FLOOD RISK ASSESSMENT

Garn Box

Prepared for: AMP Energy Services Ltd.

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Appendix 01: Proposed Site Layout
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1.0 Introduction

SLR Consulting Limited has been appointed on behalf of AMP Energy Services Limited to prepare this Flood Risk Assessment (FRA) in support of a planning application for a 200kW 800kWhr Energy Storage System (ESS) ('Battery Box') ("the proposed development").

This FRA has been prepared under the direction of a Technical Director of SLR who specialises in flood risk and associated planning matters. The report has been completed in accordance with guidance presented within the National Planning Policy Framework (NPPF)[1] and its associated Planning Practice Guidance (PPG)[2], taking due account of current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533[3].

1.1 Site Location

The proposed development will be located at Garn Transport, Wardentree Lane, Pinchbeck, Spalding, PE11 3DQ ("the site"). This site is centred on National Grid Reference (NGR) 526004 325228. A site location plan is provided in Figure 1-1 below.

The site is under the planning jurisdiction of South Holland District Council (SHDC) and Lincolnshire County Council (LCC) is the lead local flood authority (LLFA). The site is also located under an area in which drainage matters are managed by the Welland and Deepings Internal Drainage Board (IDB).

Figure 1-1: Site Location Plan



1 National Planning Policy Framework: Communities and Local Government (July 2021)

2 Planning Practice Guidance: Communities and Local Government (last updated May 2022)

3 BS8533:2017, Assessing and managing flood risk in development: Code of Practice (December 2017)

1.2 Development Proposals

A Battery Box is an ESS that imports electricity from the local electricity network when demand for electricity is low or when there are high levels of renewable energy available. It then exports that electricity back to the grid when required in periods of high demand. This provides a solution to the growing need for flexibility and helps address concerns regarding grid reliability prompted by an increased reliance on intermittent generation of the electricity system.

Battery Boxes connect into the low voltage (LV) network, this is the lowest and most local point in the system where there is an increasing demand for electricity with the electrification of transport and heating systems. Stored electricity from the Battery Box will be exported and consumed in the locality of the box (when it is required).

The proposed development covers an area of just 24m^2 and is therefore a minor[4] development which is entirely ancillary to the adjacent commercial land operations. The physical infrastructure will consist of:

- Installation of a concrete plinth foundation;
- Installation of the battery containerised units and associated equipment; and
- The construction of a new fence surrounding the Battery Box.

A plan showing the proposed site layout is included in Appendix 01.

The development will be in place for no more than 30 years; following which all infrastructure will be removed, or fresh permissions would need to be sought.

The concrete plinth will be constructed in an area that has a current ground level of 5.6m above Ordnance datum (aOD) and will be finished with a top surface 0.3m above this level at 5.9m aOD. The battery containerised units and associated equipment will be placed and secured directly onto this surface and will have a further internal freeboard of 0.08m. As such flooding would need to reach an elevation of 5.98m aOD before the operation of the battery box was compromised.

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4 The Town and Country Planning (Development Management Procedure) (England) Order 2015, defines 'Major Development' as development involving any one or more of the following—

(a) the winning and working of minerals or the use of land for mineral-working deposits;
(b) waste development;
(c) the provision of dwellinghouses where—
  (i) the number of dwellinghouses to be provided is 10 or more; or
  (ii) the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
(d) the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or
(e) development carried out on a site having an area of 1 hectare or more;

Inter alia, everything below these thresholds, including the current application, is 'Minor'.

2.0 Baseline Site Appraisal

2.1 Existing Site Features

The site is a flat unused grass verge situated next to an existing secondary substation. It is located on the eastern edge of the service yard for Garn Transport.

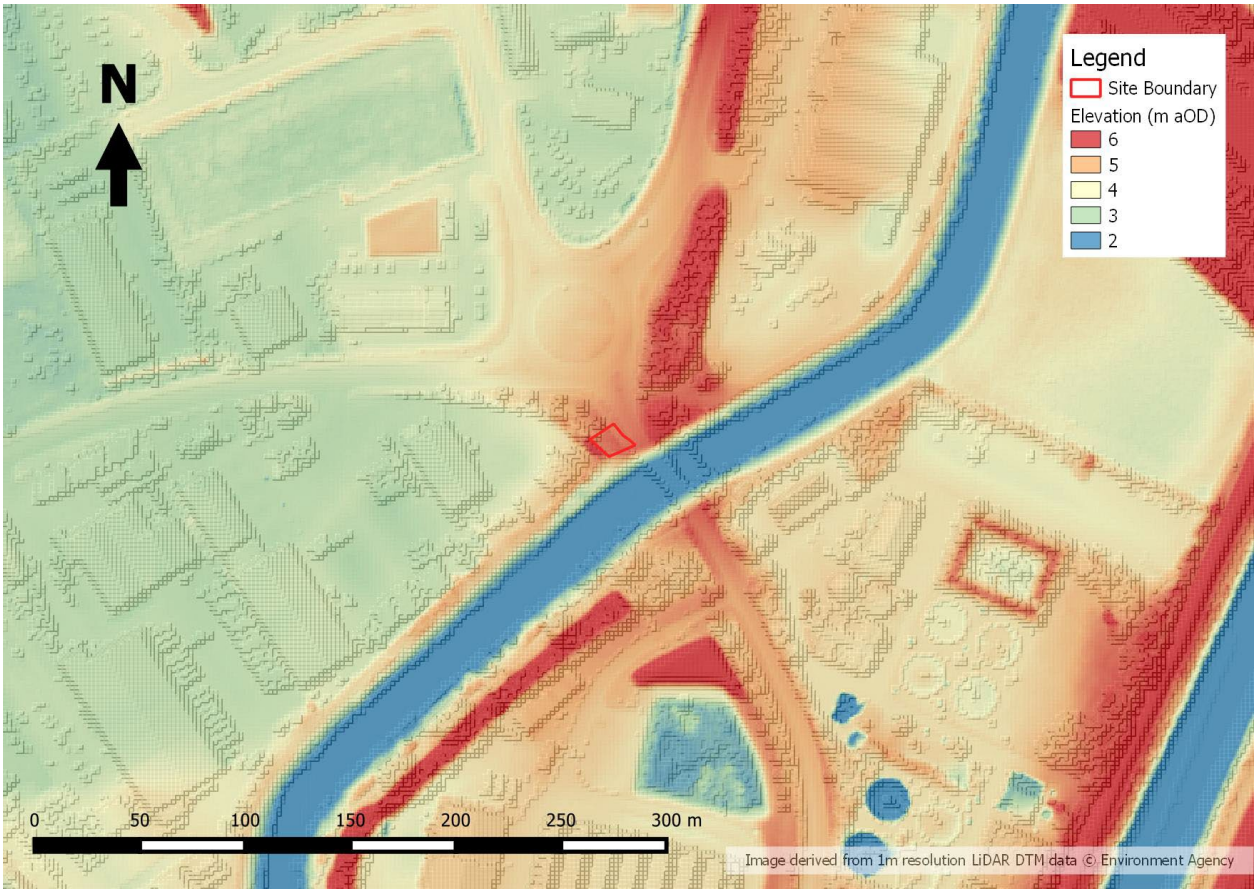
To the west of the site is West Marsh Road (B1180) with a roundabout to the north. To the south is a large open channel called Vernatt's Drain.

2.2 Topography

Topographic data from on and around the site, gathered using Light Detection and Ranging (LiDAR) aerial photogrammetric techniques, has been downloaded from the Environment Agency open data website[5]. This data has been used to provide information in relation to the topography of the land on and around the site, refer to Figure 2-1.

The LiDAR topographic data indicates that the site is on an area of built-up ground along the B1180 and around the roundabout to the north. This area is at a height of between 5.5 and 6.0m aOD. This is over 1.5m higher than the hardstanding immediately to the west and compares to typical water levels of around 1.5m aOD in the adjacent channel.

Figure 2-1: Environment Agency LIDAR of the Site



5 Defra open data website, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

2.3 Hydrology and Drainage

Vernatt's Drain, which is designated as an Ordinary Watercourse, is under the control of the Wellings and Deeping Internal Drainage Board (IDB). The channel is located just 20m to the south of the site and flows in an easterly direction.

Past the site Vernatt's Drain, runs parallel to the River Welland which is designated as a Main River.

The head of Vernatt's Drain is at a pumping station at Pode Hole (operated by Wellings and Deeping IDB) where it receives pumped flows from the local drained marshland. The drain then conveys these flows past the site to Surfleet Seas End where it joins the River Welland. Sluice gates are present at this point to prevent high water levels in the river backing up into Vernatt's Drain.

Vernatt's Drain receives pumped fluvial water from low lying drainage networks. Water levels along the drain are however influenced by whether water can freely discharge into the River Welland which is tidal.

2.4 Geological and Hydrogeological Features

2.4.1 Geology

The National Soil Resources Institute[6] indicates that the soils at the site consist of "*Loamy and clayey soils of coastal flats with naturally high groundwater*". British Geological Survey (BGS) mapping[7] indicated that the site is underlain by the Oxford Clay Formation which is overlain by drift deposits that are described as Tidal Flat Deposits of Clay and Silt.

In reality the road embankment on which the site sits, is artificially raised above adjacent ground levels. This has presumably been achieved through the import of material. The ground at the site is therefore likely to be comprised of Made Ground.

2.4.2 Hydrogeology

The Environment Agency has designated both the bedrock geology and the drift as unproductive strata[8] which is defined as "*geological strata with low permeability that have negligible significance for water supply or river base flow*".

Groundwater movement beneath the site is likely to be negligible.

6 Cranfield Soil and Agrifood Institute, Soilscapes map, http://www.landis.org.uk/soilscapes

7 British Geological Survey, Geoindex onshore, https://mapapps2.bgs.ac.uk/geoindex/home.html

8 Magic Map Application, managed by Natural England, delivered by Landmark, https://magic.defra.gov.uk/MagicMap.aspx

3.0 Planning Policy and Guidance

3.1 National Planning Policy

This FRA report has been completed in accordance with guidance presented in NPPF[1] and with reference to the PPG for flood risk and coastal change[2].

3.1.1 Development Sensitivity

Annex 3 of NPPF sets out development sensitivities with respect to flood risk that should be used to help consider the appropriateness of different development types with respect to the prevailing flood risk.

The proposed development consists of an ESS to provide highly localised grid support. This infrastructure is intended to support the immediate land usage and will not serve a wider area. Failure of the installation due to flooding would have little or no consequence beyond the immediate locale of the site.

Under the development sensitivity classifications set out in Annex 3 of NPPF, standalone energy facilities are typically considered as '*Essential Infrastructure*'. This is because normally they comprise infrastructure *'the loss or compromise of which could result in a major detrimental impact on the availability, integrity or delivery of essential services - including those services whose integrity, if compromised, could result in significant loss of life or casualties - taking into account significant economic or social impacts'*[9].

Clearly a small scale 200kW battery box, intended to serve adjacent land use only (all of which would in fact be subject to similar or higher levels of flood risk), would not fulfil this definition. It is therefore considered that a battery box development should be assessed as more similar to an electrical junction box for a site and classified as ancillary to the wider land usage.

The surrounding land usage is all commercial and light industrial. Under the development types defined within Annex 3 of NPPF these would be considered as "*less vulnerable"* with respect to flood risk which is allowed within Flood Zone 3a but not Flood Zone 3b.

3.1.2 Flood Zone Classification

PPG Table 1 defines Flood Zones as follows:

- *Zone 1 - Low Probability (Flood Zone 1): Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b).*
- *Zone 2 - Medium Probability (Flood Zone 2): Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map).*
- *Zone 3a - High Probability (Flood Zone 3a): Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map).*
- *Zone 3b - the Functional Floodplain (Flood Zone 3b): his zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:*
    - *land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or*

9 Critical National Infrastructure, National Protective Security Agency, https://www.npsa.gov.uk/critical-national-infrastructure-0

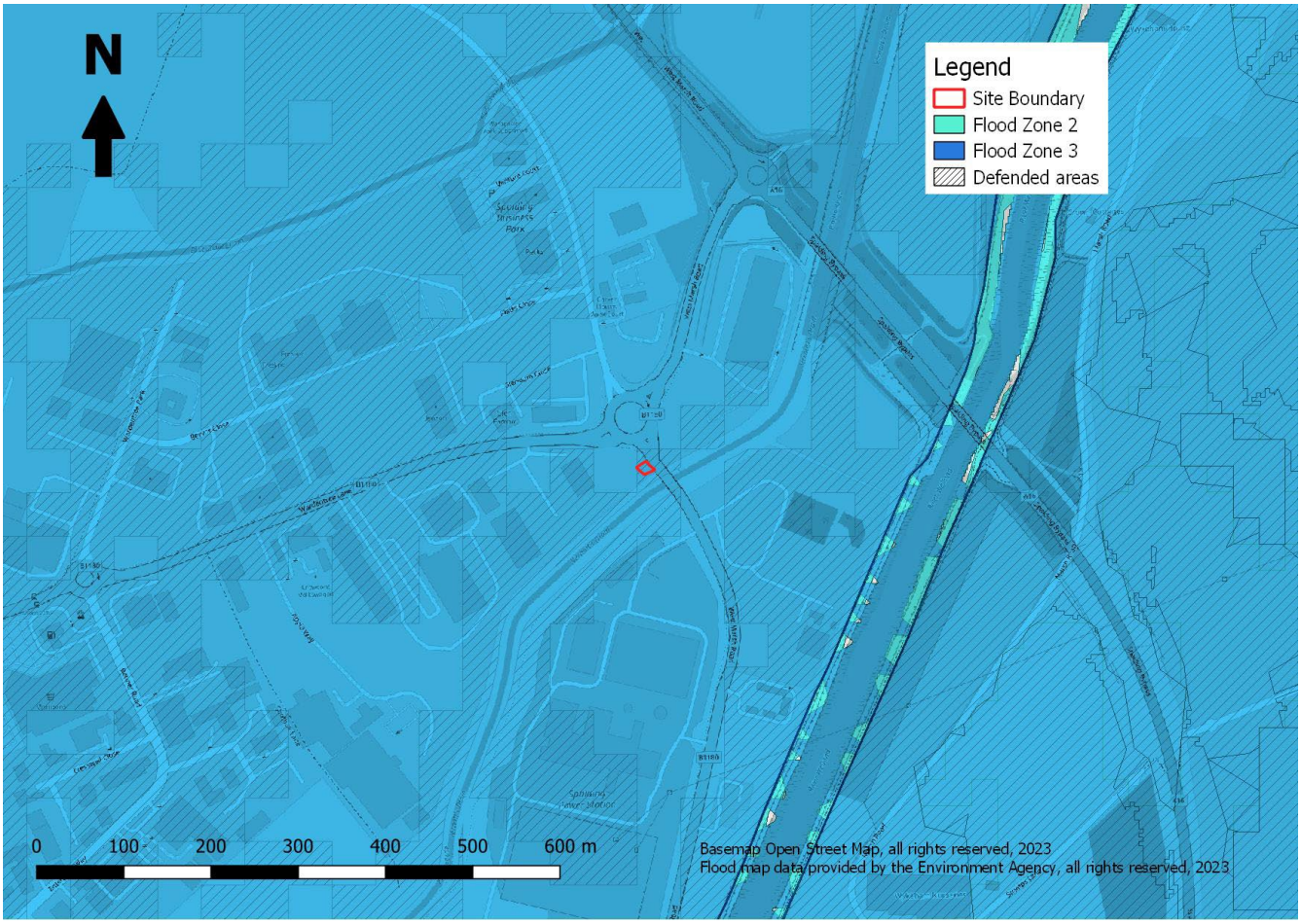
- *land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).*

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

The Environment Agency publish mapping[10] showing the Flood Zones across England. In assessing the boundary between Flood Zones 1, 2 and 3, the protection afforded by a flood defence structures, and other local circumstances, is not taken into account.

Based upon the Flood Map for Planning (Figure 3-1) the site lies within Flood Zone 3. The delineation between Flood Zone 3a and Flood Zone 3b is not shown by the flood Map for planning. This is normally defined within the local Strategic Flood Risk Assessment.

Figure 3-1: Extract of Flood Map for Planning



10 Flood Map for Planning Service: Website https://flood-map-for-planning.service.gov.uk/

The Strategic Flood Risk Assessment[11] sets out that within the South Holland District, the functional floodplain (Flood Zone 3b) is restricted to the designated flood storage reservoirs of the Crowland and Cowbit Washes and the Surfleet Reservoir. All other areas of Flood Zone 3 are considered to be Flood Zone 3a.

On this basis the area of the proposed development is classified as Flood Zone 3a.

3.1.3 Flood Risk Compatibility

As discussed in Section 3.1.2, the site lies wholly within Flood Zone 3a and, as detailed in Section 3.1.1, the development proposals are considered a *'less vulnerable*' development type.

PPG Table 2: Flood risk vulnerability and flood zone 'compatibility' (reproduced as Table 3-1) confirms that, with respect to flood risk, '*less vulnerable*' development types are considered appropriate in Flood Zone 3a.

Table 3-1: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification (PPG Table 2)		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (PPG Table 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	✓

Key: ✓ Development is appropriate x Development should not be permitted

3.1.4 Sequential Test

With reference to the NPPF, the Sequential Test gives preference to locating new development in areas that are at lowest risk of flooding.

In paragraph 162 of NPPF the Sequential Test sets out that:

> "*Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding.*"

Paragraph 161 confirms that this process should take into account;

> *"all sources of flood risk and the current and future impacts of climate change".*

Paragraph 168 of NPPF confirms that *"Applications for some minor development and changes of use should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55".* The proposed battery box is a minor development[12] which is entirely

11 South East Lincolnshire Strategic Flood Risk Assessment, Southeast Lincolnshire Joint Planning Committee, March 2017, https://www.sholland.gov.uk/media/7937/South-East-Lincolnshire-SFRA-Report-March-2017-including-guidance-on-applying-the-Sequential-Test-for-planning-applications-/pdf/SE_Lincolnshire_SFRA_2017_v6.pdf

12 As defined by the Town and Country Planning (Development Management Procedure) (England) Order 2015

ancillary to an existing commercial site and, on that basis, the Sequential Test does not need to be applied. Indeed, the proposals should be treated as a '*small non-residential extension (with a footprint of less than 250m^2)*' to the existing industrial site as defined within Footnote 56 to Paragraph 168.

Irrespective of this we note that suitable available land on which to site a battery box is not easy to find. A suitable site must be within 50m of an existing substation or a large 3 phase low voltage cable to allow for a viable electrical connection. sites must also have available space and a landowner who is prepared to host a battery box.

This site has been carefully selected for the following reasons:

- Proximity to local grid.
- Development land available.
- Suitable flat industrial land.
- Near local electricity demand.

Furthermore, while the development proposed is located within an area that is designated a Flood Zone 3a, the extent of Flood Zone 3a locally is extensive. Given that the proposed battery box is intended to support the immediate land usage, it could not reasonably be located in any areas designated as Flood Zone 1 or 2 as these are all remote from the area of commercial land that this infrastructure would support.

In Section 4.0 this assessment confirms that, given the local flood defences that are present, the risk of flooding at the site is low. In the event of a failure of the flood defence, due to the raised footprint of the proposed site, the residual risk at this site is also lower than across much is the surrounding area.

It is therefore concluded that there are no reasonably available alternative locations for the proposed battery box that are subject to a lower level of flood risk, and which could serve the surrounding industrial and commercial areas.

On this basis it is considered that, even if it were to be applied to this application (which as a minor non-residential extension it shouldn't) the Sequential Test would be passed.

3.1.5 Exception Test

The Exception Test, as set out in paragraph 164 of NPPF, states that;

> *"For the exception test to be passed it should be demonstrated that:*
>
> *(a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
>
> *(b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*
>
> *Both elements of the exception test should be satisfied for development for be allocated or permitted".*

As outlined in the Table 3-1, PPG identifies that '*less vulnerable'* development located within Flood Zone 3a does not need to pass the Exception Test.

Irrespective of this we note that as renewable power generation does not always match demand, the UK requires a more flexible energy system that allows 'excess' renewable electricity to be stored and used later when low carbon sources are unable to generate enough electricity (i.e., when it isn't windy and sunny). ESS's are a major part of the process of achieving this and thereby help prevent the need to turn on fossil fuel generators and allow the UK to maximise the use of renewable power and to facilitate the UK's transition to net-zero.

Whilst the amount of carbon saved each year will vary with changing weather and demand patterns, AMP Clean Energy expect each Battery Box will save 80 tonnes of Carbon each year and 2,400 tonnes of carbon throughout the project Lifecyle. On this basis it is clear that the proposals are highly sustainable and will be an important contributor to helping local land users move towards zero carbon.

Furthermore, as discussed in Section 4.0 this assessment confirms that, given the local flood defences that are present, the risk of flooding at the site is low. The scheme will also be unmanned and will not exacerbate flood risk locally.

On this basis it is considered that, even if it were to be applied to this application (which as a *'less vulnerable'* development type it shouldn't) the Exception Test would be passed.

3.2 Local Planning Policy

The South East Lincolnshire Joint Strategic Planning Committee is comprised of South Holland District Council, Boston Borough Council and Lincolnshire County Council. Together they have produced new Local Plan[13] which was adopted on 8th March 2019. This document provides a framework for development locally for the period from 2011 through to 2036.

As a major issue locally, consideration of flood risk is embedded throughout the plan; however, of key relevance is Policy 4 which is reproduced below.

Policy 4: Approach to Flood Risk

Development proposed within an area at risk of flooding (Flood Zones 2 and 3 of the Environment Agency's flood map or at risk during a breach or overtopping scenario as shown on the flood hazard and depths maps in the Strategic Flood Risk Assessment) will be permitted, where:

1. *It can be demonstrated that there are no other sites available at a lower risk of flooding (i.e. that the sequential test is passed). The sequential test will be based on a Borough or District wide search area of alternative sites within the defined settlement boundaries, unless local circumstances relating to the catchment area for the development justify a reduced search area, i.e. there is a specific need for the development in that location. The sequential test is not required for sites allocated in the Local Plan, minor development[1] or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site).*
2. *It can be demonstrated that essential infrastructure in FZ3a & FZ3b, highly vulnerable development in FZ2 and more vulnerable development in FZ3 provide wider sustainability benefits to the community that outweigh flood risk.*
3. *The application is supported with a site-specific flood risk assessment, covering risk from all sources of flooding including the impacts of climate change and which:*
    a. *demonstrate that the vulnerability of the proposed use is compatible with the flood zone;*
    b. *identify the relevant predicted flood risk (breach/overtopping) level, and mitigation measures that demonstrate how the development will be made safe and that occupants will be protected from flooding from any source;*
    c. *propose appropriate flood resistance and resilience measures (following the guidance outlined in the Strategic Flood Risk Assessment), maximising the use of passive resistance measures (measures that do not require human intervention to be deployed), to ensure the development maintains an appropriate level of safety for its lifetime;*

13 South East Lincolnshire Local Plan 2011-2036 Adopted March 2019, http://www.southeastlincslocalplan.org/wp-content/uploads/2019/02/Local-Plan-text-March-2019.pdf

d. include appropriate flood warning and evacuation procedures where necessary (referring to the County's evacuation routes plan), which have been undertaken in consultation with the authority's emergency planning staff;

e. incorporates the use of Sustainable Drainage Systems (SuDS) (unless it is demonstrated that this is not technically feasible) and confirms how these will be maintained/managed for the lifetime of development (surface water connections to the public sewerage network will only be permitted in exceptional circumstances where it is demonstrated that there are no feasible alternatives);

f. demonstrates that the proposal will not increase risk elsewhere and that opportunities through layout, form of development and green infrastructure have been considered as a way of providing flood betterment and reducing flood risk overall;

g. demonstrates that adequate foul water treatment and disposal already exists or can be provided in time to serve the development;

h. ensures suitable access is safeguarded for the maintenance of water resources, drainage and flood risk management infrastructure.

Development in all flood zones, and development over 1 hectare in size in Flood Zone 1, will need to demonstrate that surface water from the development can be managed and will not increase the risk of flooding to third parties.

Change of use of existing buildings will be supported providing they do not pose an increase in risk to people. Change of use that would result in self-contained ground floor residential accommodation in areas of hazard rating 'danger for some', 'danger for most' and 'danger for all' will not be supported. In these areas unrestricted access to a habitable room above the flood level and an emergency evacuation plan will be required. Caravans, mobile homes and park homes intended for permanent residential use will not be permitted in areas at risk of flooding. Caravan, chalet, log cabin, camping and touring sites at risk of fluvial flooding where there is a 'danger for most' and 'danger for all' will not be permitted. Occupancy of caravan, chalet, log cabin, camping and touring sites at risk of tidal flooding will not be permitted to open between 1st November in any one year and the 14th March in the succeeding year.

No development will be permitted within a 50m buffer from the toe of the raised Witham Haven Banks (flood defences), as shown on the indicative Plan contained in Appendix 10, to allow access for construction and maintenance.

Flood risk management infrastructure shall be provided at the strategic level, where development opportunities allow, to reduce the hazard and probability of flooding.

Where applicable to this development these local policy requirements are all either reflected in the discussion of national policy set out in Section 3.1 or considered in the assessment of flood risk detailed in Section 4.0.

3.3 Climate Change

In February 2016 the Environment Agency issued guidance on the impacts of climate change on flood risk in the UK to support the NPPF. This was most recently updated in May 2022[14]. This advice sets out that peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change.

PPG recommends that considerations for future climate change are included in FRA's for proposed developments. Consideration of wave heights and offshore wind speed are only of relevance in areas

14 Environment Agency, Flood Risk Assessments: Climate Change Allowances, February 2016 (Updated May 2022), https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

immediately adjacent to open areas of water. As such the consideration of climate change in this assessment only considers possible changes to peak river flows, sea levels and peak rainfall intensity.

3.3.1 Sea Level Change

Sea Level Allowances, published by the Environment Agency for the Anglian Region, are presented in Table 3-2. This shows the estimated annual uplifts to mean sea level which increase over time.

Table 3-2
Sea level allowances by river basin district for each epoch in mm for each year (based on a 1981 to 2000 baseline) – the total sea level rise for each epoch is in brackets

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Anglian	Higher Central	5.8 (203)	8.7 (261)	11.6 (348)	13.0 (390)	1.20
	Upper end	7.0 (245)	11.3 (339)	15.8 (474)	18.1 (543)	1.60

Taking a base date of 2006[15], the anticipated sea level rise throughout the 30-year anticipated lifetime of development, up until 2053, is 0.32m using the higher central allowance and up to 0.41m using the upper end allowance.

In reality these uplifts relate to areas of open sea and the site is located on a tidally influenced river system. In such situations best practice is to apply the projected sea level rise at the downstream boundary of a tidal flood model and then use the model to assess how this impacts water levels extending up the tidal reaches. Where available the outputs of such modelling should be used in preference to simply uplifting current day estimates of extreme flood levels.

3.3.2 Peak Fluvial Flows

Peak River Flow Allowances, published by the Environment Agency for the Welland Management Catchment, are presented in Table 3-3 This shows the anticipated changes to peak fluvial flow rates.

Table 3-3
Peak River Flow Allowances

Management Catchment	Allowance Category	2020s	2050s	2080s
Welland	Central	5%	4%	17%
	Higher	10%	10%	28%
	Upper	22%	26%	53%

15 Base data for flood level estimates provided by the Environment agency at Marsh Lane (Appendix 02), East Coast and Wash: Immingham to the West Lighthouse 2018 Coastal Flood Boundary Extreme Sea Levels

Guidance states that for "*less vulnerable*" development located in Flood Zone 3a the "central" allowance should be considered. For the 30-year anticipated lifetime of development, up until 2053, this equates to maximum uplift in peak fluvial flow of 5%.

3.3.3 Peak Rainfall Intensity

Peak Rainfall Intensity Allowances, published by the Environment Agency for the Welland Management Catchment, are presented in Table 3-4. This shows the anticipated changes to extreme rainfall intensity or depth.

Table 3-4
Peak Rainfall Intensity Allowance

Management Catchment	Annual Exceedance Rainfall Event	Allowance	2050s	2070s
Welland	3.3%	Upper End	35%	35%
		Central	20%	25%
	1%	Upper End	40%	40%
		Central	25%	40%

Guidance states that flood risk assessments should assess the 'Upper End' allowance to understand the range of impact for both the 1% and 3.3% annual exceedance events. For the 30-year anticipated lifetime of development, up until 2053, this equates to maximum uplift in rainfall intensity of 40%.

4.0 Potential Sources of Flooding

4.1 Methodology and Best Practice

This report has been prepared in accordance with the advice and requirements prescribed in current best practice documents relating to management of flood risk in development published by the Construction Industry Research and Information Association (CIRIA)[16], and BS85333[3].

This includes a screening study to identify whether there are any potential sources of flooding at the site and, where warranted further consideration refencing available flood model data.

The following potential sources of flooding are highlight within guidance:

- Flooding from the sea or tidal flooding;
- Flooding from rivers or fluvial flooding;
- Flooding from surface water and overland flow;
- Flooding from groundwater;
- Flooding from sewers;
- Flooding from reservoirs, canals, and other artificial sources; and
- Flood from infrastructure failure.

The flood risk from each of these potential sources is discussed below.

4.2 Flooding from the Sea or Tidal Flooding

The site is situated adjacent to Vernatt's Drain (Ordinary Watercourse) with the River Welland (Main River) located just to the south. The River Welland is tidal past the site.

While Vernatt's Drain is a fluvial system, water levels along the channel will be tidally influenced during periods when free discharge into the Welland is not possible. It should however be noted that tidal flood levels along Vernatt's drain will never exceed those on the River Welland and, as such, water levels on the River Welland are the primary driver of tidal flood risk locally and these are the focus of the discussion below.

Environment Agency flood mapping (Figure 3-1) places the site in Flood Zone 3 with the SFRA confirming that this is not the functional floodplain. This indicates that if flood defences were not present, the annual probability of tidal flooding would be greater than 1 in 200.

4.2.1 Flood Level Data

Tidal flood levels within the River Welland adjacent to the site (Marsh Road – NGR 525988 324065) have been provided by the Environment Agency. These are taken from the 2018 Coastal Flood Boundary Extreme Sea Levels dataset and indicates a current day (2006) 1 in 200 annual probability flood level of 5.98m aOD.

Uplifting this flood elevation by 0.41m (See Section 3.3.1) to account for climate change through to 2053 increases the 1 in 200 annual probability flood level to **6.39m aOD**.

16 CIRIA Report C624, Development and flood risk: guidance for the construction industry

4.2.2 Flood Defences

Flood defences are present along the River Welland. Adjacent to the site these consist of embankments with a crest level raised to at or above 7.48m aOD. This is considerably higher than the projected in channel flood levels. As such direct over topping from the River Welland adjacent to the site is unlikely to occur.

We note that flood defence crest levels are lower further downstream along the River Welland and over topping in these areas is more likely. The Environment Agency advise (Appendix 02) that when considered holistically the defences reduce the risk of flooding locally (i.e. not necessarily at the site) to a 1 in 100 chance of occurring in any year.

Conceptually, tidal flooding on the site resulting from over topping of the flood defences is unlikely because;

- the site is considerably raised above much of the land locally,
- the source of the flooding would be remote from the site, and
- flood water would rapidly spread out across the extensive floodplain resulting in flood levels that were significantly lower than the in-channel flood levels discussed above.

On this basis the flood risk posed to the battery box from the Sea or Tidal Flooding is assessed to be **very low**.

In reality, over topping of the embankments would likely cause erosion, resulting in flood breaches. This would exacerbate flooding and result in impacts across a larger area than might occur as a result over topping in isolation. For clarity the risk posed from over topping, and breach of the defences is assessed together in Section 4.8.

4.3 Flooding from River or Fluvial Flooding

The Environment Agency have advised (Appendix 02) that there is no risk of fluvial flooding from Main Rivers at the site.

Vernatt's Drain (Ordinary Watercourse) is a fluvial watercourse, albeit one where water levels are influenced by the ability of water to discharge into the tidal River Welland.

The majority of flows within Vernatt's Drain are derived from pumping rather than natural run-off. As such, peak flow rates are governed by upstream pumping infrastructure and not meteorological condition. The system has been designed to accommodate these flows including periods of high tide when free onward discharge is not possible. Significant uplift in peak flow associated with climate change are unlikely.

Significant flooding along Vernatt's Drain derived from the pumped flows along this channel is considered unlikely. In the event that flooding did occur, this would preferentially impact low lying undeveloped land locally.

The development site is significant raised above this and therefore fluvial flooding on the site is unlikely. On this basis the flood risk from River or Fluvial Flooding is assessed to be **very low**.

4.4 Flooding from Surface Water or Overland Flow

The proposed development is sited on an elevated area of land that is higher than all surrounding areas. As such conceptually there is little or no potential for surface water runoff to drain onto the site as there is no obvious source area.

Long Term Flood Risk Information (LTFRI)[17] provided by the Environment Agency includes mapping of surface water flood risk. Surface water modelling has been undertaken in order to seek to establish areas at risk of surface water flooding based upon latest hydrological techniques and surface terrain data.

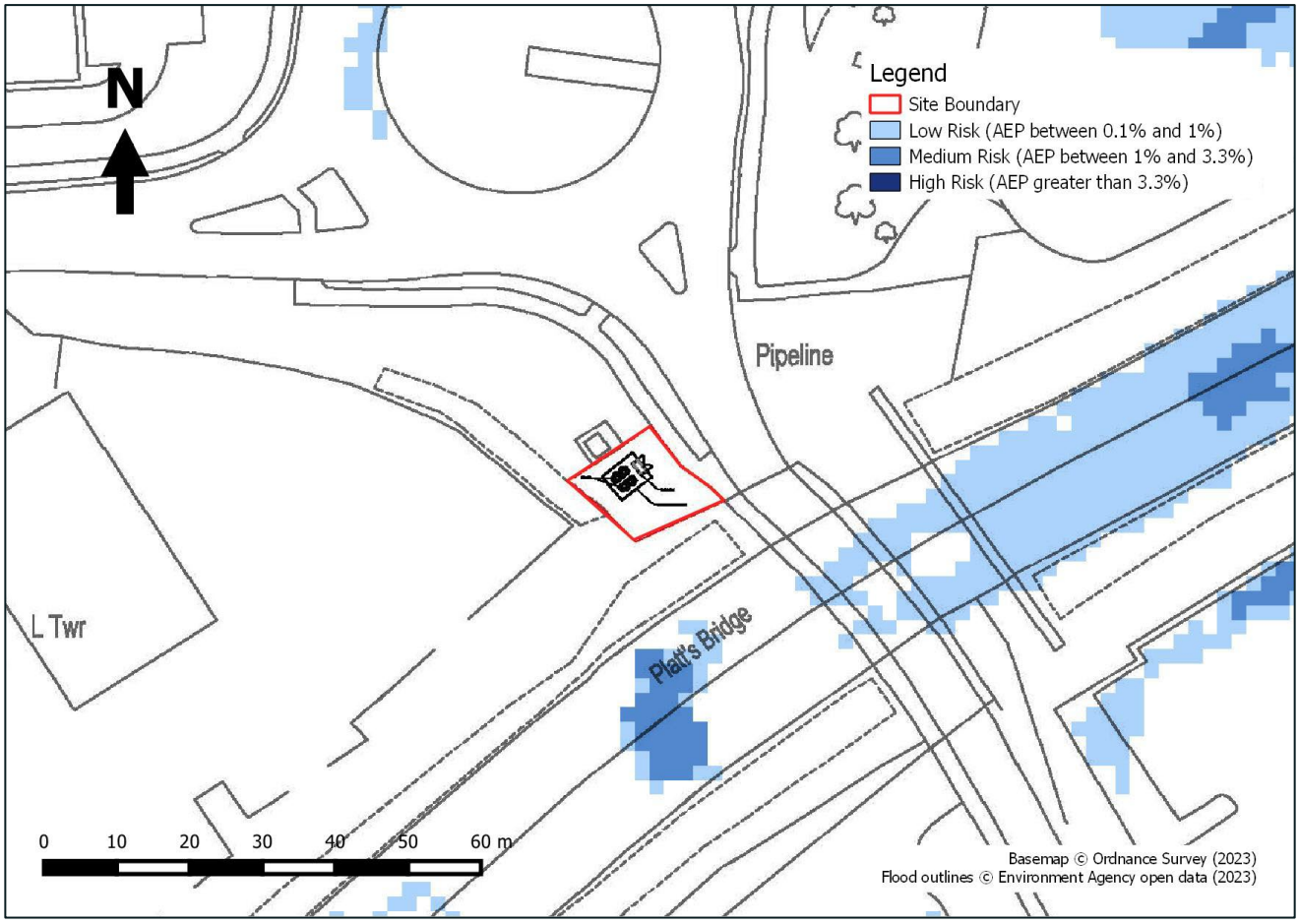
17 Long Term Flood Risk Information Service, https://www.gov.uk/check-long-term-flood-risk

An extract of the map for the site and surrounding area is presented in Figure 4-1 where the Environment Agency define the surface water flood risk categories as:

- Very Low: less than 1 in 1,000 (0.1% AEP) chance of flooding in any given year;
- Low: less than 1 in 100 (1% AEP) but greater than or equal to 1 in 1,000 (0.1% AEP) chance of flooding in any given year;
- Medium: between 1 in 100 (1% AEP) and 1 in 30 (3.3% AEP) chance of flooding in any given year; and
- High: greater than 1 in 30 (3.3% AEP) chance of flooding in any given year.

Based upon the mapping in Figure 4-1, the entirety of the site is located within an area of very low risk (less than 1 in 1000 annual probability). This confirms the conceptual understanding and, on this basis, the flood risk from Surface Water and Overland Flows is assessed to be **very low**.

Figure 4-1: Extract of Environment Agency Surface Water Flood Map



4.5 Flooding from Groundwater

Groundwater flooding can be defined as flooding caused by the emergence of water originating from subsurface strata. Groundwater flooding can occur where sites are located on permeable ground. After a prolonged period of rainfall and groundwater recharge, a considerable rise in the water table can results in inundation for extended periods of time.

As discussed in Section 2.4, the site is underlain by bedrock geology of the Oxford Clay Formation which is overlain by drift deposits that are described as Tidal Flat Deposits of Clay and Silt. These are low permeability units and groundwater flows at and around the site are likely to be negligible.

On this basis the flood risk posed to the battery box from Groundwater is assessed to be **very low**.

4.6 Flooding from Sewers and Water Mains

Flooding from sewers or water mains inherently poses a risk at any site. There are no public sewers or water mains running through the site; however, utilities are likely to be present beneath the adjacent road.

The adjacent road deck is at an elevation of 5.5m aOD. This is 0.4m lower than the proposed platform level of 5.9m aOD and, in the event of a surcharge, excess flows would preferentially drain northwards back towards the roundabout and not onto the site.

On this basis the flood risk posed to the battery box from Sewers and Water Mains is assessed to be **very low**.

4.7 Flooding from Reservoirs, Canals, and other Artificial Sources

Environment Agency mapping[17] indicates that the site does not lie within a flood risk zone due to a breach scenario of any reservoirs. No other artificial sources of flooding have been identified in the vicinity of the site.

On this basis the flood risk posed to the battery box from Reservoirs, Canals, and other Artificial Sources is assessed to be **very low**.

4.8 Flooding from Infrastructure Failure

During an extreme tidal flood event (potentially with some fluvial component) over topping of the flood defences remote from the site is possible. Such over topping would significantly increase the potential for scour and erosion of flood embankments and this could result in major breaches through which significant quantities of flood water would enter the floodplain.

The Strategic Flood Risk Assessment flags this as a major concern locally and extensive modelling has been undertaken with the aim of quantifying this risk. This breach and over topping modelling includes a breach location along the embankment of the River Welland immediately due west of the site.

Excerpts from this modelling are presented in Figure 4-2 below and confirm that, given the elevated nature of this site, the area of the proposed development is not currently within the breach flood outline (current day).

Changes in flood severity associated with climate change will increase risks; however even with these changes by 2115 (i.e. significantly beyond the project development lifetime) the projected residual flood depths at the site will be shallow (<0.25m).

Given that typical minimum ground elevations in the area at and around the site are 5.5m aOD, this suggests a maximum future (2115) breach flood height of **5.75m aOD**. While not quantified, the potential flood breach elevation at the end of the projected development lifetime in 2053 would almost certainly be considerably lower than this.

Given that the proposed concrete plinth will raise the completed platform level by 0.3m, and that there is a further 0.08m freeboard of flood resilience, breach flood levels would need to exceed 5.98m aOD before the operation of the battery box was impacted by floodwater.

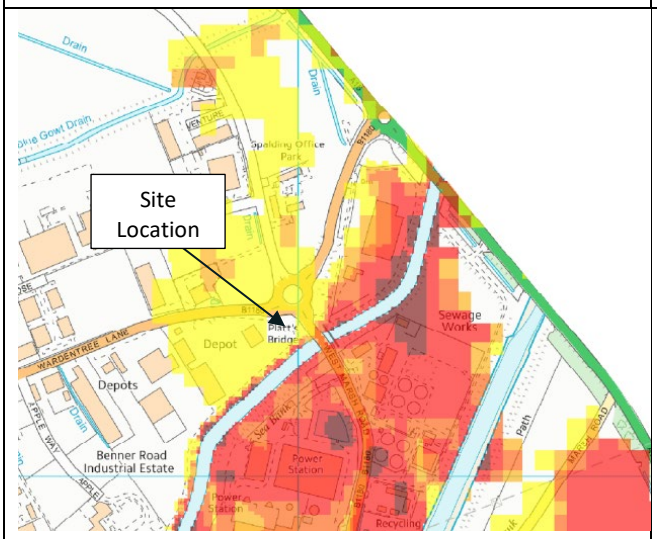
On this basis the flood risk posed to the battery box from Infrastructure Failure is assessed to be **very low**.

We would emphasise that;

- the site will only take a few weeks to constructed and following this will be unmanned. As such the location of the battery box on a raised island surround by higher risk land is not of concern.

- Being on a raised island means that there is no potential for the physical structure of the battery box to have any significant effect on flood conveyance or flood storage.

Figure 4-2: Extract of SFRA Residual Risk Mapping

Residual Peak Depth, Spalding – Present Day, 1% Fluvial / 0.5% Tidal event probability	Residual Peak Depth, Spalding – Year 2115, 1% Fluvial / 0.5% Tidal event probability
	
Map Legend **Peak Depth** 0m - 0.25m 0.25m - 0.5m 0.5m - 1m 1m - 2m 2m + Functional Floodplain South Holland District Boundary	**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. 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

4.9 Summary

A summary of potential sources of flooding and the flood risk arising from them is presented in Table 4-1.

Table 4-1: Potential Risk Posed by Flooding Sources

Potential Source	Flood Risk at Site
Sea or Tidal Flooding	Very low
Rivers or Fluvial Flooding	Very low
Surface Water and Overland Flow	Very low
Groundwater	Very low
Sewers and Water Mains	Very low
Reservoirs, Canals and other Artificial Sources	Very low
Infrastructure Failure	Very low

5.0 Conclusion

SLR Consulting Limited has been appointed on behalf of AMP Energy Services Ltd to prepare this Flood Risk Assessment (FRA) in support of a planning application for a 200kW (800kWhr) Energy Storage System (ESS) ('Battery Box') ("the proposed development").

The proposed development will be located at Garn Transport, Wardentree Lane, Pinchbeck, Spalding, PE11 3DQ ("the site"). The flood risk posed to this development has been assessed in line with BS8533 and national policy and guidance and taking into account Policy 4 of South East Lincolnshire Local Plan.

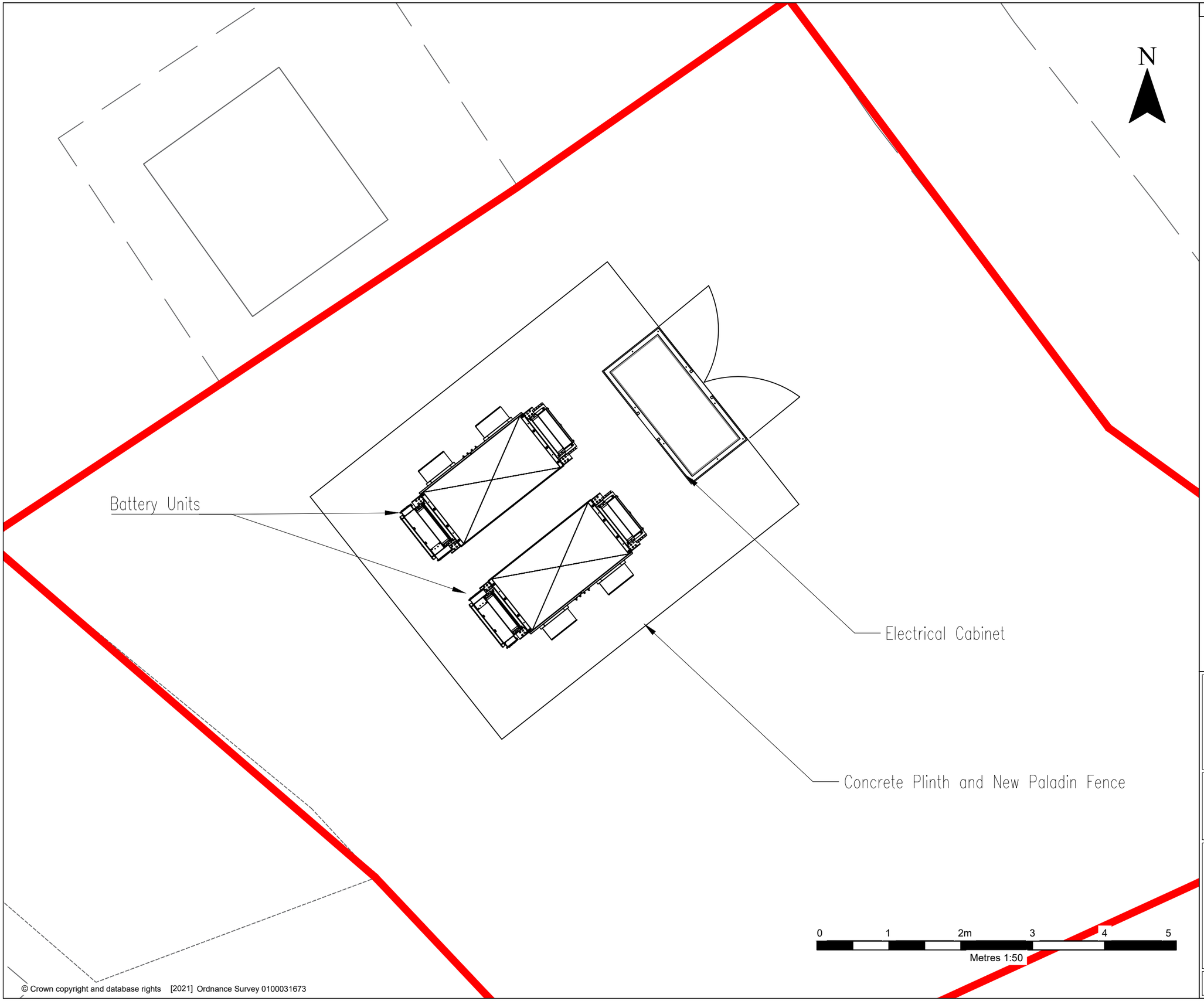
The assessment has concluded that:

1. As a minor and '*less vulnerable*' development the Sequential Test and the Exception Test do not apply to this scheme. Irrespective of this, even if they were applied, given the context of the site and the nature of the development proposed, these would be passed.
2. The site is located on an area of artificially raised ground immediately to the north of a channel called Vernatt's Drain. Ground levels on the site are at or close to the highest in the local area and are around 1.5m above most of the surrounding land.
3. Vernatt's Drain is an artificial channel constructed to convey pumped water from the surrounding marshland to the River Welland via sluices located a distance to the north. The potential for flooding directly from the flows along Vernatt's Drain is small. Given the elevated nature of the site, this poses a very low flood risk to the development.
4. The River Welland is present further to the south beyond Vernatt's Drain. This channel is tidal and in the event of a major storm surge event (potentially exacerbated by high fluvial flows from the upstream catchment) water levels in the channel could rise significant to at or close to the elevation of the proposed development. Once predicted changes in sea level associated with climate change are considered, extreme in channel flood levels could be higher than all of the local area and above the proposed platform level for development.
5. As a result of this potential source of flooding the entire local area is designated as Flood Zone 3a; however, the presence of flood defences provides some protection for the site and the wider area.
6. The probability of the flood embankments along the River Welland adjacent to the site being over topped is negligible. The crest level for the defences is however lower elsewhere and the Environment Agency estimate that the probability of the defences being over topped in any one year in the local area is around 1 in 100.
7. Given that the site is raised, over topping of the flood defences remote from the site would not pose a significant risk to this development. Water flowing over embankments could however cause erosion and scouring of the flood defences, resulting in flood breaches. This would exacerbate flooding and result in impacts across a larger area than might otherwise occur.
8. The Strategic Flood Risk Assessment flags this as a major concern locally and extensive modelling has been undertaken with the aim of quantifying this risk. The modelling confirms that given the elevated nature of this site, the area of the proposed development is not currently within the breach flood outline.
9. Changes in flood severity associated with climate change will increase the risk associated with overtopping and breach of the flood defences. The modelling indicates that, even with these changes, by 2115 (i.e. significantly beyond the end of the projected development lifetime) the estimated flood depths at the site will be shallow (<0.25m). This equates to an approximate flood level at the site of 5.75m aOD.

10. Site levels will be built up by 0.3m to facilitate development creating a development platform level at 5.9m aOD. This is higher than the estimate future breach flood level and the flood risk posed to the development from a combined over topping and flood breach event along the River Welland is assessed to be very low.
11. The site will only take a few weeks to constructed and following this will be unmanned. As such the location of the battery box on a raised island surround by areas where the flood risk is higher is not of concern.
12. Being on a raised area means that there is no potential for the physical structure of the battery box to have any significant effect on flood conveyance or flood storage.
13. A review of other potential flood sources, including surface water, sewer, groundwater and reservoir has confirmed that the flood risk from these is all very low.

The technical assessment of risk presented within this flood assessment demonstrates that the flood risks present at the site are very low and that development on the site will be 'safe' in flood risk terms throughout its lifetime without increasing flood risk elsewhere.

APPENDIX 01: PROPOSED SITE LAYOUT



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LEGEND

SITE BOUNDARY

BATTERY BOX
LEADING THE CHARGE

AMP CLEAN ENERGY
1 DOVER STREET
LONDON
W1S 4LD

Land on the South Side of Wardentree Lane
Pinchbeck, Spalding, PE11 3DQ

GARN BOX
BATTERY BOX

LAYOUT PLAN

BB00385 - 02

Scale	Date
AS SHOWN	FEBRUARY 2023

APPENDIX 02: ENVIRONMENT AGENCY DATA RESPONSE

Annissa-Kay Dryden
adryden@slrconsulting.com

Our ref: CCN-2023-298844

Date: 22/02/2023

Dear Annissa,

Provision of Flood Risk Information for land south of Wardentree Lane, Pinchbeck

Thank you for your request for our flood risk information for the above site. The information is set out below and attached. It is important you read any contextual notes on the maps provided.

If you are preparing a Flood Risk Assessment (FRA) for this site, please note this information may not be sufficient by itself to produce an adequate FRA to demonstrate the development is safe over its lifetime. Additional information may be required to carry out an appropriate assessment of all risk, such as consequence of a breach in defences.

We aim to review our information on a regular basis, so if you are using this data more than twelve months from the date of this letter, please contact us again to check it is still valid.

1. Flood Map

The attached map includes the current Flood Map for your area. The Flood Map indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

In some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defences, water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow depths and could leave pockets of locally slightly higher land as isolated dry islands. It is important to understand the actual risk of the flooding to these dry islands, particularly in the event of defence failure.

The Flood Map also shows the location of formal raised flood defences and flood storage reservoirs. It represents areas at risk of flooding for present day only and does not take account of climate change.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered flooding may occur from other sources such as surface water sewers, road drainage, etc.

2. Historic Flood Event Outlines

With regards to the history of flooding I can advise we do not have any records of flooding in this area. It is possible recent flooding may have occurred which we are currently investigating, therefore this information may be subject to change. It is possible other flooding may have occurred which other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist) have responsibility.

3. Schemes in the area

There are no ongoing capital projects to reduce or sustain the current flood risk to this site.

4. Fluvial Flood Risk Information

This site is not considered to be at risk of flooding from main rivers.

The site may be at risk from local ordinary watercourses for which other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist) have responsibility.

5. Tidal Flood Risk Information

5.1 Tidal Defence Information

The existing tidal defences protecting this site consist of earth embankments.

They are in fair condition and reduce the risk of flooding (at the defence) to a 1% (1 in 100) chance of occurring in any year. We inspect these defences routinely to ensure potential defects are identified.

Refer to paragraph 3 for details of any ongoing capital projects to reduce the flood risk to this site.

5.2 Tidal Flood Levels

The attached data sheets show our current best estimate for extreme tide levels.

Please read the information notes on the data sheets.

5.3 Tidal Hazard Mapping

For certain locations we have carried out modelling to map the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from overtopping and / or breaching of defences at specific locations for a number of scenarios.

At present this information is available along the full coastal / tidal floodplain, except the tidal Witham Haven in Boston (upstream of Hobhole) where only breaching and not overtopping has been modelled and the tidal River Welland upstream of Fosdyke Bridge where neither breaching nor overtopping are available.

The number of locations we have this information for is expected to increase in time.

The attached maps show the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from breaching of the defences at specific locations for the scenarios below. For some locations the breach mapping also includes flooding from overtopping if this is expected in that scenario. The location of modelled tidal breaches is shown on a separate attached map.

Detailed Hazard Mapping is available within the 2017 Update of South Holland Strategic Flood Risk Assessment. This can be downloaded via the following link:
http://www.southeastlincslocalplan.org/water/

5.3.1 Tidal Hazard Mapping - Breaches

- Year 2006 0.5% (1 in 200) chance
- Year 2006 0.1% (1 in 1000) chance
- Year 2115 0.5% (1 in 200) chance
- Year 2115 0.1% (1 in 1000) chance

5.3.2 Tidal Hazard Mapping - Overtopping

Your site is not affected by overtopping of the defences for the present day (2006) and climate change (2115) scenarios.

6. Development Planning

If you would like local guidance on preparing a flood risk assessment for a planning application, please contact our Sustainable Places team at LNplanning@environment-agency.gov.uk. It will help if you mention this data request and attach your site location plan.

We provide free preliminary advice; additional/detailed advice, review of draft FRAs and meetings are chargeable at a rate set to cover our costs, currently £100 (plus VAT) per hour of staff time. Further details are available on our website at https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals.

General advice on flood risk assessment for planning applications can be found on GOV.UK at https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

Climate change will increase flood risk due to overtopping of defences. Please note, unless specified otherwise, the climate change data included has an allowance for 20% increase in flow. Updated guidance on how climate change could affect flood risk to new development - 'Flood risk assessments: climate change allowances' was published on GOV.UK in **July 2021**. The appropriate updated climate change allowance should be applied in a Flood Risk Assessment.

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

7. Data Licence and Other Supporting Information

We respond to requests for recorded information we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

This information is provided in accordance with the Open Government Licence which can be found here: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Further information on flood risk can be found on the GOV.UK website at: https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

8. Other Flood Risk Management Authorities

The information provided with this letter relates to flood risk from main river or the sea. Additional information may be available from other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist).

I hope we have correctly interpreted your request. If you have any queries or would like to discuss the content of this letter further please contact Alexander Tan using the email address below and quoting our CCN reference number above.

Yours sincerely,

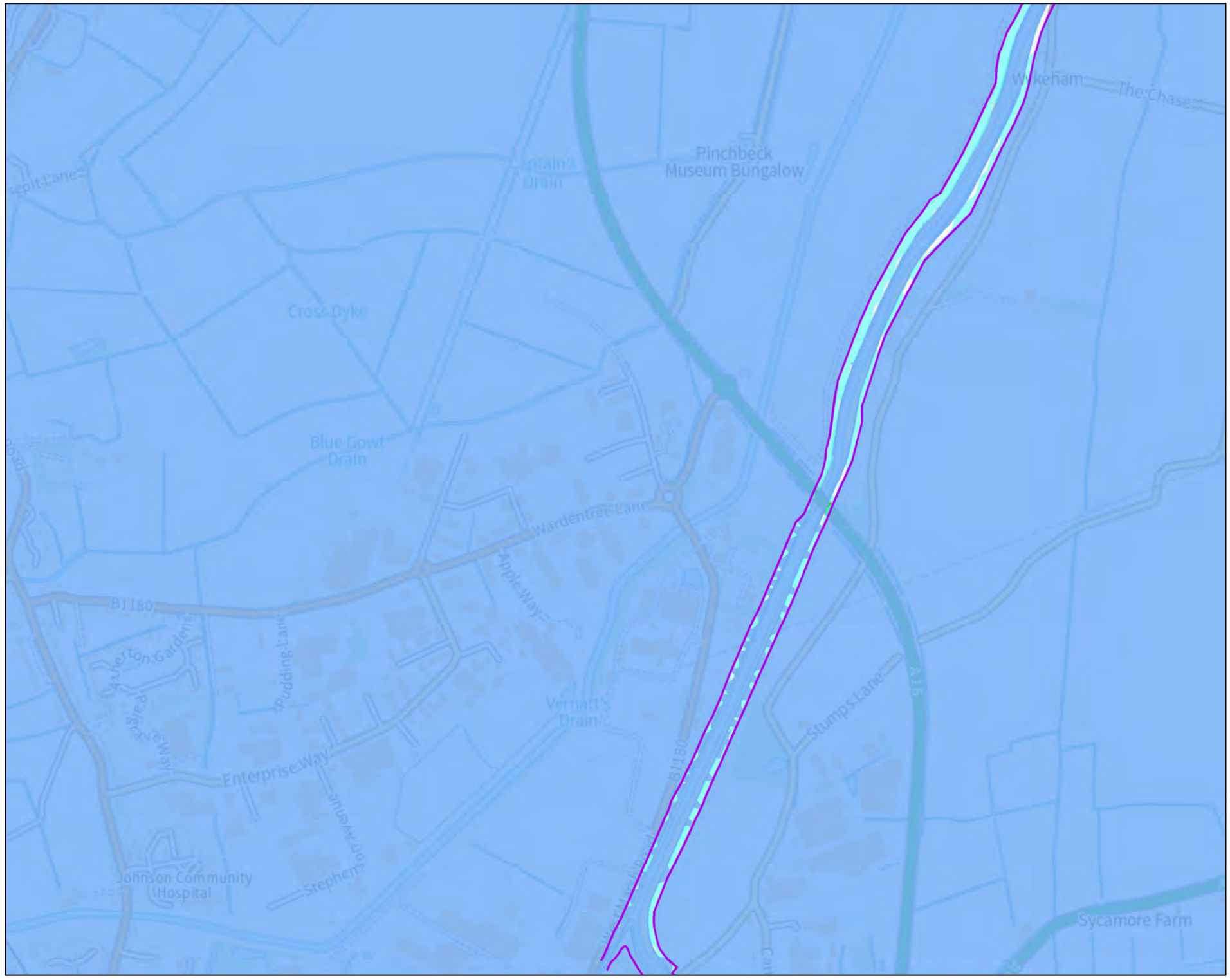


Tel: 020 302 53535

for Alastair Windler
Welland and Nene Partnerships and Strategic Overview Team Leader
e-mail PSOWN@environment-agency.gov.uk

Enc.
Flood Map
Tidal Level Data Sheets - Map and Tables
Tidal Breach Points – Locations Map
Hazard Mapping – Breaching

Flood Map centred on TF 25856 25302 - created February 2023 [Ref: CCN-2023-298844]



Environment Agency

Scale 1:10,000

N

Legend

- Raised Defences
- Flood Storage Areas
- Areas at Risk of Flooding from Rivers or the Sea
- Extreme Flood Outline

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.

- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

Created by the Partnerships and Strategic Overview Team, Kettering

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

East Coast and Wash - 2018 Coastal Flood Boundary [CFB] Dataset
Key Node Points



Environment Agency

Scale 1:550,000

N W E S

▲ East Coast and Wash

See seperate data sheet for predicted flood levels

Created by the Partnerships and Strategic Overview Team, Lincoln

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East Coast and Wash: Immingham to the West Lighthouse

2018 Coastal Flood Boundary Extreme Sea Levels

CFB Ref	Location	Easting	Northing	Annual Chance (1 in x) of Tide Level in metres ODN																	
				1			10			50			100			200			300			1000		
				Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound		
				2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%
3888	**Immingham**	520440	417625	4.16	4.17	4.19	4.50	4.53	4.62	4.73	4.80	5.00	4.83	4.93	5.19	4.93	5.06	5.41	4.98	5.14	5.55	5.15	5.38	6.01
3890	**Haborough Marsh**	522100	416512	4.14	4.15	4.17	4.48	4.51	4.60	4.70	4.77	4.97	4.80	4.90	5.16	4.90	5.03	5.38	4.94	5.10	5.51	5.11	5.34	5.97
3898	**Grimsby**	529295	413162	3.98	3.99	4.01	4.31	4.34	4.43	4.53	4.60	4.80	4.61	4.71	4.97	4.71	4.84	5.19	4.74	4.90	5.31	4.88	5.11	5.74
3906	**Buck Beck**	534709	407369	3.87	3.88	3.90	4.19	4.23	4.31	4.41	4.50	4.68	4.50	4.61	4.86	4.61	4.75	5.10	4.64	4.82	5.22	4.80	5.05	5.66
3910	**Tetney**	538035	405537	3.85	3.86	3.89	4.17	4.22	4.30	4.40	4.50	4.67	4.49	4.61	4.86	4.60	4.75	5.10	4.63	4.82	5.21	4.80	5.06	5.66
3918	**Donna Nook**	544641	401997	3.82	3.83	3.86	4.14	4.19	4.27	4.38	4.48	4.65	4.47	4.60	4.85	4.58	4.74	5.10	4.63	4.82	5.22	4.81	5.08	5.68
3928	**Saltfleet**	549131	393360	3.78	3.79	3.82	4.11	4.16	4.26	4.36	4.46	4.64	4.47	4.59	4.86	4.57	4.74	5.11	4.63	4.83	5.25	4.83	5.11	5.74
3942	**Boygrift**	555131	380860	3.72	3.74	3.77	4.06	4.11	4.22	4.33	4.43	4.65	4.43	4.57	4.87	4.56	4.73	5.13	4.62	4.83	5.28	4.85	5.15	5.82
3968	**Gibraltar Point**	557652	356181	4.16	4.17	4.20	4.51	4.56	4.67	4.76	4.85	5.08	4.85	4.97	5.27	4.94	5.10	5.49	4.99	5.18	5.63	5.14	5.41	6.09
3992_14	**Hobhole**	535990	340116	4.96	4.97	5.01	5.40	5.44	5.56	5.66	5.76	5.98	5.78	5.90	6.20	5.88	6.04	6.44	5.92	6.11	6.57	6.03	6.31	6.99
	Grand Sluice*	532366	344510	4.93	4.94	4.98	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
3992_9	**Boston Barrier**	532754	342852	4.93	4.94	4.98	5.41	5.45	5.57	5.73	5.83	6.05	5.85	5.97	6.27	5.93	6.09	6.49	5.94	6.13	6.59	5.98	6.26	6.94
3992_5	**Fosdyke Bridge**	531886	332234	4.87	4.88	4.92	5.31	5.35	5.47	5.58	5.68	5.90	5.71	5.83	6.13	5.82	5.98	6.38	5.87	6.06	6.52	6.01	6.29	6.97
4008	**West Lighthouse**	550094	329971	4.87	4.88	4.91	5.21	5.26	5.37	5.46	5.56	5.78	5.56	5.68	5.98	5.66	5.82	6.21	5.71	5.90	6.35	5.86	6.14	6.81
-	**Marsh Road**	525988	324065	-	5.04	-	-	5.44	-	-	5.73	-	-	5.85	-	-	5.98	-	-	-	-	-	-	-
-	**Wisbech**	546110	309940	-	4.83	-	-	5.25	-	-	5.53	-	-	5.66	-	-	5.78	-	-	-	-	-	-	-
-	**Dog-in-a-Doublet**	527200	299287	-	3.67	-	-	4.00	-	-	4.22	-	-	4.32	-	-	4.42	-	-	-	-	-	-	-

See next page for notes

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(i.e. numbers beginning with 01 or 02)

Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency

East Coast and Wash: Immingham to the West Lighthouse

2018 Coastal Flood Boundary Extreme Sea Levels

NOTES:

The following notes apply to all CFB sites (ie all on table excluding Marsh Road, Wisbech, Dog-in-a-Doublet)

- The base date for the data is 2017.
- The levels are still water levels. Depending on the use of the data it may be necessary to consider wave heights and / or joint probability analysis of water level and other variables.
- Levels for other annual chance probabilities are available if required.
- For additional information relating to the 2018 Coastal Flood Boundary Extreme Sea Levels or to access the full dataset for the above sites or intermediate locations refer to the Defra Metadata Catalogue at https://deframetadata.com/geonetwork/srv/eng/catalog.search#/metadata/84a5c7c0-d465-11e4-b0bd-f0def148f590

The following notes apply to all Marsh Road, Wisbech, Dog-in-a-Doublet

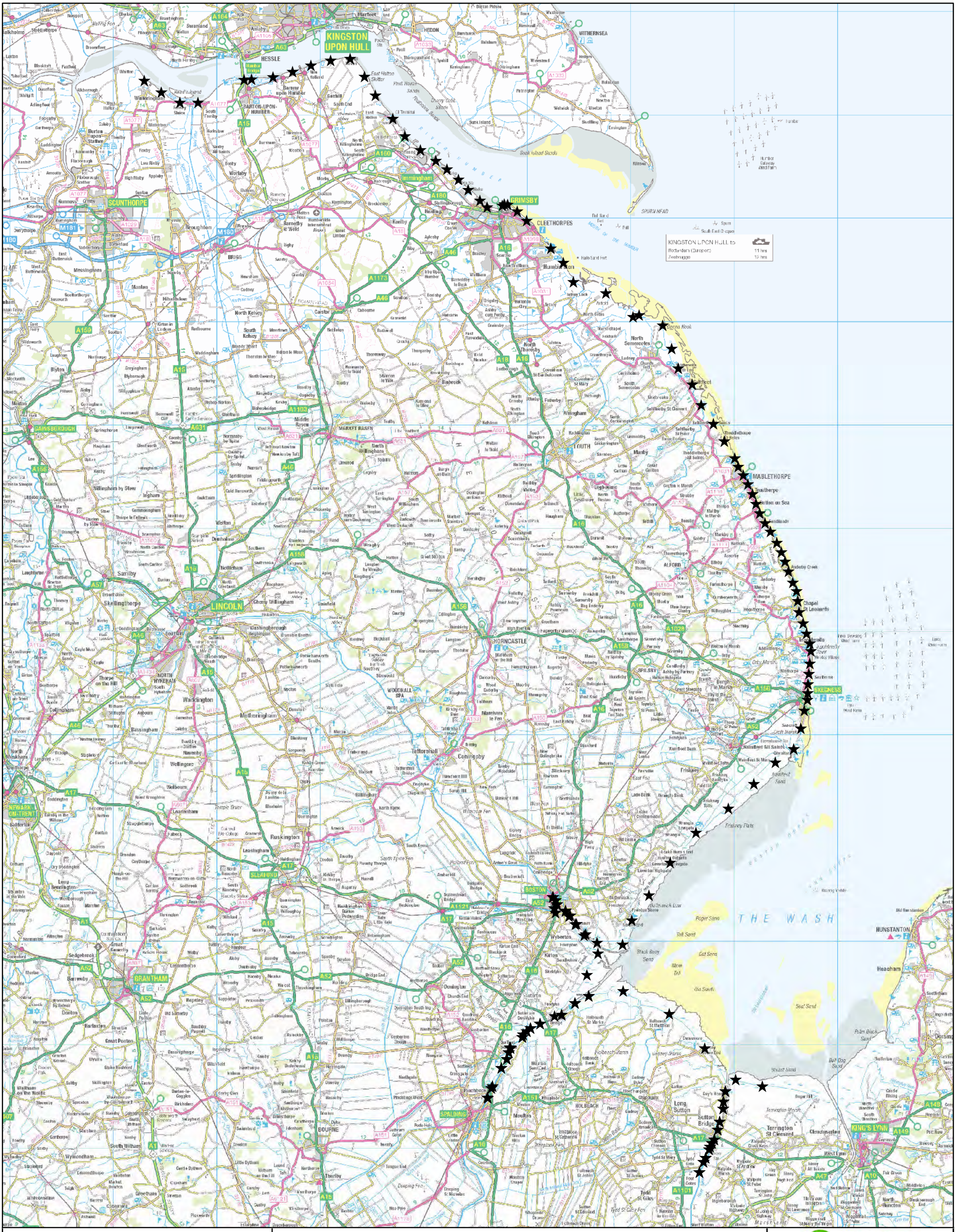
- The base date for the data is 2006
- The levels are still water levels. Depending on the use of the data it may be necessary to consider wave heights and / or joint probability analysis of water level and other variables.
- Levels for other annual chance probabilities are available if required.
- These levels will be updated as their respective tidal river models are updated.

The following notes apply to Grand Sluice

- The data is based on CFB 2018 data for Boston Barrier site, capped at 5.3mAOD to reflect use of the barrier.
- The base date for the data is 2017
- The levels are still water levels. Depending on the use of the data it may be necessary to consider wave heights and / or joint probability analysis of water level and other variables.
- For additional information relating to the 2018 Coastal Flood Boundary Extreme Sea Levels or to access the full dataset for the above sites or intermediate locations refer to the Defra Metadata Catalogue at https://deframetadata.com/geonetwork/srv/eng/catalog.search#/metadata/84a5c7c0-d465-11e4-b0bd-f0def148f590

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www.gov.uk/environment-agency



★ **Modelled Breach Locations**

0 3.5 7 14 Kilometers

This map idicates the location of where we have modelled the consequence of breaches in the defences along the coastline and tidal rivers. We have mapped 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.

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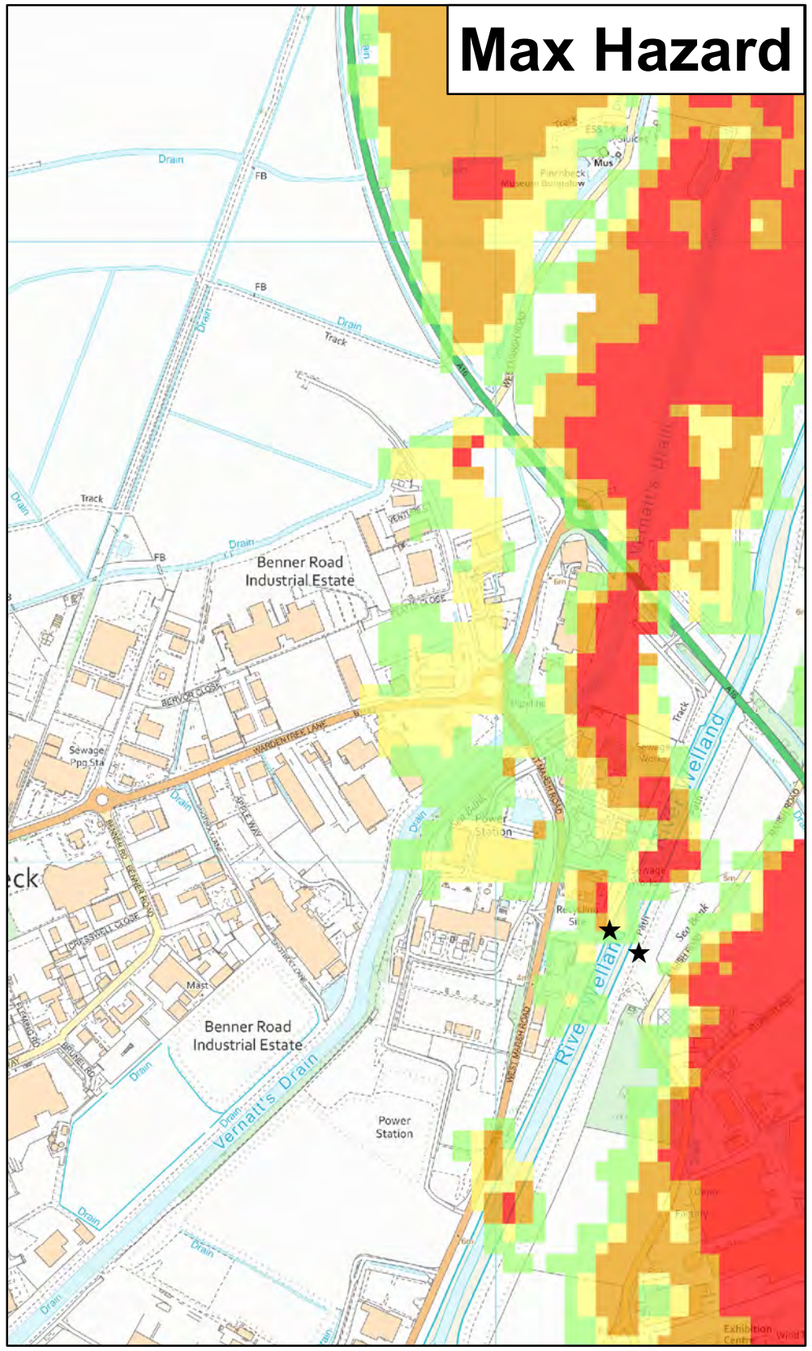
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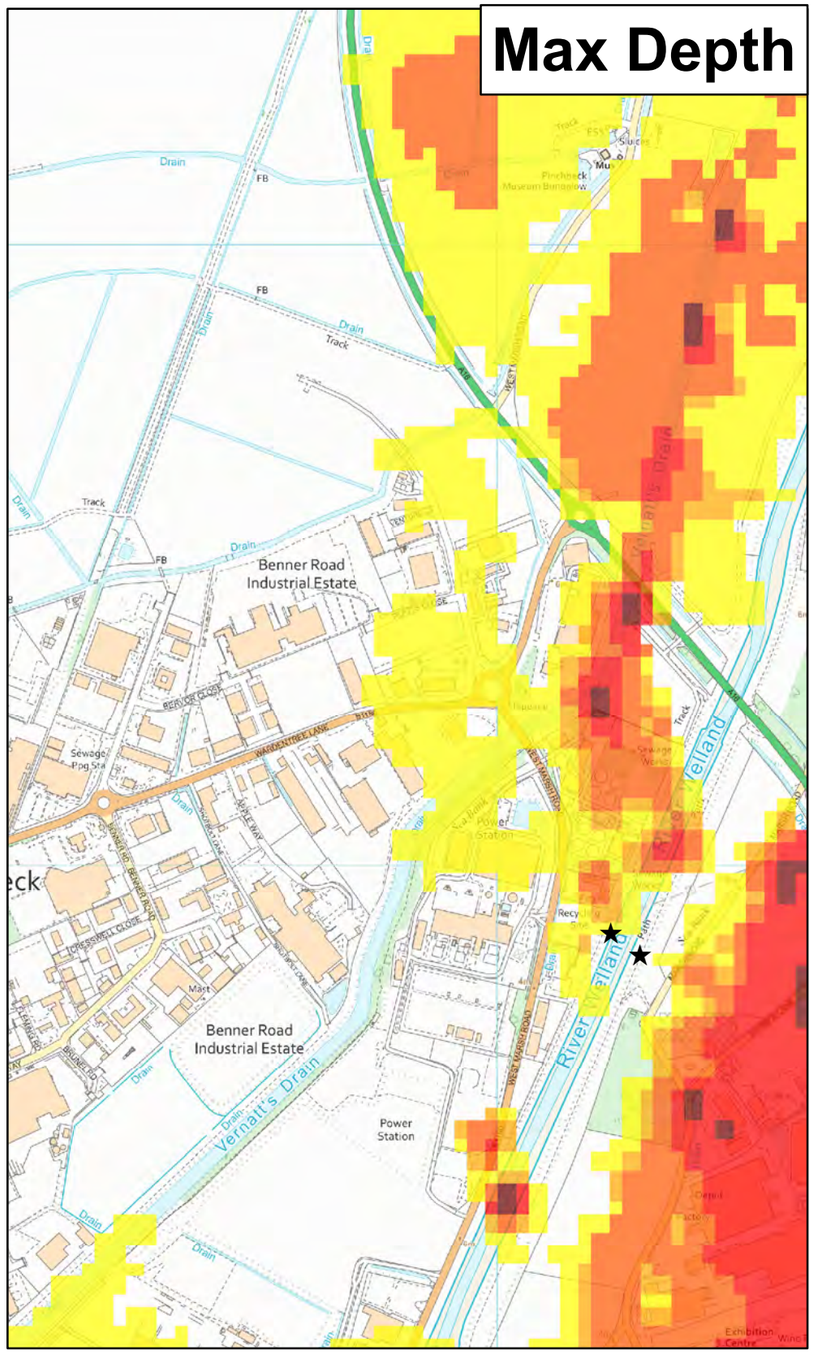
Produced by the Partnership and Strategic Overview Team, Lincoln
General Enquiries No: 03708 506 506

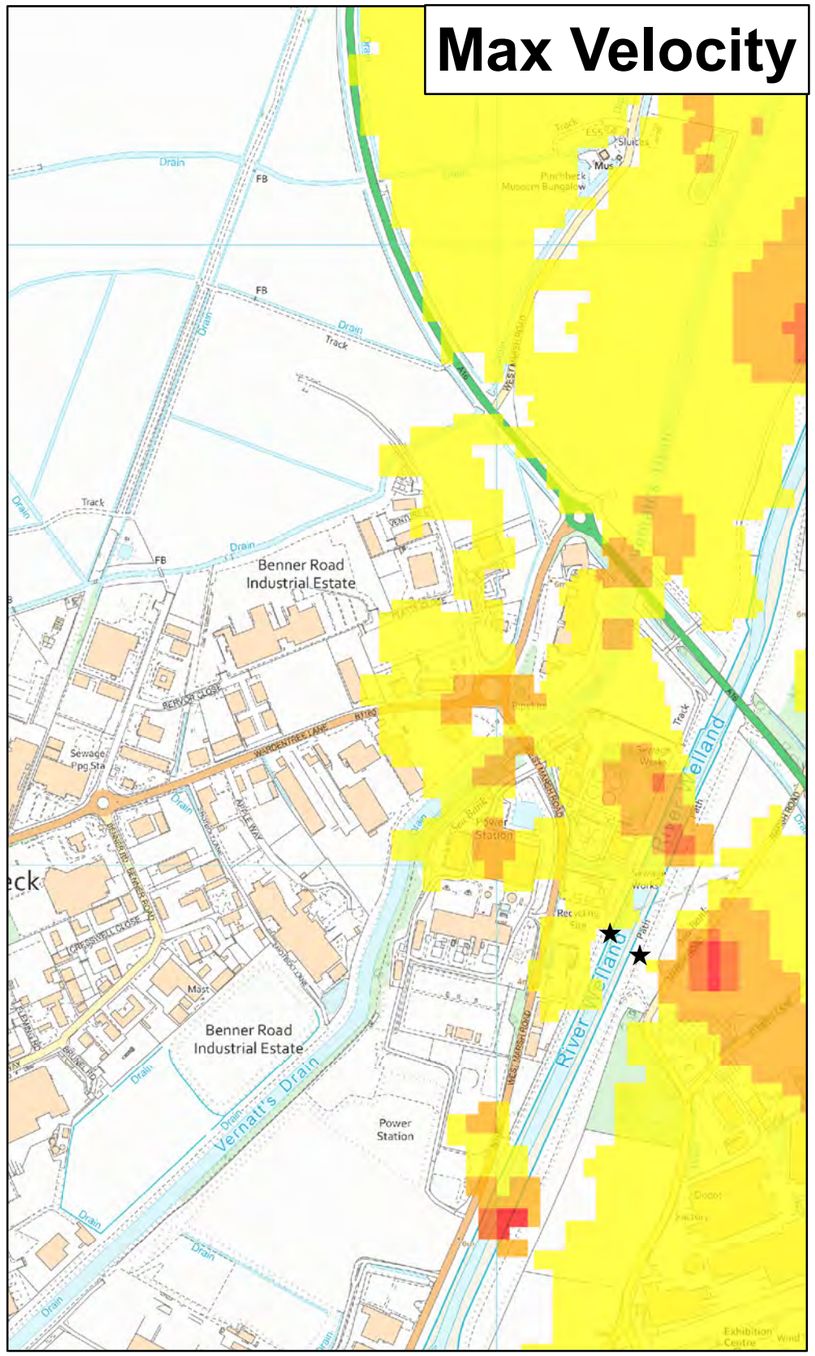
Northern Area Tidal Hazard Mapping

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 - 1.6
- 1.6 +

Max Velocity (m/s)

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

Date Printed	February 2023	Scenario year	2006	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2023 - 298844

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.

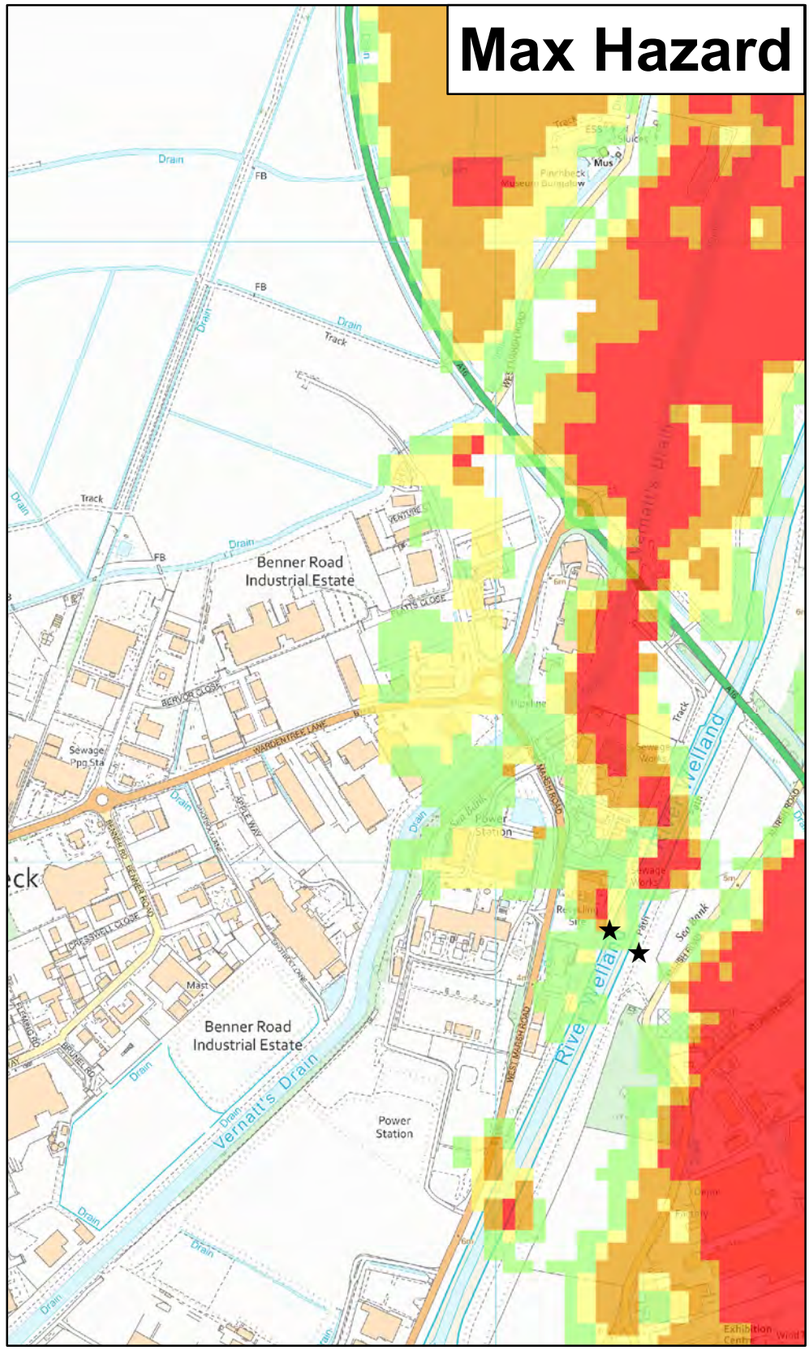
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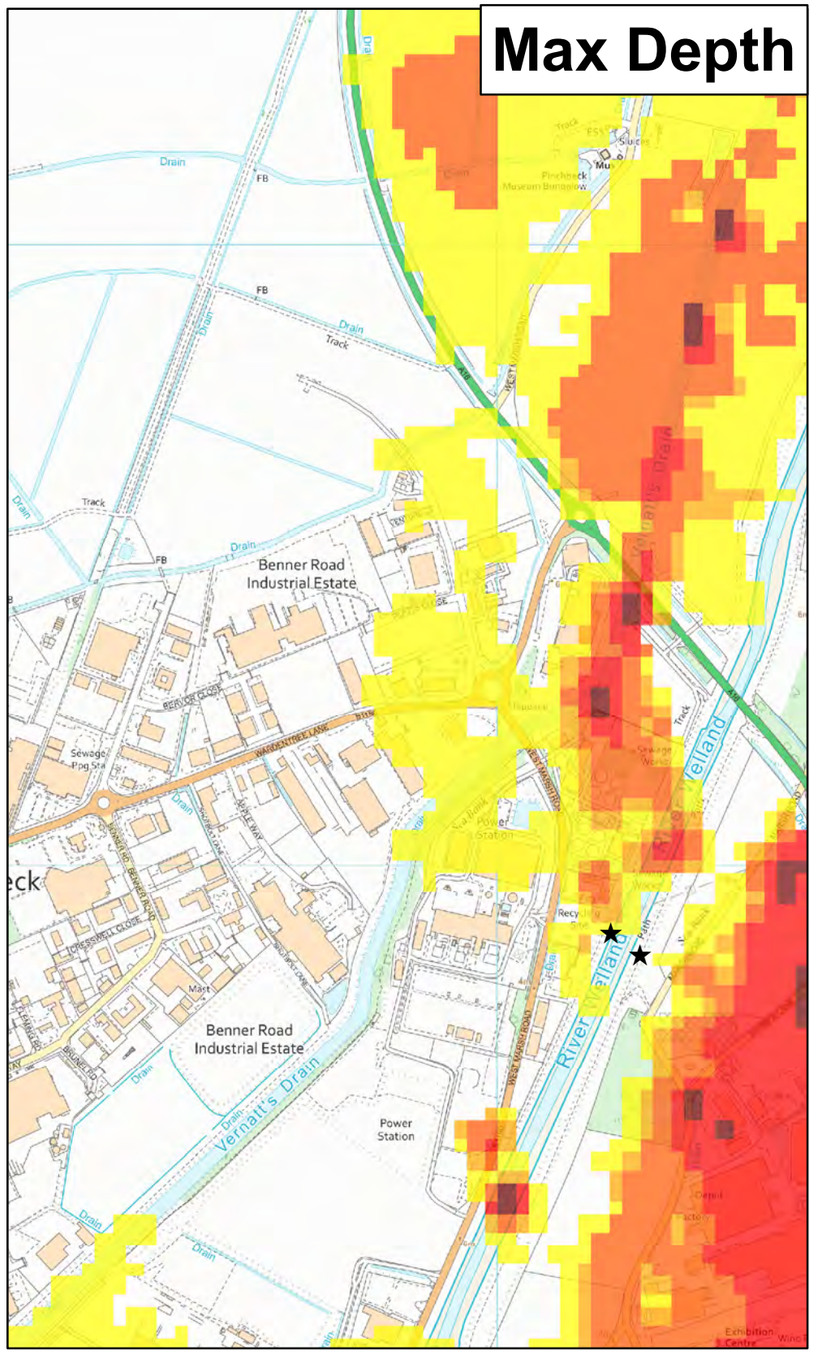
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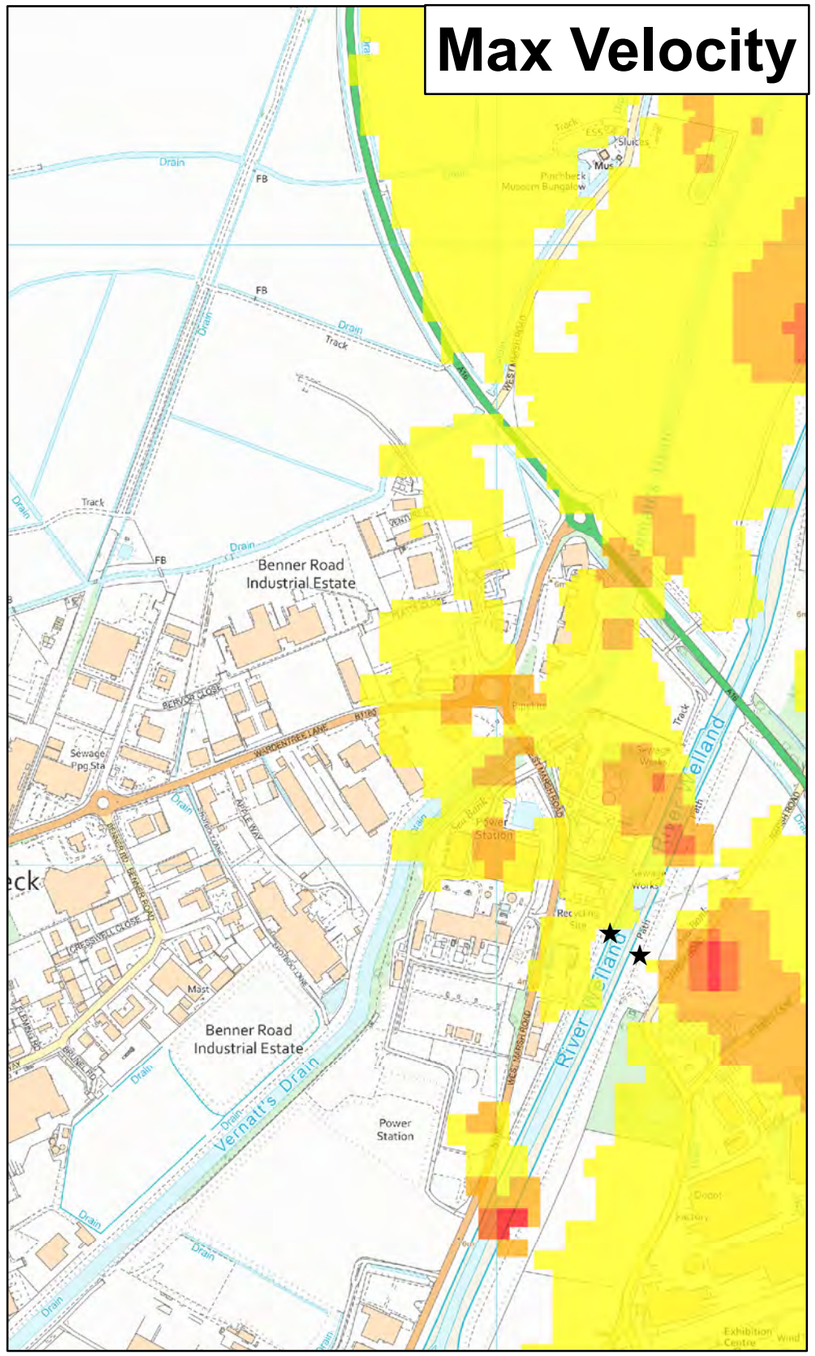
Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 25856 25301

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(Flood Risk to People : FD2320)

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- 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 - 1.6
- 1.6 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
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Date Printed	February 2023	Scenario year	2006	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2023 - 298844

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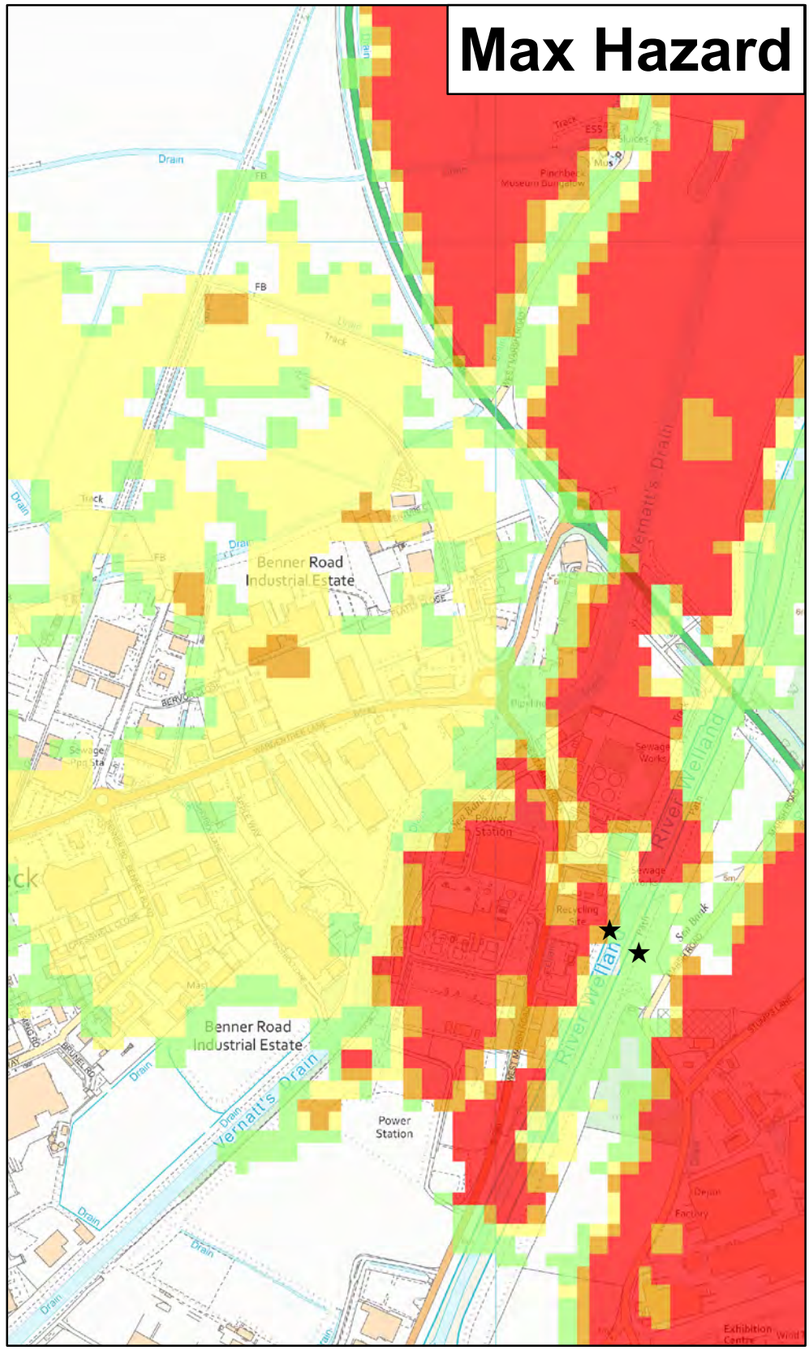
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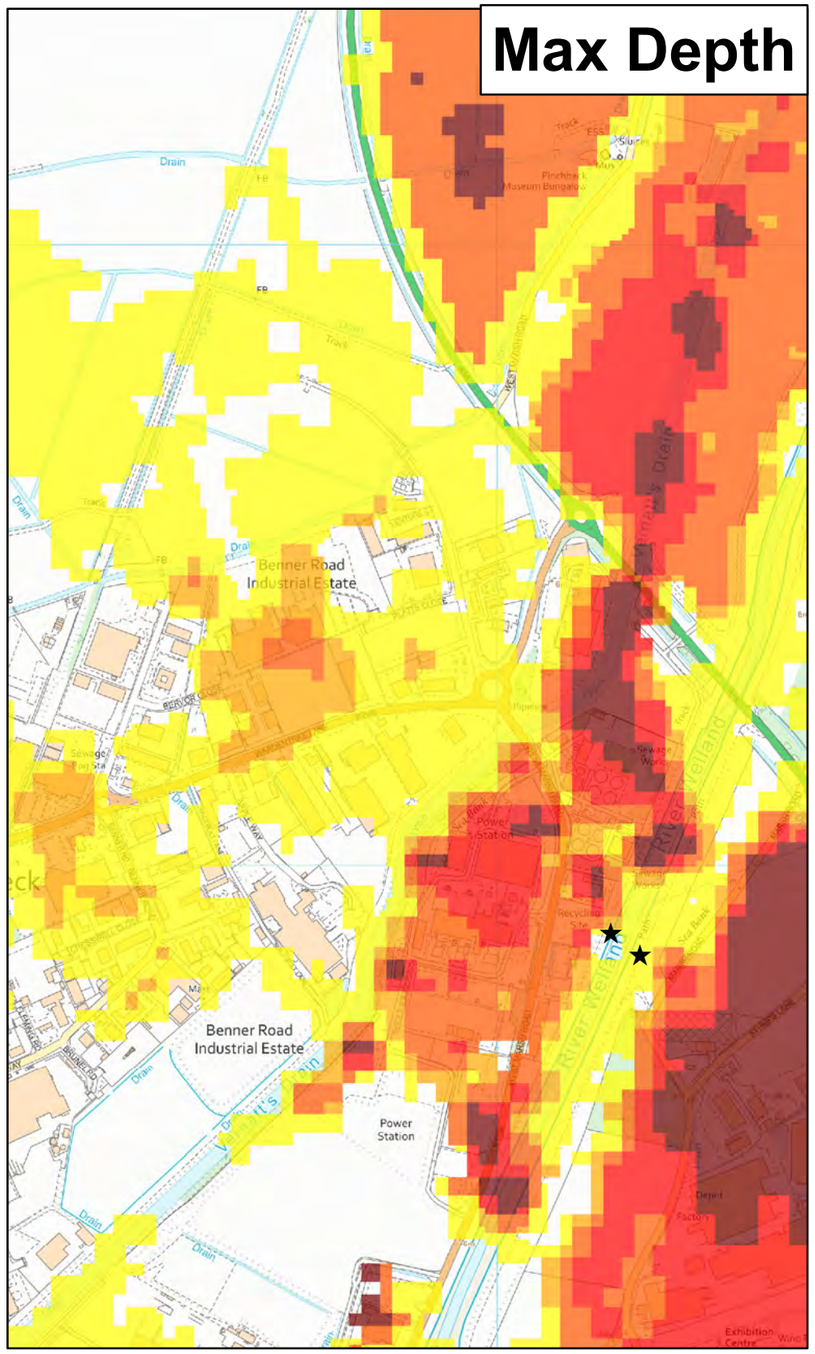
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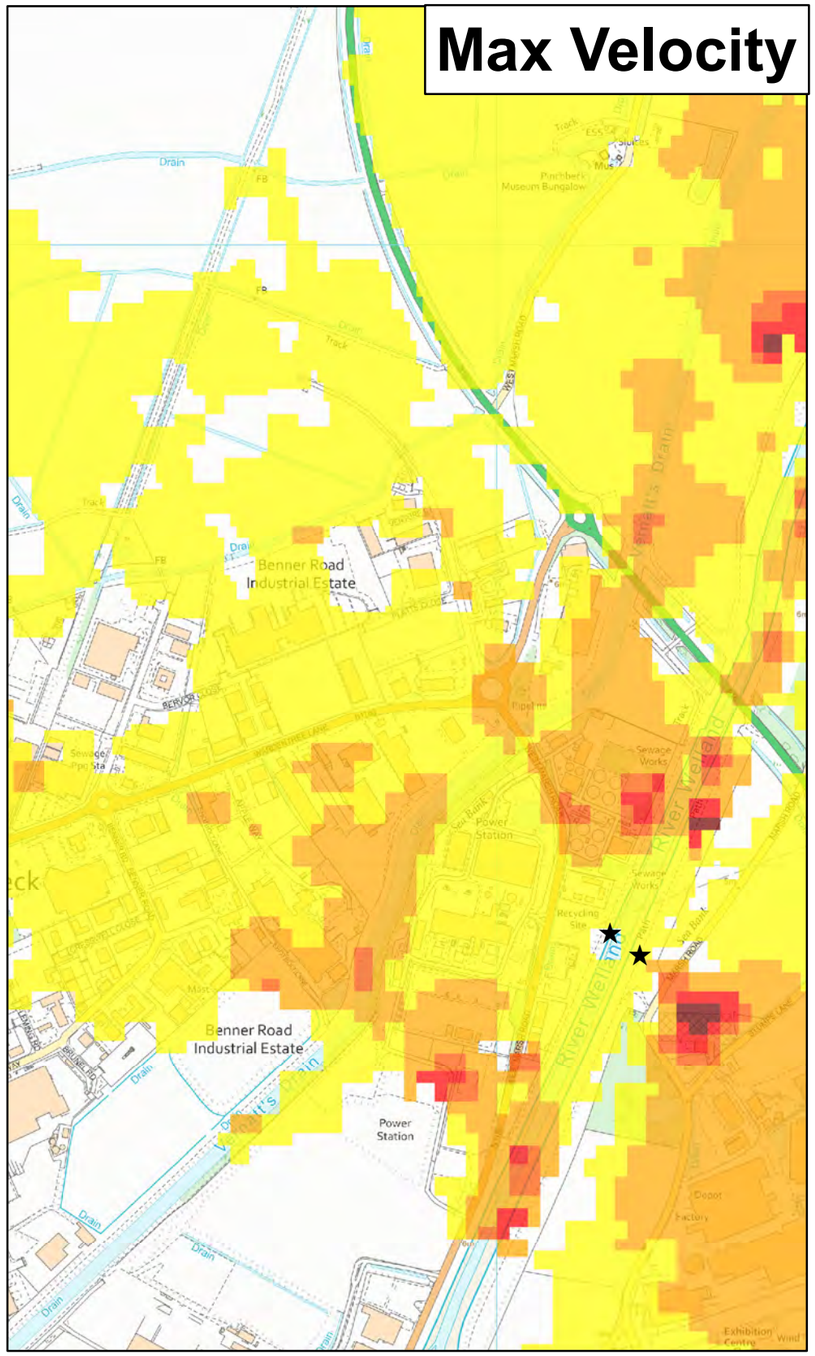
Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 25856 25301

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

Date Printed	February 2023	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2023 - 298844

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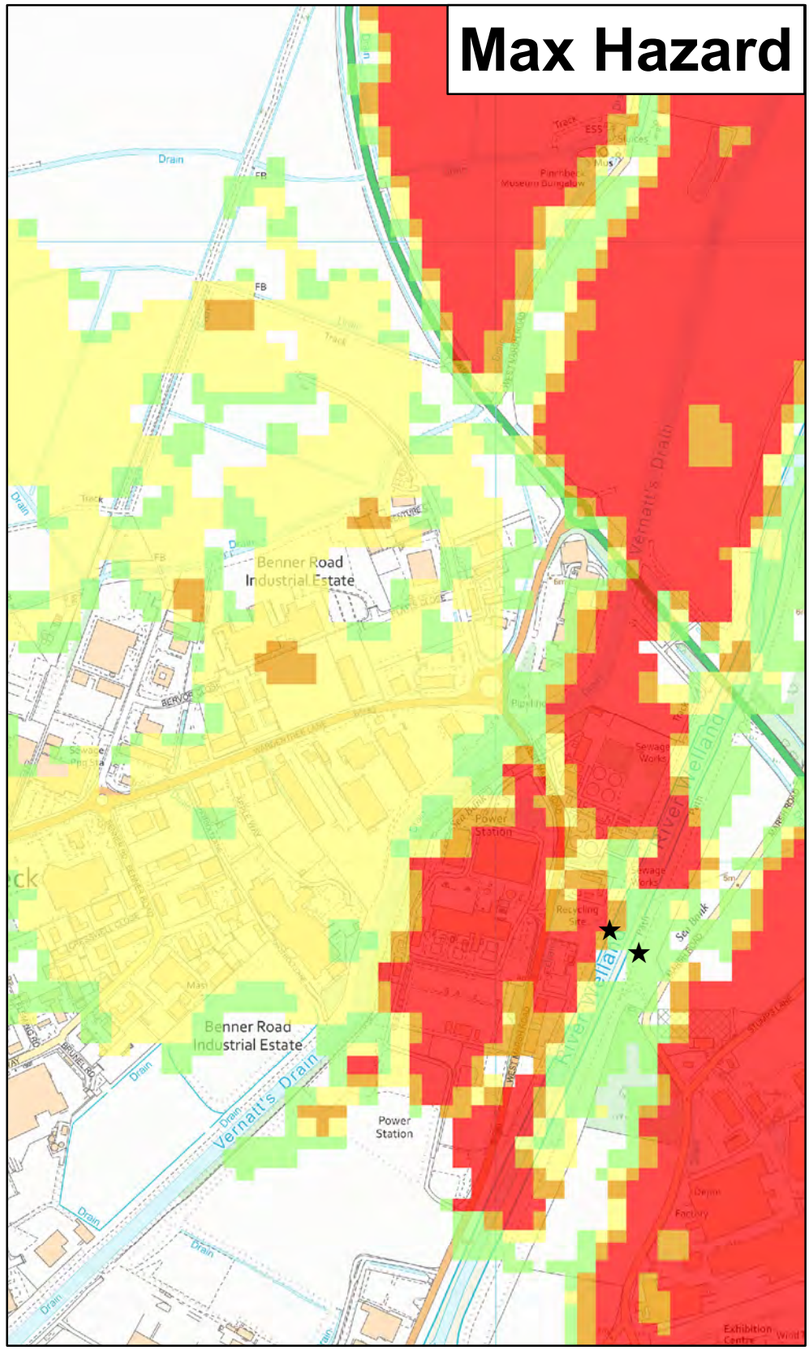
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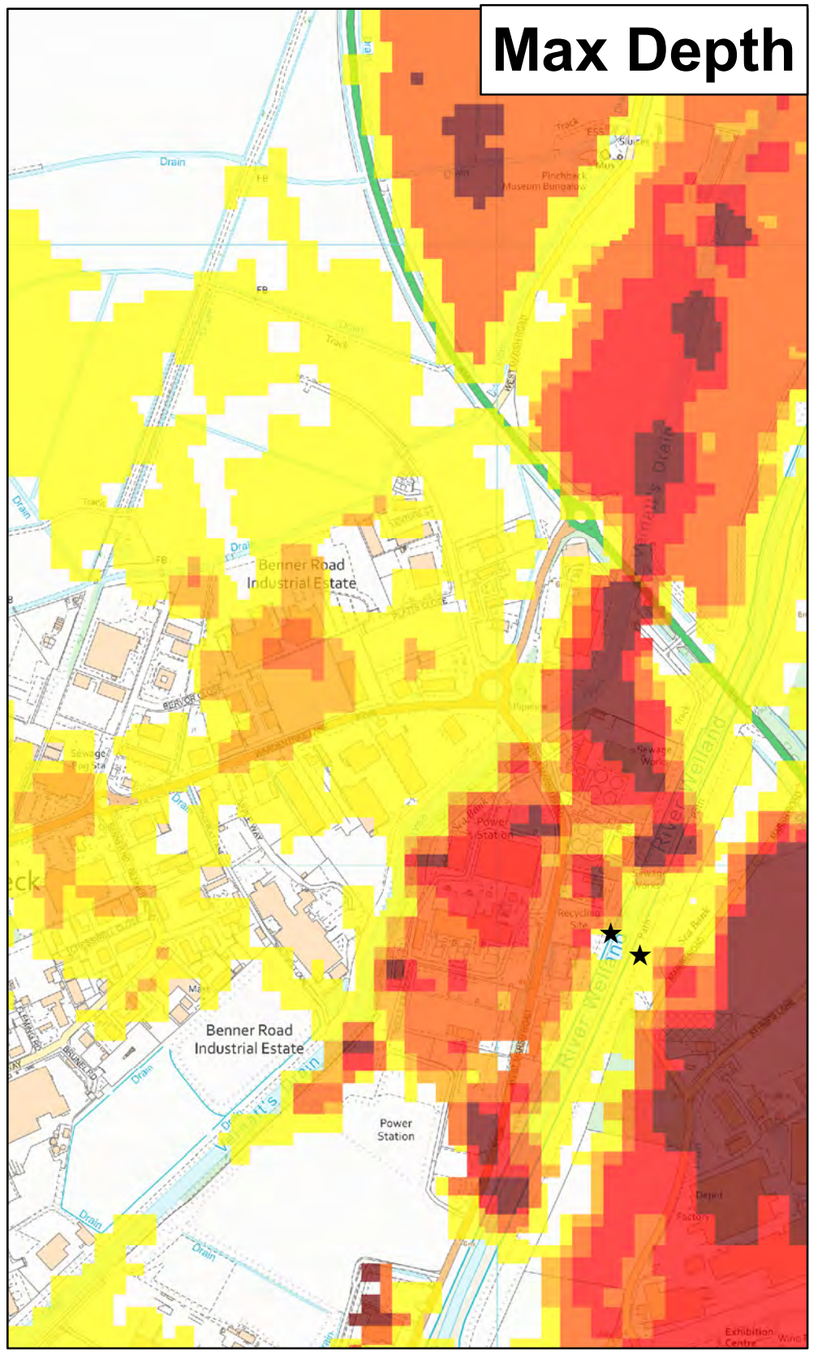
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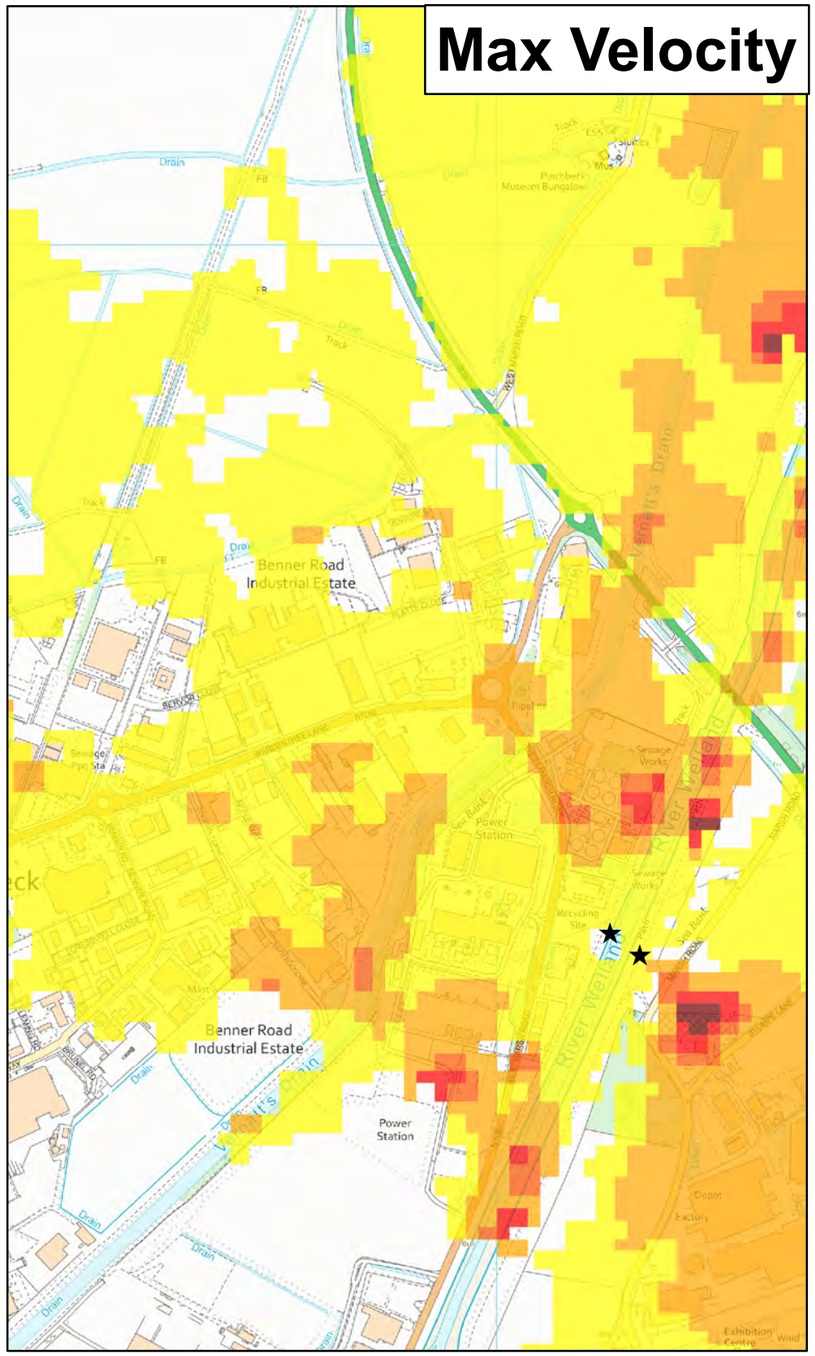
Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 25856 25301

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- 1.0 - 1.5
- 1.5 - 2.5
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Date Printed	February 2023	Scenario year	2115	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2023 - 298844

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Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

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EUROPEAN OFFICES

United Kingdom

AYLESBURY
T: +44 (0)1844 337380

BELFAST
belfast@slrconsulting.com

BRADFORD-ON-AVON
T: +44 (0)1225 309400

BRISTOL
T: +44 (0)117 906 4280

CARDIFF
T: +44 (0)29 2049 1010

CHELMSFORD
T: +44 (0)1245 392170

EDINBURGH
T: +44 (0)131 335 6830

EXETER
T: + 44 (0)1392 490152

GLASGOW
T: +44 (0)141 353 5037

GUILDFORD
T: +44 (0)1483 889800

LONDON
T: +44 (0)203 805 6418

MAIDSTONE
T: +44 (0)1622 609242

MANCHESTER (Denton)
T: +44 (0)161 549 8410

MANCHESTER (Media City)
T: +44 (0)161 872 7564

NEWCASTLE UPON TYNE
T: +44 (0)191 261 1966

NOTTINGHAM
T: +44 (0)115 964 7280

SHEFFIELD
T: +44 (0)114 245 5153

SHREWSBURY
T: +44 (0)1743 23 9250

STIRLING
T: +44 (0)1786 239900

WORCESTER
T: +44 (0)1905 751310

Ireland

DUBLIN
T: + 353 (0)1 296 4667

France

GRENOBLE
T: +33 (0)6 23 37 14 14