PROPOSED FENLAND CARAVAN CENTRE AT CARRINGTONS DROVE SOUTH, CROWLAND PE6 0BZ

FLOOD RISK ASSESSMENT



Existing Poultry House

S M Hemmings B Sc C Eng MICE MIWEM,
13 Lea Gardens,
Peterborough,
PE3 6BY

This flood risk assessment and has been prepared solely to support the planning application for the proposed Fenland Caravan Centre at Carringtons Drove South, Crowland. 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 purpose other than for which it was originally commissioned.

Introduction

An application is due to be submitted to South Holland District Council for planning permission to refurbish an existing building previously used as a poultry shed to form the Fenland Caravan Centre at Carringtons Drove South, Crowland. There are four large vacant poultry sheds on the site at the present time. The two sheds on the north west side will remain as existing. It is planned to refurbish the third poultry house and this will become the Caravan Centre and the fourth shed on the south eastern side has been demolished and the area will be used as an external caravan display area.

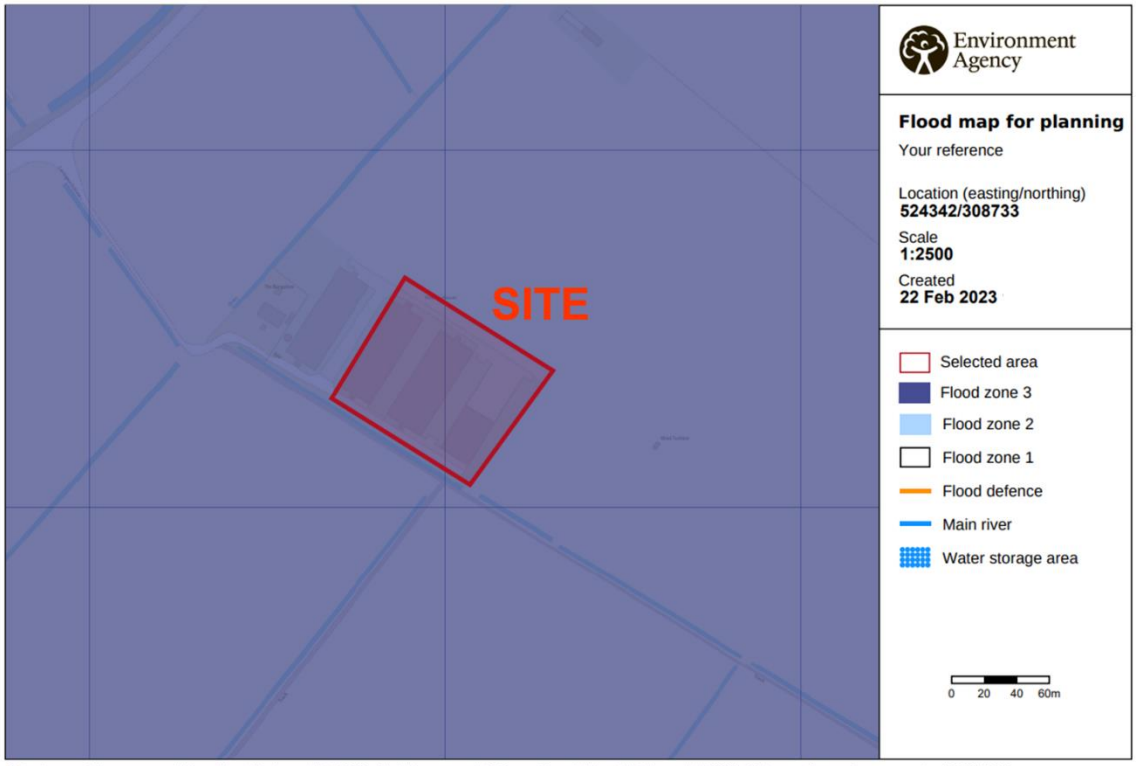
The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

The Planning Application requires a Flood Risk Assessment to be carried out as required in the Technical Guidance to the National Planning Policy Framework.

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 North Level 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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Application Site

The development is located on the eastern side of the new Crowland By Pass. The National Grid Reference of the site is 524330 308730.

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

The site can be considered to be within flood zone 3(a) because it is within a defended area as defined in Table 1 of the Technical Guidance.

The flood risk vulnerability classification for the site should next be assessed. The types of development in the “less vulnerable” category is shown Table 2 of the Guidance which is shown below.

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the ‘more vulnerable’ class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

It can be seen that the existing buildings used as poultry sheds are classified as “less vulnerable”, and the proposed use for the Caravan Sales and Repair facility is also classified “less vulnerable”.

Table 3 of the Guidance is shown below:

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Table 3 shows that “Less Vulnerable” development is deemed to be satisfactory development in flood zone 3(a).

Sequential Test

As the proposed development is located in Flood Zone 3(a) the NPPF requires the sequential test to be applied to determine if there are any reasonably available and suitable alternative sites at a lower flood risk for this type of development. The developers have not been able to find any alternative site with a lower flood risk where there are buildings available for conversion. Therefore the site can be considered as a brownfield site with potential for redevelopment. It is unlikely that there would be a similar site with a lower flood risk in this area, as the whole of this locality is within Flood Zone 3(a), is at a similar level and therefore will have the same flood risk.

Therefore the sequential test can be considered to be passed.

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
	Peak Velocity ……. Zero
For year 2115	Depth of flooding … Zero
	Extent of flooding …Low or medium
	Peak Velocity …… Zero

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 …500mm – 1.0m
	Extent of flooding .. High
	Hazard……. 1.25 – 2.0 (danger to most)
	Peak Velocity …… 0 – 0.3m/sec
For the year 2115	Depth of flooding …500mm – 2.0m
	Extent of flooding .. High
	Hazard……. 1.25 – 2.0 (danger to most)
	Peak Velocity …… 0 – 0.3m/sec

The hazards for the 0.1% fluvial or tidal event probability are as follows.

For the year 2115	Depth of flooding …1.0 m – 2.0m
	Extent of flooding .. High
	Hazard……. 1.25 – 2.0 (danger to most)

Peak Velocity …… 0 – 0.3m/sec

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

Maximum fluvial flood levels in the River Welland at Crowland at chainages between 10km and 14km are shown below in the 2010 SFRA report as follows:

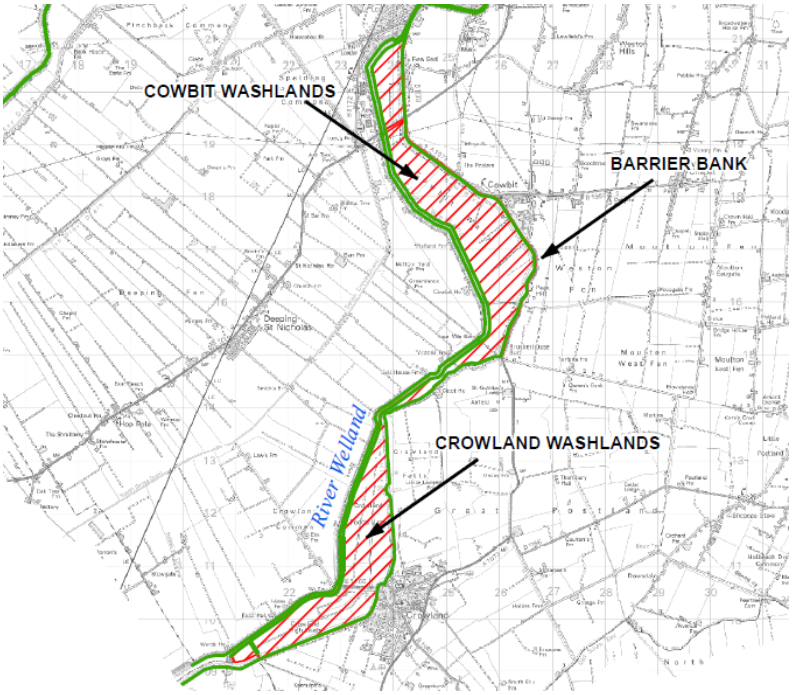
	Present	Present + Climate Change
1 in 100 year	4.76 - 4.99	4.81 - 5.03
1 in 1,000 year	4.79 - 5.03	4.82 - 5.05

The lowest level of the Barrier Bank of the River Welland stated in the SFRA is 5.81m OD at 10km and 6.08m OD at 14km.

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 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



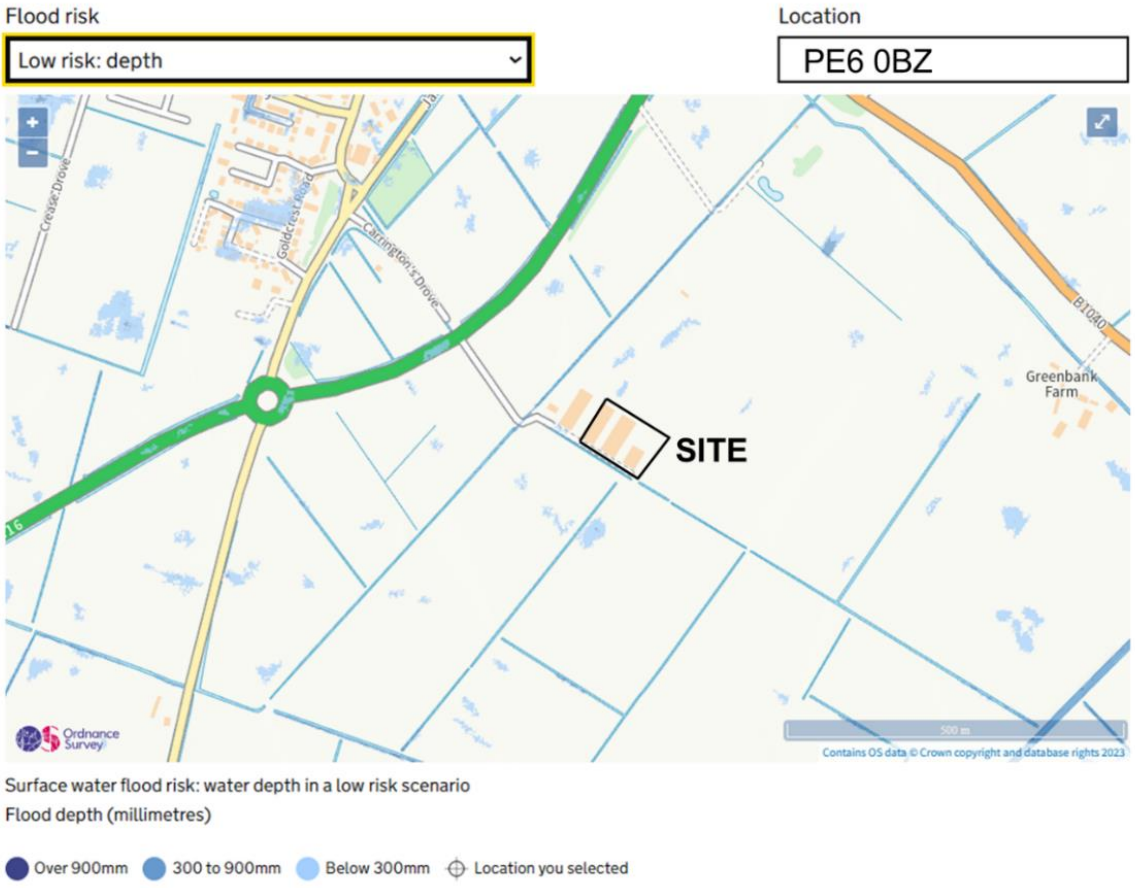
These areas are designed to alleviate very high flows in the River Welland. When the water level in the River Welland reaches a level of approximately 5.00m OD large syphons are activated which discharge excess water onto the Washes. The Barrier

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.

The development site is approximately 1.6km from the Barrier Bank.

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 there is no predicted risk of surface water flooding to the site.

Existing Ground Levels

The level of the site where the existing poultry houses are located is between 2.40m and 2.50m OD. The field to the north east of the poultry houses, which forms part of the proposed site, is lower at between 2.25m and 2.35m OD. The field northwest of the site between the IDB Drain and the new By pass is slightly lower at around 2.10m OD. The By Pass has been elevated by about 900mm above the surrounding land at approximately 3.00m OD.

Potential Sources of Flooding

The following sources of flooding have been identified:

1. Failure or overtopping of the Barrier Bank
2. Flooding from IDB Drain
3. Surface Water Flooding

1. Failure or Overtopping of the Barrier Bank.

The Barrier Bank is the eastern bank of the Crowland 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. This would occur when the water level in the river is approximately 5.00m ODN and the water level in the water level in the Washes will increase steadily to a similar level.

The predicted flood levels in the updated SFRA map of the Crowland area are assumed to be the consequence of a possible breach in the Barrier Bank.

If a breach occurred in the Barrier Bank in this scenario then flood water would flow eastwards towards the development site. The flow of flood water eastwards would be held back by the new A16 Crowland By-Pass which has been constructed approximately 900mm above original field level (as shown below)



Mitigation will be provided by ensuring that there is a robust evacuation plan to ensure there are no staff or visiters on the site if and when flooding starts to occur.

2. Flooding from IDB Drain

The watercourse on the north western boundary of the site of all the poultry houses is the Kings Dyke, which is maintained by North Level IDB. This drain flows in a north

easterly direction and flows into the Greenbank Drain approximately 1 km north of the site. The Greenbank Drain flows in a south easterly direction into the New South Eau approximately 2.5 km south east of the development site. It then flows eastwards to the North Level Main Drain and the levels of all these watercourses are controlled by the Pumping station at Tydd which is approximately 24 km east of Crowland.

The normal water level in the North Level IDB maintained drain called Kings Dyke on the north western boundary of the site is approximately 0.80m OD, which is about 1.4 metres below the fields alongside the development.

IDB drains were designed to provide at least a 1 in 10 year standard of service with a freeboard of at least 900mm. This normally provides at least a 1 in 50 year standard of service against overtopping and in many cases a 1 in 100 year standard at the present time.

North Level IDB have a policy of monitoring standards of protection in all their catchments and will carry out improvements to pumping stations, sluices and drainage channels to ensure they do not fall due to higher run-offs predicted with climate change.

It is unlikely that any failure of assets such as pumping stations, sluices or drainage channels would lead to overtopping of the watercourse because North Level IDB have an excellent maintenance regime and monitor all assets with a modern telemetry system.

Any high water levels in the IDB drains would not occur quickly and if these were to occur the staff of the caravan centre would have adequate time to assess the situation and make arrangements to ensure no visitors or staff would be affected by the flooding.

3. Surface Water Flooding

There is no predicted risk of surface water flooding shown on the Environment Agency map. Excess surface water on the site is assumed to flow into the dyke on the southern boundary of the site, and the site will continue to drain in this way after the internal refurbishment of the building.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties having been flooded in the last 50 years. The last time that a breach occurred in the River Welland was 1947, and since that date considerable investment has been made to raise banks and provide a banks which are above the 1 in 100 year flood level.

Probabilities and Trends of Flooding

The probability of this site 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

There is a residual flood risk to the site if the Barrier Bank approximately 1 to 2km south of Crowland breached when the Crowland Washes are full. Water would flood eastwards towards the proposed development site. However this flow would be held back by the new A16 By pass which has been constructed 900mm above the level of the fields. Therefore flood water would not flow unimpeded to the site as assumed in Appendix 1.

However there are a number of culverts under the new A16 and these would allow flood water to flow at a substantially increased rate into the area east of the new By pass. The Kings Dyke would probably fill with water and start to flood onto the fields, and there would be a risk of the development site flooding.

Climate Change

The predictions of flood depths for this flood risk assessment use information in the SHDC SFRA which was produced in 2010, and further information provided by the Environment Agency. The EA have issued new guidance on recommended contingency allowances for predicted sea level rises, fluvial flows and rainfall intensities which from 19th February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 15 to 18). 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. The planning application is for a change in use and therefore category 7 should be used. In the explanation of the category under A7 the following advice is given:

The EA makes "no comments" to the following change of use applications (see NPPG Table 2 for vulnerability classification).

Water compatible to water compatible
Less vulnerable to less vulnerable use
More vulnerable to less vulnerable use
More vulnerable to more vulnerable use – where there is no increase in risk to people (if this is not clear, please refer to the EA for bespoke advice.

Summary of Predicted Flood Depths to the Site

The plan on the next page is an extract from the map of predicted residual peak depths of flooding in a 1 in 100 year event in 2115 in the South East Lincolnshire Strategic Flood Risk Assessment (March 2017) Appendix A – Fluvial & Tidal Hazard Mapping which shows the bands of residual flood depths on the site.



The plan below of predicted depths of flooding in a 1 in 1000 year event in 2115 in the South East Lincs SFRA shows the bands of residual flood depths on the site.



The 1 in 100 year event map in 2115 indicates flood depths of between 500mm and 1.0 metres to the two buildings on the site and between between 1.0 metre and 2.0 metres in most other parts of the site. The 1 in 1000 year event map in 2115 indicates flood depths of mostly between 1.0 metre and 2.0 metres.

From this the best estimation is a flood depth to the buildings of 900mm in the 1 in 100 year event and 1.1 metres in the 1 in 1000 year event.

Conclusions

The risk of flooding from a breach in the Barrier Bank is extremely low. However the consequence of a breach in this bank is predicted to be flooding on the development site.

The flood depths resulting in high levels in IDB drains can be considered low compared with the predicted flood depths resulting from a breach in the Barrier Bank.

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 2.15m OD and flood the proposed development.

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

Recommendations

Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service. As soon as there is a warning that the Washes are being flooded the management should closely monitor the situation and be prepared to evacuate the area if a breach were to occur in the Barrier Bank.

Management of the site should prepare a flood and evacuation plan, similar to outline in Appendix 1, which will detail how the situation would be managed in an emergency.

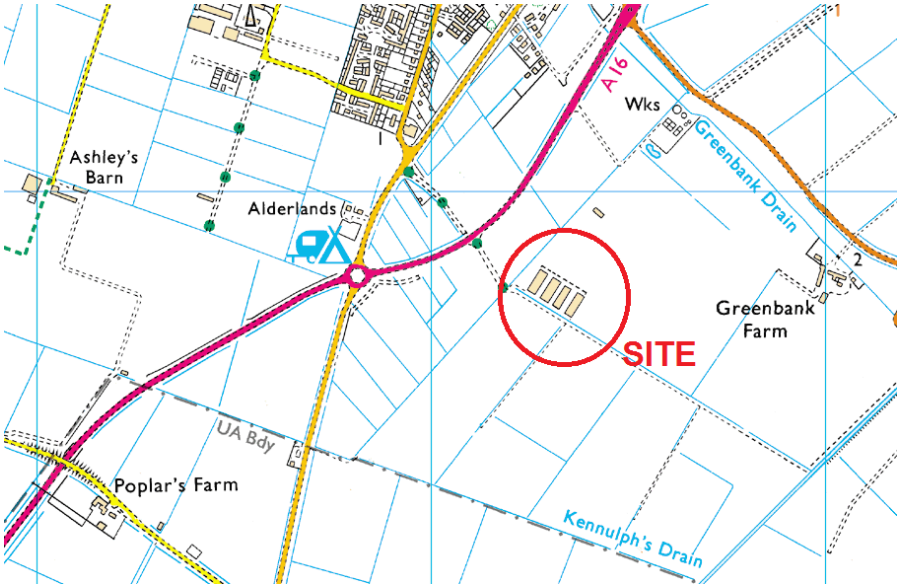
All future owners and occupiers of the building should be given a copy of the Flood Risk Assessment so that they are fully aware of the risk and possible consequence of flooding in this area.

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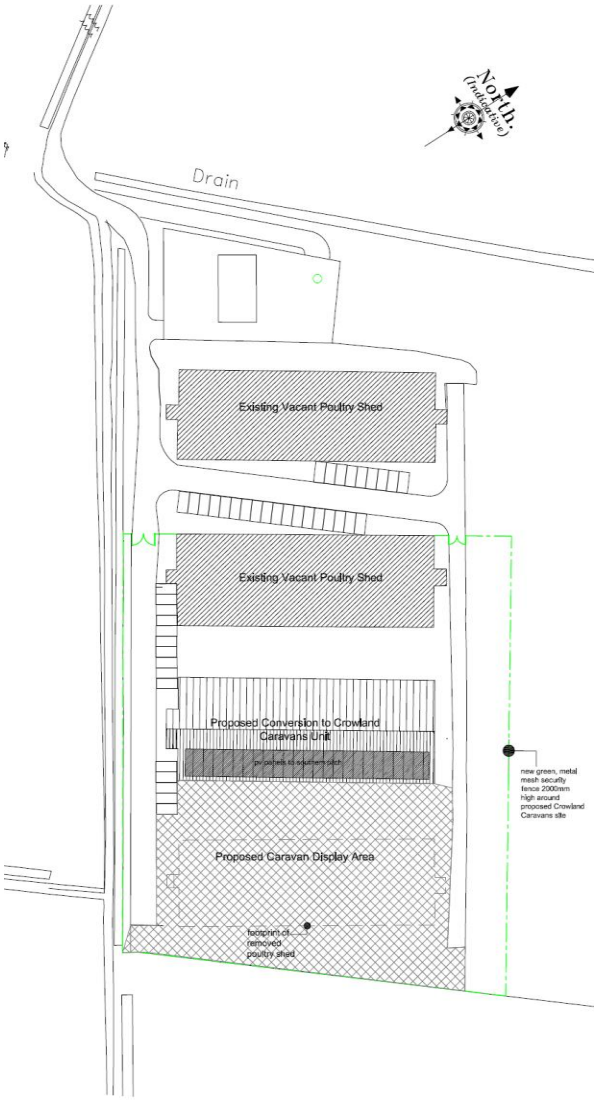
stuart.hemmings@btinternet.com

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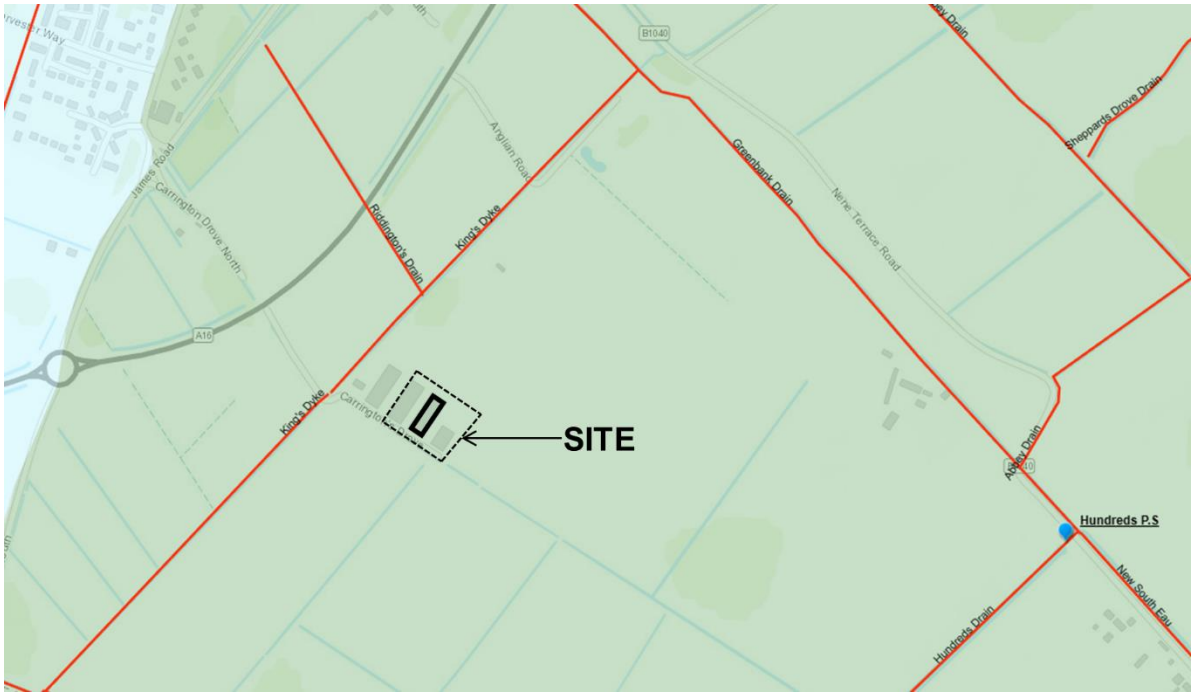
LOCATION PLAN



BLOCK PLAN



PLAN OF NORTH LEVEL IDB DRAINS



APPENDIX 1 FLOOD WARNING AND EVACUATION PLAN FOR THE FENLAND CARAVAN CENTRE.

There is a risk of flooding to the Fenland Caravan Centre if a breach occurred in the Barrier Bank after the Crowland Washes had been flooded. The Flood Risk Assessment indicates that the flooding could be approximately 1.0 metre deep on the fields adjacent to the site. If the flood depths exceed 250mm then the Caravan repair and Storage Buildings could become flooded.

The first visual indication of the flooding would be the rapid rise in levels of the Kings Dyke on the north west side of the development. If the water rose to the top of the Dyke flooding would start to occur on the adjoining fields. Flood water would continue to rise until either the breach was repaired or the level in the River Welland fell to a suitable level.

It is recommended that occupiers of the site should sign up to receive the Environment Agency's (EA) Floodline Warnings Direct Service. This service will telephone them to give them warnings of either FLUVIAL or TIDAL flooding.

Three levels of warning are sent by the EA:

1) Flood Alert: This will give between 2 days and 2 hours warning of very high water levels in the area.
2) Flood Warning: This will be given out when there is a greater chance of very high water levels occurring, typically between 1 day and half an hour before these high levels are likely to occur.
3) Severe Flood Warning: When the flooding poses a danger to life.

Management of the site should enquire as soon as a warning is received if the Washes are beginning to flood. They should continue to monitor the situation and warn staff and visiters to the site that if the Barrier Bank were to breach then they should be prepared to evacuate the site immediately.

Management and Visitors should particularly listen to local radio which will give information on the situation.

A safe area to evacuate to is central Peterborough where ground levels are higher than the maximum flood level possible in the area.

Stuart Hemmings B Sc C Eng MICE MIWEM

APPENDIX 2 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 3 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 report has identified that the main sources of flooding to the proposed development are from the River Welland and the IDB drainage system

As the developments are in flood zone 3 and are classed as less vulnerable, the higher central climate change allowance, which is 35%, should firstly be considered. After considering the effects of this increase the upper end allowance, which is 65%, should be considered.

The EA have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. The SHDC SFRA also has used this figure of 20%. The increase to 35% and 65% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the Barrier Bank. If there are additional flows along this part of the River Welland it will lead to the storage systems of the Cowbit and Crowland Washes operating and additional overtopping over lower banks rather than any significant increase in levels in the river.

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.

North Level 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 North Level 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 flood warning and evacuation plan, is satisfactory.