# PROPOSED DEVELOPMENT WEST OF MILL DROVE SOUTH, COWBIT, SPALDING, PE12 6FS

# FLOOD RISK ASSESSMENT



View of site from south end

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Peterborough

PE3 6BY

This flood risk assessment has been prepared solely to support the planning application for a development west of Mill Drove South, Cowbit. 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

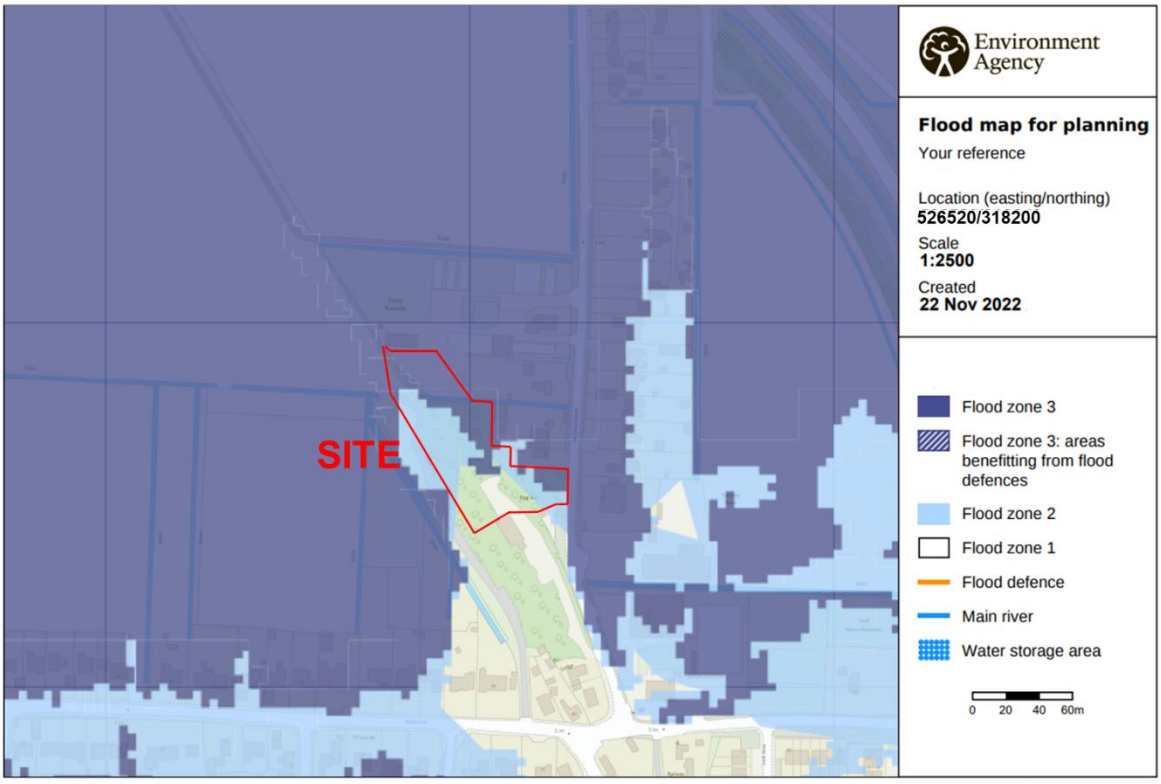
A residential development is proposed on the west side of Mill Drove South, north of the Railway Goods Shed in Cowbit, Spalding, PE12 6FS. The proposed development includes the construction of twenty one dwellings on the site. The site is located on the eastern side of the village of Cowbit and is approximately 5 km from Spalding. A planning application was approved for a larger area on both the east and west side of Mill Drove South (reference H01-0871-18) and this proposed development is part of that area.

The site of the proposed development is within Flood Zones 1, 2 and 3 as shown on the Environment Agency's Flood Zone map below.

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 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.



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It can be seen that the site is within flood zones 1, 2 and 3.

## Application Site

The National Grid Reference of the centre of the site is 526520, 318200.

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 part of the proposed development site within flood zone 3 can be categorised as 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 a dwelling house is classified as "more vulnerable".

Table 3 of the Guidance is shown on the next page:

| 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 * | ✗ | ✗ | ✗ | ✓* |

Therefore it can be seen that for "More vulnerable" development to be satisfactory in flood zone 3 the sequential and exception test need to be 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.

As the site is part of a larger site that has been granted outline planning permission the principal of development on this site has been agreed by the Council.

The safety of the site will be delivered by ensuring the ground floor level is above the predicted flood level in 2115.

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

| | |
|---|---|
| For the present day | Depth of flooding … zero |
| | Extent of flooding .. Low or medium flood probability |
| | Peak Velocity ……. Nil |
| For year 2115 | Depth of flooding …. 0 – 1.0 metre |
| | Extent of flooding….. High Risk |
| | Peak Velocity …… 0 – 0.1 metres/second |

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

| | |
|---|---|
| For the present day | Depth of flooding …. 0 – 1.0 metre |

Extent of flooding .. High Risk
Hazard rating…… 0 – 1.25 (Danger for some)
Peak Velocity …. 0 – 0.3 metres/second

For the year 2115 Depth of flooding … 0mm – 1.0 metre
Extent of flooding .. High Risk
Hazard rating…… 0 - 1.25 (Danger for some)
Peak Velocity .. 0 – 0.3 metres/second

Figure 16 of the general maps show that the site is not within the rapid inundation zone for the present day and 2115.

Maximum flood level and bank levels in the tidal section of the River Welland

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 and 7.5km north of the development site, 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 south side of the Coronation Channel between chainage 2.5 km and 3.2 km.

| | 2007 | 2115 |
|---|---|---|
| Peak 1 in 100 year flood level | 4.36m OD | 4.69m OD |
| Peak 1 in 1,000 year flood level | 4.38m OD | 4.69m OD |

The bank levels on this section vary between 5.35m OD and 5.9m OD. Therefore it can be seen there is a minimum freeboard of 650mm to the predicted design maximum levels in 2115.

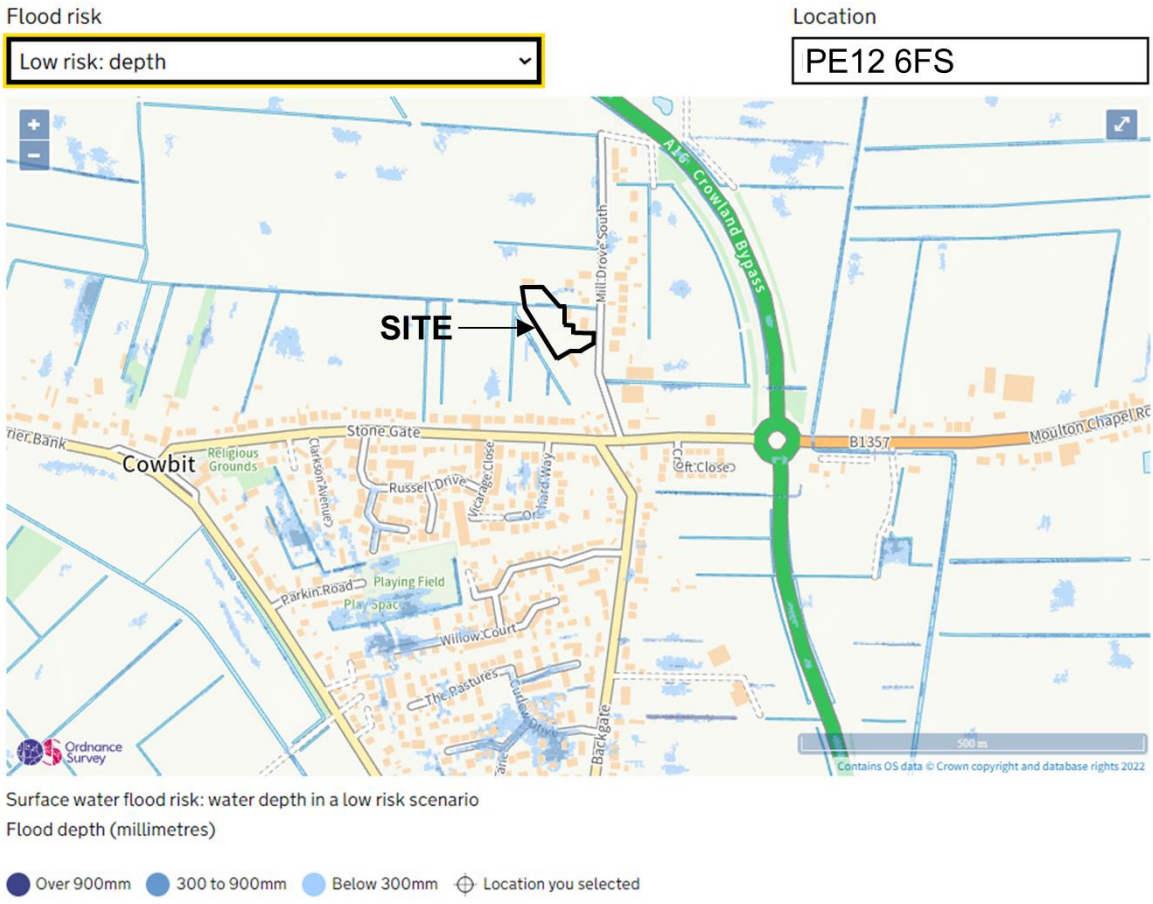
Tables in the SFRA show the following details of the maximum predicted levels in the fluvial section of the River Welland between chainage 4.5 km and 5.0 km.

| | 2007 | 2115 |
|---|---|---|
| Peak 1 in 100 year flood level | 4.57m OD | 4.69m OD |
| Peak 1 in 1,000 year flood level | 4.59m OD | 4.69m OD |

The levels of the Barrier Bank on this section are 5.9m OD. Therefore it can be seen there is a minimum freeboard of 1200mm to the predicted design maximum levels in 2115.

## Information on Surface Water Flooding on Environment Agency Website

The map below shows areas around the site where there is a low risk of surface water flooding. The light blue areas indicate the low risk of up to 300mm of surface water flooding, and the darker blue areas indicate that between 300mm and 900mm of surface water flooding could occur.




It can be seen the map does not predict any surface water flooding in this area of Cowbit.

## 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.

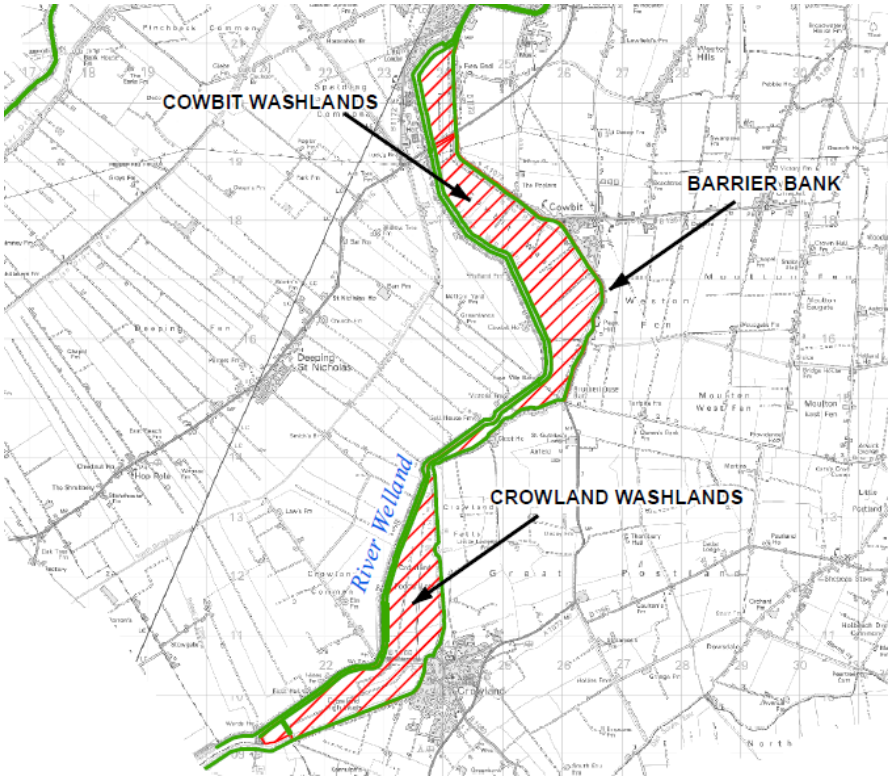
The site is located approximately 7.5 km south of the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located approximately 450 metres east of the Barrier Bank which is the eastern bank of the Cowbit Washes.

The site is located approximately 3.2 km from the south bank of the Coronation Channel which is maintained by the Environment Agency.

The internal watercourses in the area are maintained by South Holland IDB.

The section of the River Welland from south of Crowland to the southern outskirts of Spalding has two washlands located on the east side of the River, called Crowland Washlands and Cowbit Washlands. These areas are designed to alleviate very high flows in the River Welland. When the water level in the River Welland reaches a level of approximately 5.00m OD large syphons are activated which discharge excess water onto the Washes. The Barrier Bank is located on the east side of the Washes to contain the water in the Washlands and is the main flood defence bank on the east side of the river.




## Existing Ground Levels

A topographical survey of the site was carried out and some of these levels from this survey have been reproduced on a plan shown on page 15 of this report.

Levels on the site vary between 3.04m ODN on the southern end of the site and 1.86m ODN adjacent to the IDB watercourse which is located towards the northern end of the site.

The level of Mill Drove South east of the site is between 2.46m and 2.58m ODN.

## Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Welland or the Wash
2. Failure or Overtopping of the Coronation Channel
3. Failure or overtopping of the Barrier Bank
4. High water levels in IDB drainage channels.
5. Localised flooding in the area.

### 1. Failure or overtopping of tidal defences of the River Welland or the Wash

The nearest tidal defences are the banks of the River Welland north of Spalding, which are 7.5km north of the site.

The SFRA maps indicate floodwater from a breach in the tidal bank in a 1 in 200 year event in 2115 would probably reach the A151 Spalding to Holbeach Road, but not spread any further south.

Therefore this source of flooding can be considered remote and will be adequately mitigated by the raising ground floor levels above the predicted flood level in a 1 in 200 year event in 2115.

### 2. Failure or Overtopping of the Coronation Channel

The SFRA states that the maximum design level in the Coronation Channel is 4.69m OD. The minimum crest level of the south bank of the Channel is 5.35m OD, which gives a minimum freeboard of 650mm. However, generally there is a freeboard of at least 800mm along this bank of the Channel.

The maps in the SFRA predicts that the residual flood depth in a 1 in 100 year event in 2115 could be up to 500mm. This could be result of a breach occurring in the bank of the Coronation Channel.

The new A16 road north of Cowbit will have some effect in slowing down the flow from a breach in a 1 in 100 year event.

This risk will be adequately mitigated by the raising ground floor levels above the predicted flood level in a 1 in 100 year event in 2115.

### 3. Failure or overtopping of the Barrier Bank

The Barrier Bank is the eastern bank of the Cowbit Washes. The Washes are only flooded in extreme conditions (around 1 in 50 years) and are used the rest of the time as agricultural land. There are two syphons which operate automatically to allow water to flood on to the Washes and alleviate high water levels in the River Welland. When this occurs the level of water in the washes will quickly rise to probably around 4.70m OD.

As the road level on top of the bank is 5.9m OD, it is unlikely that the bank will be overtopped along this length between Backgate and Stone Gate. The possibility of a breach occurring in this section of bank is remote as there is a very shallow back slope

to the bank, and there is the road on the top of the bank. There is a greater chance of the bank breaching north of Stonegate of south of Backgate where the bank slopes are steeper.

The SFRA predicts that the residual flood depth in a 1 in 100 year event in 2115 could be up to 1.0 metres deep. This could be the result of a breach in the Barrier Bank.

This risk will be adequately mitigated by the raising ground floor levels above the predicted flood level in a 1 in 100 year event in 2115.

## 4. High Water Levels in IDB drains

Although the whole of this area is below high tide level and levels in the rivers, the retained water levels in the drainage channels ensure that the risk of flooding is extremely low. South Holland IDB maintains a system of sluices, pumping stations, and drainage channels which convey surface water into the River Welland, the Wash and the River Nene to control water levels throughout the South Holland IDB area.

South Holland IDB maintain drainage channels in this area. There is a piped IDB watercourse that crosses the northern part of the site. At present part of this is an open drain and part is piped. The proposed layout of the site (shown on page 15 of this report) shows the open section of the drain will be piped as part of the development. This drain flows eastwards then northwards to flow into the Clowacre Drain. This flows eastwards to discharge into the Wheatmere Drain (B35) which flows southwards into the South Holland Main Drain (B30). The water level in the South Holland Main Drain is controlled by Wisemans Pumping Station.

Wisemans Pumping Station is operated and maintained in excellent condition by South Holland IDB and the likelihood of flooding due to this source is low. IDB systems are designed to provide a freeboard of between 600mm and 1000mm to all land in a 1 in 10 year return period rainfall event. South Holland IDB watercourses generally state that their watercourses provide a standard of 1 in 100 years with a freeboard of 300mm in urban areas. In an extreme event water levels will rise but this will be a slow process and it would be at least 24 hours before levels were high enough to begin to flood low land in the area, and after this the level of the flood water would need to rise another 1.0 metre before the development site would be affected.

The channels maintained by South Holland IDB in urban areas are classified as high priority watercourses and as such receive a higher maintenance priority.

There are possibilities of failure of outfall sluices, but these are mitigated by the high level of maintenance given to these structures by the IDB. If a failure did occur the IDB would immediately be warned of the problem by their telemetry system and take action to repair the fault or to bring in temporary pumps to reduce the risk of any flooding in the area. Similarly any failures of culverts or other blockages would be dealt with immediately.

Therefore the risk of flooding from IDB drainage channels can be considered to be extremely low, and will be adequately mitigated by the raising ground floor levels above the predicted flood level in a 1 in 100 year event in 2115.

## 5. Localised Flooding in the area

It is anticipated that the surface water from the houses will be discharged into soakaways. The hardstandings should be constructed with permeable paving or gravel. The soakaways will be designed to BRE digest 365 using rainfall values for a 1 in 100 year event with 30% increase for climate change and approved under the Building Regulations.

The Environment Agency map showing risk of surface water flooding does not predict any risk to the site from this source.

This surface water disposal system along with the raising of ground floor levels will adequately mitigate the risk of surface water flooding to this development.

### Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of this area of Cowbit having been flooded in the past 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 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 16 to 19). 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 part of the development is in flood zone 3 and the predicted flood hazard is 0.75 – 1.25 (danger for some) reference should be made to Category E8 which shows the following advice.

*The NPPF requires that the proposal is accompanied by a Flood Risk Assessment which contains evidence that appropriate mitigation measures / flood resilience techniques have been incorporated into the development.*

*The applicant is advised to refer to the following document for information on flood resilience and resistance techniques to be included "Improving Flood Performance of New Buildings – Flood Resilient Construction (DCLG 2007)"*

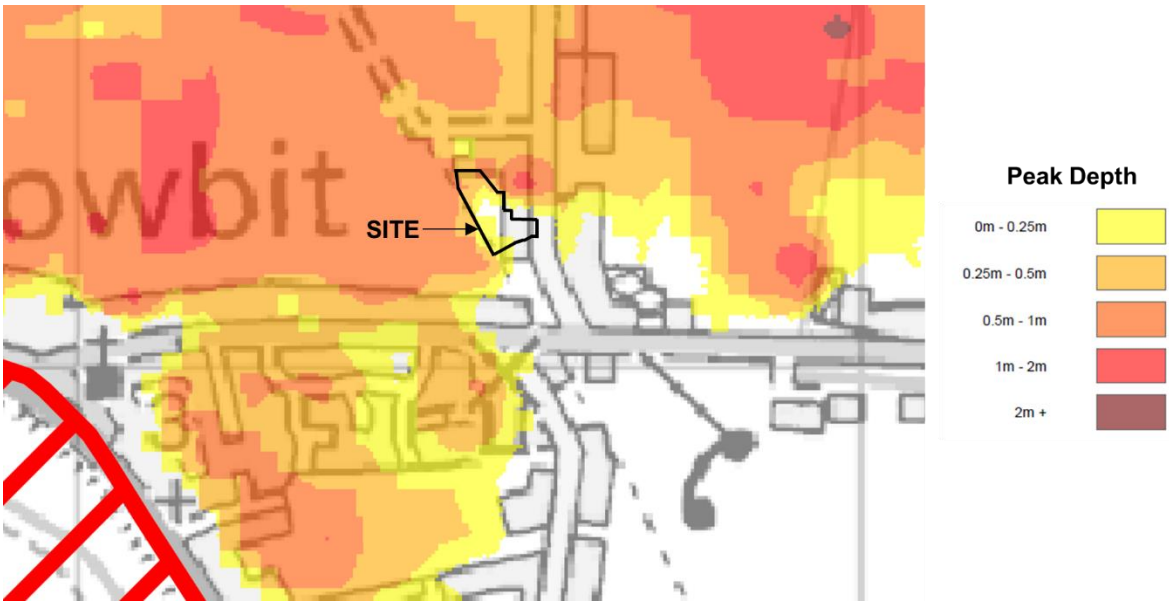
*Finished floor levels (FFL) should be informed by the predicted flood depth maps (refer to the relevant 2115 1% fluvial or 0.5% tidal maximum depth map) and set as required below (single storey proposals must use the 0.1% event, 2115 scenario, for setting FFLs).*

*For flood depths of 250mm – 500mm, FFL should be set 500mm above ground level with flood resilient construction to a height of 300mm above the predicted flood depth.*

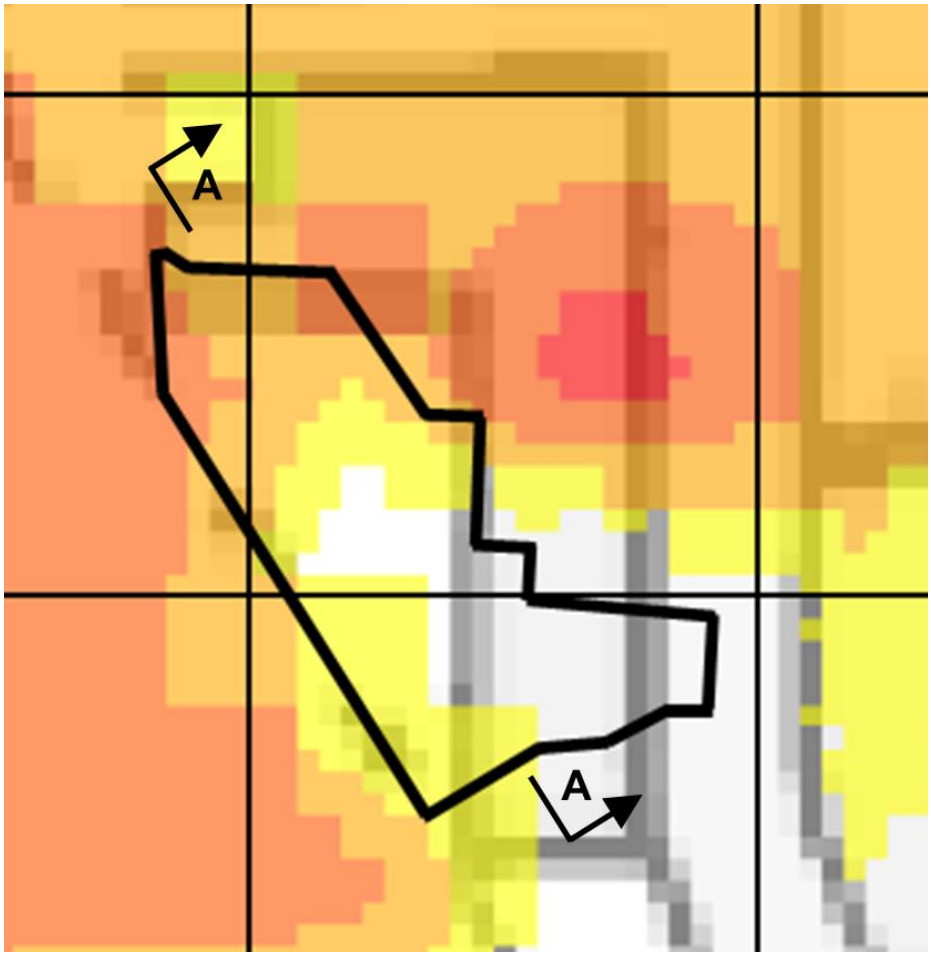
*For flood depths of 0 – 250mm, FFL must be set 300mm above ground level.*

**Conclusions**

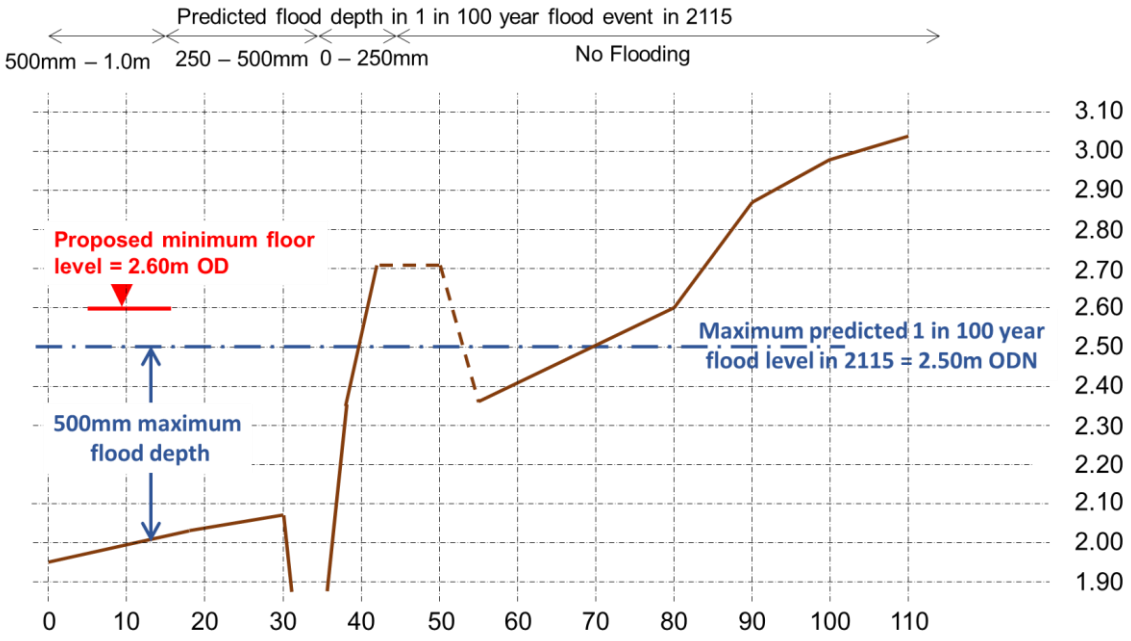
The plan (shown below) of predicted depths of flooding in the SFRA show residual flood depths of between zero (no flooding) and 1.0 metre with some very small areas shown to be within the 1.0 to 2.0 metre band.




The relevant part of the map has been enlarged which is shown on the next page.




A cross section has been drawn through the site as shown on the map above, using the levels from the topographical survey. This is shown below.




The correlation between the levels on the topographical study and the predicted flood depths are inconsistent.

It can be seen that it is difficult to come to an exact conclusion, but the best fit for the predicted 1 in 100 year flood level in 2115 is 2.50m ODN.

The levels along Mill Drove South can be tabulated and compared with the levels taken in the topographical survey, as shown below.

| | 250mm – 500mm | | | 0 – 250mm | | No flooding | | | |
|---|---|---|---|---|---|---|---|---|---|
| Level | 2.43 | 2.49 | 2.54 | 2.53 | 2.58 | 2.49 | 2.46 | 2.46 | 2.51 |

As can be seen the levels and the predicted flood depths do not give a reasonable fit, but using the “no flooding” levels would confirm the flood level of 2.50m ODN is the best possible estimation.

The risk of flooding to the building from IDB drains can be considered low, especially as the ground floor level will be raised 300mm above ground level.

The IDB have adequate arrangements to bring in contractors and use their own staff if a failure of any part of the pumping stations or the sluices occurred. If drains become full any flooding that would occur would happen very slowly and affect lower land in the area before the development site. It would be very unlikely to reach a level above 2.75m OD and flood the proposed development.

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

**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 finished ground floor level of the proposed new buildings should be a minimum level of 2.60m ODN, or 300mm above the existing ground level where the ground level is higher than 2.30m ODN.

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

The developer should be aware that there is an IDB piped drain on the western side of Mill Drove South. The IDB has a Bye Law which restricts development within 9.0 metres of an IDB watercourse.

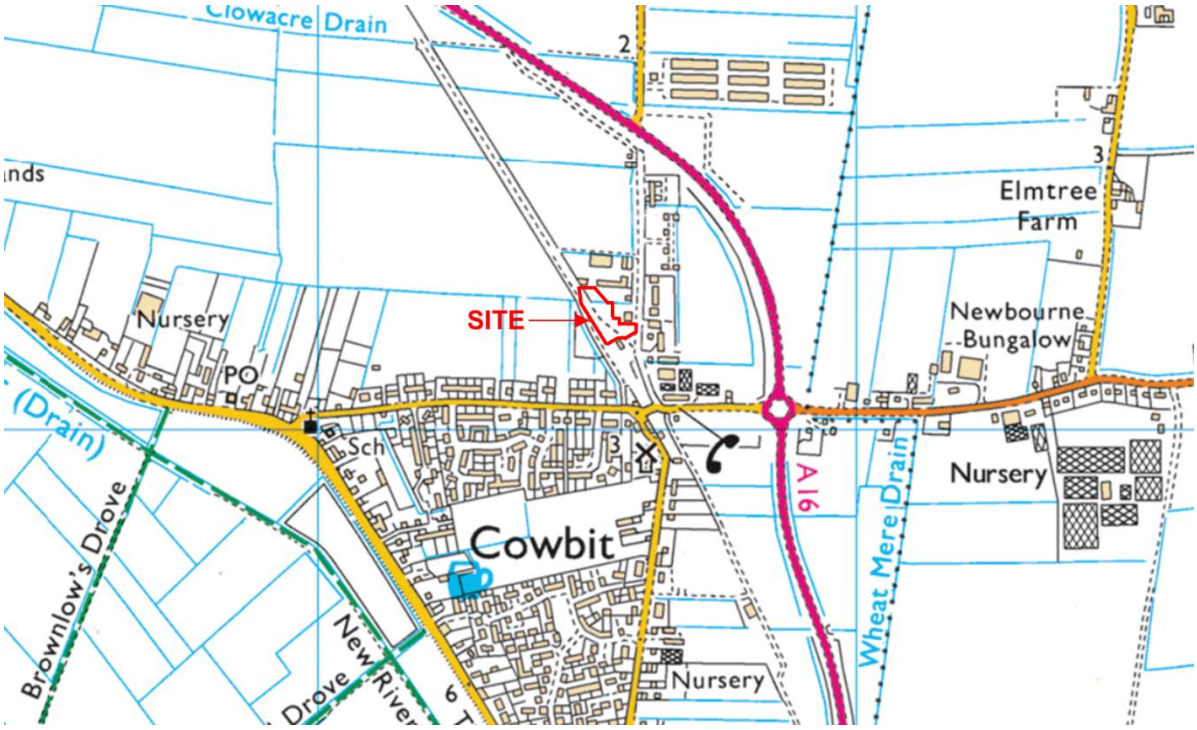
Rainwater from the roofs of the buildings should be discharged if possible into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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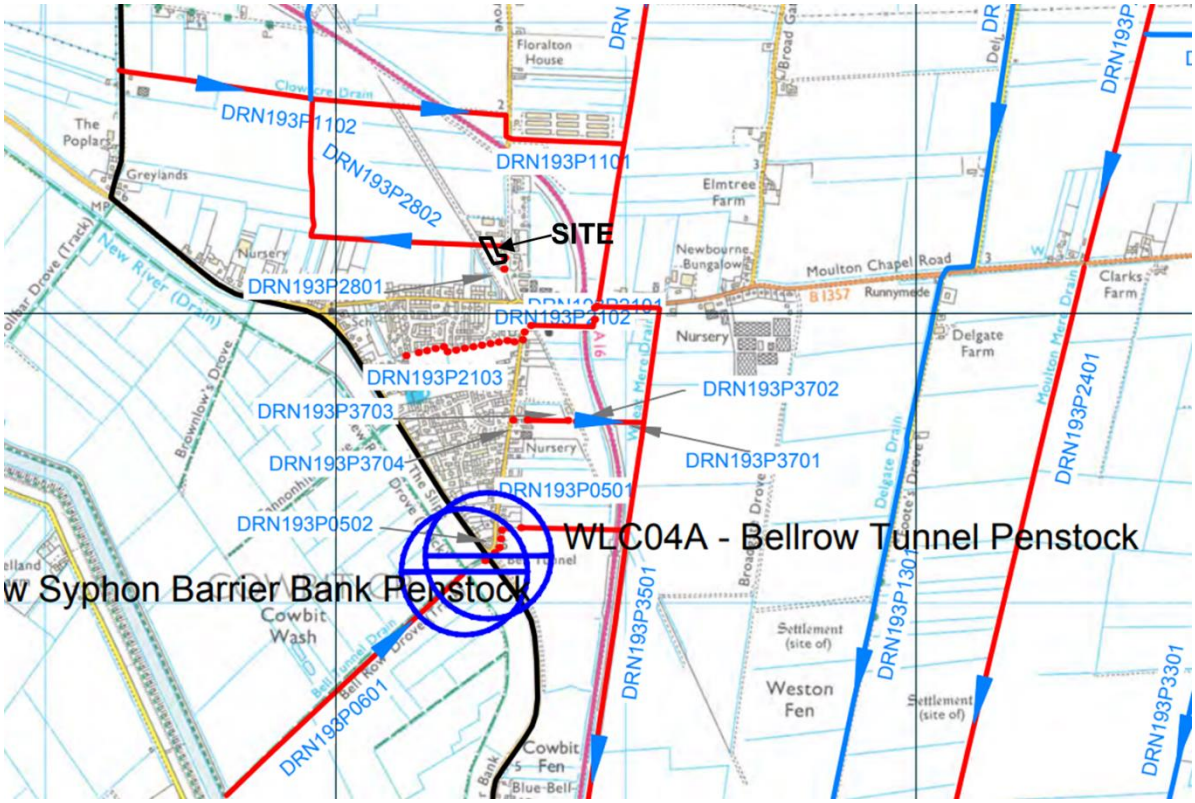
stuart.hemmings@btinternet.com

8th December 2022

## LOCATION PLAN



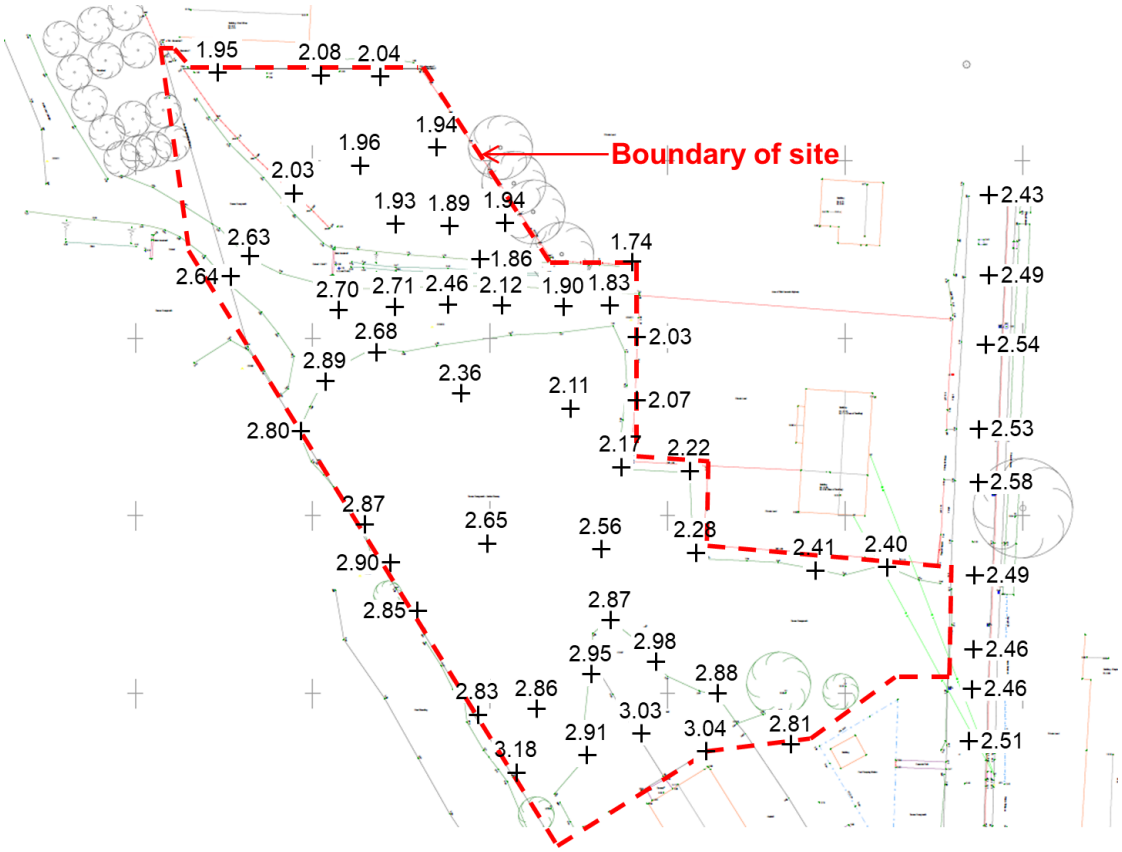

## PLAN OF IDB DRAINS



## PLAN OF PROPOSED DEVELOPMENT




## PLAN OF EXISTING GROUND LEVELS



## 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'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 1 the central and higher central 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 first 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. Although the maps in the SFRA indicate flood depths of up to 500mm could occur on the site this report has concluded that it is unlikely to be

the result of tidal flooding. The small increase in maximum tide levels will not change the predictions of flood depth on this site.

2) Flooding from River Welland, Coronation Channel 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 25%, should firstly be considered. After considering the effects of this increase the higher central, which is 35%, 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 25% and 35% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the Coronation Channel or the Barrier Bank. 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 a minimum level of 2.60m ODN or 300mm above the existing ground level where the ground level is higher than 2.30m ODN, is acceptable.