

**PROPOSED DEVELOPMENT AT 1 PARK LANE, SURFLEET,
SPALDING, PE11 4AF.**

FLOOD RISK ASSESSMENT



View of proposed site looking east

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This flood risk assessment has been prepared solely to support the planning application for the proposed development at 1 Park Lane, 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

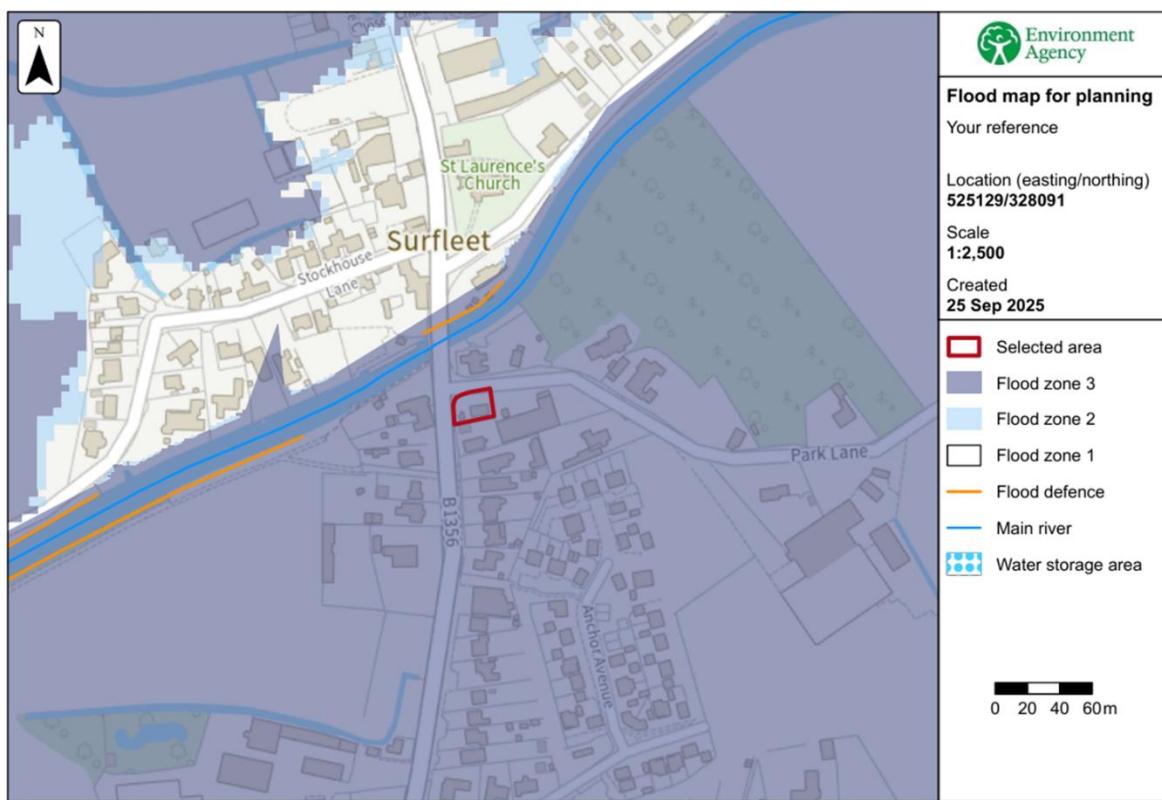
A planning application is due to be submitted to South Holland District Council for permission to construct three dwellings on the site at 1 Park Lane, Surfleet. Spalding, PE11 4AF. The office building at present on the site will be demolished.

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 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 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.

Environment Agency (EA) Flood Zones

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



It can be seen that the whole of this area of Surfleet south of the River Glen is in Flood Zone 3.

Application Site

The development is located on the western side of the River Welland. The National Grid Reference of the site is 525130 328090.

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

As the site of the proposed development is within a defended area it can be considered to be within Flood Zone 3(a) "High Probability", as defined in Table 1 of the Technical Guidance.

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

Table 3 of the Guidance is shown below:

| <u>Flood Zones</u> | <u>Flood Risk Vulnerability Classification</u> | | | | |
|--------------------|------------------------------------------------|-------------------------|-------------------------|-----------------|------------------|
| | 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 considered for this 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.

All of this area of Surfleet south of the River Glen is within flood zone 3, and therefore it is unlikely that an alternative site can be found within flood zones 1 or 2 with a lower risk of flooding.

The site of this proposed development is within the existing urban boundary and the South East Lincolnshire Local Plan adopted in March 2019 recognises in paragraph 5.3.5 that infill and speculative applications will come forward within the South Holland

District Council area. It states that there will be numerous opportunities for infill developments which it is not practical to identify, and the plan encourages these types of developments provided that the material considerations of the Local Plan and particular sites are met. The existing commercial building is unused and therefore this development will provide further residential dwellings in this area.

The safety of the development will be delivered by demonstrating that the ground floor level of the proposed building is above the predicted flood levels in this area.

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

A Strategic Flood Risk Assessment (SFRA) was produced for the South Holland District Council (SHDC) in 2010. This document provides details of the flood risk in the Council's area.

The maps in this document 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 |
| | Peak Velocity Greater than 0.25m/sec |

The maps showing the residual flood hazards 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 for the 1% fluvial or 0.5% tidal event probability are as follows:

| | |
|---------------------|--------------------------------------------|
| For the present day | Depth of flooding.... 0 – 500mm |
| | Extent of flooding ... High |
| | Hazard 0.75 – 1.25 (Danger for some) |
| | Velocity 0 – 0.3 m/sec |
| For the year 2115 | Depth of flooding 0 – 1.0 metre |
| | Extent of flooding ... High |
| | Hazard 1.25 – 2.0 (Danger for most) |
| | Velocity 0.3 – 1.0 m/sec |

Figure 16 of the general maps in the 2010 SFRA show that the site is not within the rapid inundation zone for the present day but will be within the zone in 2115.

The extreme tide levels in the section of the River Welland north of Fulney Lock at chainage 18.5km is shown in the 2010 SFRA 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 |

The bank levels for the 600 metres north of Fulney Lock are approximately 7.00m OD but further north (chainage 18.0 – 19.0) the bank levels are between 7.50m and 7.80m OD.

The maximum flood levels in the River Glen at chainage 3.3km are shown in the 2010 SFRA as follows:

| | Present | Present + Climate Change |
|-----------------|---------|--------------------------|
| 1 in 100 year | 4.23 | 4.65 |
| 1 in 1,000 year | 4.34 | 4.68 |

The bank levels around chainage 3.3km are shown below.

| Chainage (km) | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 |
|------------------|------|------|------|------|------|------|------|------|
| Bank level (mOD) | 5.28 | 5.72 | 5.96 | 4.89 | 4.25 | 5.19 | 5.15 | 5.35 |

Maximum flood levels in the Vernatt's Drain at chainage 2.0km are shown in the reports as follows:

| | Present | Present + Climate Change |
|-----------------|---------|--------------------------|
| 1 in 100 year | 3.75 | 3.75 |
| 1 in 1,000 year | 3.75 | 3.75 |

The bank level between 1.4km and 2.0km is 6.00m OD, between 2.1km and 2.3km it is 4.35m OD and 2.4km to 3.0km it is 4.35m OD.

Information from the Environment Agency

The Environment Agency has provided information for this site reference EIR2025-31917.

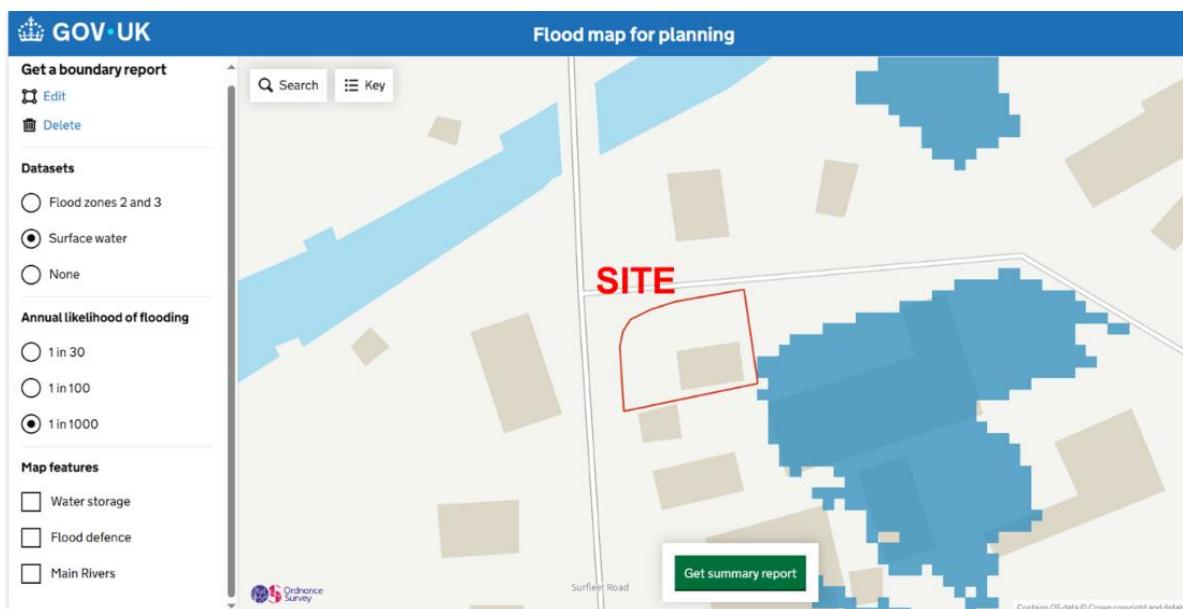
The predicted flood levels for the River Glen which are taken from the Welland Catchment Model (2016) are shown as:

| | 2007 | 2115 |
|----------------------------------|----------|----------|
| Peak 1 in 100 year flood level | 4.26m OD | 4.78m OD |
| Peak 1 in 1,000 year flood level | 4.38m OD | 4.81m OD |

The EA also provided a map, reproduced on page 15, which shows the modelled flood extents with defences, which was produced with the Welland Glen Model (2016). This does not predict any flooding in the immediate area of the proposed site south of the River Glen in a 1 in 1000 year event with 20% increase for climate change.

Information on Surface Water Flooding on Environment Agency Website

The map below shows the annual likelihood of surface water flooding in this area of Surfleet south of the River Glen in a 1 in 1000 year event.



The above map does not predict that any surface water flooding will occur on the site in a 1 in 1000 year event.

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 60 metres south of the River Glen, which is main river and maintained by the Environment Agency.

The site is approximately 2.1 km west of Vernatts Drain which is maintained by Welland and Deepings IDB.

The site is approximately 2.3 km west of the tidal section of the River Welland to the east, which is main river and maintained by the Environment Agency.

There are open drainage channels and piped drains in the Pinchbeck area which are maintained by Welland and Deepings Internal Drainage Board.

Site Levels

A topographical survey of the site has been produced and will be submitted as part of the planning application. The levels of the site and Park Lane have been transferred onto the plan which is shown on page 14 of this report. The levels of Park Lane are shown to fall from 5.36m OD at the junction with Surfleet Road to 4.72m OD north east of the site. The levels immediately north of the existing building fall from a level of 5.19m OD at the edge of Surfleet Road to 4.52m OD on the eastern boundary of the site.

The ground floor level of the existing building is shown on the survey to be 4.94m, 5.02m and 5.04m OD, an average of 5.00m OD.

The ground levels immediately south of the existing building are shown to be between 4.55m and 4.65m OD.

Potential Sources of Flooding

The following sources of flooding will be considered:

1. Failure or overtopping of the tidal defences.
2. Overtopping of the River Glen.
3. Flooding from Vernatts Drain
4. Flooding from IDB watercourses
5. Flooding from a failure of IDB Pumping Stations
6. Surface water flooding

1. Failure or overtopping of tidal defences.

The River Welland is tidal north of Fulney Lock, which is approximately 4.0km south 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 would be overtopped with a 0.5% probability event. It is more likely that a breach would occur in the 600 metres length alongside West Marsh Road immediately north of Fulney Lock than the higher bank north of this section of bank. However if overtopping or a breach occurred water would flow westwards from the tidal Welland and would flood into Vernatts Drain which would reduce the impact of this flood.

It is reasonable to presume that within the next one hundred years works will be undertaken on this lower section of the bank to ensure that there will be a 1 in 200

year standard of defence continuing into the future, especially considering the value of the industrial and residential properties protected by these defences.

It is considered that the precaution of raising floor levels to mitigate the risk of flooding from the River Glen will provide adequate mitigation against the risk from this source.

2. Overtopping of the River Glen.

The predicted maximum 1 in 100 year water level at the present time is 4.26m OD and the predicted maximum water levels with 20% climate change is 4.78m OD. Although the actual risk is extremely low there is a residual risk if the defences were to fail. The River Glen does not have a 1 in 100 year standard of service at the present time, and the flood risk will increase in the future unless work is carried out by the EA to raise banks. The most common reason for breaches is overtopping of earth banks. This type of failure is more likely to happen at locations to the west of Pinchbeck where the earth banks are lower.

This source of flooding is the greatest risk to the site, and the hazards will be reviewed later in this report.

Adequate mitigation against flooding to the proposed building will be provided by raising the ground floor level to be above the predicted flood levels in a 1 in 100 year event in 2115.

3. Flooding due to high water levels in Vernatt's Drain

The SFRA states that the maximum water level in Vernatt's Drain is 3.75m OD. This is 500mm below the lowest bank levels of 4.25m OD shown in the 2010 SFRA. This maximum water level is lower than the proposed finished ground floor level of the new building and therefore this source of flooding can be considered to be adequately mitigated.

4. Flooding from IDB watercourses

Surface water from this area south of the River Glen drains into the Woods Lane Drain which flows in a south easterly direction alongside Woods Lane and Dunnegate Way. This drain discharges into the Old Sea Drain which flows eastwards and then southwards alongside West Marsh Road as far as Pinchbeck Marsh Pumping Station. This pumping station, which is 1.7km south east of the site, pumps excess water into the Blue Gowt Drain which flows northwards and discharges into the River Glen 300 metres west of the outfall sluice on the river.

If a failure occurred in any part of the IDB system water levels would rise in the drainage channels and eventually lower agricultural land outside the Surfleet village area could start to flood.

Drainage channels maintained by the Welland and Deeping IDB generally have a 1 in 10 year standard with up to 1.0 metre of freeboard, which generally provides between 1 in 50 and 1 in 100 year standard against flooding.

The risk of water levels rising to above 3.00m OD in the IDB drain are remote but as the average land levels in the area are lower than 3.00m OD a large area of land would be flooded before the proposed development was affected.

It is considered that the precaution of raising floor levels to mitigate the risk of flooding from the River Glen will provide adequate mitigation against this risk from this source.

5. Flooding from Failures of IDB Pumping Stations

The water in the Old Sea Drain flows to Pinchbeck Marsh Pumping Station. The original pumps at Pinchbeck Marsh had a capacity of 1.5 cumecs, and the new part of the pumping station built approximately ten years ago added a further 1.5 cumecs of capacity. The catchment area that the pumps serve is 850 hectares.

Maximum predicted water levels in the IDB catchment controlled by Pinchbeck Marsh Pumping Station in a 1 in 100 year event in 2115 are below 1.00m OD and therefore this source of flooding can be considered to be adequately mitigated.

6. Surface Water Flooding

Although the level of Park Lane is higher than the existing site level any accumulation of surface water in Park Lane will flow eastwards along Park Lane and will not flow onto the site.

The surface water from the proposed dwellings will be disposed of into soakaways.

The above will provide adequate mitigation against the risk of flooding from surface water to the proposed building.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of any flooding having occurred in this area of Pinchbeck.

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 bank of the River Glen.

The risk of a breach occurring directly north of the site, where land levels are approximately 5.00m OD, is low. Water is more likely to overtop the bank 50 to 100metres east of the site and this flood water would flow in a south easterly direction and not affect the higher western part of Park Lane.

Although this site is within Flood Zone 3 because of the current standards of drainage and flood risk in this area of Surfleet there is a very low risk of flooding to this site.

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 the development is in flood zone 3 and the flood hazard is 1.25 – 2.0 (danger for most) reference should be made to Category D8 which states that the following standing advice is:

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 1.0 – 1.6 metres, proposals must have two stories, with FFL set 1.0 metre FFL above existing ground level with flood resilient construction to a height of 300mm above the predicted flood depth, and demountable defences to 600mm above FFL.

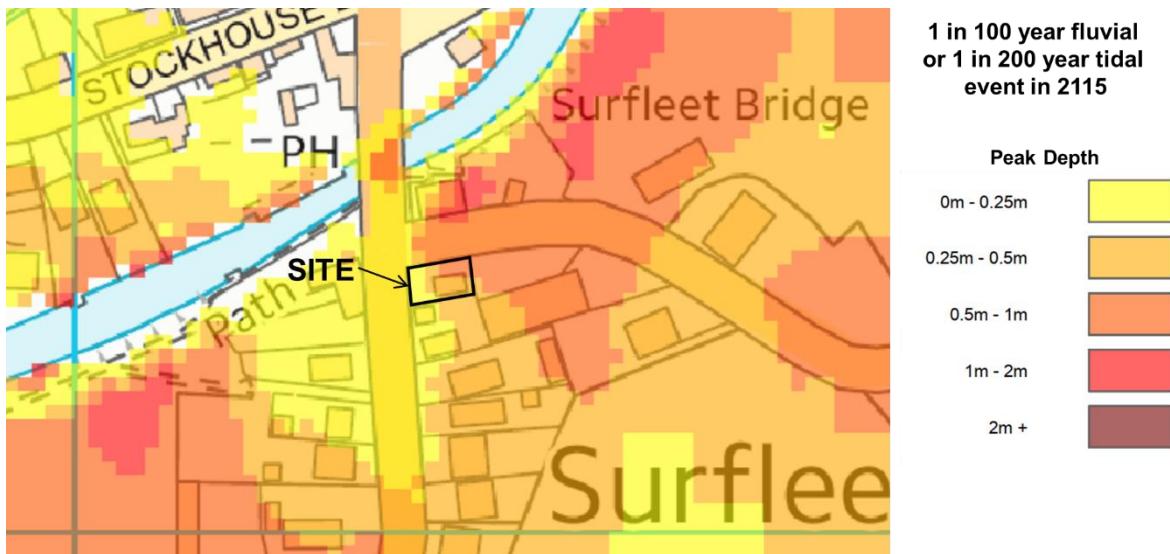
For flood depths of 500mm – 1.0m, FFL must be set 1.0m above existing ground level with flood resilient construction to a height of 300mm above the predicted flood depth.

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

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

Summary of Risk of Flooding to the Site

Part of the map which can be found on the South East Lincolnshire Planning website which shows the residual peak depth in 2115 for the 0.5% (1 in 200 year) tidal and the 1% (1 in 100 year) fluvial event probability is shown on the next page.



It can be seen that this map predicts that there is a risk of between 500mm and 1.0 metre on the north east corner of the site and between 250mm and 500mm on eastern half of the site.

Conclusions

The proposed development is not in a functional flood plain as defined by the Technical Guidance.

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

The risk of flooding if there is a breach in the tidal defences has been shown to be extremely low. Flood water from a breach in the west bank of the River would immediately be held up and flow into Vernatts Drain, and higher land west of Vernatts Drain would further prevent flood water reaching the proposed site in Park Lane.

The highest risk of flooding to the site is considered to be from the River Glen north of the site. The map showing the predicted flood depths shown on page 10 considerably over estimate the flood depths on this site. Looking at the levels along Park Lane, these vary between 5.36m OD to the west and 4.79m OD immediately north of the eastern boundary of the site. The maximum predicted level of the River Glen in a 1 in 100 year event in 2115 is 4.78m OD. However the map showing the predicted flood depths indicates a flood depth of between 500mm and 1.0 metre.

There is a similar discrepancy if the levels of the site north of the existing building are considered.

If the average level of the site is assumed to be 4.65m OD and the proposed dwellings are raised 300mm above this level then a minimum finished ground floor level of 4.95m can be proposed, which is 180mm above the highest predicted flood level in the River Glen in a 1 in 100 year event in 2115. This compares with the level of the existing building of 5.00m OD.

The risk of flooding from any IDB drains will be adequately mitigated by raising floor levels of the proposed building by 300mm above the existing ground level on the site.

This development will not increase flood levels elsewhere in this area.

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

The finished ground floor level of the proposed buildings should be a minimum level of 4.95m OD which is approximately of 300mm above the average existing ground level on the site.

The developer should inform future occupants of these dwellings that they should register with the Environment Agency's Floodline Warnings Direct Service to receive automatic telephone flood warnings.

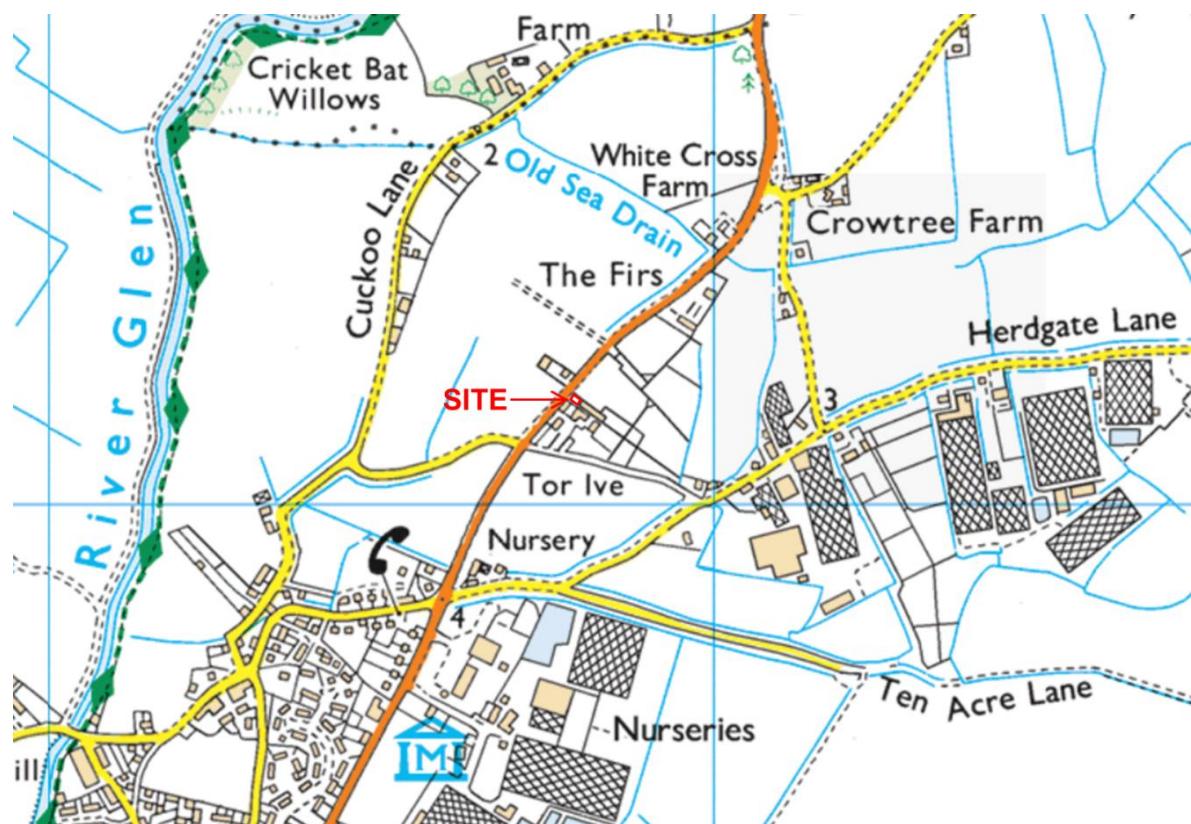
The surface water from the roofs of the proposed building should if possible be discharged into soakaways. These should be designed to comply with the recommendations of BRE 365 and approved under the Building Regulations.

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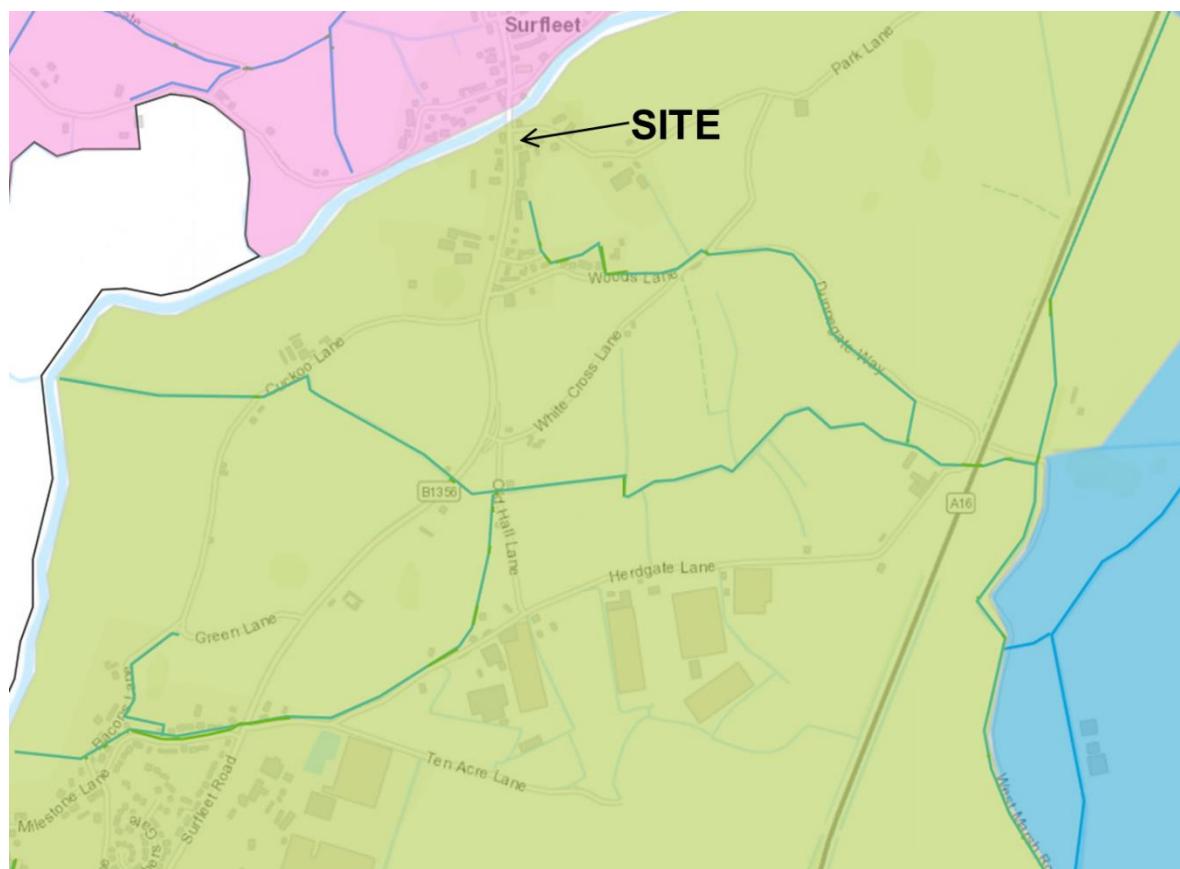
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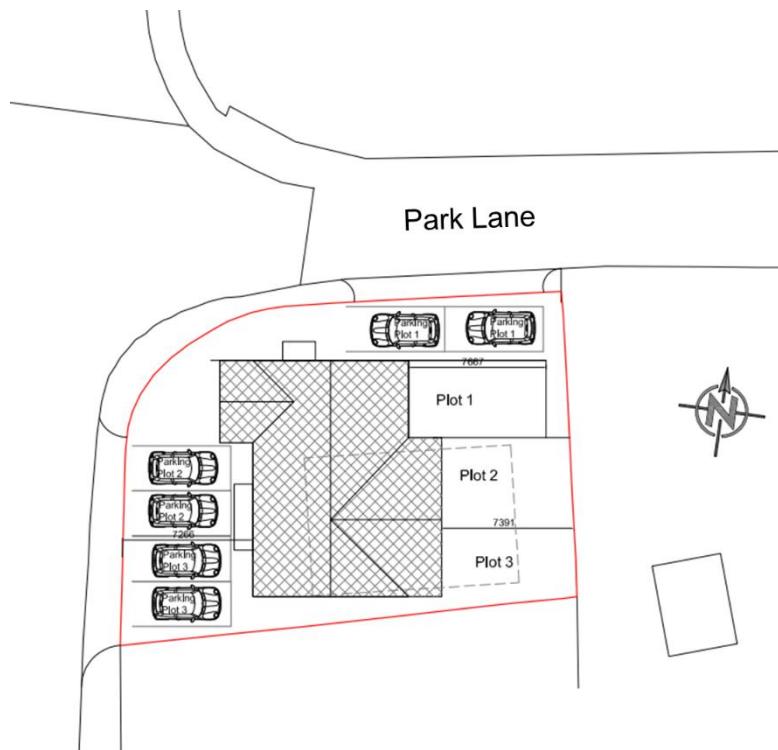
LOCATION PLAN



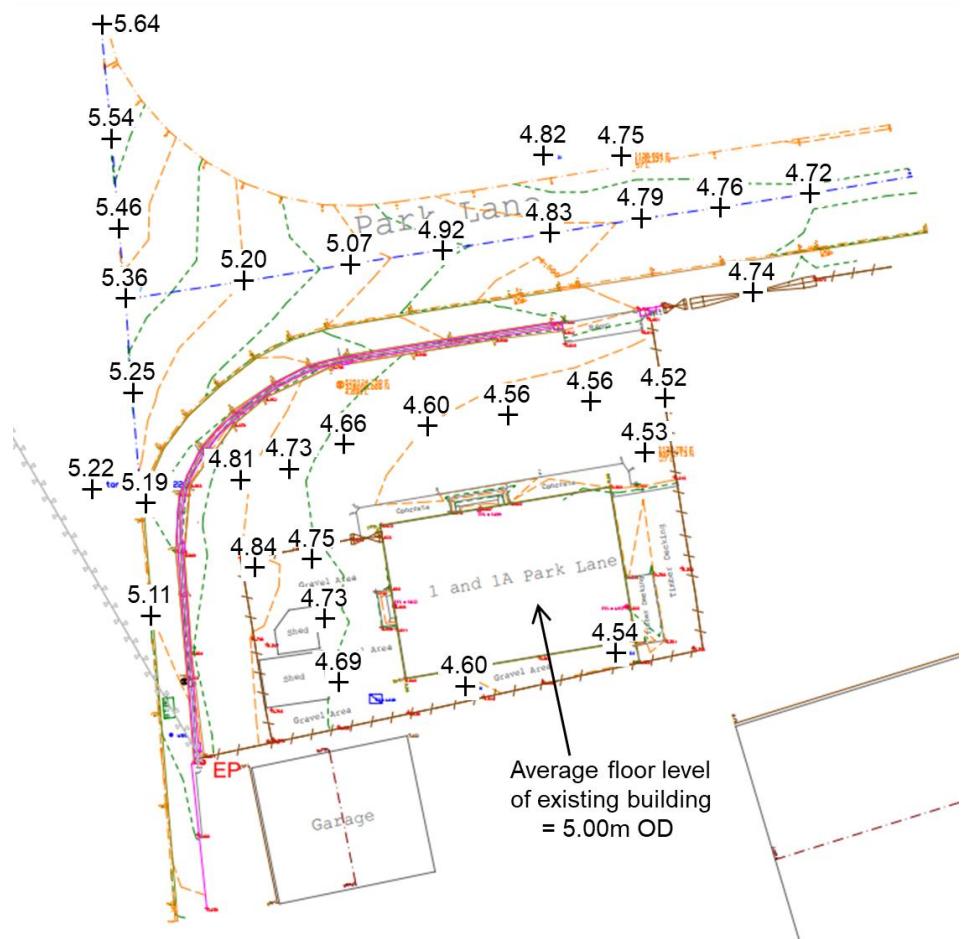
PLAN SHOWING IDB DRAINAGE CHANNELS



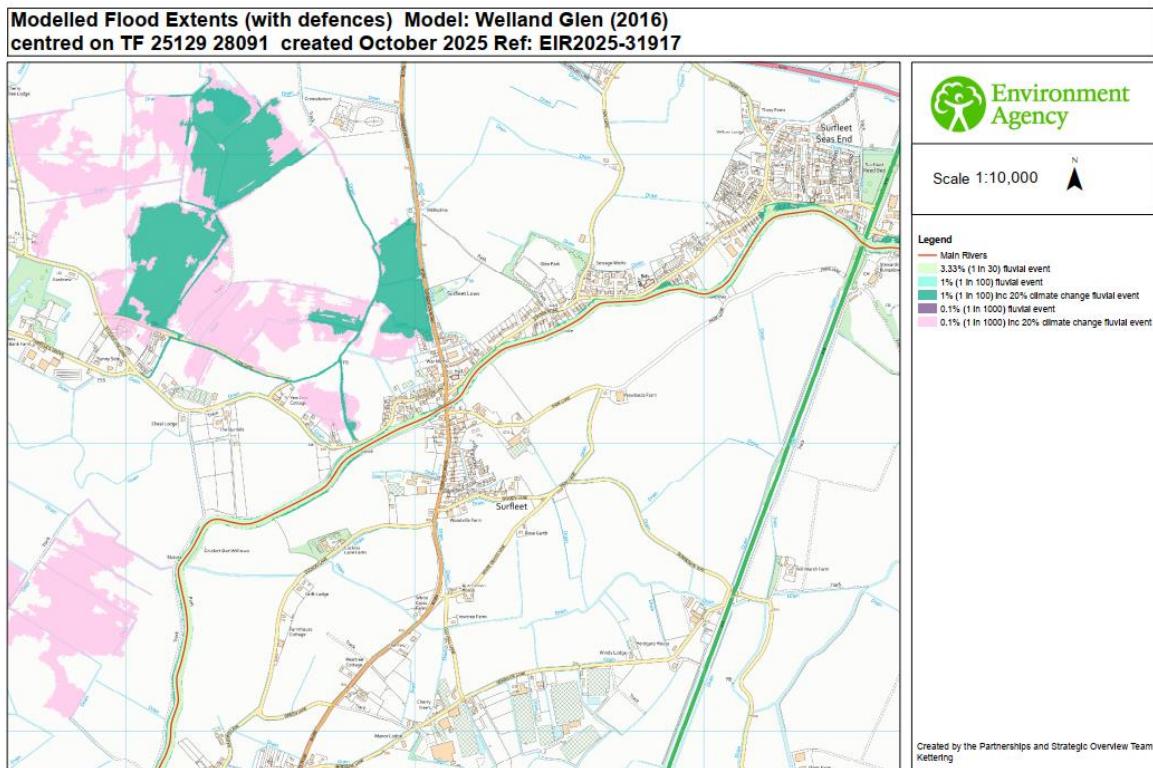
BLOCK PLAN



SITE LEVELS



MODELLED FLOOD EXTENTS WITH DEFENCES



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 PPS25¹. 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)

| <u>Area of England</u> | 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 fluvial section of the River Glen or the IDB drainage system

- 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 |

Therefore it can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. This may slightly increase the risk of a breach occurring in the tidal bank north of the site. It may also slightly increase the flow of water into the area west of the tidal River Welland. However it will not change the conclusions and recommendations in this report.

Fluvial Flooding.

As the development is in flood zone 3 and is classed as more vulnerable, the advice from the Environment Agency is that the higher central climate change allowance, which is 35%, should 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.

Maximum flood levels in the River Glen will not be increased by the increase in flows projected in the new climate change allowances. If flows increase by 65% in these systems it will have the effect of flooding over the long sections of bank between Bourne and Surfleet and the maximum levels will not increase significantly.

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.

Welland and Deepings IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations, sluices and drainage channels. Pumping stations and sluices only have a 30 year life and will need to be refurbished or rebuilt within this timespan. It is assumed that Welland and Deepings IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that the Board continues to provide the same standard of service as the present day.

It is considered that the mitigation proposed for the development, with the recommendation that the finished ground floor level of the proposed buildings should be a minimum level of 4.95m OD which is approximately of 300mm above the average existing ground level on the site, is satisfactory.