

FLOOD RISK ASSESSMENT

**Leisure Development
Midville Road, Stickney**

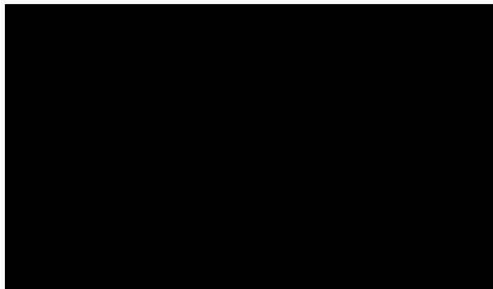
**Mr A Downes
May 2022**

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Limitations

The conclusions drawn by Roy Lobley Consulting are based on information supplied and could differ if the information is found to be inaccurate or misleading. In which case Roy Lobley Consulting accepts no liability should additional information exist or becomes available with respect to this project.

The information in this report is based on statistical data and qualitative analysis which are for guidance purposes only. This study provides no guarantee against flooding or of the absolute accuracy of water levels, flows and associated probabilities.

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EXECUTIVE SUMMARY

This Flood Risk Assessment is compliant with the requirements set out in the National Planning Policy Framework, and the associated online Planning Practice Guidance. It has been produced on behalf of Mr A Downes. This report demonstrates that the proposed development is not at significant flood risk, and will not increase flood risk to others, subject to the recommended flood mitigation strategies being implemented.

Policy

Development Type	Flood Zone	Vulnerability
Short Let Holiday Site	3	More Vulnerable

Climate Change Allowance

Peak River Flow

WITHAM MANAGEMENT CATCHMENT	
Allowance Category	Percentage Increase
Central	8

Sea Level Rise

Area of England	Allowance	2000-2035 (mm/year)	2036-2065 (mm/year)	2066-2095 (mm)/year	2096-2125 (mm/year)
Anglian	Higher Central	5.8	8.7	11.6	13.0
	Upper End	7.0	11.3	15.8	18.1

Flood Risk and Mitigation

Flood Risk Source	Level of Risk Without Mitigation	Proposed Mitigation
Residual (fluvial)	Medium	Minimum floor level 1.20m AOD. Flood emergency plan
Fluvial Tidal Pluvial Groundwater Sewers Reservoir	Low	
Canal/Artificial	None	

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1.0 INTRODUCTION

- 1.1 This Flood Risk Assessment, (FRA), is compliant with the requirements set out in the National Planning Policy Framework, (NPPF), and the associated online Planning Practice Guidance.
- 1.2 The FRA has been produced on behalf of Mr A Downes in respect of a planning application for a leisure development at Midville Road, Stickney.

Data Used

- 1.3 This FRA is based on the following information:
 - LiDAR 2m DTM
 - Proposed Plans
 - British Geological Survey Drift & Geology Maps
 - Environment Agency Consultation
 - Environment Agency Data
 - British Geological Survey Hydrogeology Data

Existing Site

- 1.4 The site is located at grid reference TF3544656623 as shown in **Figure 1.1** below.

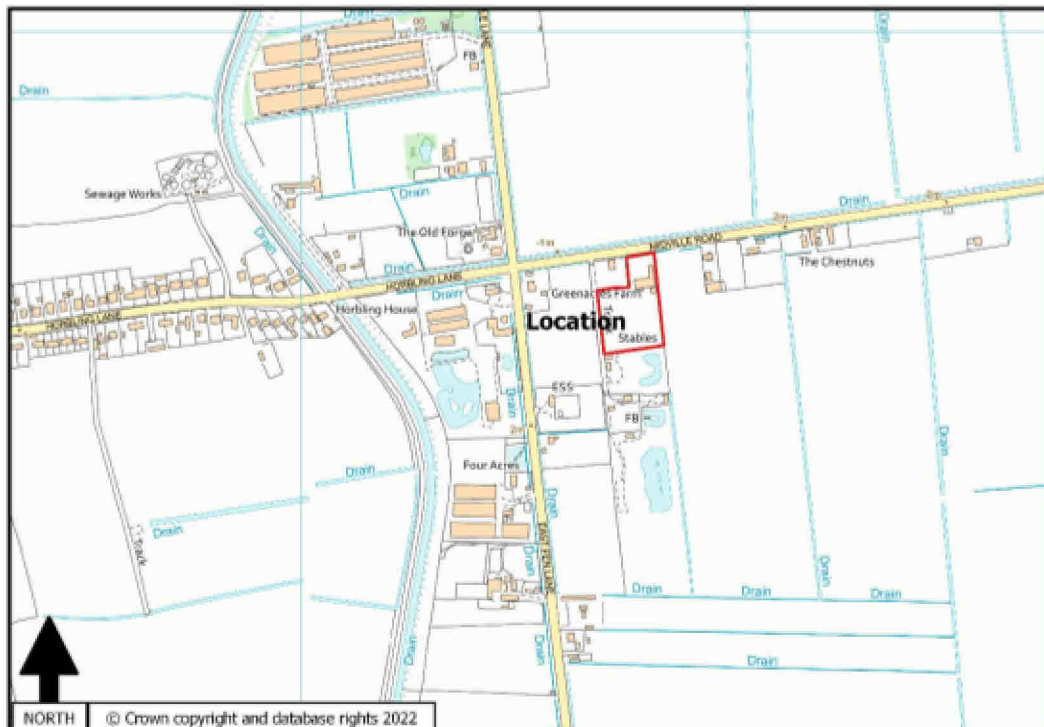


Figure 1.1 Site Location

- 1.5 LiDAR 2m DTM shows that existing land levels are at approximately 0.90m AOD.
- 1.6 The online British Geological Survey maps indicates that the site is located on superficial deposits of peat over a bedrock of mudstone.

Proposed Development

- 1.7 The proposed development consists of a leisure development of four holiday lodges and a restaurant as shown on the extract of the proposed plan below in **Figure 1.2**

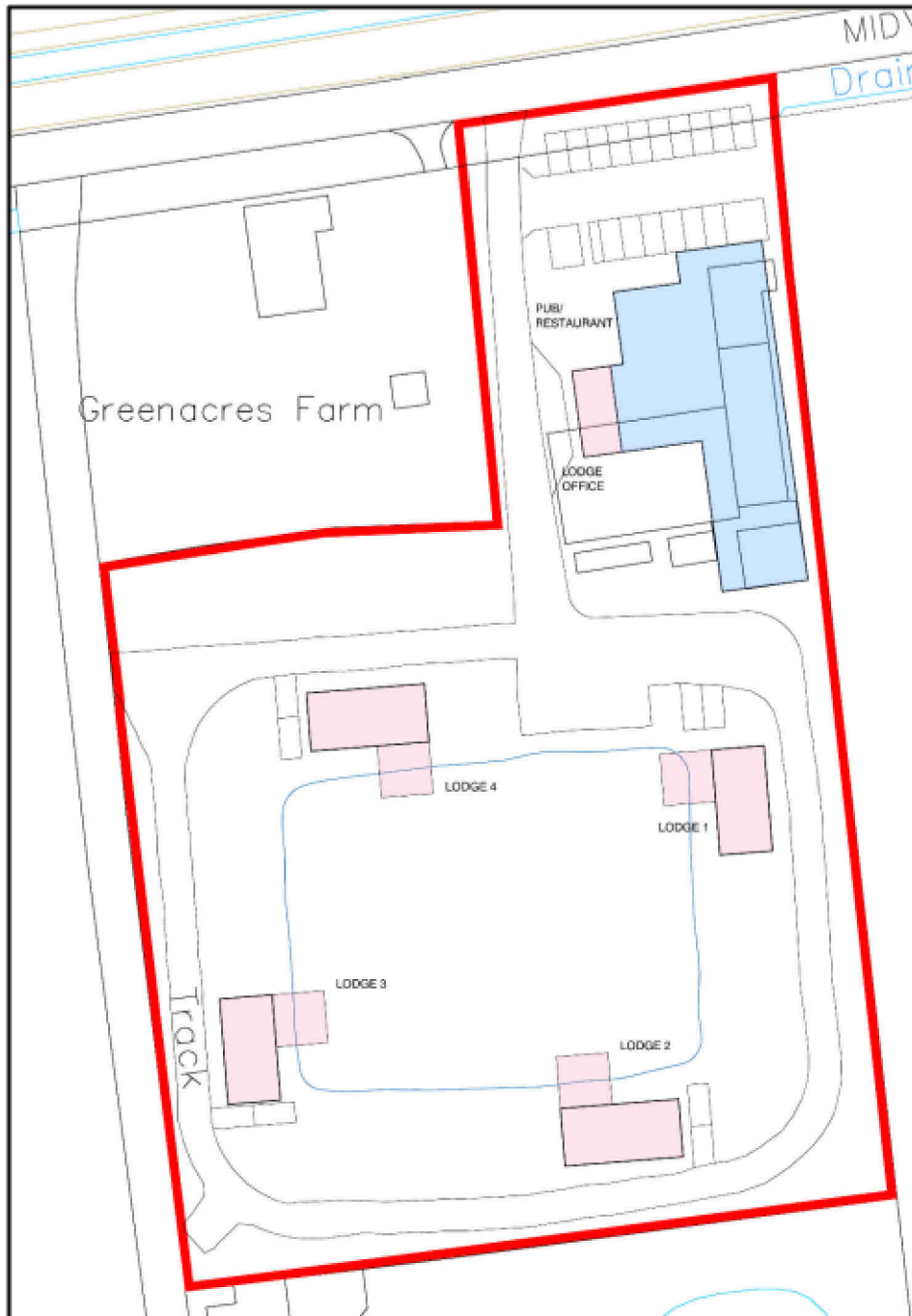


Figure 1.2 Proposed Plan

2.0 FLOOD RISK PLANNING POLICY

National Planning Policy Framework

- 2.1 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. A supporting web-based Planning Practice Guidance is also available.
- 2.2 The guidance uses four Flood Zones to characterise flood risk which refer to the probability of river and sea flooding, ignoring the presence of defences.

Sequential Test

- 2.3 The NPPF requires the application of a Sequential Test to ensure that new development is in areas with the lowest probability of flooding and the Flood Zones provide the basis for applying the Test.

Flood Zone Definition

Flood Zone 1	Low probability (1 in 1000 annual probability of river or sea flooding (<0.1%)).
Flood Zone 2	Medium probability (between 1 in 100 and 1 in 1000 annual probability of river flooding (1.0%-.0.1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-.0.1%) in any given year).
Flood Zone 3a	High probability (1 in 100 or great annual probability of river flooding (>1.0%) or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
Flood Zone 3b	This zone comprises land where water must flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5.0%), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

- 2.4 The Flood Zones do not consider the projected effects of climate change and may not represent potential flooding from smaller watercourses.
- 2.5 The aim is to steer new development to Flood Zone 1 and where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should consider the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required.
- 2.6 Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, considering the flood risk vulnerability of land uses and applying the Exception Test if required.
- 2.7 The guidance also sets out the vulnerability to flooding of different land uses and some of these are detailed below.

Flood Risk Vulnerability Classification

Essential Infrastructure	Transport Infrastructure; Utility Infrastructure; Wind Turbines.
Water Compatible	Flood Control Infrastructure; Water and Sewage Infrastructure; Navigation Facilities.
Highly Vulnerable	Emergency Services (which are required in times of flood); Basement Dwellings; Caravans, Mobile Homes and Park Homes, (intended for permanent residential use); Installations requiring Hazardous Substances Consent.
More Vulnerable	Hospitals and other Health Services; Residential Institutions; Dwelling Houses, Drinking Establishments; Nightclubs; Hotels; Non-residential uses for Health Services; Nurseries; Educational Establishments; Landfill and Hazardous Waste Management Facilities; Sites used for Holiday or short-let Caravan and Camping sites, (subject to a specific warning and evacuation plan).
Less Vulnerable	Commercial Establishments; Emergency Services not required in times of flood; Land and Buildings used for Agriculture and Forestry. Waste Treatment; Minerals Working; Water Treatment Works; Sewage Treatment Works.

Appropriate Development

- 2.8 Based on the vulnerability of a development the guidance states what Flood Zone(s) the development is appropriate within. The flood risk compatibility is summarised below.

Flood Zone 1	Appropriate Development – All.
Flood Zone 2	Exception Test - Highly vulnerable. Appropriate Development - Essential Infrastructure; More vulnerable; Less vulnerable and Water Compatible.
Flood Zone 3a	Should not be permitted – Highly vulnerable. Exception Test – Essential Infrastructure, More vulnerable. Appropriate Development – Less vulnerable; Water compatible.
Flood Zone 3b	Should not be permitted – Highly vulnerable; More vulnerable; Less vulnerable. Exception Test – Essential Infrastructure. Appropriate Development –Water compatible.

- 2.9 The Planning Practice Guidance also states that all sources of flooding should be considered when preparing a FRA.

Exception Test

- 2.10 The Exception Test is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.
- 2.11 The first part of the Exception Test is to show that the proposed development will provide wider sustainability benefits to the community that outweigh flood risk. The second part is the requirement for a FRA to demonstrate that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Development Proposals

2.12 The proposed development consists of a Short Let Holiday Site.

Flood Zones

2.13 The Flood Zones are shown on **Figure 2.1** below which shows the site to be in Flood Zone 3.

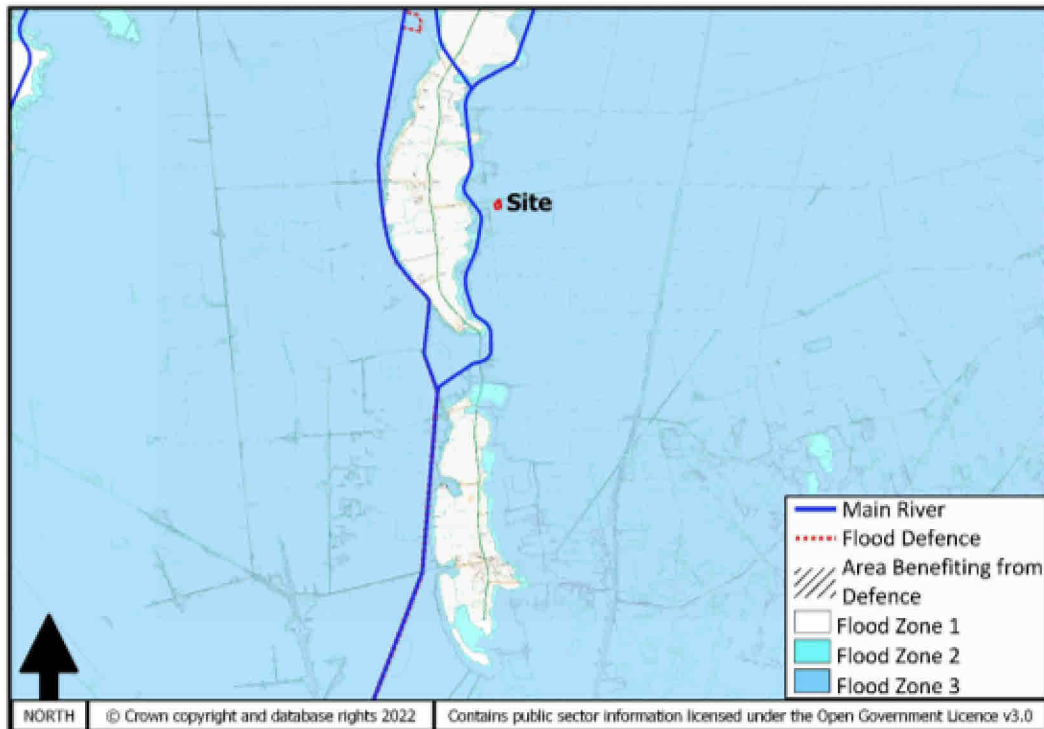


Figure 2.1 Flood Zones

Development Vulnerability

2.14 Short Let Holiday Sites are More Vulnerable.

Exception Test

2.15 A FRA is required to ensure the development will remain safe over its lifetime from all sources of flooding and not increase flood risk elsewhere.

3.0 CLIMATE CHANGE

- 3.1 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change.
- 3.2 As the Government's expert on flood risk on 19th February 2016 the Environment Agency, (EA), published revised climate change allowances to support the NPPF. The sea level rise allowances were revised on the 17th December 2019 and the peak river flows revised on the 20th July 2021.
- 3.3 The climate change allowances are based on projections and different scenarios of carbon dioxide (CO₂) emissions to the atmosphere and provide predictions of anticipated change for:
- peak river flow by river Management Catchment;
 - peak rainfall intensity;
 - sea level rise;
 - offshore wind speed and extreme wave height.

Peak River Flow Allowances

- 3.4 The peak river flow allowances show the anticipated changes to peak flow by Management Catchment, which are sub-catchments of River Basin Districts, with three allowances; central; higher central and upper end.
- 3.5 This proposed development is in the Witham Management Catchment.
- 3.6 The appropriate allowance depends on the Flood Zone and vulnerability classification of the development and for this proposal it is appropriate to use the Central allowance.
- 3.7 The allowances change over three periods of time over the next century. The appropriate period should be chosen based on the expected lifetime of the development and for commercial that is 50 years.
- 3.8 The following climate change allowances in peak river flows therefore need to be applied:

WITHAM	
Allowance Category	Percentage Increase
Central	8

Table 3.1 Climate Change Allowances for Peak River Flow

Peak Rainfall Intensity Allowance

- 3.9 Increased rainfall affects river levels and land and urban drainage and should be applied to surface water drainage systems. However, the proposed development does not increase the impermeable area enough for these allowances to apply.

Sea Level Allowances

- 3.10 There is a range of allowances for each region and epoch or time frame for sea level rise as follows:

Area of England	Allowance	2000-2035 (mm/year)	2036-2065 (mm/year)	2066-2095 (mm/year)	2096-2125 (mm/year)
Anglian	Higher Central	5.8	8.7	11.6	13.0
	Upper End	7.0	11.3	15.8	18.1

Table 3.2 Climate Change Allowances for Sea Level Rise

4.0 FLOOD RISK SOURCES

4.1 The following flood risk sources have been identified and where mitigation is required to reduce the flood risk this is discussed in **Section 5**.

Fluvial

Main River

4.2 The nearest EA Main River to the site is the East Fen Catchwater Drain approximately 0.35km to the west.

4.3 Information provided by the EA states that the existing fluvial defences reducing the risk of flooding to this site consist of earth embankments. They are in fair condition and reduce the risk of flooding (at the defence) to a 4% (1 in 25) chance of occurring in any year. The EA inspect these defences routinely to ensure potential defects are identified.

4.4 Information provided by the EA from the Stonebridge 2017 model at node EF_3664 gives the following modelled, in-channel, flood levels:

Return Period	Level (m AOD)
1.0% (1 in 100)	2.40
1.0% (1 in 100) + 20%	2.42
0.1% (1 in 1000)	2.44

Table 4.1 East Fen Catchwater Drain Flood Levels

Climate Change

4.5 The above results have a climate change increase of 20% added to the peak river flows whereas the guidance now indicates that in the Witham Management Catchment, for commercial establishments 8% should be added.

Actual Risk of Flooding

4.6 The EA have produced maps showing the modelled flood extents, an extract of which is shown below in **Figure 4.1**, which shows the site not to be at risk of flooding for all events up to and including the 0.1%, (1 in 1000) + 20% climate change event.

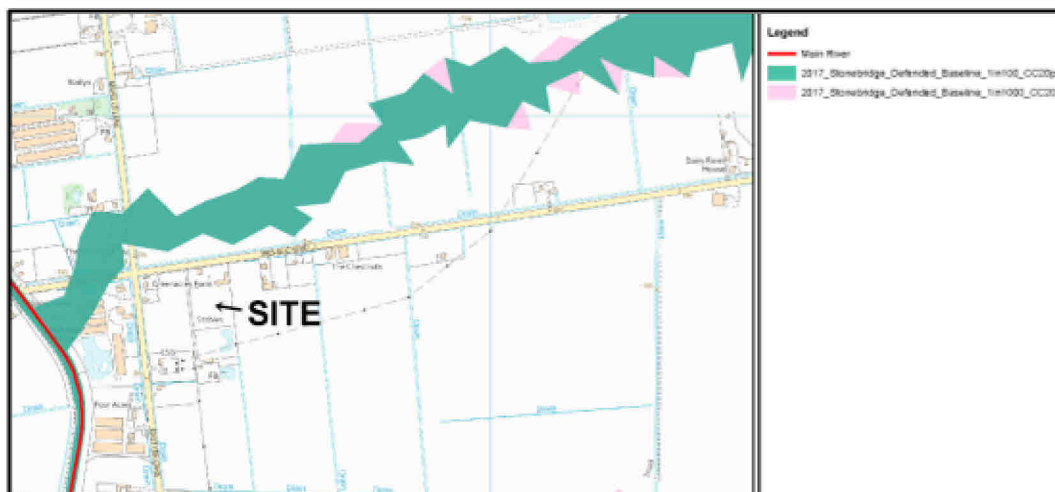


Figure 4.1 Flood Risk Map

Ordinary Watercourses

- 4.7 The site lies within the district of the Witham Forth Internal Drainage Board, (IDB), and the Boards maintained watercourse is located on the northern side of Midville Road.
- 4.8 The site is bounded on the west and east by ordinary watercourses.
- 4.9 The risk of flooding from fluvial sources is low.

Residual Risk

- 4.10 The site is protected from flooding from the East Fen Catchwater Drain by defences, including a raised defence. However, if that defence was to be breached then flooding could occur, but hazard mapping is not currently available for this site.
- 4.11 Standard broad crested weir calculations have been used to establish the flood depths, velocity and hazard rating at the site should a breach in the defences occur.
- 4.12 The site is 350m from the defence.
- 4.13 It has been assumed that a breach in the defences will act as a broad crested weir where the quantity calculation is;

$$Q = 1.7b \times H^{3/2}$$

- Q = quantity of water flowing through the breach (m³/sec).
- b = breach width (m).
- H = height of breach (m).

$$\text{Velocity} = Q/b \times H \text{ (m/sec).}$$

- 4.14 Assuming a breach width of 40m and a depth of breach from the 1.0% (1:1000) + 20% Climate Change flood level of 2.44m AOD to the site level of 0.90 AOD = 1.54m then;

$$Q = 129.95\text{m}^3/\text{sec}$$

- 4.15 Assuming the breach width propagates at 45° then as the site is 350m away the effective width of the breach at the site is 740m. With the same quantity of water as before, Q = 129.95m³/sec, then the depth of flooding at the site, (H), is;

$$H = (Q/1.7b)^{2/3}$$

$$H = 0.22\text{m}$$

$$\text{Velocity} = 0.8\text{m/sec}$$

- 4.16 The flood level on the site is therefore 0.90m AOD + 0.22m = 1.12m AOD
- 4.17 The hazard rating, (HR), is calculated as;

$$\text{HR} = d \times (v+n)+\text{DF}$$

- d = depth of flooding.
- v = velocity

- n = constant of 0.5
- DF = debris factor = 0.5 where $d \leq 0.25\text{m}$ and 1.0 where $d > 0.25\text{m}$.

HR = 0.79 which is moderate.

4.18 Flood risk from a breach is medium and will require mitigation.

Tidal

4.19 The site is over 20km from the east coast. Information provided by the EA states that the existing tidal defences protecting this site consist of earth embankments which are supplemented by saltmarsh to maintain foreshore levels. They are in good condition and reduce the risk of flooding (at the defence) to a 0.67% (1 in 150) chance of occurring in any year. The EA inspect these defences routinely to ensure potential defects are identified.

Residual Risk

4.20 The site is protected from flooding from by defences, including a raised defence. However, if that defence was to be overtopped or fail then flooding could occur .

Breach in Defences

4.21 The EA have produced hazard mapping and **Figure 4.2** below shows the flood depths as a result of a breach for the 0.1% (1:1000) 2115 climate change event.

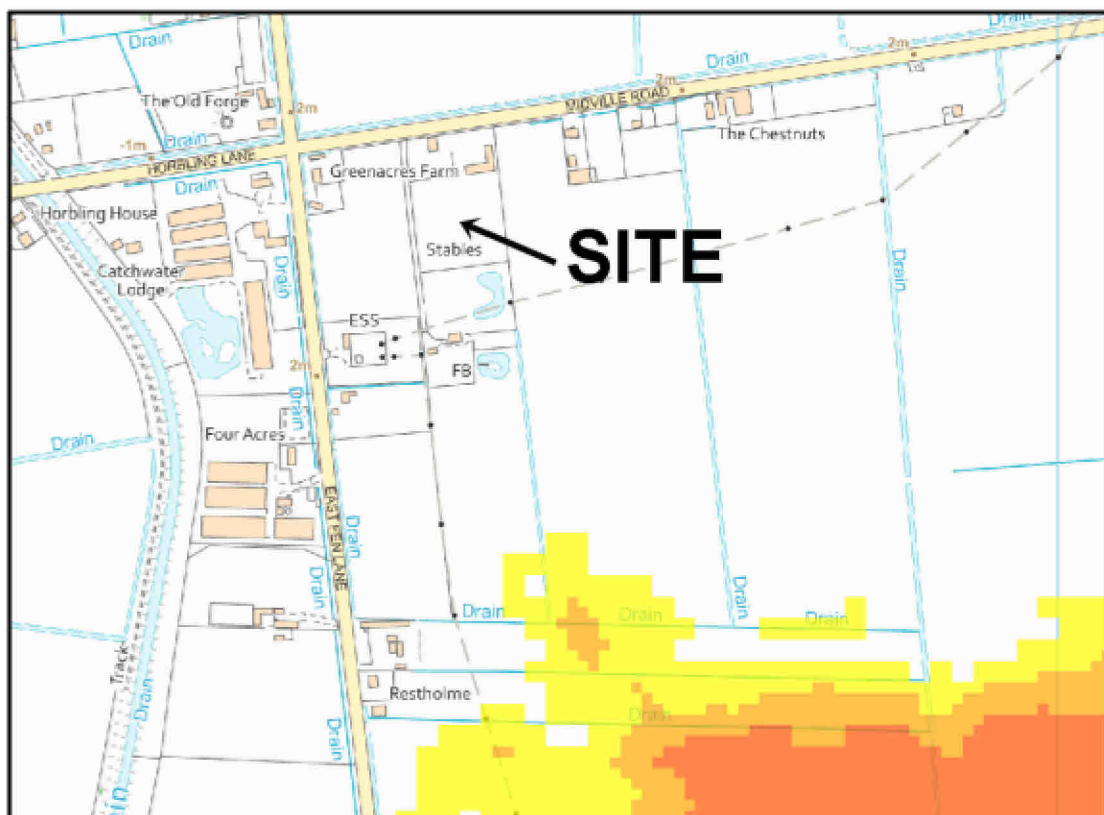


Figure 4.2 Breach Depth of Flooding for 0.1% (1:1000) 2115 Climate Change Event

Overtopping of Defences

- 4.22 The information provided by the EA confirms that the site is not affected by overtopping in the present day.
- 4.23 The site could be affected by overtopping in 2115. However, it is assumed that the EA will take action to keep up with climate change and the risk will therefore not increase. This approach has previously been agreed between the EA and the local authorities.
- 4.24 The residual risk of flooding from tidal sources is low.

Pluvial

- 4.25 The EA have produced maps showing flooding when rainwater lies or flows over the ground. The surface water flooding extents are shown below in **Figure 4.3**. Unlike the fluvial mapping, which is based on a detailed hydraulic model, this mapping is based purely on applying rainfall to a digital terrain model. As such this mapping serves to represent a worst-case scenario which may well overstate the actual probability of flooding in this area.
- 4.26 There is a caveat, as to the use of these maps and that they are not to be used to identify that an individual property will flood. Because of the way they have been produced and the fact that they are indicative these maps are not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

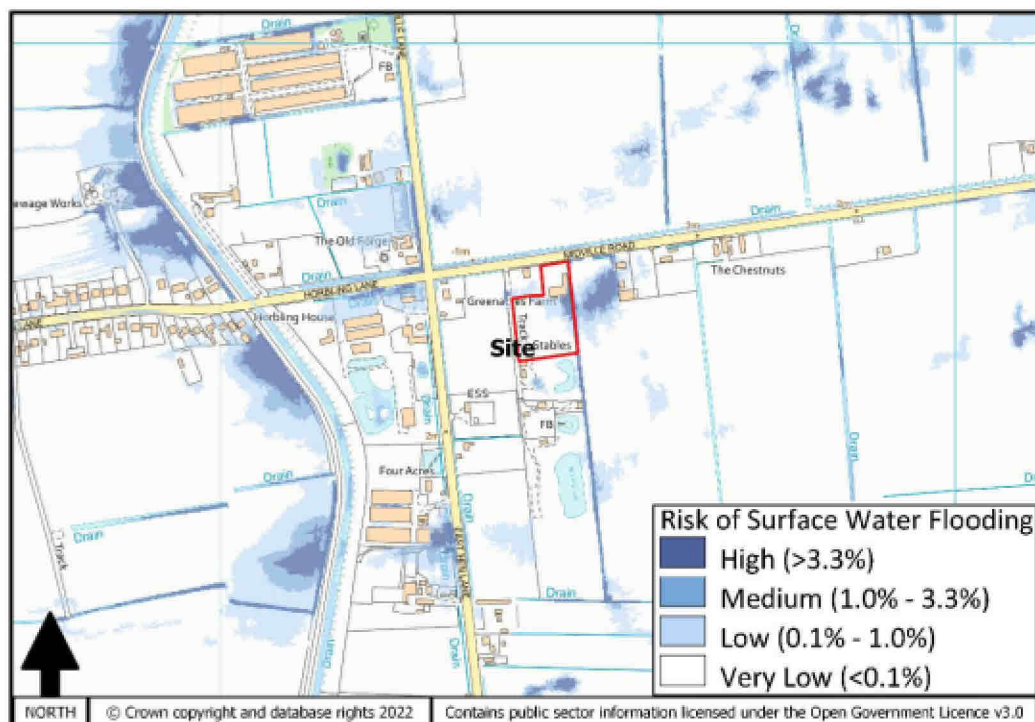


Figure 4.3 Surface Water Flooding Extents

- 4.27 The small area of high risk surface water flooding has depths of up to 300mm.
- 4.28 The overall risk of flooding from pluvial sources is low.

Groundwater

- 4.29 The site is located on rocks with essentially no groundwater and there are no known instances of groundwater flooding in the area.
- 4.30 The risk of flooding from groundwater is low.

Sewers

- 4.31 Public maintained sewers are unlikely to pose a significant flood risk as they are well maintained.
- 4.32 The risk of flooding from existing sewers is low.

Reservoirs

- 4.33 The EA has prepared reservoir failure flood risk mapping to show the largest area that might be flooded if a reservoir were to fail and release the water it holds. The mapping displays two scenarios as follows:
- Dry this is the extent when the river levels are normal,
 - Wet this is the extent when there is also flooding from rivers.
- 4.34 The mapping displays a worst-case scenario and is only intended as a guide.
- 4.35 The site is shown to be at risk of flooding due to the failure of a large, raised reservoir in the wet scenario. However, given the legal requirement to design, construct, inspect and maintain a reservoir under the Reservoirs Act this type of failure is very unlikely and therefore the risk of flooding is considered to be low.

Canals and Artificial Water Bodies

- 4.36 The site is not at risk of flooding from canals.

5.0 MITIGATION

5.1 Section 4.0 has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

Site Layout

5.2 The proposed development is at a **residual** risk of fluvial flooding with potential breach flood depths of 0.22m.

5.3 The floor level of the proposed lodges and restaurant will be raised by 300mm above the existing ground level to a minimum of 1.20m AOD.

5.4 It is recommended that the future occupants sign up to the EA flood warning service and a flood emergency plan be the subject of a condition which includes as a minimum;

- Potential sources of flooding and severity;
- Flood warning trigger level;
- Actions to be taken by staff on receipt of warning;
- Identification of escape routes and potential flood depths;
- Deploying flood protection and safe refuge;
- Reoccupation of the Site;
- Training and Exercising;
- Emergency contact information.

6.0 CONCLUSIONS

- 6.1 This FRA is compliant with the requirements set out in the NPPF and the associated online Planning Practice Guidance.
- 6.2 The FRA has been produced on behalf of Mr A Downes.
- 6.3 This report demonstrates that the proposed development is not at significant flood risk, and will not increase flood risk to others, subject to the recommended flood mitigation strategies being implemented.
- 6.4 The identified risks and mitigation measures are summarised below;

Flood Risk Source	Level of Risk Without Mitigation	Proposed Mitigation
Residual (fluvial)	Medium	minimum floor level 1.20m AOD. Flood emergency plan
Fluvial Tidal Pluvial Groundwater Sewers Reservoir	Low	
Canal/Artificial	None	

Table 6.1 Summary of Risk and Mitigation

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