2115
Depth of flooding …250mm to 1.0 metre
Extent of flooding .. High
Hazard…….....1.25 - 2.0 (danger for most)
Peak Velocity ……. 0 – 0.3 m/sec

Figure 16 of the general maps shows that the site is not within the rapid inundation zone for the present day or in 2115.

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 A16 road bridge, between chainage 19.8km and 20.8km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.98m OD	6.31m OD	7.12m OD
Peak 1 in 1,000 year extreme tide level	6.27m OD	6.60m OD	7.41m OD

With an average defence crest level between 7.80 and 7.90 m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1870mm	1540mm	730mm
Peak 1 in 1,000 year freeboard	1580mm	1250mm	440mm

Tables in the SFRA show the following details for the defence bank on the east side of the Coronation Channel between chainage 0 km and 2.0 km.

	2007	2115
Peak 1 in 100 year extreme tide level	4.32m OD	4.69m OD
Peak 1 in 1,000 year extreme tide level	4.34m OD	4.69m OD

The bank levels on this section vary between 5.35m OD and 6.0m OD. Therefore it can be seen there is a minimum freeboard of 650mm to the predicted design maximum levels in 2115.

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", which is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding occurring due to overtopping or failures of the defences is considered to be very low.

The site is located approximately 2.8 km from the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located approximately 1.4 km from the Coronation Channel which is maintained by the Environment Agency.

The arterial system of watercourses in the area are maintained by South Holland IDB. The watercourse on the southern side of Weston Hills Road opposite the site is a drain maintained by the IDB.

Existing Ground Levels

A full topographical study has been carried out and the drawing will be submitted with the planning application. A sample of these levels have been replotted on a plan which is shown on page 16 of this report.

The area at the front of the site is at a level of approximately 2.80m OD, and the rear (northern) part of the site is at a similar level. The area immediately behind the property on the western side (No 19) is lower with levels of approximately 2.50m OD. The ground floor level of the existing bungalow (The Gables) on the eastern boundary is 3.11m OD and the level of Western Hills Road in front of the property is 2.85m OD.

The water level in the IDB drain on 23rd February 2016 was 1.35m OD and the level in the dyke in front of the property (on the north side of Weston Hills Road) was 1.45m OD.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Overtopping or breaching in the Coronation Channel
2. Failure or overtopping of tidal defences of the River Welland
3. Failure of Little Holland Pumping Station (IDB)
4. Blockages in IDB drains or culverts
5. Surface Water Flooding

1. Overtopping or breaching in the Coronation Channel

The SFRA states that the maximum design water level in the Coronation Channel is 4.69m OD. The minimum crest level of the east bank of the Channel is 5.14m OD,

which gives a minimum freeboard of 450mm. However, generally there is a freeboard of 600 mm along this bank of the Channel.

If the Channel were to breach water would flow eastwards towards the site. However, it would be retained for a short time by the A16 which is higher than the surrounding land. The SFRA indicates that with a serious breach water would not reach the site in a 1 in 100 year event.

With the site being only 1.4 km from the Coronation Channel there is a risk that flood water from this source could reach the development site if a breach occurred in the east bank of the watercourse. As the most common cause of a breach is from overtopping of a bank the risk at this location can be considered very low. If a breach were to form the flood water would be held up on the western side of the new A16 for some time, because the road is higher than the surrounding grounds levels, giving residents in the Fulney area time to prepare for flooding.

2. **Failure or overtopping of tidal defences**

As shown above, the east bank of the River Welland, which is approximately 2.8 km from the site, has at least a 1 in 200 year standard of protection. If the eastern bank of the tidal section of the River Welland breached then the maps in the SFRA indicate that flood water could flow as far as the site in a 1 in 200 year event in 2115.

3. **Failure of Little Holland Pumping Station**

The dyke on the north side of Weston Hills Road discharges into the IDB drain on the south side of the road through a culvert under the road 280 metres east of the site opposite Mallard Road. The water level in this IDB drain is controlled by Little Holland Pumping Station which is 10.0 km south east of the development site. The South Holland IDB have advised that the maximum 1 in 100 year predicted level at the pumping station is 0.30m OD. and the maximum 1 in 100 year level in the western end of the Little South Holland Drain is not likely to exceed 1.70m OD.

If levels in the system exceeded 2.5m OD low land south of Weston would start to flood and this would prevent levels rising and it follows that the possibility of levels rising to 2.90m OD and above and causing flooding to the proposed site is remote.

4. **Blockages in local watercouses and culverts**

The watercourse in front of the site flows into the IDB drain through a culvert under Weston Hills Road 280 metres east of the site. This IDB drain flows eastwards and then flows southwards along a watercourse called Delgate Drain which is maintained by South Holland IDB. All drains maintained by the South Holland IDB have a regular maintenance programme. The normal water level in the drain is approximately 0.9m OD.

The flow in the Delgate Drain runs southwards and joins into a larger channel alongside Austendyke Road which runs eastwards to join a drain which runs southwards to flow into the Little South Holland Drain.

The South Holland IDB have a regular maintenance programme which ensures that drains and culverts are regularly inspected and any blockages in the system are quickly rectified. The risk of a large blockage in the system causing very high water levels which would flood the proposed houses is extremely low.

5. Surface Water Flooding

There is a risk that a blockage in the dyke in front of the site could lead to high water levels and in extreme circumstances waterlogging and flooding of the site. This did happen a number of years ago but the high water levels in the dyke were seen by the local residents and remedial measures were taken before water levels became high enough to cause flooding to the gardens of the local properties or the road.

Therefore the risk of flooding to the proposed development 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 in the last fifty 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 tidal defences

The risk of this happening in this case is low and the hazard from any flooding is also low.

Climate Change

The predictions of flood depths for this flood risk assessment use information provided by the Environment Agency which was produced in 2006. 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 14 to 17). 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 “Danger to Most” (1.25 – 2.0) reference should be made to Category D8 which states:

For Depths 500mm – 1.0 metre

Finished floor levels must be set 500mm above ground level, with flood resilient construction to a height 300mm above the predicted flood depth.

For Depths 250mm - 500mm

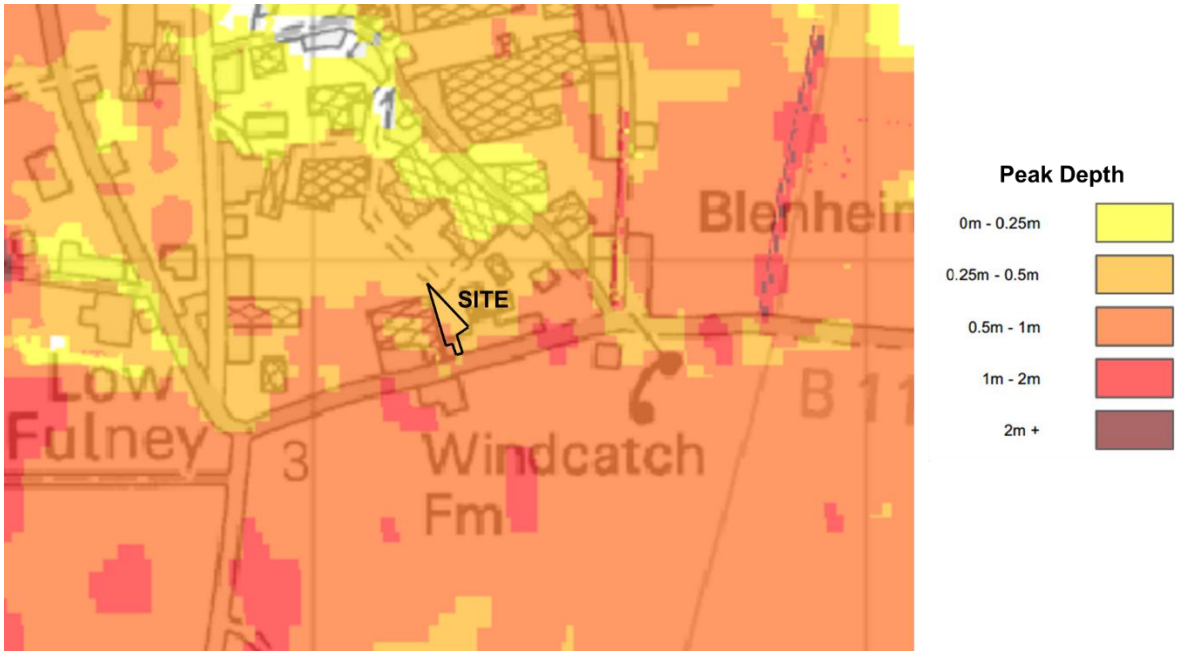
Finished floor levels must be set 500mm above ground level, with flood resilient construction to a height 300mm above the predicted flood depth.

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

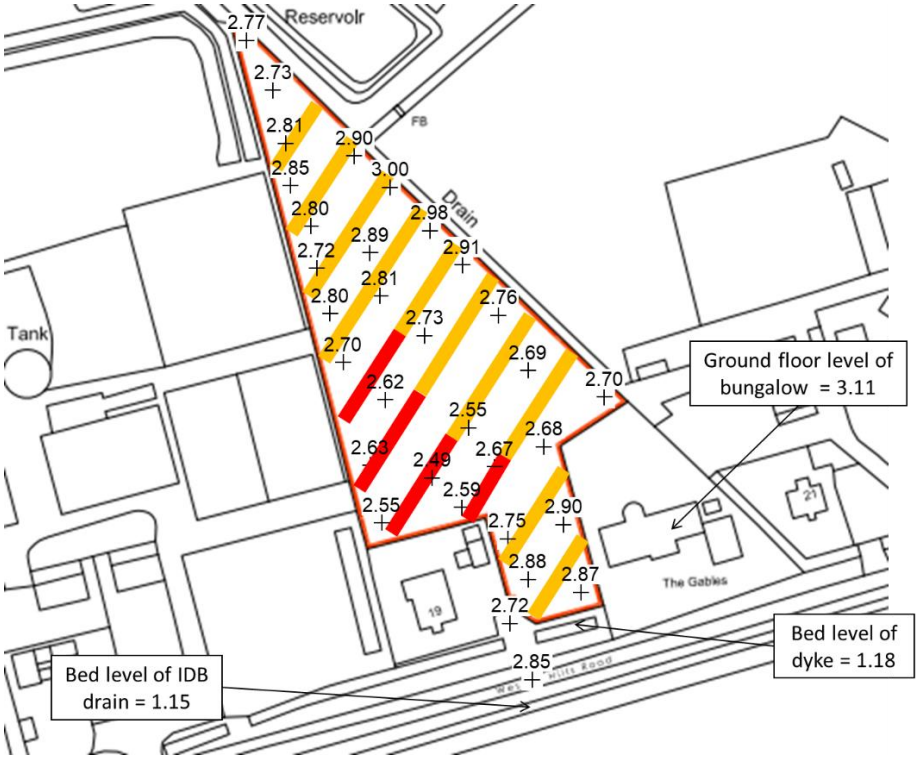
Conclusions

The main risk of flooding to the site is if a breach were to occur in the west bank of the tidal River Nene or the tidal defences of the Wash. The risk of this happening along this section of bank can be considered to be low.

The relevant part of the map in the SFRA of predicted residual flood depths in 2115 in a 1% fluvial and 0.5% tidal event probability is shown below:



The information from the above map has been overlaid onto the map showing the levels and this is shown below.



It can be seen from the above plan that across most of the site the predicted flood depth in a 1 in 200 year tidal or a 1 in 100 year fluvial event in 2115 is between 250mm and 500mm which is shown cross hatched yellow. The area in red has a predicted flood depth of between 500mm and 1.0 metre. As the flood bands are taken from small scale plan of the district the edge of the two bands is not exact, but it is reasonable to take the boundary between the two bands to be at a level of approximately 2.70m OD. Therefore the maximum flood level on this site can be taken to be 3.20m OD.

Therefore it is recommended that the proposed new buildings should have a minimum ground floor level of 3.30m OD which will be 100mm above the predicted flood level in 2115.

The risk of flooding from IDB drains can be considered very low. The proposed floor level of 3.30m OD is higher than much of the land in the area which will flood to a depth of at least 500mm before the house is affected, and this would prevent the level of any flood water from this source from rising above 3.00m OD. If the pumping stations were to fail then the IDB have adequate arrangements to operate pumps with alternative motive power, or to bring in mobile pumps.

It can be assumed that the IDB will continue to monitor predicted water levels in the area and carry out improvements to the system over the next 100 years to retain the present standard of defence.

The proposed development is not in a functional flood plain as defined by PPS 25.

Although the site is in flood zone 3, the actual risk of the site flooding from any Environment Agency or IDB watercourse is very 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. However if any flooding that did occur it would happen slowly and residents would have adequate time to prepare themselves for the event.

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 buildings were to become flooded after a major breach of the tidal bank, and ensure there is no danger to residents when they are asleep.

The ground floor level of the proposed buildings should be raised to a level of 3.30m OD which is approximately 500mm above the average existing ground levels.

The developer should advise owners and occupiers of the properties to register with the Environment Agency's Floodline Warnings Direct Service.

Rainwater from the roofs of any new buildings should be discharged if possible into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations. Hardstandings around the development should be constructed with permeable paving.

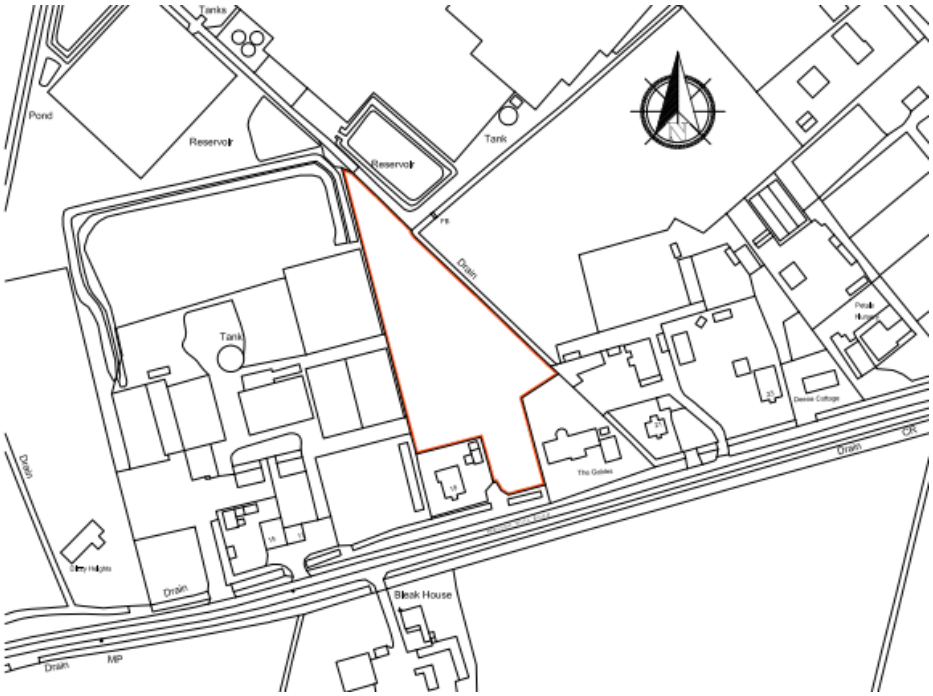
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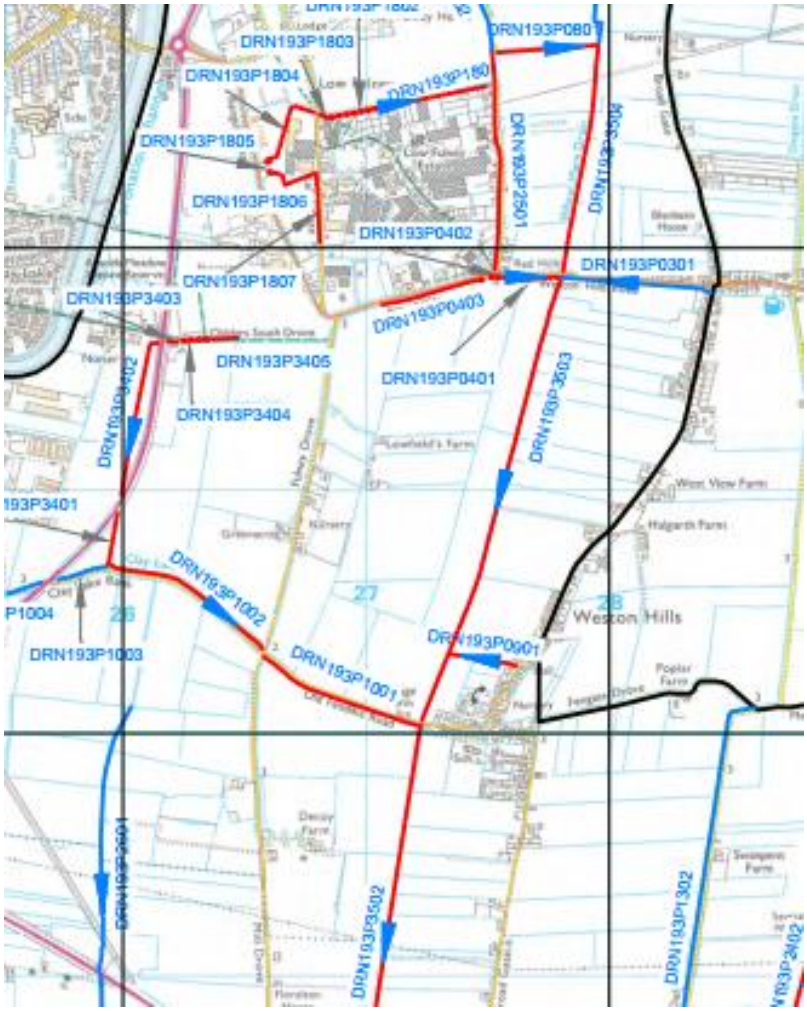
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Revision A 7th December 2018 FRA rewritten

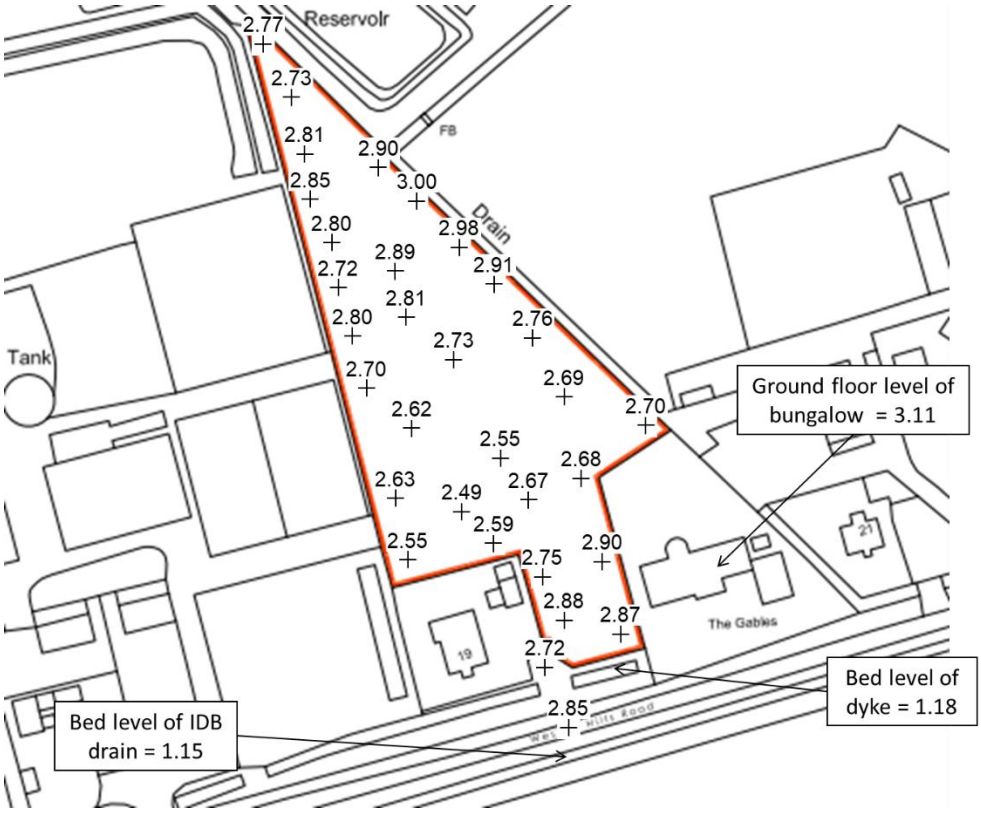
LOCATION PLAN



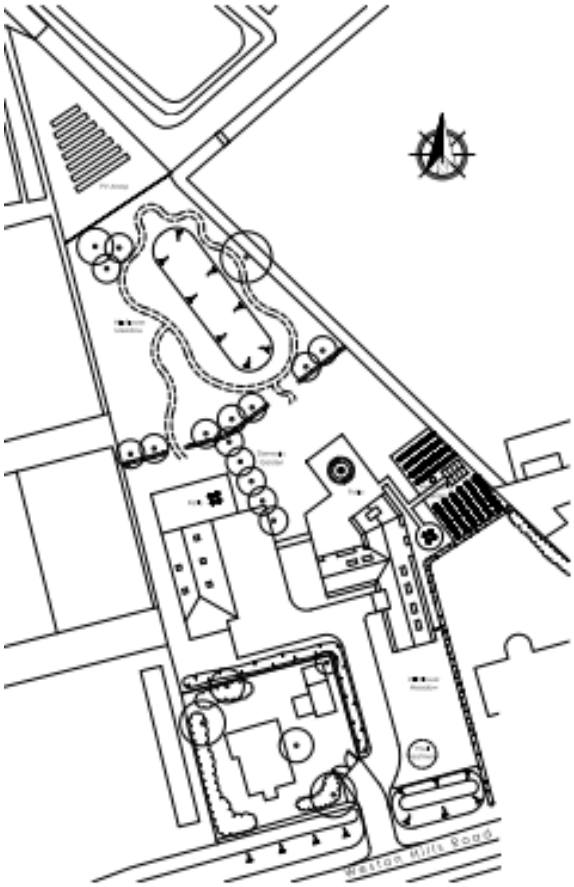
PLAN OF IDB DRAINS



PLAN SHOWING SITE LEVELS



PROPOSED PLAN OF DEVELOPMENT



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%	

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

1) Flooding from Tidal River Welland

The FRA has identified the main source of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site is 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 for the maps in the SFRA and 40mm for maps issued by the Environment Agency. The SFRA maps do not predict any flooding on this site

in a 1 in 200 year event in 2115. The small increase shown above will not change this map significantly and cause any flooding on the site in this event.

2) Flooding from Coronation Channel, Barrier Bank and the IDB drainage system

As the development is in flood zone 3 and is classed as more vulnerable, the central climate change allowance, which is 35%, should firstly be considered. After considering the effects of this increase the higher central, 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% and 65% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the Coronation Channel. If there are additional flows along this part of the Coronation channel and 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.

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.

South Holland 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 South Holland 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.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the floor levels should be raised to a level of 3.30m OD, is satisfactory.