PROPOSED DEVELOPMENT OF THIRTY HOUSES AT STATION ROAD SURFLEET, PE12 6HG FLOOD RISK ASSESSMENT

View from IDB Drain on Northern boundary

S M Hemmings B Sc C Eng MICE MIWEM,

69 Charlotte Way

Peterborough

PE39ER

Revn A: 12th July 2016 Recommendations amended

This flood risk assessment has been prepared solely to support the planning application for a development at Station Road, Surfleet. 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

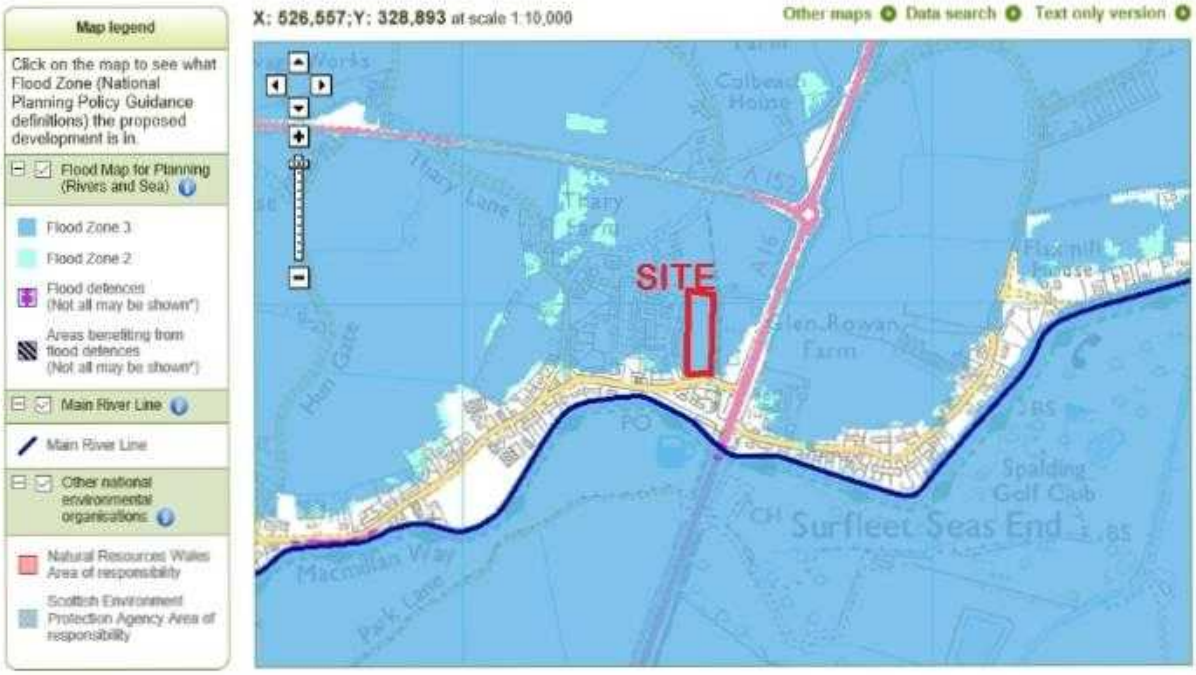
A development of 30 dwellings is proposed on a field north of Station Road in Surfleet and east of the existing small estate called Kingfisher Drive. The site is situated just west of the new A16 and is approximately 4 km north of Spalding.

All of 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 specified 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 Welland and Deepings Internal Drainage Board District.

Environment Agency (EA) Flood Zones

The map below is taken from the Environment agency website and shows the flood zones in this area.



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

Application Site

The site is located 1.5 km from the tidal section of the River Welland. The National Grid Reference of the site is 526510 328930.

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

The proposed development is 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 consisting of dwelling houses 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 †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

Therefore it can be seen that for "More Vulnerable" development the sequential and the exception tests need to be applied to the development.

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.

As can be seen from the map on page 2 of this report the whole of this area north of Spalding with the exception of the narrow strip of higher land on the north bank of the River Glen is in Flood Zone 3. Therefore it would be difficult to find a similar site for development that is in a lower flood zone.

Taking into account the guidance, it can be seen that it is extremely unlikely that an alternative site with a lower flood risk could be found in the Surfleet area. The safety of the development will be delivered by ensuring the floor level of the proposed new dwelling is above predicted residual flood levels for this area.

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 … zero
	Extent of flooding…. Low or medium flood probability
	Peak Velocity …… zero

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

Figure 16 of the general maps show 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

Tables in the SFRA show the following details for the predicted flood levels in the River Glen at chainage 1.8 km.

	2007	2115
Peak 1 in 100 year flood level	4.16m OD	4.65m OD
Peak 1 in 1,000 year flood level	4.24m OD	4.68m OD

The bank levels on this section vary between 4.57m OD and 5.35m OD on this length of the River Glen. Therefore it can be seen there is a risk of overtopping of the lower lengths of the River Glen overtopping in the 1 in 100 year event in 2115.

Information from the Environment Agency

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

	2007	2115
Peak 1 in 100 year flood level	4.16m OD	5.09m OD
Peak 1 in 1,000 year flood level	4.24m OD	5.23m OD

The predicted flood levels for 2115 seem to have been computed ignoring any effect of overtopping that will occur between Bourne and the outfall.

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 1.5 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 100 metres north of the River Glen which is maintained by the Environment Agency.

There are watercourses in the area that are maintained by Welland and Deepings IDB. The watercourse on the northern boundary of the site is a Board's drain.

Existing Ground Levels

A full survey of the ground levels on the development site has been produced and a simplified version of this is shown on page 11. The land levels vary between 3.00m OD and 3.15m OD. The normal water level in the IDB drain is approximately 1.10m OD, 1.9 metres below the lowest land level. The level of Station Road on the southern boundary of the site is 4.70m OD on the western side and rises to 5.10m OD on the eastern side of the site.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Welland.
2. Overtopping or breach in the River Glen.
3. Failure of Surfleet Pumping Station (IDB).
4. Blockages in IDB drains or culverts
5. Surface Water Flooding

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

As shown above, the east bank of the tidal River Welland, which is approximately 1.5 km east of 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 the site is not predicted to experience flooding in a 1 in 200 year return period event in 2115.

The maps in the SFRA indicate that if a breach were to occur in the western bank of the tidal River Welland lower land north of Surfleet would be flooded and the A16 trunk road would form a barrier to prevent flood water from flowing any further westwards.

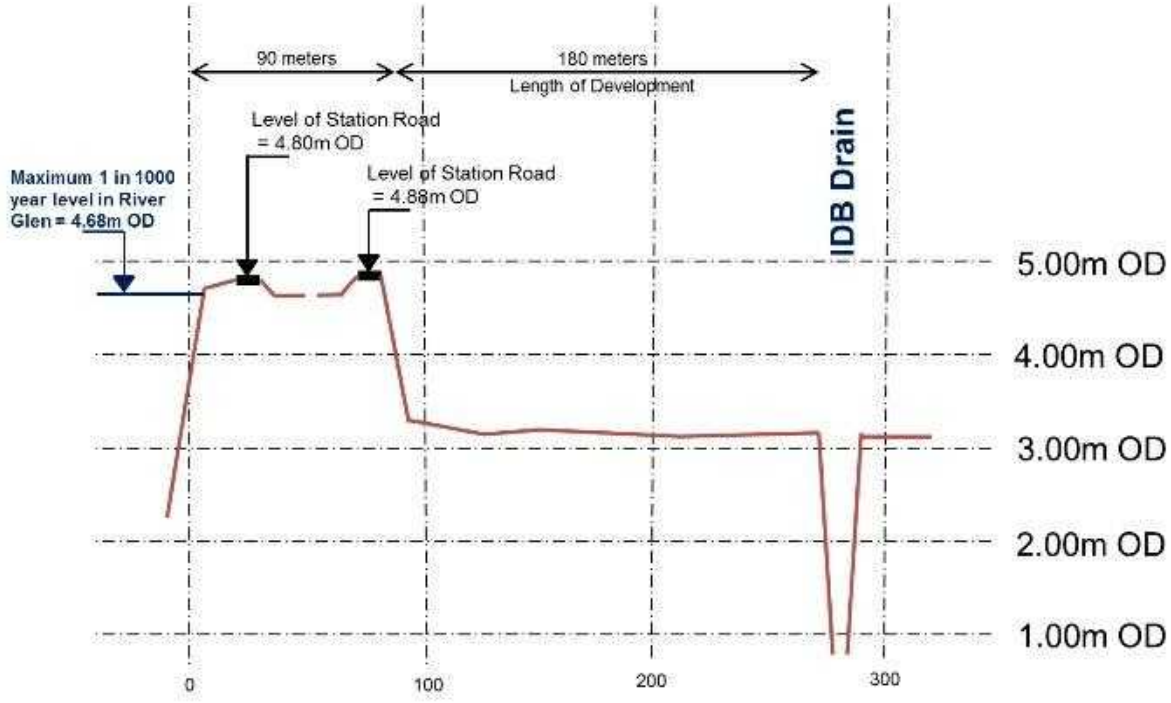
2. **Failure or overtopping of the banks of the River Glen**

The SFRA gives predicted levels for the River Glen of 4.65m OD and 4.68m OD for the 1 in 100 year and 1 in 1000 year events in 2115. However the Environment Agency advise that the levels will be much higher at 5.09 and 5.23m OD for the 1 in 100 year and 1 in 1000 year events in 2115.

The levels of the earth bank on the north side of the River Glen between chainage 4.1km and 6.4 km, which is 2 km upstream of the development site, vary between 4.60m OD and 5.1m OD. Therefore it would seem very unlikely that maximum levels in the River Glen could actually rise to the levels predicted by the EA.

What would happen in a 1 in 100 year event in 2115 would be that water would be overtopping the earth banks in numerous places between Surfleet and Bourne which would prevent river levels rising much above the levels predicted in the SFRA.

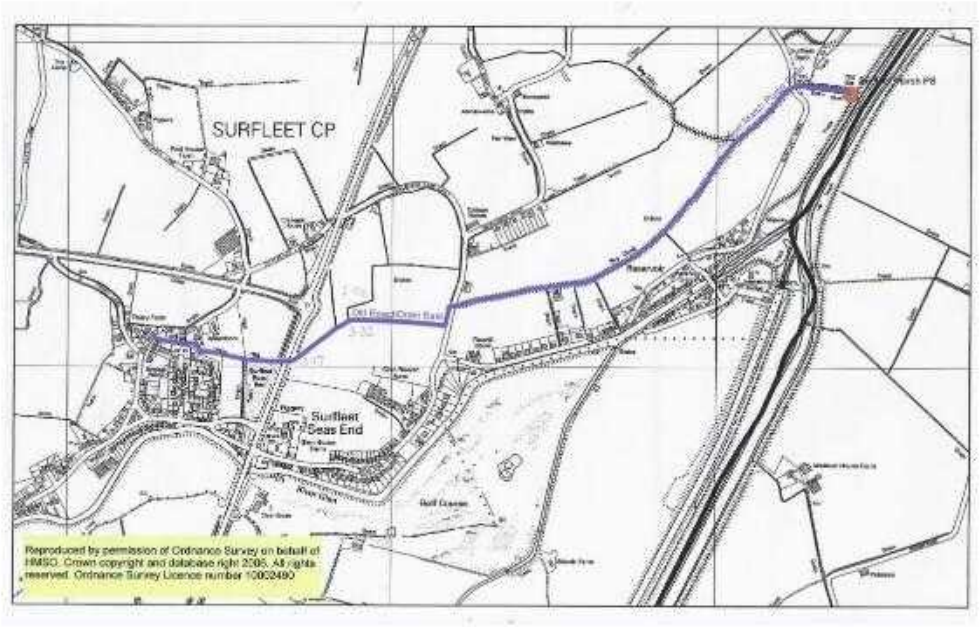
A section south to north from the River Glen and across the site is shown below.



It can be seen that the defence to the River Glen consists of a very wide bank approximately 90 meters wide with two sections of road on top. The risk of this breaching can be considered remote. Therefore the risk to the development site is by any overtopping of this defence. If this occurs it is likely to be only a maximum of 200mm deep over a possible width of 30 meters. If this flows onto the site the depth of flood water will be less than 200mm. Therefore if the properties are raised 300mm above existing ground levels then the risk of flooding to the properties from this source is extremely low.

3. Failure of Surfleet Marsh Pumping Station

The water level in the IDB Drain on the north of the development is controlled by Surfleet Marsh Pumping Station which is 2.0 km east of the development site. The Welland and Deepings IDB have advised that the pumping range at this pumping station is from 1.38m OD down to 1.05m OD, and the design maximum flood level is 1.20m OD. The route to the pumping station is shown on the map below.



4. Blockages in IDB drains and culverts

The Welland and Deepings IDB have a regular maintenance programme which ensures that drains and culverts are regularly inspected and any blockages in the system are quicxkly 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 surface water that has been discharged from roofs, roads or hardstandings on the site could accumulate and flood some of the dwellings on the site.

The risk from this source will be mitigated by carrying out the following measures:

a) Buildings should be raised at least 150mm above the level of the central site road.

b) A suitable surface water and foul water system will be designed and constructed.

The proposed new buildings on the site will need to be raised above the existing ground level to comply with the flood risk to the site. It is assumed these will be constructed with normal strip foundations and ground floors will be elevated by using precast concrete beam and block type floors.

The principle of SuD's design which are set out in the SuD's manual (CIRIA report C753) will be followed in the design of the surface water disposal system for the site.

A separate Drainage Strategy has been produced which shows details of the surface water disposal system, and this design will ensure that no flooding from this source will occur in the 1 in 100 year event with climate change.

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 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 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 this FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 14 to 18).

Conclusions

The maps in the SFRA do not predict any flooding to any part of the site in a 1 in 200 year event in 2115. However taking a precautionary approach it is recommended that

ground floor levels of all new dwellings should be at a minimum level 3.50m OD, which is 450mm above the average ground level on the site, to reduce the risk of flooding if an event greater than 1 in 200 years occurring in 2115.

The risk of flooding from IDB drains can be considered low. 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. Welland and Deepings IDB have advised that the 1 in 100 year predicted level in the drain on the northern boundary is unlikely to exceed 2.00m OD in a 1 in 100 year event. It can be assumed that the IDB will continue to monitor predicted water levels in the drain and carry out improvements to the system over the next 100 years to retain the present standard.

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

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

If any flooding that did occur it would happen very slowly and residents would have adequate time to prepare themselves for the event.

Recommendations

In an area where there is a flood risk, however small, it would be preferable that all the new dwellings should be two story houses designed with all sleeping accommodation located on the first floor.

The ground floor level of the proposed buildings should be at a minimum level of 3.50m OD and at least 150mm above proposed levels of the access road on the site.

If bungalows are to be constructed in the development the Environment Agency have stated that the ground floor level of single story properties with sleeping accommodation on the ground floor should be above the 1 in 1000 year flood level in 2115. Therefore it is recommended that the ground floor level of any bungalows that may be included within this development should be 3.80m OD.

Flood resilient construction shall be incorporated throughout all the properties to a minimum height of 300mm above finished floor level.

All future occupiers of the properties should register with the Environment Agency's Floodline Warnings Direct Service.

S M HEMMINGS B Sc C Eng MICE MIWEM

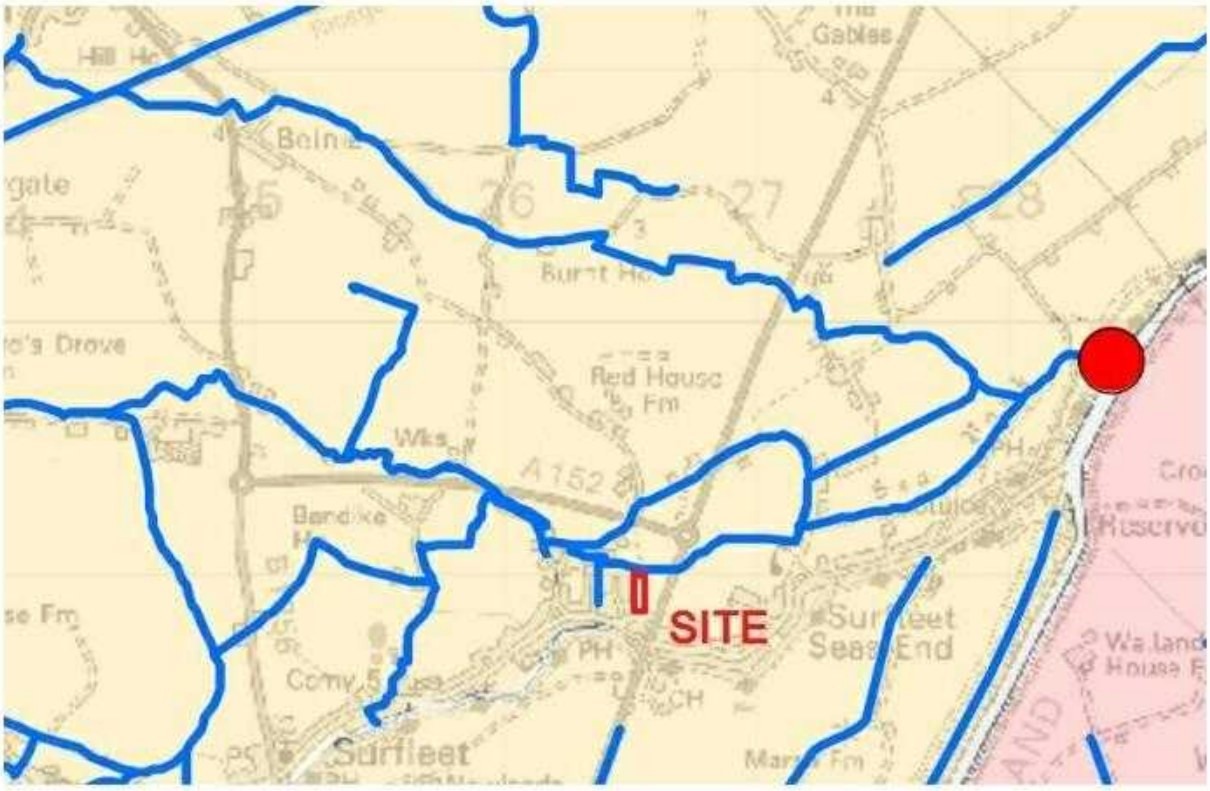
stuart.hemmings@btinternet.com

16th May 2016

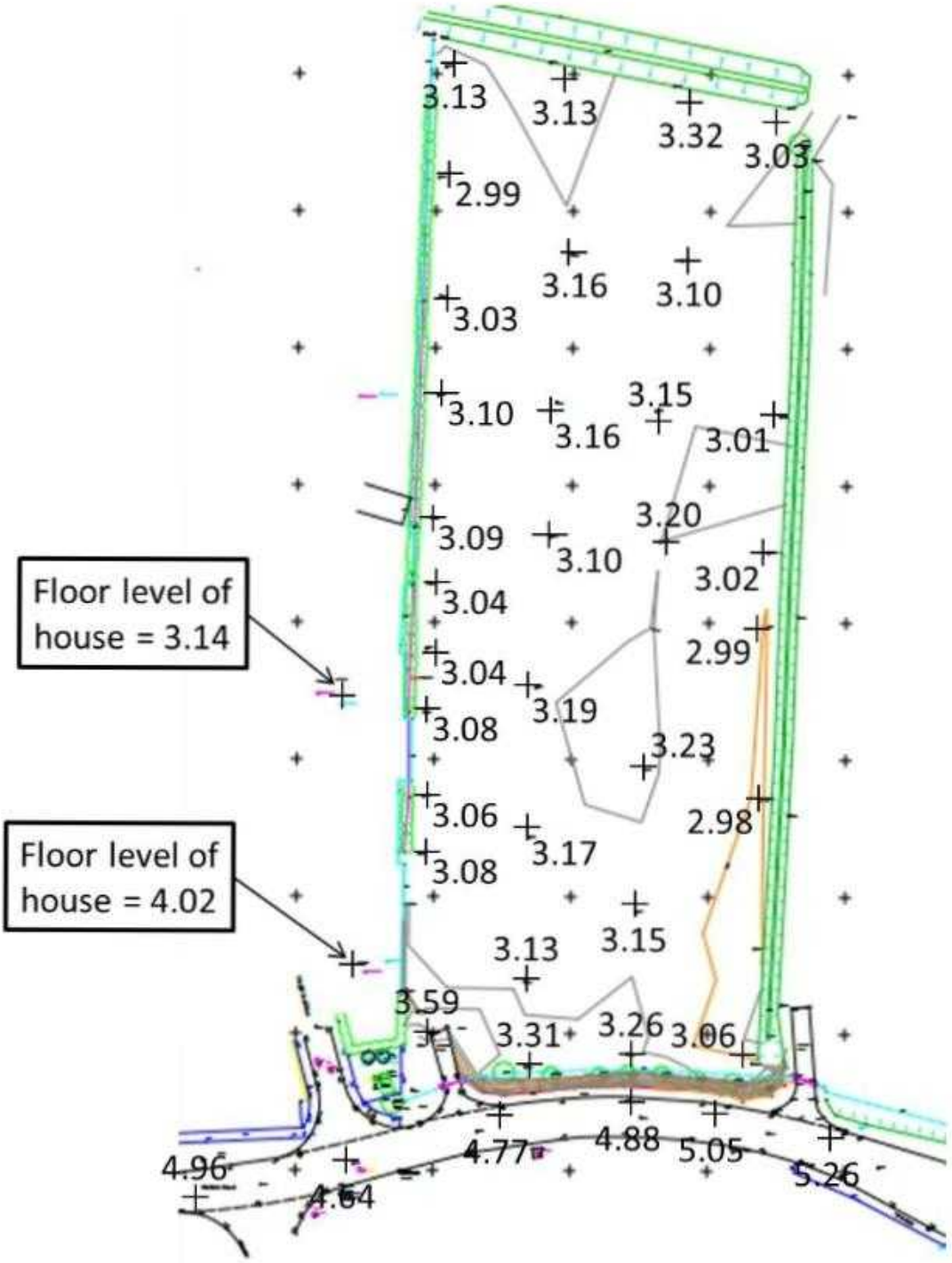
Revn A: 12th July 2016 Recommendations amended

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

Table 2: Recommended national precautionary sensitivity ranges for peak rainfall intensity, peak river flow, offshore wind speed and wave height

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

Revised 2016 EA Guidance

Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%

For 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 the River Glen

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

The SFRA does not predict any residual flooding on any part of the site in a 1 in 200 year event in 2115. The risk of flooding from the tidal River Welland is extremely low due to the reasons set out on page 7 of this report.

An increase of 100mm in maximum tidal levels is unlikely to change the maps in the SFRA to predict flooding on the development site.

The precaution of recommending that the new two story buildings should have a ground floor level of 3.50m OD should still ensure that no flooding will occur to properties.

2) Flooding from the River Glen

The contingency allowance for river flows in the SFRA compared with the guidances, assuming a river flow of 50 cumecs, is shown below:

Year	SFRA	2013 guidance	Revised 2016 guidance
1990	50	50	50
2055	60	-	63.25
2115	72	66	93 (+86%)

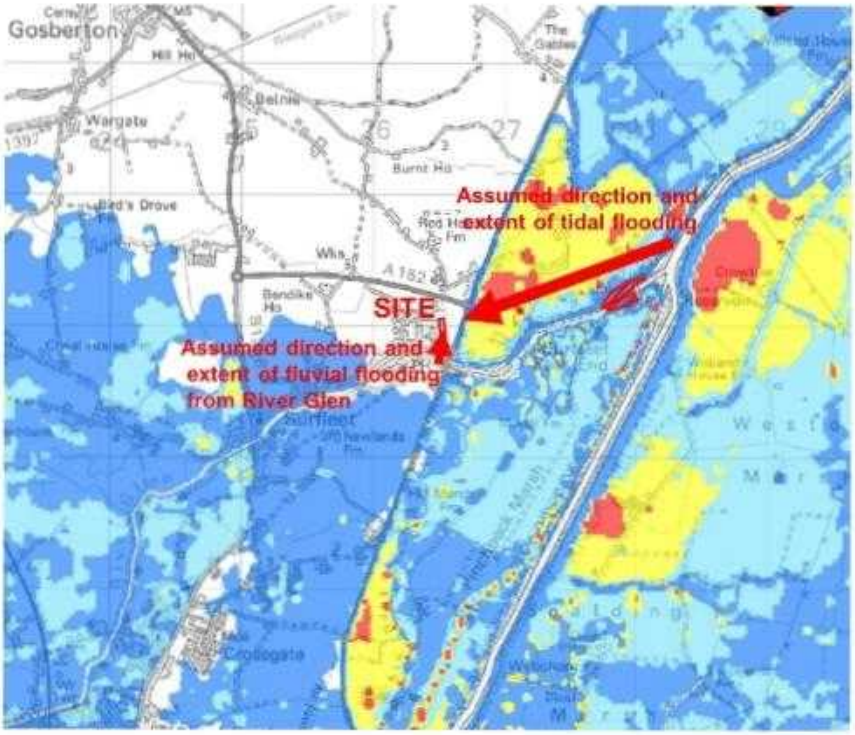
The revised 2016 guidance figures use the higher central allowance band of figures given in the 2016 guidance. However if the upper end allowance is used the 2115 figure increases to 139 cumecs, an increase of 178% over the 1990 figures.

These figures seem to be very high for use in fenland rivers with a percentage of pumped inflows from IDB systems, and at first it can be concluded that the overall impact on river systems such as the fluvial River Glen could be very large.

In practice what would happen in the River Glen if there were large increases in flow would be that extensive flooding would occur in the upper reaches of the catchment. There may be a small increase in predicted river levels in the River Glen south of the site, but this would not be large enough to increase the flood depth on the site if the banks of the River Glen were overtopped at this location.

Conclusions

The 1 in 200 year residual flood depth map in 2115 is shown below:



It can be seen that the predicted tidal flooding from River Welland seems to only extend as far as the new A16 road. It can be assumed that this would still be the case with the small increase in predicted tide levels.

The amended climate change guidance does increase predicted river and fluvial flows. However in a fenland river such as the Glen this will have the effect of causing extensive flooding in the upper reaches of the catchment.

Therefore it is concluded that the proposed floor level of 3.50m OD will be a satisfactory level so that the risk of flooding to the proposed new dwellings in a 1 in 200 year event in 2115 with the new allowances for climate change is extremely low.