FLOOD RISK ASSESSMENT
Holbeach Institute of Technology

For
GF Tomlinson

GFT01682/3FR/V1.1

REPORT DETAILS

Reference/Rev	Report Type	Author / Approved	Issue Date
GFT01682/3FR	Flood Risk Assessment	MPW/TSL	20/01/2020

REVISIONS

Revision	Details of Revision	Initials	Date
V1.0	First Issue	MPW	20/12/2019
V1.1	Climate change allowance increased to 40%	MPW	20/01/2020

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1.0 INTRODUCTION

1.1 Terms of Reference

1.1.1 This Flood Risk Assessment (FRA) has been prepared to reflect the requirements of the National Planning Policy Framework 2019 and guidance documents.

1.1.2 The report relates to the proposed development of the site.

1.1.3 The report is based on the following information:

(i) OS Explorer Series Mapping
(ii) Environment Agency Mapping
(iii) Internal Drainage Board Mapping
(iv) Sewerage Undertaker Mapping

1.1.4 This study relies on statistical assessments and therefore positive conclusions with respect to flooding should not be interpreted as a guarantee against flooding of the study site.

2.0 DETAILS OF SITE

2.1 Site Location

2.1.1 The proposed development site is currently an agricultural field and forms part of a wider development site accessed off the A151. The development is for the University of Lincoln. The site is relatively flat with a nominal fall towards the south and an Internal Drainage Board ditch.

The Institute of Technology (IOT) plot is located on a wider site which has outline planning approval. A Flood Risk Assessment was produced by JBA Consulting in August 2016 for this outline approval however the IOT was not part of the proposed development at that time. This assessment therefore covers the flood risk to the IOT plot only.

One of the proposed buildings on the wider site, the Centre of Excellence, is due to commence construction at the beginning of 2020.

A location plan and aerial photograph are provided below in Figures 1 & 2.

Table 1 – Site Summary

Project Name	Holbeach Institute of Technology
Address	A151, Holbeach CP, South Holland, Lincolnshire, PE12 7BF
OS NGR	E: 534864 N: 325678
Site Area	0.304ha
Development Type	Educational
EA Development Control Area	Lincolnshire and Northamptonshire
Local Planning Authority	South Holland District Council

Figure 1 – Site location plan



Figure 2 – Aerial Photograph



2.2 Development Proposals

2.2.1 The development proposals comprise the construction of a single storey modular building for educational purposes including a number of teaching rooms, office space and a library. A proposed development layout is presented below in Figure 3.

The proposed development is supplementing a building currently under construction for the University of Lincoln on the adjacent plot and will be serviced through that plot.

Figure 3 – Development Proposals

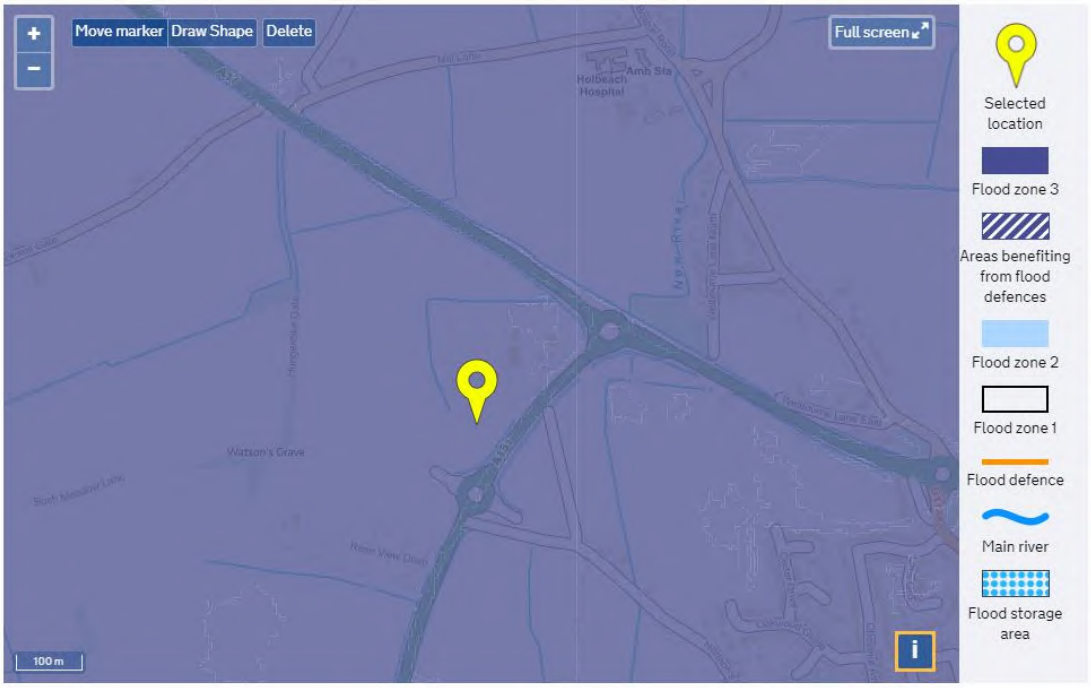


3.0 INITIAL ASSESSMENT

3.1 Flood Zone Classification and Historical Flooding

Figure 4 below shows the indicative flood plain map as presented on the Environment Agency Website. The site is shown to generally lie within Zone 3 (within the 1 in 100 year flood plain).

Figure 4 - Environment Agency Indicative Flood Map



3.2 Possible Flood Mechanisms

Set out below are the potential sources of flood risk to the site. The significance of these sources is investigated further in Section 4.0 of this report where applicable.

Table 2 – Possible Flood Mechanisms

Flood Source	Presence	Description
Flooding from Rivers (Fluvial)	✓	The site is in close proximity to the River Welland and River Nene with the former being classed as tidal. The indicative Environment Agency map indicates the site to be with Flood Zone 3. This is discussed further in Section 4.1.
Flooding from the Sea (Tidal)	✓	The site is situated <15km from the sea and is, along with the nearby rivers, considered to be influenced by tidal waters. This is discussed further in Section 4.2.
Flooding from Groundwater	✓	The Strategic Flood Risk Assessment does not include specific guidance on the risk of groundwater flooding susceptibility however site investigation works which have been undertaken on the adjacent plot have indicated water strikes at shallow depth. This is discussed further in Section 4.3.
Flooding from Sewers	✓	There are no adopted sewers within close proximity to the site however there is an Internal Drainage Board ditch between the building and the A151. External levels and drainage should therefore be designed to divert and capture overland flows away from the buildings. This is discussed in Section 4.4.
Overland flow originating off site	✓	The surrounding land is relatively flat however there is a nominal fall to the south towards the ditch on the south east boundary. External levels and drainage should therefore be designed to divert and capture overland flows away from the building. This is discussed further in Section 4.5.
Development Drainage	✓	There will be a local increase in impermeable area from the proposed development. A detailed drainage design should therefore be undertaken to manage the increased surface water run-off from the site. This is discussed further in Section 4.6.
Reservoirs canals and other artificial sources	X	The site is not deemed to be at risk of flooding from reservoirs according to Government flood maps. The Reservoir Act 1975 further places restrictions on owners of reservoirs to mitigate the risk of flooding downstream.

The primary sources of flood risk are considered to be from Fluvial and Tidal flows.

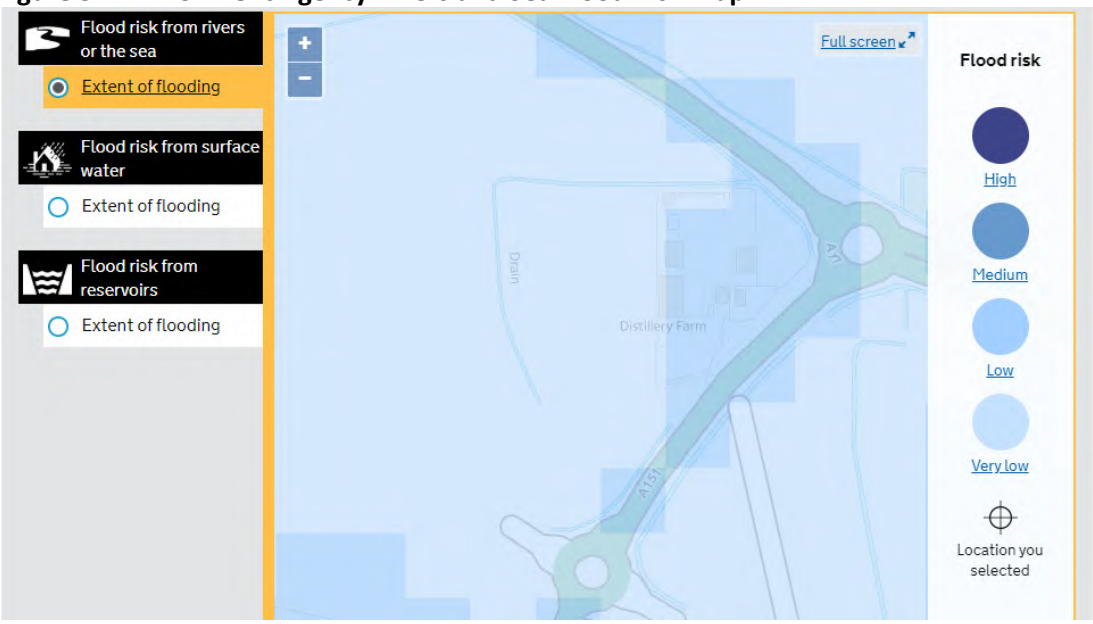
4.0 FLOOD RISK ASSESMENT

4.1 Flooding from Rivers and the Sea (Fluvial and Tidal)

The Environment Agency's indicative flood maps show the development area is located wholly within the **Flood Zone 3** which is defined as being land at a high probability of flooding (within the 1 in 200 year floodplain for a tidal breach situation).

The Environment Agency Rivers and Sea Flood Risk map in Figure 5 below indicates the site to be at very low/low risk of flooding. This is likely due to the fact the tidal sea defences as indicated within Appendix B would need to be breached prior to the area flooding.

Figure 5 - Environment Agency Rivers and Sea Flood Risk Map



The JBA Consulting flood risk assessment produced for the wider site included correspondence and mapping from the Environment Agency on the tidal breach situation. This information is included within Appendix B and indicates in the 1:200 year event of 2115 that there is a maximum hazard of between 0.75-1.25 which is 'Danger to Some'. The maximum depth indicated is between 0 - 0.5m and velocity is between 0 - 0.3m/s.

The maximum hazard in the 1:1000 year event of 2115 is also indicated to be between 0.75-1.25, 'Danger to Some'.

These are hazard maps are corroborated by the ones included within the Strategic Flood Risk Assessment.

The topographic survey indicates the lowest site level, excluding the ditch to the eastern boundary, to be 2.84m AOD. Based on the maximum depth indicated on the breach assessment the finished floor level of the proposed building should be no lower than 3.34m AOD. The adjacent building has been designed at a flood level of 3.7m which if adopted for this development would provide 0.36m of freeboard.

4.2 Flooding from Groundwater

As discussed in Table 3 the Strategic Flood Risk Assessment does not include flood susceptibility mapping however the site investigation did identify shallow water strikes. Ground water monitoring was undertaken and confirmed a relatively shallow water table although no flooding.

It would be prudent to ensure that external levels fall notionally away from the building to direct any flooding away from the building.

However, the tidal sea defence breach situation is more onerous. Setting the proposed floor level as discussed in Section 4.1 will limit the risk of flooding from groundwater.

4.3 Flooding from Sewers

Sewer records have been obtained from Anglian Water and are included in Appendix D. They indicate that there a no existing sewers in proximity to the development site. There is an existing drawing ditch on the south eastern boundary which drains into an IDB ditch on the eastern side of the A151.

It would be prudent to ensure that development drainage is designed to intercept any overland flows from the sewers prior to affecting the building. External levels should also fall notionally away from the building to direct any overland flows away from the building.

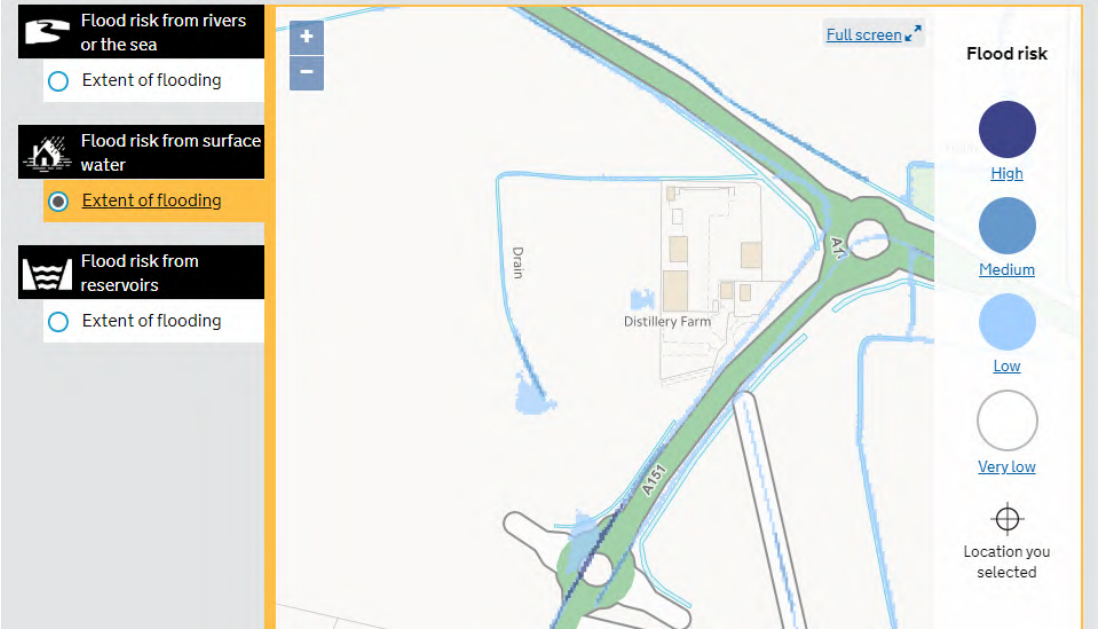
However, the tidal sea defence breach situation is more onerous. Setting the proposed floor level as discussed in Section 4.1 will limit the risk of flooding from sewers.

4.4 Overland flow

No evidence or report of overland flow has been identified in the production of the report however it is proposed that the external works design for the development should ensure that any potential overland flows are routed away from buildings.

However, the tidal sea defence breach situation is more onerous. Setting the proposed floor level as discussed in Section 4.1 will limit the risk of flooding from overland flows.

Figure 6 - Environment Agency Surface Water Flood Risk Map



4.5 Development Drainage

4.5.1 Existing Drainage Survey

The site is currently an agricultural field which has no positive storm or foul water drainage however there is a drainage ditch on the eastern boundary of the site

4.5.2 Proposed Storm water Discharge

The National Planning Policy Framework Technical Guidance seeks to promote the use of Sustainable Urban Drainage Systems (SUDS) for new developments to limit both peak discharges and the volumes of surface water leaving sites.

CIRIA C697 The SUDS Manual defines a hierarchy of SUDS methods with Prevention identified as most preferable followed by Source Control, Site Control and ultimately regional control. Consideration of suitable development drainage proposals has been undertaken with consideration being given to this hierarchy and commentary in relation to the decision making process is presented in Table 3 below.

The use of Sustainable Urban Drainage not only reduces the volume of water discharged from the site and the rate of discharge but also has the potential to increase water quality. CIRIA C697.

Table 3 – Consideration of appropriate SUDS techniques

SUDS Technique		Commentary	Suitability
Prevention	Development Layout	There is limited space available within the site layout to accommodate above ground SUDS features.	X
	Maintenance Responsibility	Maintenance responsibility will fall to the university which owns and operates the building.	✓
	Rainwater harvesting	Rainwater harvesting may have been suitable however the high groundwater limits the potential for below ground storage due to the risk of floatation.	X
Source Control	Infiltration by Soakaway	A review of the Phase 2 Site Investigation indicates the presence of materials with limited infiltration potential and a high water table.	X
	Green roofs	Green roofs are a relatively heavy roof construction and would likely not be suitable on the proposed modular construction.	X
	Permeable paving	There are limited external areas due to the development being serviced from the adjacent building.	X
	Swales	The high water table requires open storage features to be lined and ballasted down to prevent seepage into the storage/conveyance features or floatation of the lining.	✓ / X
Site Control	Detention Basins/ Ponds/ Wetlands	The adjacent building will service the new development and incorporates an open attenuation pond. It will be sized to accommodate runoff from this development.	✓

The development proposals incorporate limited external areas with only a footpath around the building for access. The roof area and footpaths equate to a catchment of 668m^2.

It is currently proposed that the adjacent plot's open attenuation pond is to be increased in size to accommodate the catchment from this proposed building. Currently the adjacent plot has an agreed discharge rate of 5l/s into the onsite ditch and subsequent IDB ditch with the pond having been sized for their catchment and this discharge rate.

To calculate the additional storage required for our proposed building a storage estimation has been undertaken using Flow and is included in Appendix C. This calculation has been undertaken on the basis that none of the agreed discharge rate is apportioned to the proposed building and therefore a discharge rate of 0l/s has been used in the calculation.

This calculation indicates that for a 1:100 year + 40% climate change storm event the pond requires an additional 94m3 of storage volume. The drainage model for the adjacent plot has been revised incorporating the proposed catchment from this building to corroborate this volume.

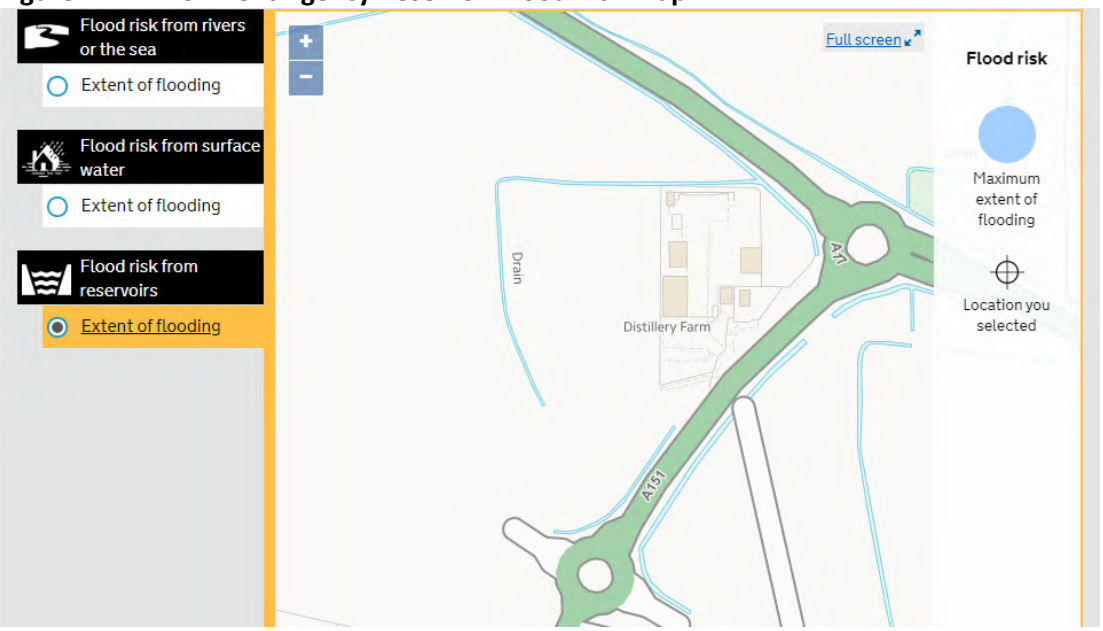
4.6.3 Proposed Foul Water Discharge

The foul water from the proposed development will discharge into a stub provided within the adjacent plot.

4.7 Flooding from Reservoirs, Canals and Other Artificial Sources

Not Applicable.

Figure 7 - Environment Agency Reservoir Flood Risk Map



5.0 SEQUENTIAL TEST AND EXCEPTION TEST

5.1 The development proposals comprise an educational end use which is classified in the Technical guidance accompanying the National Planning Policy Framework as a more vulnerable classification.

5.2 As discussed in Section 4.1 the site is generally classified as being situated in Flood Zone 3 as defined in the National Planning Policy Framework technical guidance.

5.3 With reference to the requirements of the National Planning Policy Framework Technical Guidance summarised in tables NPPF2 and NPPF3 below the site may be considered sequentially preferable subject to an exception test.

5.4 In line with the requirements of the National Planning Policy Framework Technical Guidance an exception test is required.

5.5 In consideration of the wider aspects of the exception test it should be noted that the site has the benefit of planning approval for educational use and this proposed building will be ancillary to one of these approved buildings.

With respect to the wider social and economic benefits necessary to satisfy an exception test many of these are considered beyond the scope of this report although the following commentary is offered to illustrate the general setting.

This development consists of the construction an ancillary building to the approved Centre of Excellence on the adjacent plot and will be serviced via this building. The IOT plot is at no greater risk of flooding than the approved Centre of Excellence.

Table NPPF2: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; 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 plants. • Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan**.

Table NPPF3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (See Table D.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	X	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	X	X	X

6.0 SUMMARY OF FLOOD MITIGATION MEASURES

6.1 The proposed development is considered to be at a very low/low risk of flooding but could be inundated during a breach situation. However, even in this situation there would only be a 'Danger to Some' with the flood waters not indicated to exceed 0.5m in depth or 0.3m/s in velocity.

6.2 The proposed building is to have a minimum floor level of 3.34m AOD based on the breach assessment maximum flood water depth over the lowest site surveyed site level. If the building was raised to match the adjacent building's floor level of 3.7m AOD this would provide a freeboard of 0.36m.

6.3 The proposed impermeable roof area of the development is 668m^2 and the runoff from this is proposed to be accommodated in the adjacent building's attenuation pond. On the basis of a 0l/s outflow the pond will need to be increased in volume by 94m^3 for the 1:100 year + 40% storm event.

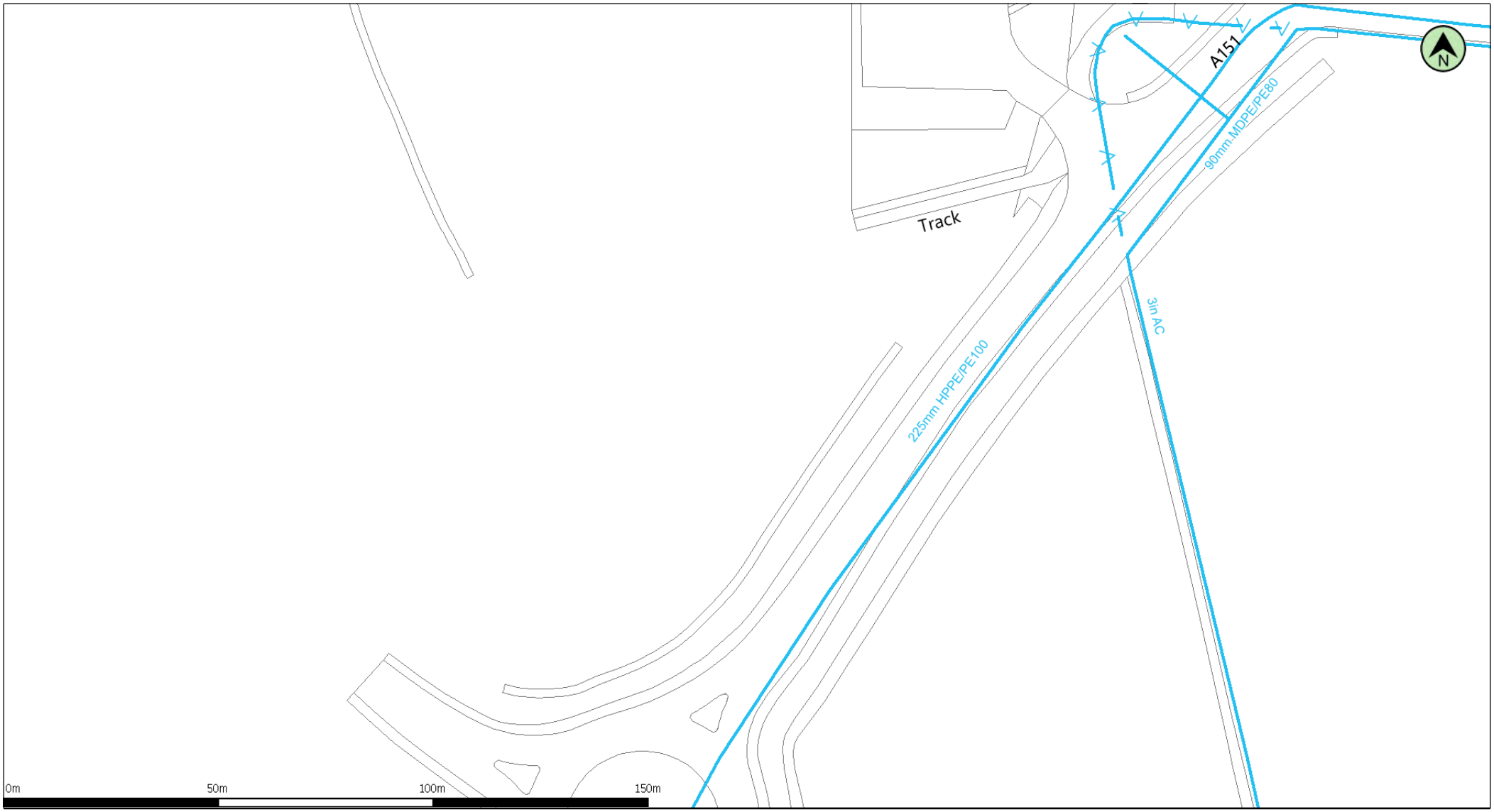
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Appendix A

Anglian Water Sewer Records



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Date: 21/08/19 Scale: 1:1250 Map Centre: 534868,325669 Data updated: 31/07/19 Our Ref: 330245 - 1 Clean Water Plan A4

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2019 Ordnance Survey 100022432.This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Potable Water

Raw Water

Decommissioned Water

Fitting

Hydrant

nickts@greenhatch-group.co.uk

U of L

love every drop anglianwater

Appendix B
Environment Agency Breach Mapping

Gavin Hodson
Gavin.Hodson@jbaconsulting.com

Our ref: CCN-2016-14295

Date: 16 June 2016

Dear Gavin Hodson,

Flood Hazard Mapping – Holbeach. Grid Reference TF3483525626

Thank you for your request for copies of our flood hazard mapping for the above location.

Hazard Mapping – Breaching Enclosed with this letter is a plan showing the location of the breaches we have modelled, together with two plans showing the maximum values of flood depth, velocity and hazard rating (danger to people) for the following scenarios:

- Year 2115 0.5% (1 in 200) chance event
- Year 2115 0.1% (1 in 1000) chance event

Your site is not affected by overtopping for the 0.5% (1 in 200) and 0.1% (1 in 1000) chance events in 2006.

I hope that we have correctly interpreted your request. Please see the Standard Notice or licence for details of permitted use. The Standard Notice can be found at the link below.

http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

If you have any queries about the hazard mapping please contact the PSO team using the telephone/email details below. Please quote our CCN reference number in all correspondence where data is referenced.

Yours sincerely

FOR Ian Cappitt
Partnerships and Strategic Overview Team Leader Lincolnshire

Awarded to Lincolnshire & Northamptonshire Area

Direct dial 0203 025 4942
Direct fax 01522 785018
Direct e-mail PSOLINCS@environment-agency.gov.uk
Enc.
FRA/FCA Advisory Text
Breach Location Plan
Breach Hazard Maps x 2

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Important
If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

http://www.environment-agency.gov.uk/research/planning/33580.aspx

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

http://www.environment-agency.gov.uk/research/planning/82587.aspx

http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance

http://www.communities.gov.uk/publications/planningandbuilding/pps25guideupdate

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

In **Wales,** you should refer to TAN15 for information about what flood consequence assessment is needed for new development in the different flood zones
http://new.wales.gov.uk/splash;jsessionid=8ylGTfGZthmB0t2vhp6hS1GcB1LXvZzB3Ylczf20Xn7LK3zK0nMk!981825250?orig=/topics/planning/policy/tans/tan15/

You should also consult the Strategic Flood Consequence Assessment if one has been produced by your local planning authority.

In both **England and Wales** you should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.

3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.

4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

^ **Modelled Breach Locations**

0 3.5 7 14 Kilometres

This map indicates the location of where we have modelled the consequence of breaches in the defences along the coastline and tidal rivers. We have mapped the the maximum values of Hazard Rating (Danger to People), Depth and Velocity.

We have not assumed that all breaches occur at the same time, but have modelled each breach individually and overlaid the results to find the maximum values.

Our modelling only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. Our defences generally provide a good standard of flood defence but a risk of breaching remains.

Please contact the Environment Agency for information on how these maps are used in the management of flood risk.

General Enquiries No: 03708 506 506.
Weekday daytime calls cost 5p plus up to 6ppm from BT Weekend Unlimited. Mobile and other providers charges may vary

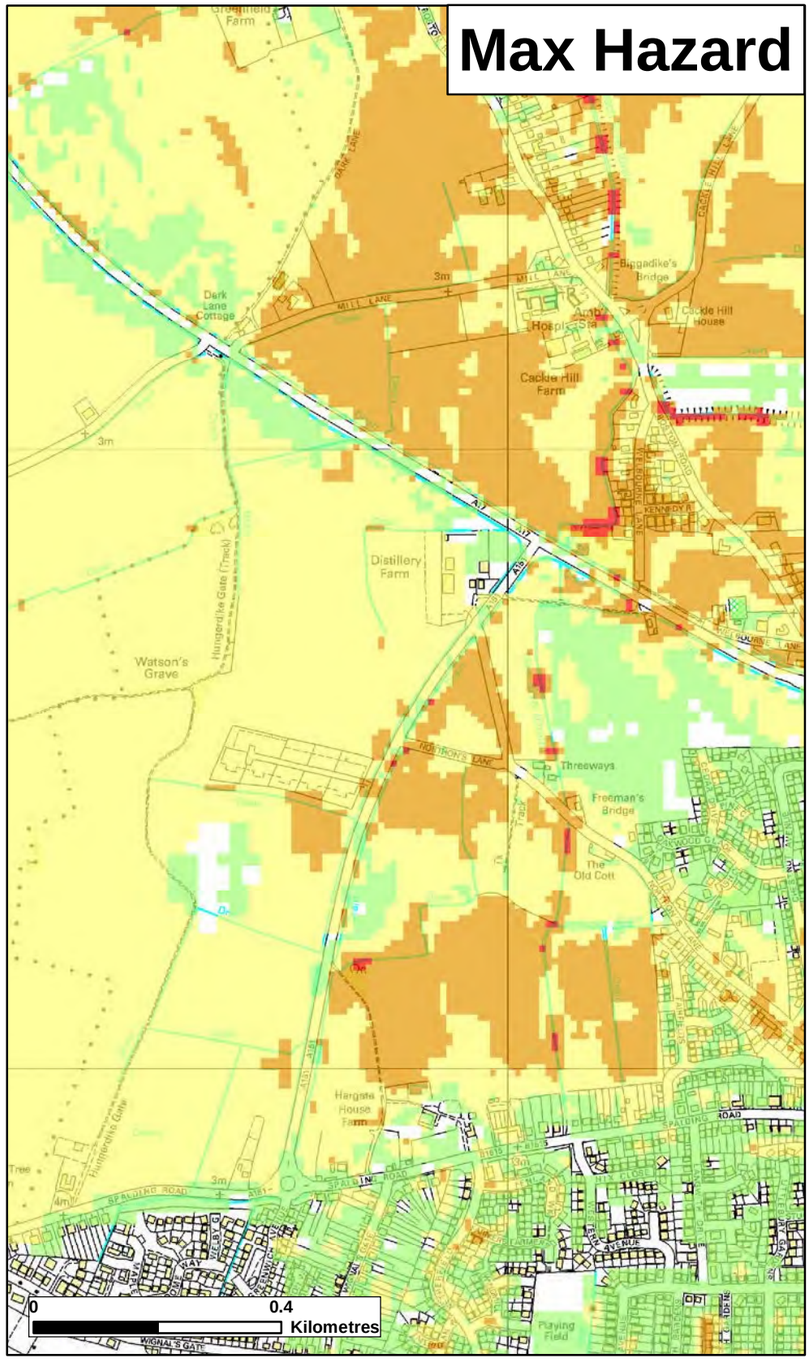
Environment Agency

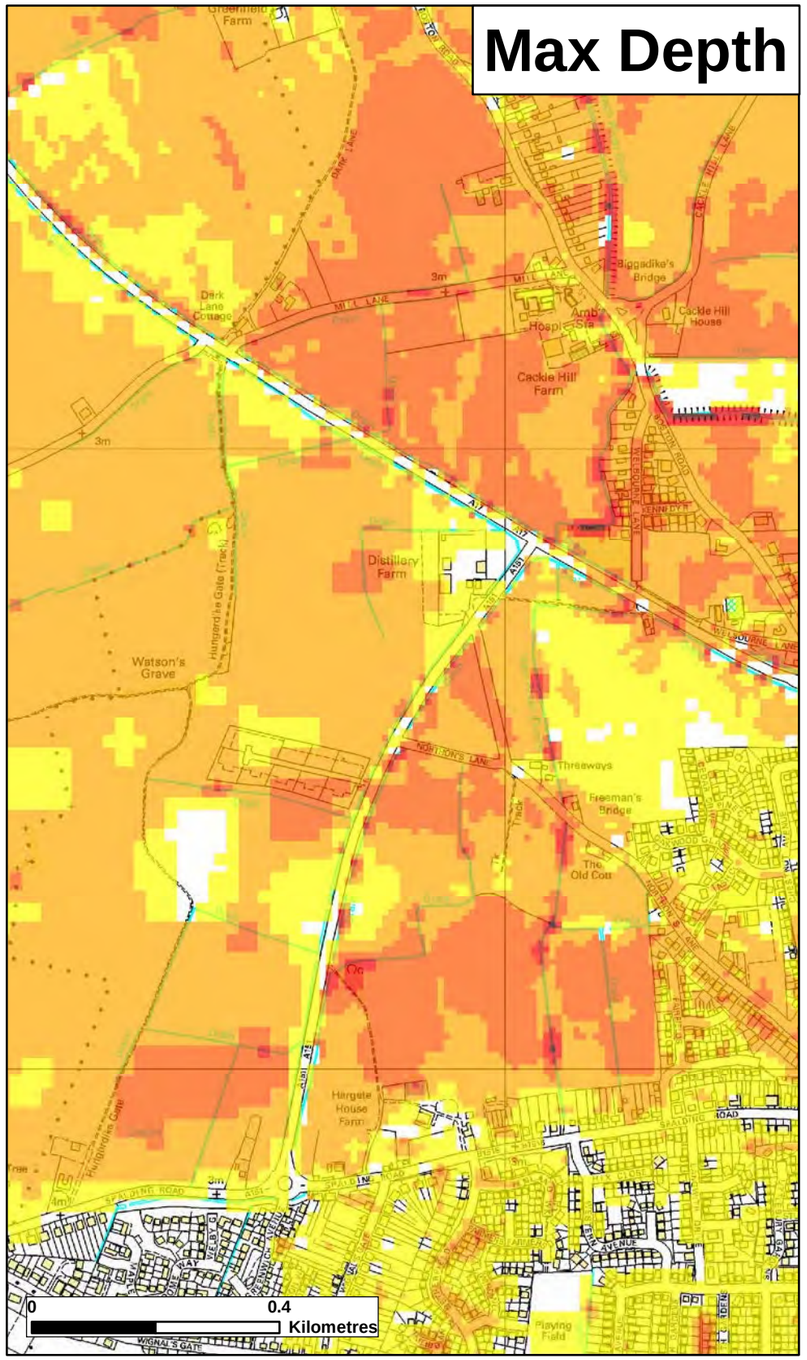
Produced by the Partnership and Strategic Overview Team, Lincoln
General Enquiries No: 03708 506 506

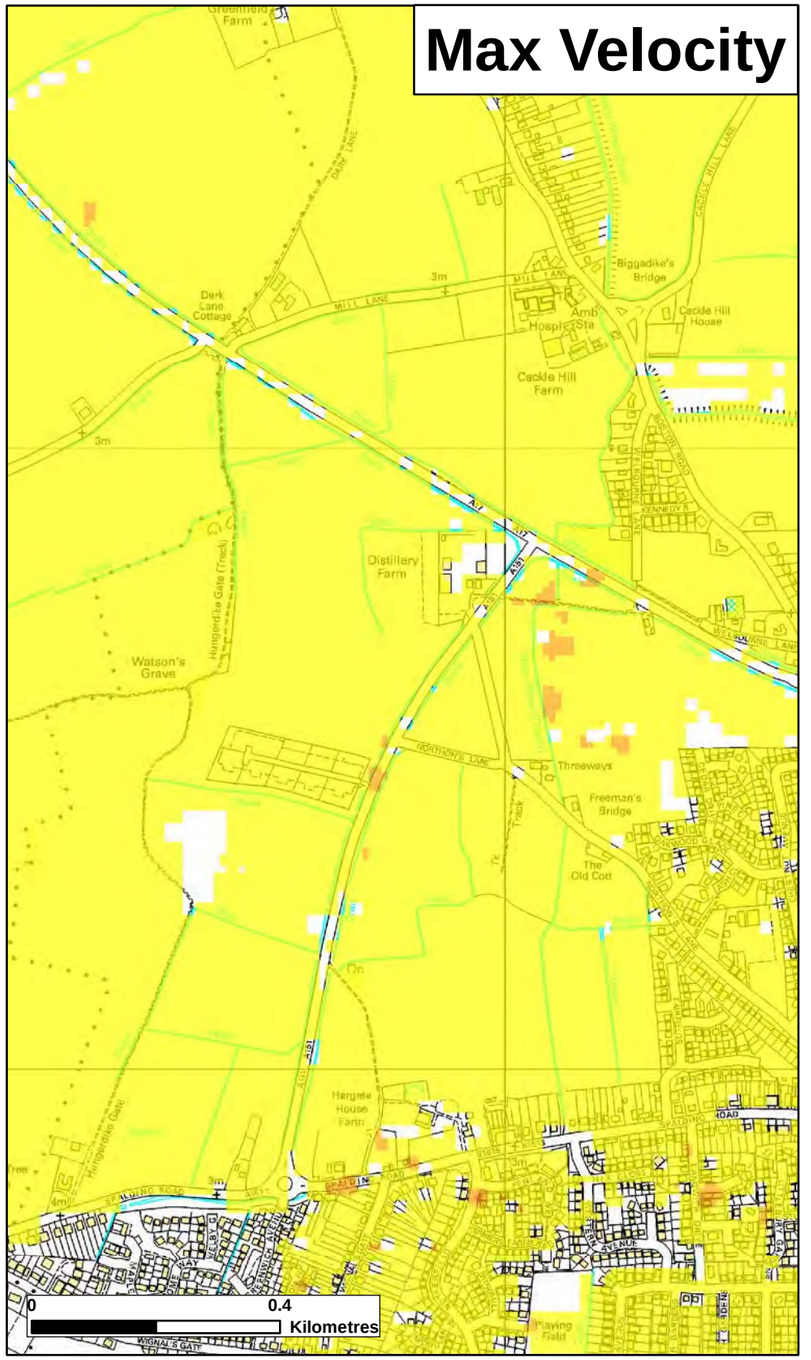
Northern Area Tidal Hazard Mapping

Location of Modelled Breaches

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★ Modelled Breach Locations

- see also the accompanying plan "Location of Modelled Breaches"

Max Hazard
(Flood Risk to People : FD2320)

- Less than 0.75 (Low Hazard)
- Between 0.75 and 1.25 (Danger for Some)
- Between 1.25 and 2.0 (Danger for Most)
- Greater than 2.0 (Danger for All)

Max Depth (m)

- 0 - 0.25
- 0.25 - 0.50
- 0.50 - 1.0
- 1.0 - 2.0
- 2.0 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 +

Date Printed	June 2016	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2016-14295

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.

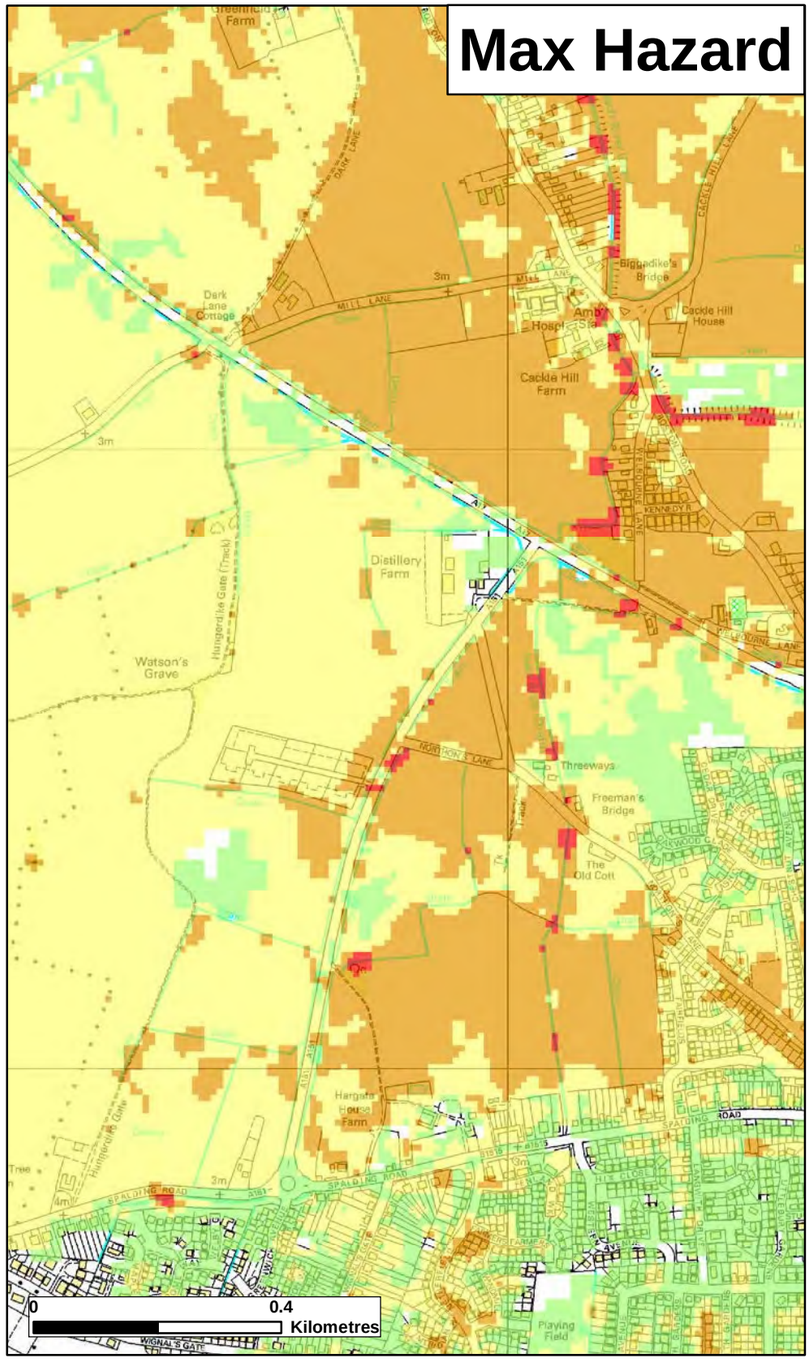
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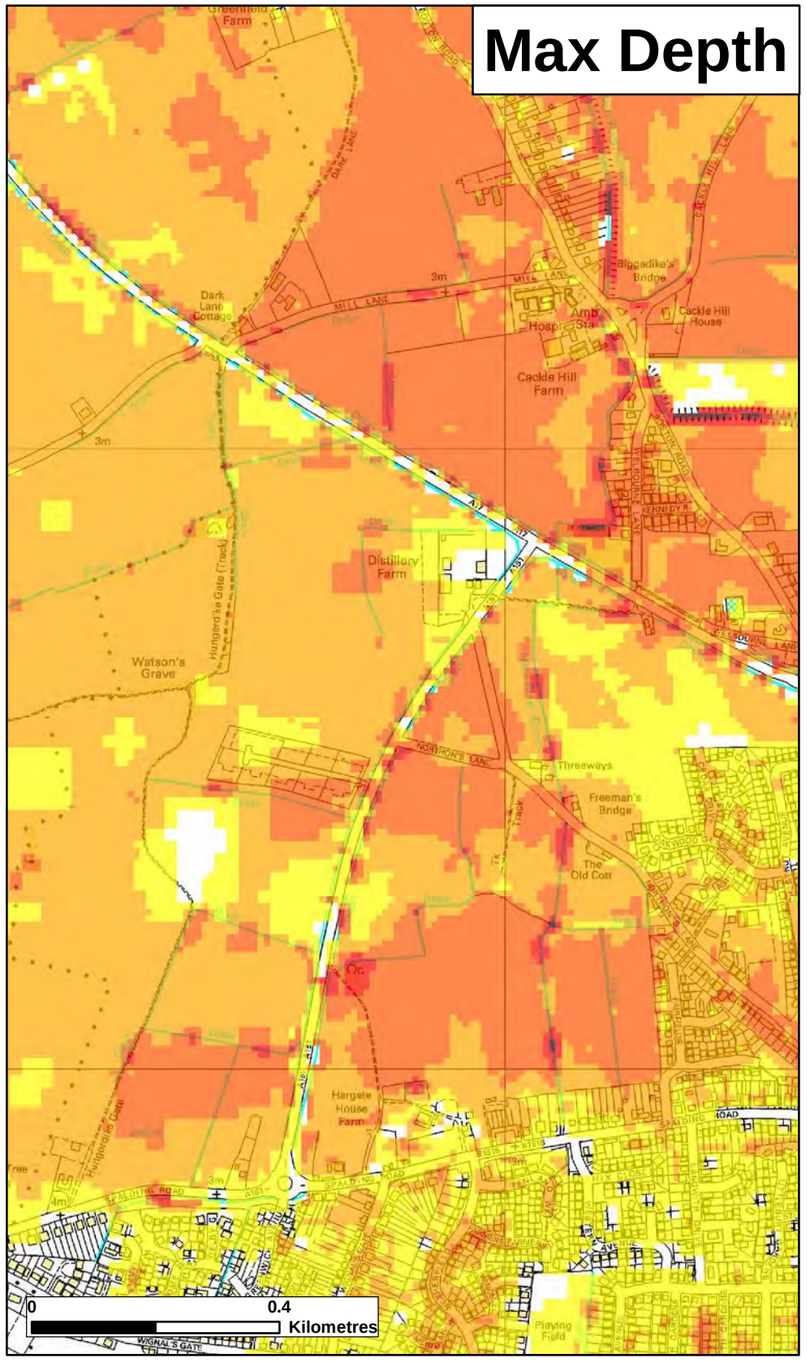
Environment Agency

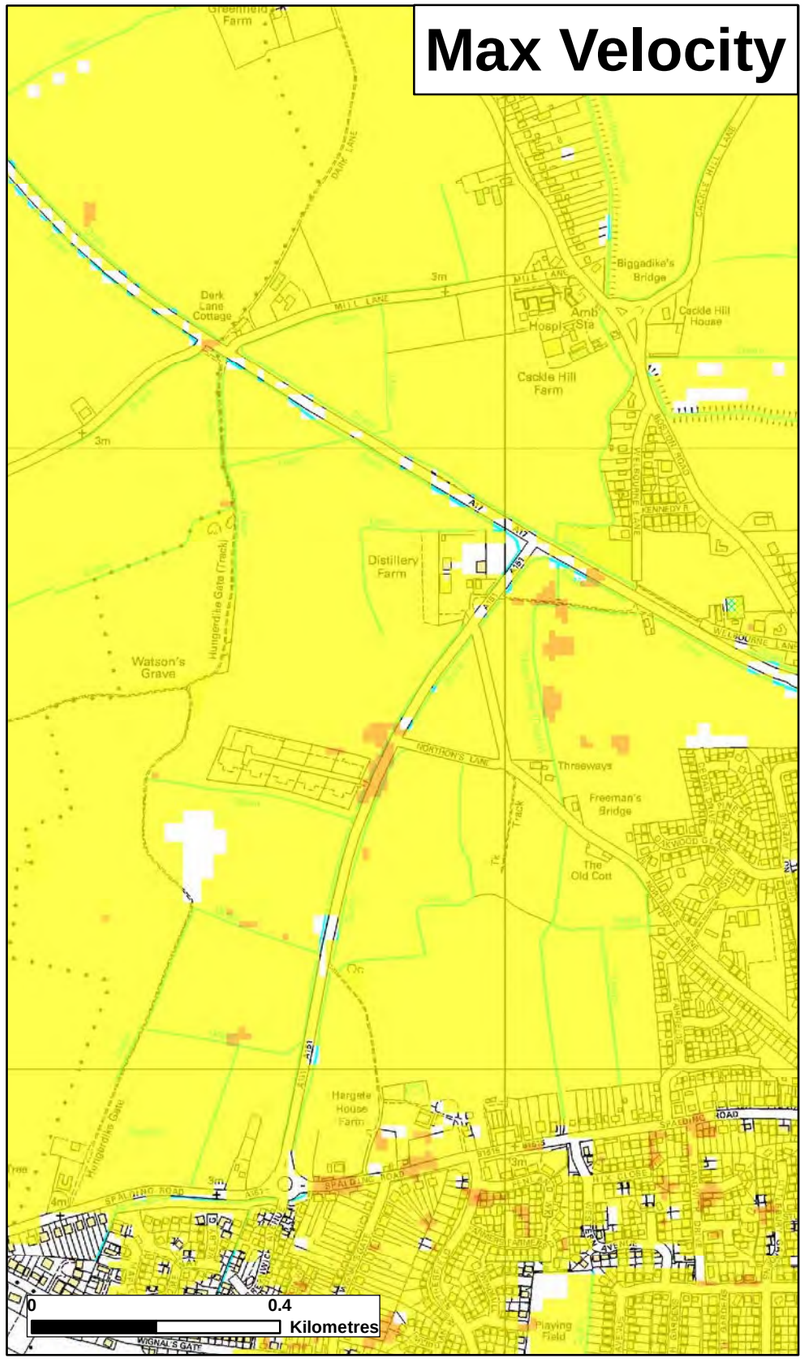
Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF3483525626

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★ Modelled Breach Locations

- see also the accompanying plan "Location of Modelled Breaches"

Max Hazard
(Flood Risk to People : FD2320)

- Less than 0.75 (Low Hazard)
- Between 0.75 and 1.25 (Danger for Some)
- Between 1.25 and 2.0 (Danger for Most)
- Greater than 2.0 (Danger for All)

Max Depth (m)

- 0 - 0.25
- 0.25 - 0.50
- 0.50 - 1.0
- 1.0 - 2.0
- 2.0 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 +

Date Printed	June 2016	Scenario year	2115	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2016-14295

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.

General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

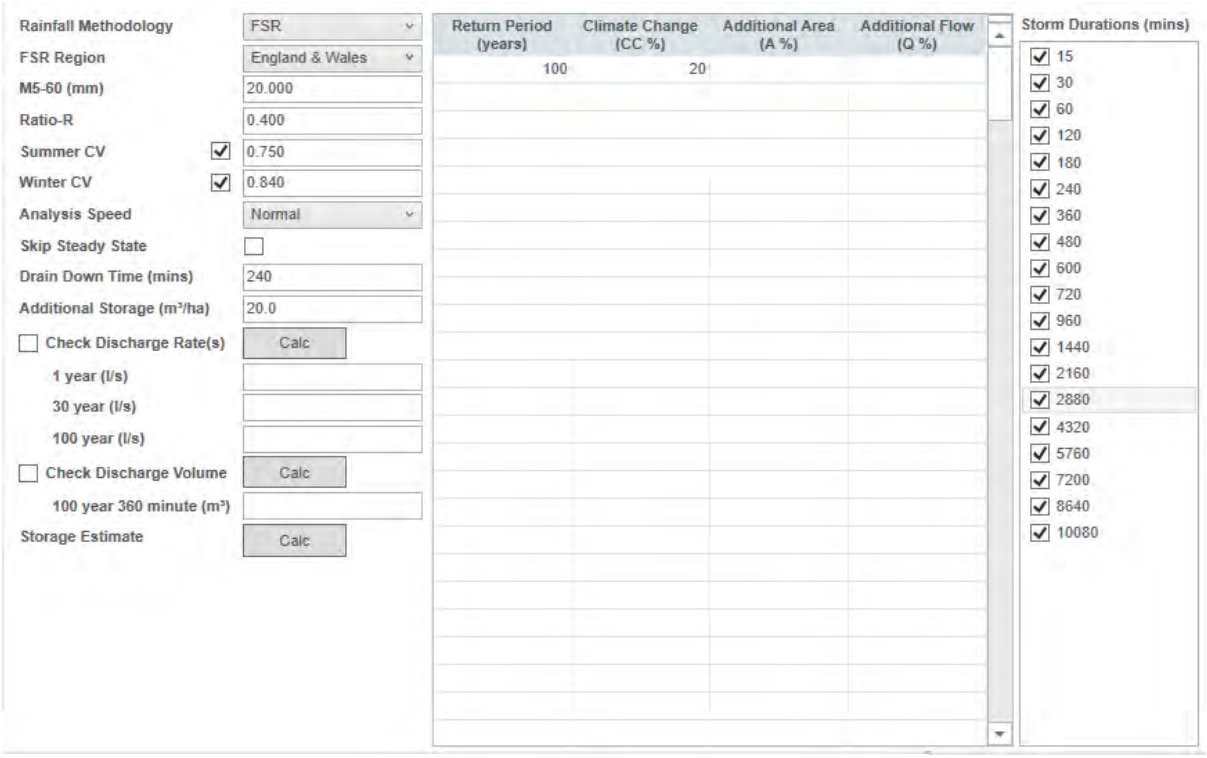
Environment Agency

Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF3483525626

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Appendix C
Quick Storage Estimate



Storage Estimate

Return Period (years)	100	OK
Climate Change (%)	40	Cancel
Impermeable Area (ha)	0.067	
Peak Discharge (l/s)	0.000	
Infiltration Coefficient (m/hr) (leave blank if no infiltration)		Calc
Required Storage (m³)	Calc	
from	94	
to	94	
With infiltration (m³)		
from		
to		

Appendix D
Site Investigation Extract

5.5 Obstructions Encountered

No obstructions were encountered below ground level as part of the site investigation works.

5.6 Groundwater

A summary of the groundwater levels recorded during the siteworks, and subsequent monitoring, is presented in Table 5.6. Full details of the water strikes recorded during progression of the investigation positions are presented on the exploratory hole logs included in Appendix A2 and full details of the water levels recorded during the monitoring visits are presented in Appendix A5.

Table 5.6 - Groundwater strikes during investigation and subsequent monitoring levels.

Exploratory Hole Location Ref.	Water Strikes During Site Investigation		Post Investigation Monitored Water Levels	
	Strike Depth (mbgl)	Strata	Installation Strata	Monitored Levels (mbgl)
WS02	-	-	Silty SAND	1.04 – 1.50
WS04	-	-	Silty SAND	0.95 – Dry
WS05	-	-	Silty SAND	1.29 – 1.60
WS07	-	-	Silty SAND	1.16 – Dry
CP02	-	-	Silty SAND	1.36

- No groundwater strikes recorded during site investigation works.

No groundwater strikes were recorded during the site investigation works, which were completed during the heavy rainfall period in mid-July nationwide. The deposits were recorded to be wet within all the exploratory holes. Post investigation monitoring has recorded groundwater levels relatively shallow on the first visit, and over the weeks this water level has dropped from 0.96m bgl at its shallowest to below 1.60m bgl generally. This is likely to be due to the water from the heavy rainfall period in mid-June slowly migrating through the deposits and dropping in level. It should be noted that these groundwater monitoring visits have been completed in the summer of 2019 and would expect the groundwater levels to rise to higher levels in the winter/spring time due to the permeable nature of the deposits.

5.7 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, third edition of 2005. Table 5.8 details the classification.

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Appendix E
Strategic Flood Risk Assessment Maps

N

NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.

2. This update only included new flood risk information from River Welland (Fluvial), River Glen (Fluvial) and Tidal hazard mapping (River Welland, River Nene and the Wash sea defences). No new information from the Internal Drainage Boards and associated systems was used for this update.

3. In addition to the potential flood extents shown on this map, there may be shallow flooding in low-lying rural areas

4. The consequences designated as being a Residual Risk arise from direct overtopping of defences, where this would occur, together with breach failure which is assumed could occur at any point along the defences.

5. The potential flooding consequences relate to flood probability bandings as follows:

Probability Band	Annual probability of Flooding	
	from a river (fluvial)	from the sea (tidal)
Low	<0.1%	<0.1%
Medium	1%-0.1%	0.5%-0.1%
High	>1%	>0.5%

6. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.

7. Land outside South Holland District is not considered.

8. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Flooding Probability bands :

- High
- Low or medium, but reliant on protection by flood defences for this standard
- Functional Floodplain
- South Holland District Boundary

REV	DATE	REMARKS
2	Feb 17	Modelling and Mapping Update
1	Dec 16	Modelling and Mapping Update

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UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Risk Extent
District - Present day
1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017 **REV NO:** 2

SCALE: 1 : 60,000 @ A1

MAP NO:

N

NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.

2. This update only included new flood risk information from River Welland (Fluvial), River Glen (Fluvial) and Tidal hazard mapping (River Welland, River Nene and the Wash sea defences). No new information from the Internal Drainage Boards and associated systems was used for this update.

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High	>1%	>0.5%

6. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.

7. Land outside South Holland District is not considered.

8. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Flooding Probability bands :

- High
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UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Risk Extent
District - Year 2115
1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017 **REV NO:** 2

SCALE: 1 : 60,000 @ A1

MAP NO:

N

NOTES

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5. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.

6. Land outside South Holland District is not considered.

7. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Peak Depth

- 0m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1m
- 1m - 2m
- 2m +
- Functional Floodplain
- South Holland District Boundary

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UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Peak Depth
District - Present Day
1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017 **REV NO:** 2

SCALE: 1 : 60,000 @ A1

MAP NO:

N

NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.

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Residual Peak Depth
District - Year 2115
1% Fluvial / 0.5% Tidal Event Probability

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MAP NO: