FloodSmart Plus

Flood Risk Assessment

Site Address

Six Penny Piece
Campaign Lane
Spalding
PE11 3EX

Grid Reference

E 521743 N 316360

Report Prepared for

Project Worx Ltd
Unit 4, Green Lodge Barn
Nobottle
Northampton
Northamptonshire
NN7 4HD

Date

2021-06-10

Report Status

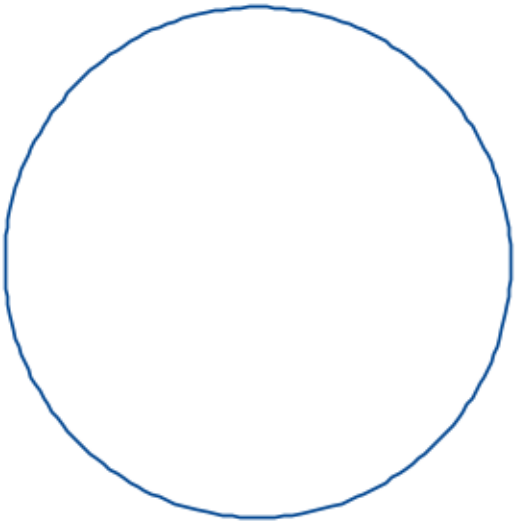
FINAL

Site Area

975 m^2

Report Reference

74847R1



FLOOD RISK – VERY LOW

The Site is located within the Environment Agency's fluvial Flood Zone 3 but benefits from the presence of flood defences. Taking into consideration the presence of defences, the risk of flooding from rivers and sea is classed as Very Low. An area of Medium risk is mapped, but this is not considered accurate because of the coarse nature of the RoFRaS maps. The Site is at a Very Low risk of surface water (pluvial) flooding and a Negligible risk of groundwater flooding.

The Site is potentially at risk from a breach event, an assessment of the SFRA (2017) Residual Flood Hazard flood map which accounts for the consequences from overtopping of defences and breach failure at any point along the defences confirms the Site has a Low hazard for the 2115 1 % fluvial AEP event (climate change). Flooding could occur at the Site and recommendations for flood mitigation are included.

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1. Executive summary

A review has been undertaken of national environmental data sets to assess the flood risk to the Site from all sources of flooding in accordance with The National Planning Policy Framework (NPPF) (2019) and National Planning Practice Guidance (NPPG) (2014). A site-specific flood risk assessment, to assess the flood risk to and from the development Site, is provided within this concise interpretative report written by an experienced GeoSmart consultant. Baseline flood risk and residual risks that remain after the flood risk management and mitigation measures are implemented are summarised in the table below.

Site analysis

Source of Flood Risk	Baseline	After Analysis and Mitigation
River (fluvial) flooding	Very Low to Medium[1]	Very Low
Sea (coastal/tidal) flooding	Very Low	N/A
Surface water (pluvial) flooding	Very Low	N/A
Groundwater flooding	Negligible	N/A
Other flood risk factors present	Yes	Yes[2]
Is any other further work recommended?	Yes	Yes (see below)

N/A = mitigation not required

[1] The medium risks mapped are considered to be formed as a result of the coarseness of the EA's RoFRaS maps.

[2] A risk has been identified from reservoirs, although the level of risk could not be determined.

Summary of existing and proposed development

The Site is currently used in a residential capacity comprising a single-storey bungalow dwelling. Development proposals include the demolition of the existing structure and the erection of two single-storey semi-detached residential dwellings.

Summary of flood risks

The flood risks from all sources have been assessed as part of this report and are as follows:

- According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located within a fluvial Flood Zone 3 (High probability), associated with The River Welland, 3.5 km to the east.
- The Site does benefit from the presence of flood defences 3.5 km to the east along the River Welland, with an upstream crest level of 5.99 mAOD and a downstream crest level of 5.94 mAOD (left bank). The EA inspects the defences twice a year and classifies their current condition as "Fair (Condition Grade: 3)".
- According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, the Site has a Very Low risk of flooding from Rivers and the Sea.
- Modelled flood data has been obtained from the EA and analysed in line with the most up to date guidance on climate change (EA, 2020), to confirm a maximum "design" flood level at the Site.

  During a 1 in 100 and 1000 year plus 20 % climate change allowance event, the in-channel flood level would be 4.79 mAOD. Under such conditions, the Site is not anticipated to flood due to overtopping above the elevated crest level of the defences along the River Welland, which are raised between approximately 5.94 and 5.99 and are in fair condition.

  The EA do not hold any modelled data which confirms what would happen in the unlikely event of a breach of the River Welland flood defences. However the South East Lincolnshire Council's Strategic Flood Risk Assessment (SFRA) (2017) includes mapping associated with a study completed by Royal HaskoningDHV and South Holland District Council for the 2017 SFRA.

  The Council's SFRA maps (2017) (Appendix E) confirm flooding would spread out across the wider floodplain and interact with land drainage channels. The resultant maximum flood level and flow routes in a breach scenario are not known in this instance, as the SFRA maps do not provide this, but flooding levels at the Site are likely to be lower than within the channel when the defences have not been breached.

  Flood levels have been estimated using the extents of the 2017 SFRA Residual Flood Hazard Map and the EA's LiDAR ground elevation data. These confirm the flooding extents which could occur in a present day 1 in 100 year fluvial event and the 2115 1 in 100 year event (climate change scenario).

  This analysis indicates the Site would not be affected by a breach in a present day scenario but would be affected by flooding in a 2115 scenario. The resultant flood level is 2.1 mAOD and depths of up to 0.15 m. The SFRA confirms this is a Low hazard.

  On the basis of the estimated flood levels, the flood depths in the area proposed for development could be up to 0.15 m. Flood mitigation measures are included in the next section. Emergency evacuation routes are available to the north east.

- According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a Very Low risk of pluvial flooding.
- Groundwater Flood Risk screening data indicate that there is a Negligible risk of groundwater flooding at the surface in the vicinity of the Site during a 1 in 100 year event.
- The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:
    - The EA's Risk of Flooding from Reservoir map confirms the Site is at risk of reservoir flooding.
    - Ordnance Survey (OS) data confirm that there are no canals near to the Site.
    - A sewer flooding history search was undertaken using the Strategic Flood Risk Assessment (South East Lincolnshire Joint Planning Unit, 2017). This confirms no recorded incidences of sewer flooding at or within the vicinity of the Site.

  A flooding risk has been identified from reservoirs, although the level of risk could not be determined. The EA's regulation of formal reservoirs are robust and the likelihood of a breach occurring is Low, therefore the risks of flooding from artificial sources are considered to be Low.

The risk to the development has been assessed over its expected 100 year lifetime, including appropriate allowances for the impacts of climate change. More extreme weather events could increase the risk to the Site from river flooding. Site specific assessment indicates risk to the Site will not increase significantly and appropriate mitigation measures are proposed.

Recommendations

Recommendations for flood mitigation are provided below, based upon the proposed development and the flood risk identified at the Site.

- Ground floor Finished Floor Levels (FFL) should be set at least 0.6 m above the 1 in 100 year plus allowance for climate change flood level of 2.1 mAOD (i.e., following a breach event) to 2.7 mAOD.
- A Flood Warning and Evacuation Plan (FWEP) is recommended to ensure persons using the Site can evacuate safely on receipt of a Flood Warning.
    - Occupants of the Site should be signed up to receive EA Flood Alerts and Flood Warnings.
- A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

2. Introduction

Background and purpose

A site-specific flood risk assessment has been undertaken, to assess the flood risk to and from the development Site. This assessment has been undertaken by firstly compiling information concerning the Site and the surrounding area. The information gathered was then used to construct a 'conceptual site model', including an understanding of the appropriateness of the development as defined in the NPPF (2019) and the source(s) of any flood risk present. Finally, a preliminary assessment of the steps that can be taken to manage any flood risk to the development was undertaken.

This report has been prepared with reference to the NPPF (2019) and NPPG (2014).

"*The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied*" (NPPF, 2019).

The NPPF (2019) and NPPG (2014) promote a sequential, risk based approach to the location of development. This also applies to locating a development within a Site which has a variable risk of flooding.

"*This general approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high risk flood areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible*" (NPPG, 2014).

The purpose of this report is to provide clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at the Site.

Report scope

In accordance with the requirements set out within NPPG 2014 (Paragraph: 030 Reference ID: 7-030-20140306), a thorough review of a commercially available flood risk report and EA supplied data indicating potential sources of flood risk to the Site from rivers and coastal sources, surface run-off (pluvial), groundwater and reservoirs, including historical flood information and modelled flood extent. Appropriate measures are recommended to manage and mitigate the flood risk to the property.

Information obtained from the EA and a review of the South East Lincolnshire Strategic Flood Risk Assessment (SFRA) (South East Lincolnshire Joint Planning Unit, 2017) is used to ascertain local flooding issues and, where appropriate, identify information to support a Sequential and/or Exception test required as part of the NPPF (2019).

The existing and future flood risks to and from the Site from all flood sources is assessed in line with current best practice using the best available data. The risk to the development has been assessed over its expected lifetime, including appropriate allowances for the impacts of climate change. Residual risks that remain after the flood risk management and mitigation

measures are implemented, are considered with an explanation of how these risks can be managed to keep the users of the development safe over its lifetime.

An indication of whether the Site will potentially increase flood risk elsewhere is provided, including where the proposed development increases the building footprint at the Site. A drainage strategy to control runoff can be commissioned separately if identified as a requirement within this report.

Report limitations

It is noted that the findings presented in this report are based on a desk study of information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and a proportionate programme of site investigations would be required to fully verify these findings.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Datasets

The following table shows the sources of information that have been consulted as part of this report:

Table 1. Datasets consulted to obtain confirmation of sources of flooding and risk

Source of flooding	Datasets consulted			
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency (Appendix B)	OS Data
Historical	X	X	X	
River (fluvial) / Sea (tidal/coastal)	X	X	X	
Surface water (pluvial)	X	X	X	
Groundwater	X	X		
Sewer		X		
Culvert/bridges		X		X
Reservoir		X	X	

*Local guidance and policy, referenced in Section 6, has been consulted to determine local flood conditions and requirements for flood mitigation measures.

3. Site analysis

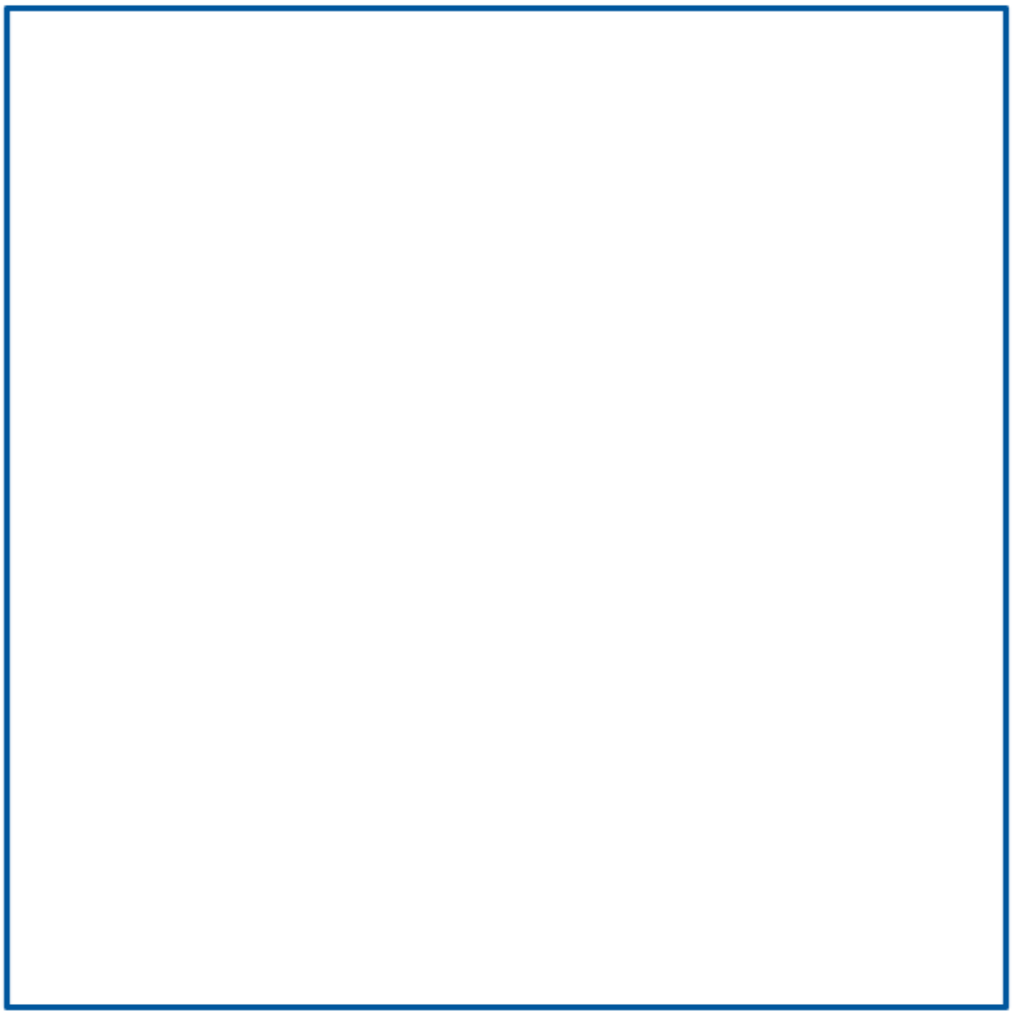
Site information

The Site is located to the north of Deeping St Nicholas in a setting of residential land use at National Grid Reference TF 21743 16360. Site plans & drawings are provided in Appendix A.

According to OS data, using a 500 m buffer around the Site, the area is on a gentle slope (Figure 1). It is noted that to the north land falls to c. 1.08 m above Ordnance Datum (AOD). To the west land falls to c. 1.93 mAOD, to the east land falls to c. 0.92 mAOD and to the south falls to c. 0.89 mAOD.

The ground levels at the Site are between 1.74 m AOD and 2.85 mAOD with the Site falling gradually in a north easterly direction. The ground levels in the area proposed for building development are between 1.95 mAOD and 2.76 mAOD. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ±0.15 m (Appendix C).

Figure 1. Site Location and Relative Elevations (GeoSmart, 2021).



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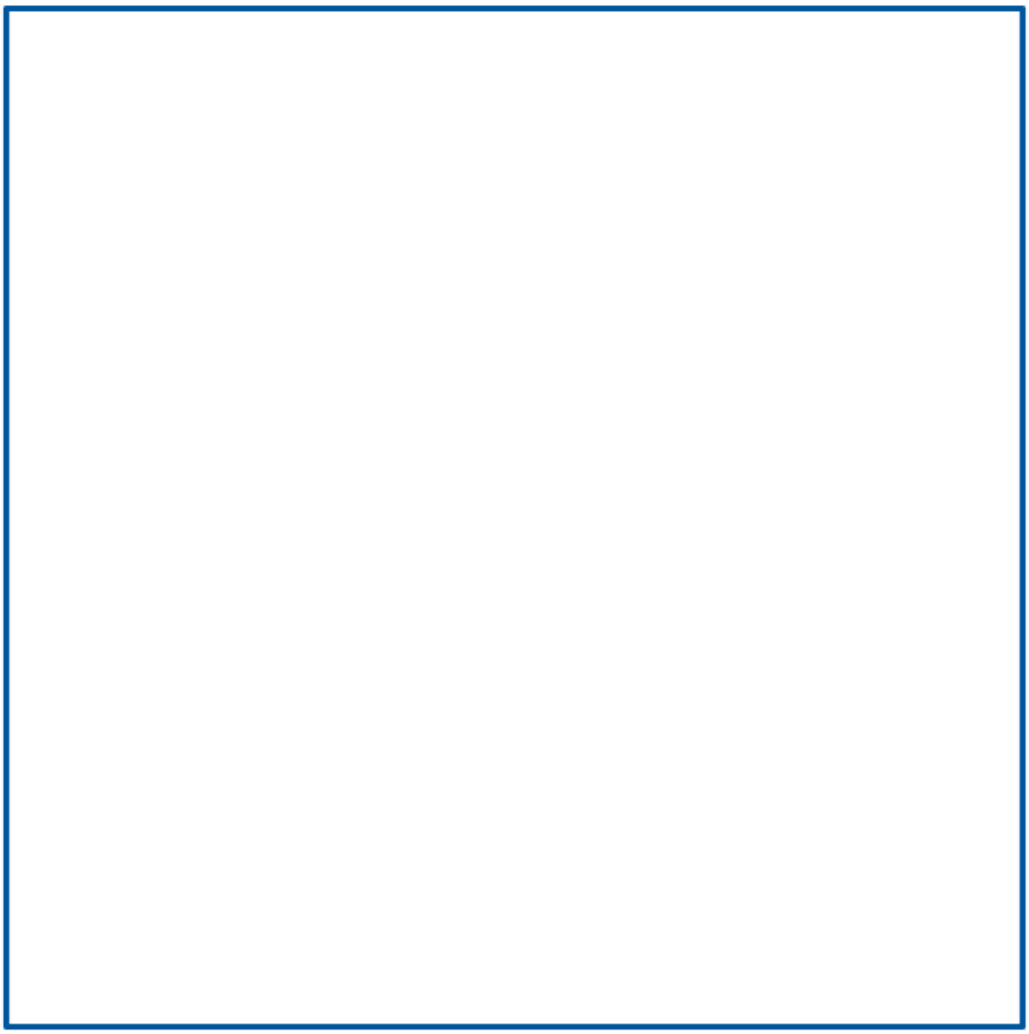
Development

The Site is currently used in a residential capacity comprised of a single-storey dwelling. Existing Finished Floor Levels (FFL) are approximately 0.15 m above ground elevation. Development proposals include the demolition of the existing structure and the erection of two single-storey semi-detached residential dwellings. Site plans are included within Appendix A.

The effect of the overall development will result in an increase in number of occupants and/or users of the building but will not result in the change of use, nature or times of occupation. According to Table 2 of the NPPG (2014), the vulnerability classification of the existing development is More Vulnerable and the proposed development is also More Vulnerable. The estimated lifespan of the development is 100 years.

Hydrological features

Figure 2. Surface water features (EA, 2021)



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A pond is present 180 m to the south west of the Site.

Drainage ditches are located:

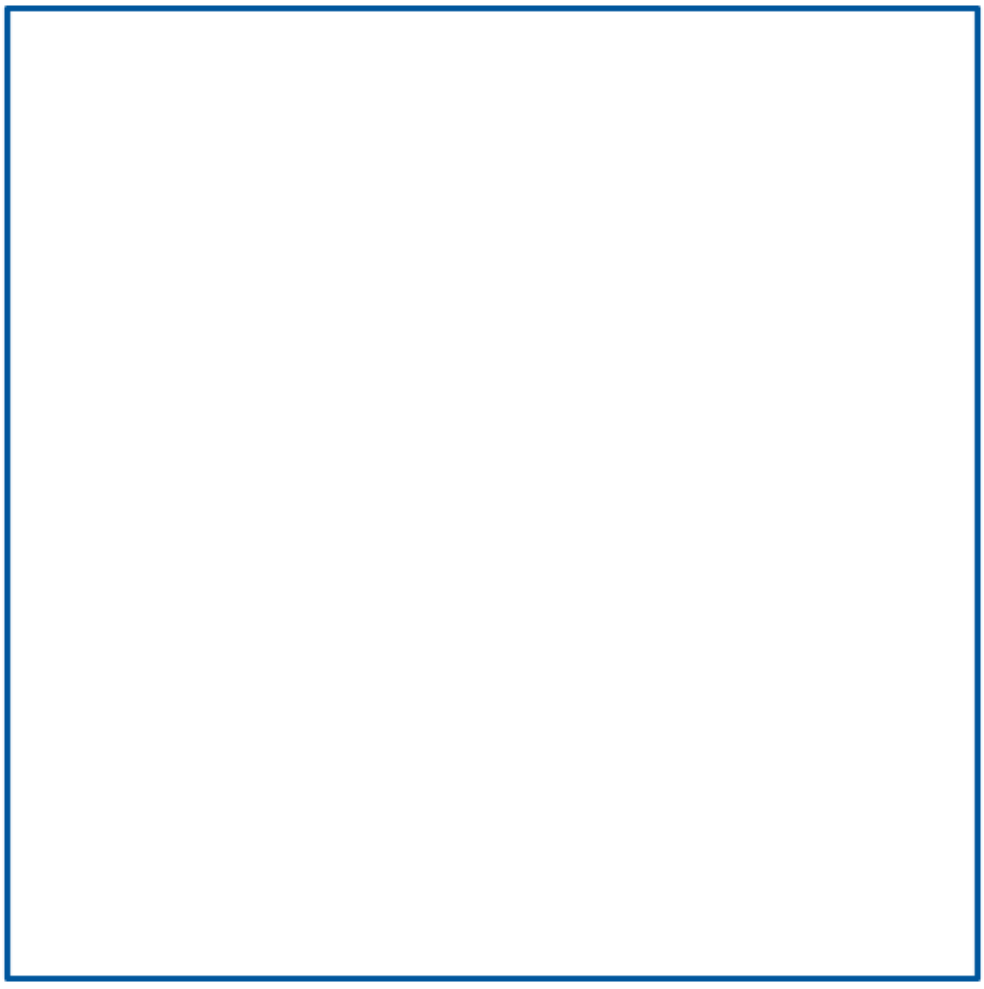
- 275 m and 490 m to the south west;
- 265 m to the south;
- 75 m to the north;
- 50 m, 225 m, and 390 m to the north east; and
- 330 m the north west.

The River Welland is located 3.5 km to the east of the Site.

Hydrogeological features

British Geological Survey (BGS) mapping indicates the underlying superficial geology (Figure 3) consists of Tidal Flat Deposits (TDF) (clay and silt) BGS, 2021) which are classified as an Unproductive Strata (EA, 2021).

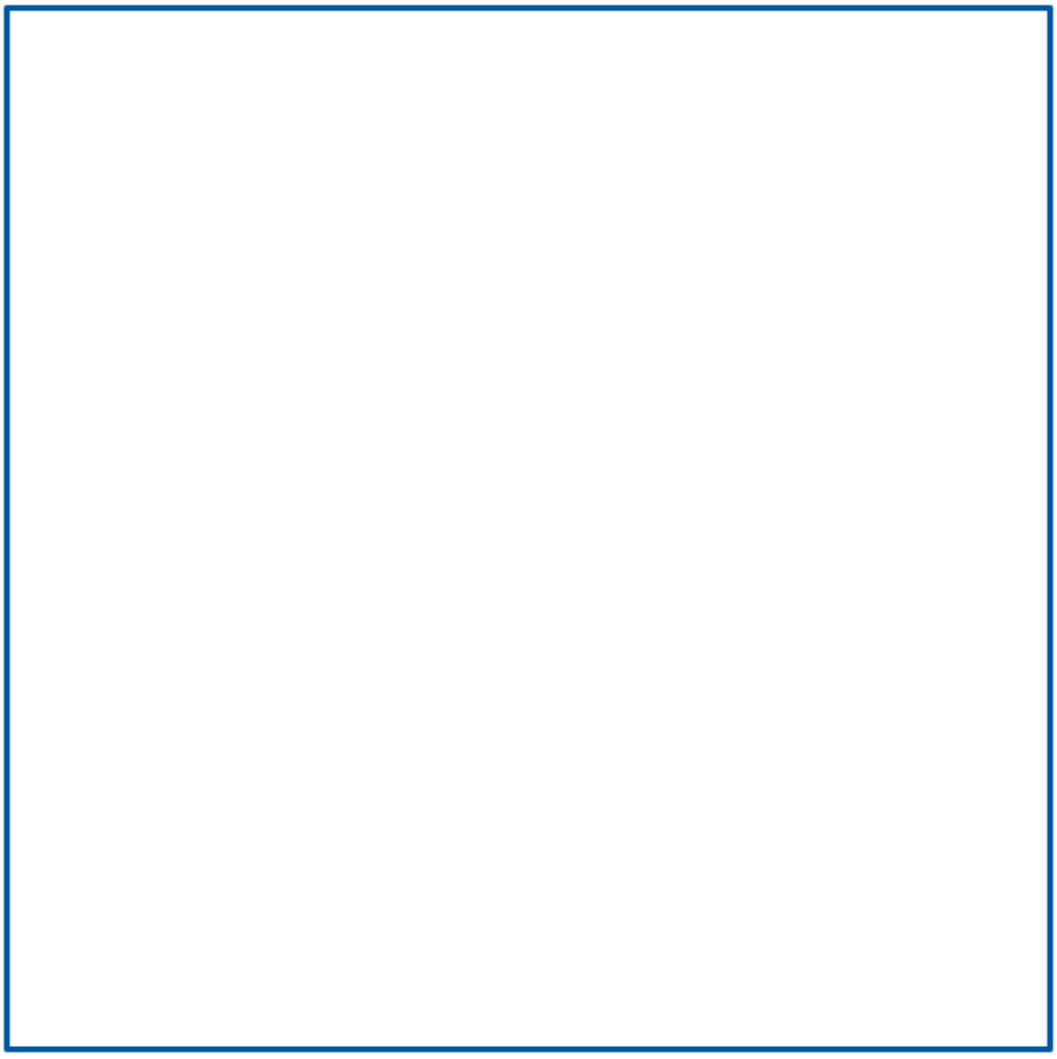
Figure 3. Superficial Geology (BGS, 2021)



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BGS mapping indicates the underlying bedrock geology (Figure 4) consists of the Oxford Clay Formation (OXC) (mudstone) (BGS, 2021) which is classified as an Unproductive Strata (EA, 2021).

Figure 4. Bedrock Geology (BGS, 2021)



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The Site does not lie within a groundwater Source Protection Zone (SPZ) (EA, 2021).

A review of the BGS borehole database (BGS, 2021) indicates there are no relevant boreholes within the vicinity of the Site (250 m) from which the mapped geology can be inferred.

The hydrogeological characteristics suggest there is unlikely to be a coherent shallow groundwater table beneath the Site.

Proximity to relevant infrastructure

A private access bridge (driveway) is located 185 m to the north-east of the Site over a drainage ditch.

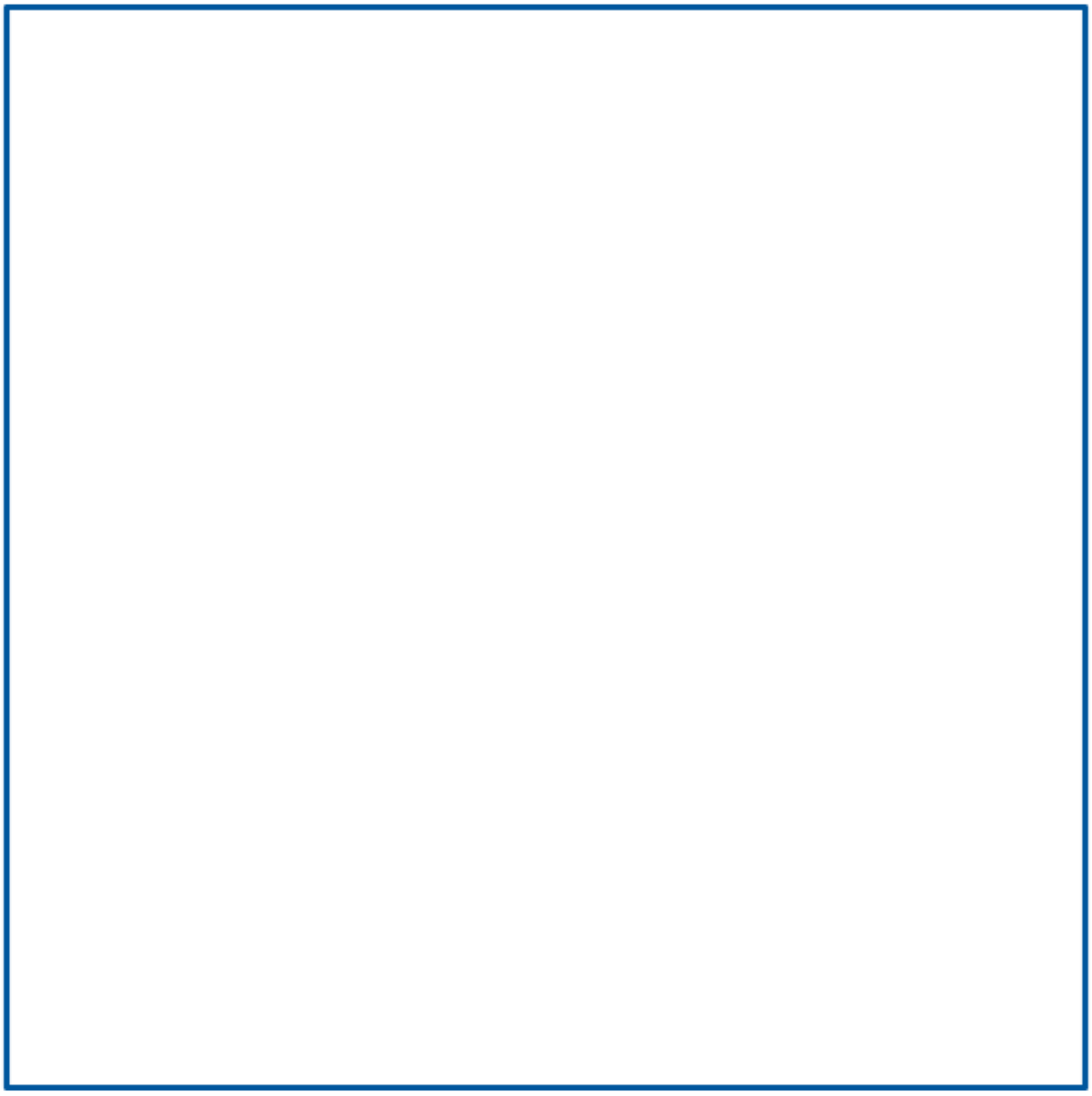
4. Flood risk to the development

Historical flood events

According to the EA's Historical Flood Map (Figure 5) (EA, 2021) and the SFRA (South East Lincolnshire Joint Planning Unit, 2017), no historical flood events have been recorded at the Site (EA, 2021).

The purpose of historical flood data is to provide information on where and why flooding may have occurred in the past. The absence of any recorded events does not mean flooding has never occurred on-Site or that flooding will never occur at the Site.

Figure 5. EA Historic Flood Map



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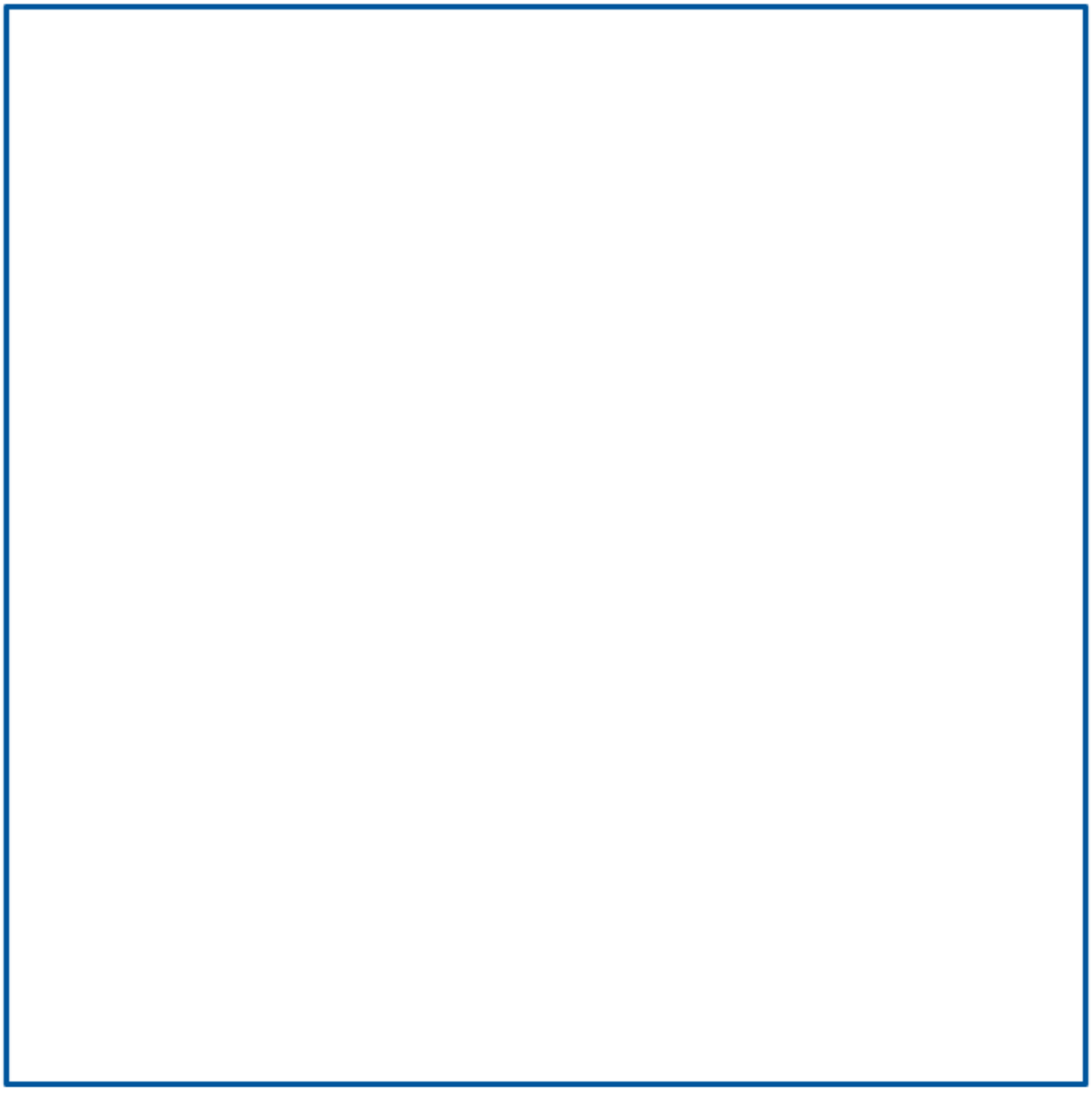
Rivers (fluvial) / Sea (coastal/tidal) flooding

The predominant risk at the Site is from flooding from rivers, termed as fluvial flooding. The Site is located in an inland location and the risk of flooding from coastal and tidal processes are therefore considered to be Negligible.

River (fluvial) flooding occurs during times of heavy rainfall or snow melt when watercourses' capacity can be exceeded, over topping the banks and any flood defences.

According to the EA's Flood Map for Planning Purposes (Figure 6), the Site is located within fluvial Flood Zone 2 and 3 and is therefore classified as having a High probability of fluvial flooding from the River Welland. The Site lies approximately 6.5 km to the north east of the nearest land outside Flood Zones 2 and 3 that is not a dry island.

Figure 6. EA Flood Map for Planning Purposes (EA, 2021)



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Guidance

As defined in the NPPF (2019):

Ignoring the presence of any defences, land located in a Flood Zone 3 is considered to have High probability of flooding with a 1 in 100 year or greater annual probability of fluvial flooding or a 1 in 200 or greater annual probability of coastal flooding in any one year.

Development of "Water-Compatible" and "Less Vulnerable" land uses are suitable for this zone with "More Vulnerable" and "Essential Infrastructure" requiring an Exception test to be passed prior to development taking place. (see glossary for terminology).

Flood defences

Guidance

Sites that are located close to flood defences are likely to be zones where rapid inundation will occur in the event of the flood defences being overtopped or breached. A Site located close to flood defences (within 250 m) may require a more detailed FRA subject to local topography.

- There are formal flood defences 3.5 km east of the Site and land drainage channels within 1.4 km of the Site.
- There are no ongoing capital projects to reduce or sustain the current flood risk in the areas surrounding the Site.
- There are embankment and storage reservoir flood defences 3.5 km to the east along the River Welland, with an upstream crest level of 5.99 mAOD and a downstream crest level of 5.94 mAOD (left bank). The EA inspects the defences twice a year and classifies their current condition as "Fair (Condition Grade: 3)". They are designed to provide protection up to the 1 in 100 year event.
- The Site is within the Welling and Deepings Internal Drainage Board (IDB) watershed catchment area, responsible for the operation, maintenance and improvement of watercourses and seeks to achieve water level management to drain and irrigate agricultural land and reduce flood risk to developed areas. The board maintains 660 km of surface water drainage, 14 pumping stations and 3 tidal sluices.
- Pumping stations are located within 5.5 km to the north (Adventures/Deeping St Nicholas NGR: TF 21270 21970) and 6 km to the north (Fourth District NGR: TF 21510 22210) (Welland and Deepings Internal Drainage Board, 2018).

Model data

As the Site is located within the EA's fluvial floodplain, modelled flood elevation and flow datasets were obtained from the EA.

Overtopping of Flood Defences

Defended modelled flood data from the Welland Catchment Strategy Model (2016) was obtained for nine 1D node points, located in-channel of the River Welland. The relevant extracted data is provided in the table below and also included within Appendix B [1].

Assessment of the upstream and downstream node points provided (4.4 km apart) confirm a shallow gradient across the floodplain and therefore, the highest flood level upstream has been used to compare with the crest height of the EA's flood defences (node reference WELLAND 25001.5).

The embankment flood defences are located approximately 3.5 km to the east along the River Welland, with an upstream crest level of 5.99 mAOD and a downstream crest level of 5.94 mAOD (left bank).

Table 2. EA Modelled Flood Level Data

Ground levels in areas for building development (mAOD)	In-channel Modelled Flood Levels (mAOD)			
	1 in 20 year	1 in 100 year	1 in 100 year plus 20% CC	1 in 1000 year
Between 1.95 and 2.76	4.60	4.76	4.79	4.77
Height of flood defence	Between 5.94 and 5.99			
	No flooding anticipated from overtopping			

[1] The accuracy of the modelled flood levels are not known. These are dependent on the accuracy of input datasets such as LiDAR data, used to model the impacts of flooding within the 2D domain. Confirmation of the accuracy of the modelled flood data can be obtained separately from the Environment Agency.

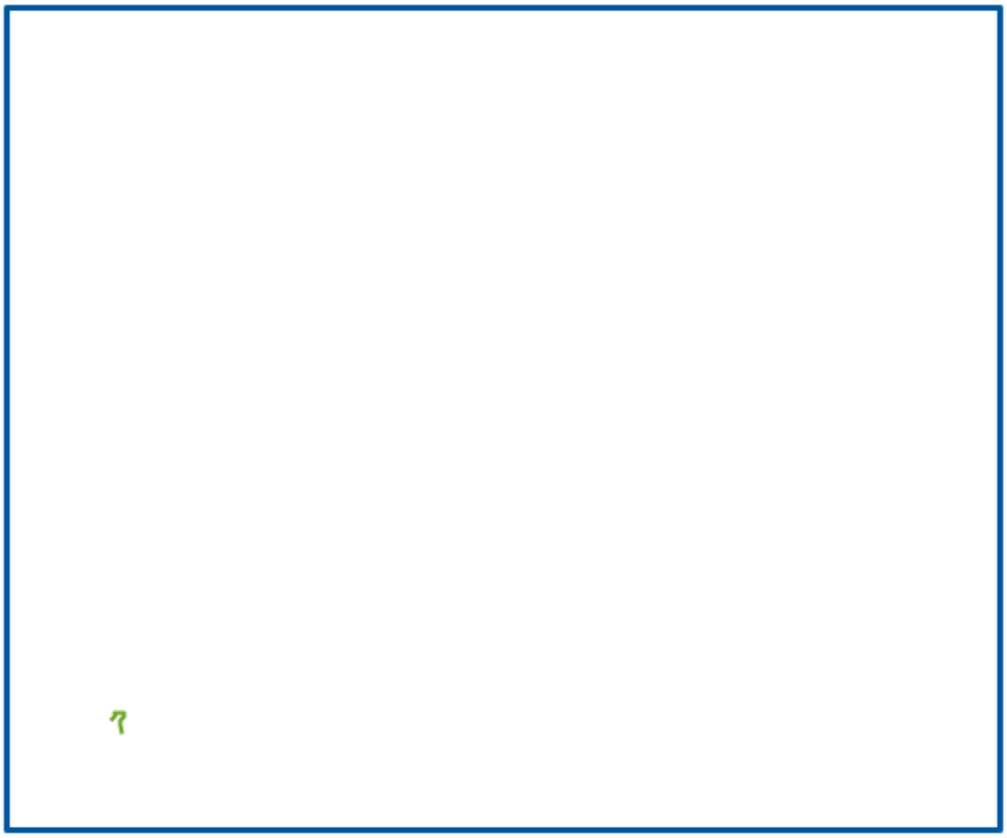
Breach of Flood Defences

The EA could not provide any information regarding the effects of flooding from a breach in the flood defences and so the Breach flood maps included within the South East Lincolnshire Joint Planning Unit's SFRA (2017) have been used.

An assessment of the 2017 SFRA Residual Flood Hazard flood map of the South Holland District confirms the consequences from overtopping of defences and breach failure at any point along the defences, for the 1 % AEP fluvial present day (Figure 7, below) and the 2115 1 % AEP fluvial event (with climate change) (Figure 9).

The present day Residual Flood Hazard Map extents (South East Lincolnshire Joint Planning Unit, 2017) were compared with LiDAR elevation data (obtained for the Site to a 1 m resolution with a vertical accuracy of ±0.15 m) to interpolate a maximum breach flood level which results in a flood level of approximately 1.6-1.7 mAOD, however the present-day breach event is not anticipated to affect the Site.

Figure 7. Residual Flood Hazard Map (South East Lincolnshire Joint Planning Unit, 2017)



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(South East Lincolnshire Joint Planning Unit, 2017)

Climate change factors

The EA's *Flood risk assessments: climate change allowances* guidance (Published 19 February 2016 and updated 22 July 2020) has been used to inform a suitable increase in peak river flows for the proposed development. The updated guidance confirms 'More Vulnerable' developments are required to undertake a Basic assessment approach.

Assessment of the upstream and downstream node points was undertaken and node ref: WELLAND 25001.5 and the adjacent flow node ref: WELLAND 25127.8 was used to interpolate a flow / level relationship. A stage graph has been produced (Figure 8) using the EA's modelled flood level data.

Figure 8. Stage / Discharge Relationship Graph

As can be seen from the above graph, the flows within the river channel increase with the frequency of the storm event, until the 1 in 100 year plus 20 % climate change event, when they begin to reduce thereafter, as shown in the table below. This may be because the model is losing flows to the floodplain from overtopping of defences along the reach of the watercourse. Given the raised nature of the embankments adjacent to the watercourse relevant to the Site, it is not likely the water is being lost to the floodplain in this location though.

In order to confirm the impacts of climate change on the flows within the watercourse, the 35 % and 65 % growth above the 1 in 100 year event are required. However it is difficult to form a relationship between the modelled flows and levels, to interpolate the 35 % and 65 % growth, as the flows reduce and the flood levels rise in response. As the flood embankments are raised between 5.99 mAOD and 5.94 mAOD, flooding would not overtop the defences and flow into the floodplain.

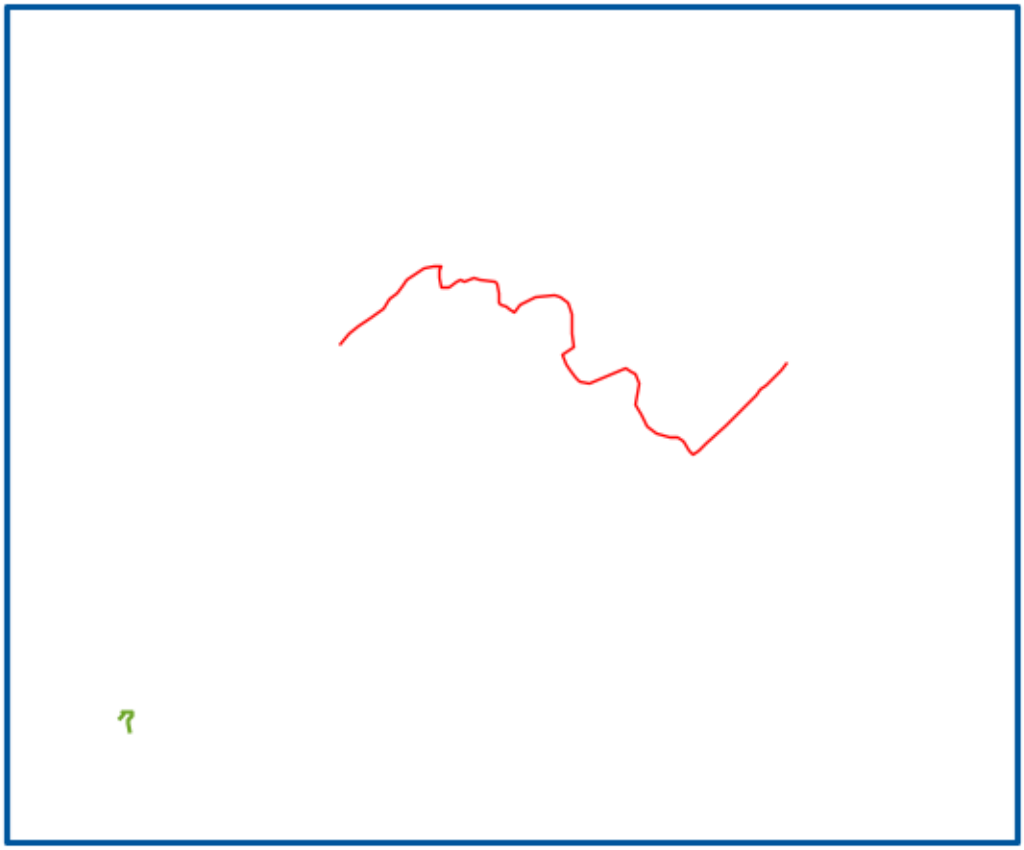
Table 3. Modelled flows and levels

Node		% AEP Event										
		50	20	10	5	2	1.33	1	1 plus 20 %	0.5	0.1	0.1 plus 20 %
Levels	25001.5	3.79	4.12	4.34	4.6	4.73	4.75	4.76	4.79	4.77	4.77	4.79
Flows	25127.8	49.8	65.93	75.78	94.11	117.54	121.58	126.01	124.44	125.58	124.05	128.35

Breach scenario - Climate change impacts

In the absence of detailed breach modelling, the 2115 Residual Flood Hazard Map extents (South East Lincolnshire Joint Planning Unit, 2017) were compared with LiDAR elevation data (obtained for the Site to a 1 m resolution with a vertical accuracy of ±0.15 m) to interpolate a maximum breach flood level for the Site (Figure 9). A breach flood level of 2.1 mAOD has been interpolated.

Figure 9. Residual Flood Hazard flood Map (South East Lincolnshire Joint Planning Unit, 2017)



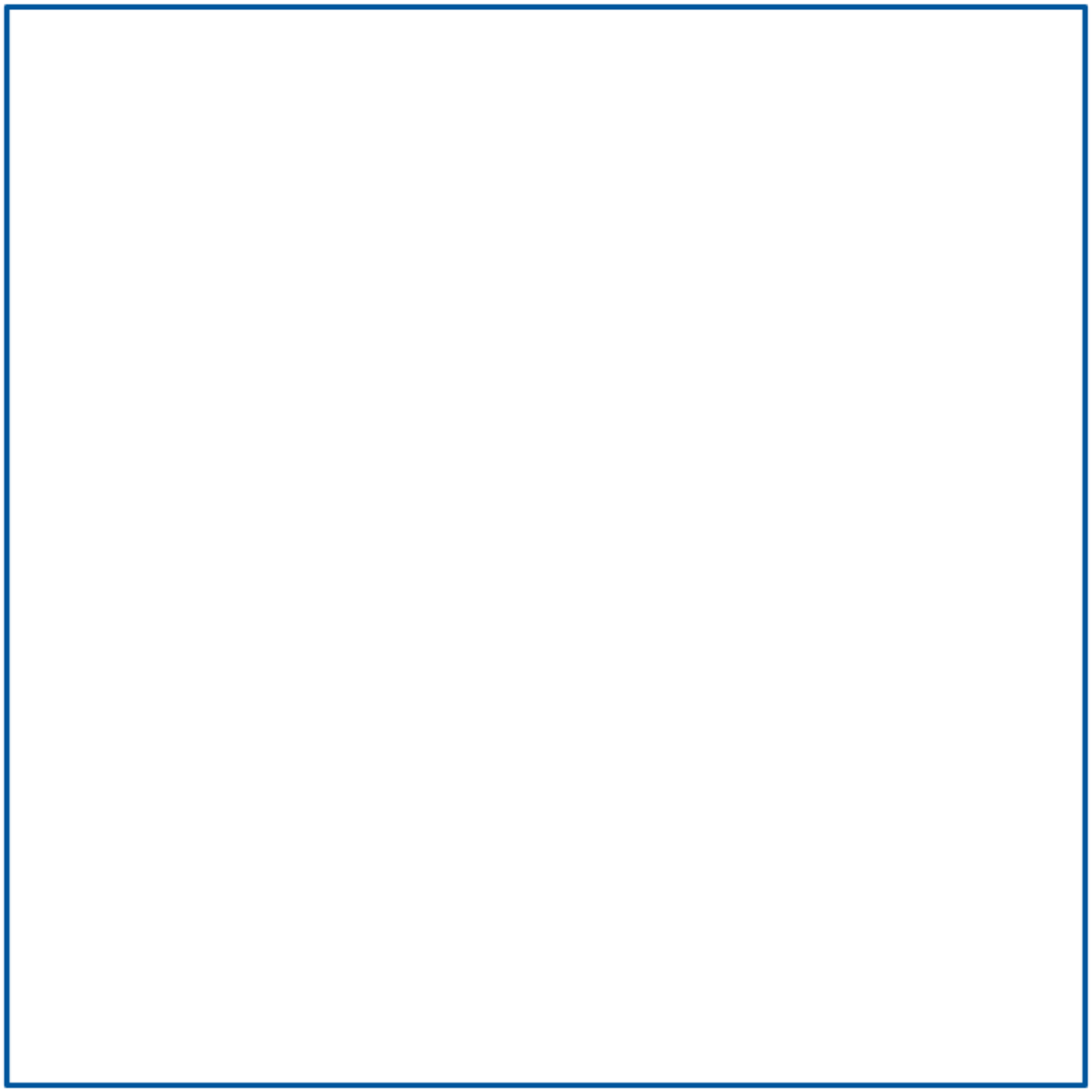
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(South East Lincolnshire Joint Planning Unit, 2017)

Flood risk including the benefit of defences

The type and condition of existing flood defences influence the 'actual' risk of fluvial flooding to the Site, albeit the long-term residual risk of flooding (ignoring the defences) should be considered when proposing new development.

According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) mapping (Figure 10), which considers the crest height, standard of protection and condition of defences, the flood risk from Rivers and the Sea is Very Low for the majority of the Site and Medium risk in an isolated area in the east. It is not clear what the Medium risk is associated with on the Site, although the risk rating may be a result of the coarseness of the grid used and the lower ground levels east of the Site, so it is not likely a true reflection of the actual risk at the Site.

Figure 10. Risk of Flooding from Rivers and Sea map (EA, 2021)



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Surface water (pluvial) flooding

Surface water flooding occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems. It can occur in most locations even at higher elevations and at significant distances from river and coastal floodplains.

- According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a Very Low risk of pluvial flooding.

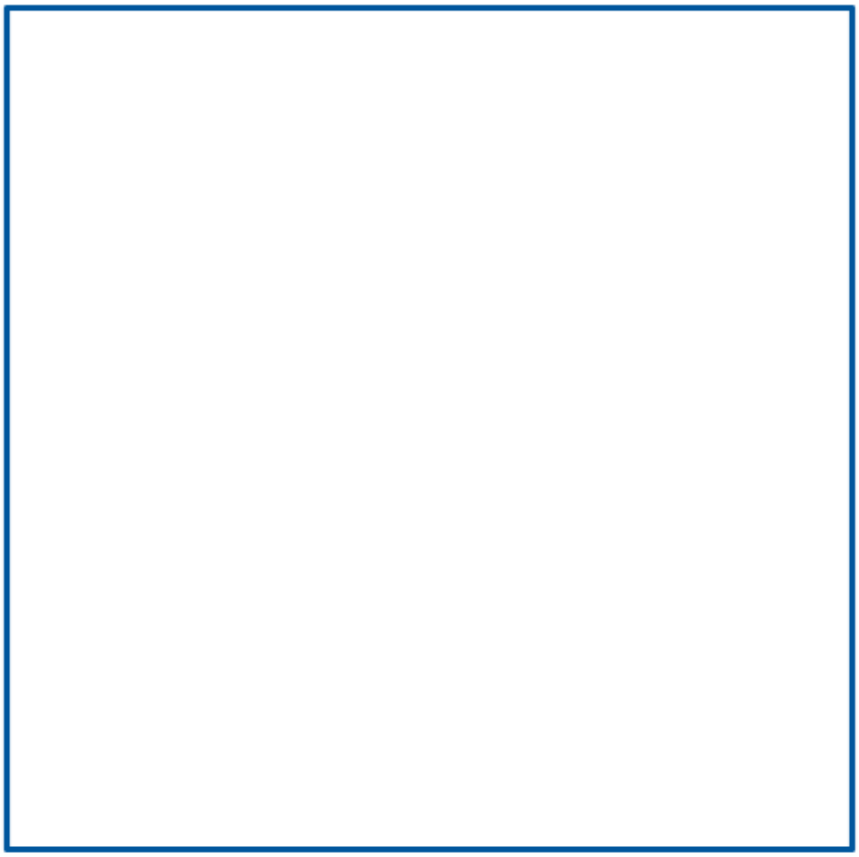
Guidance

According to EA's surface water flood risk map the Site is at:

- Very Low risk - chance of flooding of less than 1 in 1000 (0.1%).
- Low risk - chance of flooding of between a 1 in 1000 & 1 in 100 (0.1% and 1%).
- Medium risk - chance of flooding of between a 1 in 100 and 1 in 30 (1% and 3.3%).

Figure 11 confirms the extent and depth of flooding during a 1 % AEP (1 in 100 year - Medium risk) event. No flooding is shown to occur at or within at least 100 m of the Site.

Figure 11. EA Medium surface water flood risk map (EA, 2021)



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Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 1000 year event confirms the Site is not located on a potential overland flow route during a Low risk scenario.

The SFRA does not indicate any reported incidents of historical surface water flooding within 100 m of the Site (South East Lincolnshire Joint Planning Unit, 2017).

Climate change may lead to an increase in rainfall intensity which affects river levels, land and urban drainage systems. Rainfall intensity for small and urban catchments may increase from 5 to 20 % (central estimate) or 10 % to 40 % (Upper estimate) over the period to 2115 (EA, 2021). The increase in surface water flood risk is best represented by the 1 in 1000 year pluvial flood extent but according to the mapping this is unlikely to impact the Site.

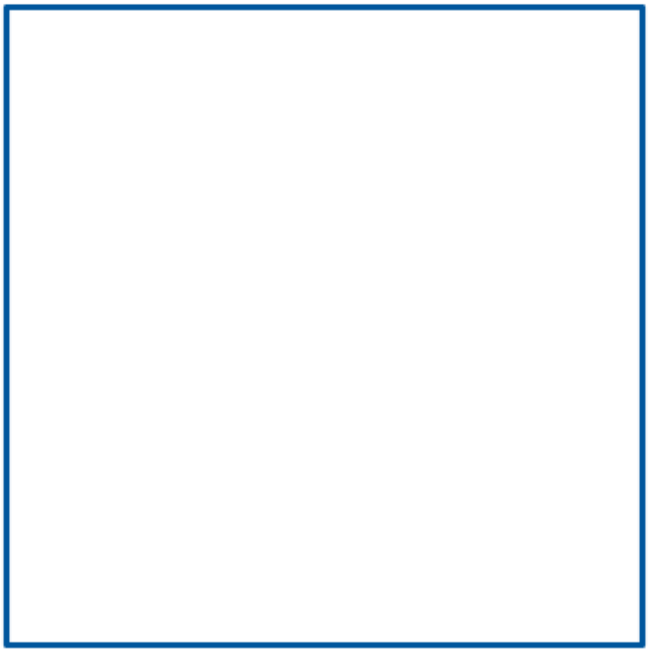
On-Site surface water drainage systems should be designed appropriately to manage the run-off.

Groundwater flooding

Groundwater flooding occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. This may be as a result of persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits. Flooding may last a long time compared to surface water flooding, from weeks to months. Hence the amount of damage that is caused to property may be substantially higher.

Groundwater Flood Risk screening data (Figure 12) indicates there is a Negligible risk of groundwater flooding at surface in the vicinity during a 1 in 100 year event.

Figure 12. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2021)



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Mapped classes combine likelihood, possible severity and the uncertainty associated with predicting the subsurface system. The map is a national scale screening tool to prompt site-specific assessment where the impact of groundwater flooding would have significant adverse consequences. Mapping limitations and a number of local factors may reduce groundwater flood risk to land and property even where it lies within mapped groundwater flood risk zones, which do not mean that groundwater floods will occur across the whole of the risk area.

Site specific assessment suggests that groundwater levels are unlikely to reach the surface at the Site:

- The SFRA does not indicate any reported incidents of historical groundwater flooding within 20 m of the Site (South East Lincolnshire Joint Planning Unit, 2017).
- The presence of local drainage features are likely to intercept local groundwater.
- The groundwater system is considered unlikely to be in continuity with the Site surface due to the presence of low permeability material overlying the Site, as indicated by BGS maps.

On the basis of the site-specific assessment the groundwater flood risk is considered to be Negligible.

The risks may be higher for buried infrastructure and soakaway systems which may be affected by high groundwater levels, although this would need to be confirmed through site investigation.

Guidance
Negligible Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Climate change predictions suggest an increase in the frequency and intensity of extremes in groundwater levels. Rainfall recharge patterns will vary regionally resulting in changes to average groundwater levels. A rise in peak river levels will lead to a response of increased groundwater levels in adjacent aquifers subject to the predicted climate change increases in peak river level for the local catchment. The impact of climate change on groundwater levels beneath the Site is linked to the predicted rise in peak river levels. Based on the available evidence the resulting increase to groundwater flood risk is not considered significant.

Flooding from artificial sources

Artificial sources of flood risk include waterbodies or watercourses that have been amended by means of human intervention rather than natural processes. Examples include reservoirs (and associated water supply infrastructure), docks, sewers and canals. The flooding mechanism associated with flood risk from artificial sources is primarily related to breach or failure of structures (reservoir, lake, sewer, canal, flood storage areas, etc.).

Sewer flooding

The SFRA does not state that the area surrounding the Site is at risk from sewer flooding (South East Lincolnshire Joint Planning Unit, 2017).

Guidance

Properties classified as "at risk" are those that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system either once or twice in the ten year reference period. Records held by the sewage utility company provide information relating to reported incidents, the absence of any records does not mean that the Site is not at risk of flooding.

Culverts and bridges

The blockage of watercourses or structures by debris (that is, any material moved by a flowing stream including vegetation, sediment and man-made materials or refuse) reduces flow capacity and raises water levels, potentially increasing the risk of flooding. High water levels can cause saturation, seepage and percolation leading to failure of earth embankments or other structures. Debris accumulations can change flow patterns, leading to scour, sedimentation or structural failure.

Culverts and bridges have been identified within 500 m of the Site. A private access bridge (driveway) is located 185 m to the north east of the Site over a drainage ditch. However, this structure is a significant distance from the Site and is unlikely to represent a flood risk to the Site in the event of a blockage.

The SFRA has not identified any historical drainage issues within the Site area (South East Lincolnshire Joint Planning Unit, 2017).

Canal failure

According to Ordnance Survey (OS) mapping, there are no canals within 500 m of the Site.

Water supply infrastructure

Water supply infrastructure is comprised of a piped network to distribute water to private houses or industrial, commercial or institution establishments and other usage points. In urban areas, this represents a particular risk of flooding due to the large amount of water supply infrastructure, its condition and the density of buildings. The risks of flooding to properties from burst water mains cannot be readily assessed.

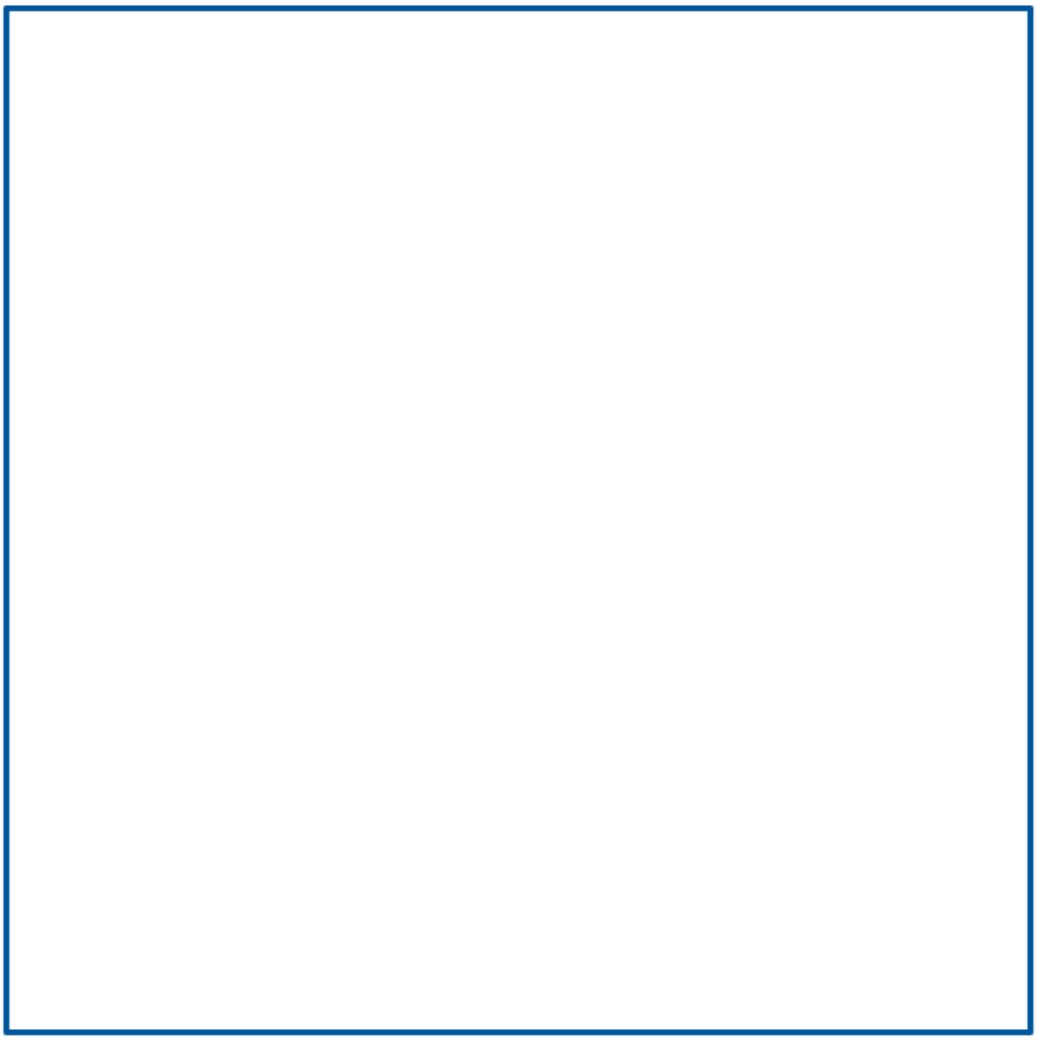
If more information regarding the condition and history of the water supply infrastructure within the vicinity of the Site is required, then it is advisable to contact the local water supplier (Anglian Water).

Reservoir flooding

According to the EA's Risk of Flooding from Reservoir mapping the Site is at risk of flooding from reservoirs (Figure 13) (EA, 2021).

The Site is considered to be at risk of flooding from the Rutland Water, Empingham and Crowlands Cowbit Washes Reservoirs, located over 6 km south and over 27 km south west respectively of the Site, where flood depths are between 0.3 and 2 m and speed of flooding below 0.5 m/s could impact the Site.

Figure 13. EA Risk of Reservoir Flooding (EA, 2021)



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Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m^3 of water) and is based on the worst-case scenario. Reservoir flooding is extremely unlikely to occur (EA, 2021).

5. Flood risk from the development

Floodplain storage

It is considered best practice to ensure new development does not displace flooding in areas which are protected by formal flood defences.

The development is located within fluvial Flood Zone 3 but analysis suggests it would not be impacted through the overtopping of flood embankments, in all events up to the 1 in 100 year plus 35 % and 65 % climate change scenario events.

The Site could potentially flood from a breach in the flood defences though and the development does involve an increase in building footprint. The modelled flood level in a 2115 1 in 100 year breach event is 2.1 mAOD and could impact the area proposed for development.

Scoping estimates of the flooding volumes displaced and resultant storage requirements can be made by multiplying the increase in building footprint (95 m^2) by the average flood depth at the development, during the 2115 1 in 100 year breach event (0.15 m). An estimated 14.25 m^3 of floodplain storage would be lost to the development during a breach event, where the flood level is 2.1 mAOD, an equivalent volume of compensatory floodplain storage is required.

Compensatory flood storage must be provided through a level for level, volume for volume approach and may require an area at the edge of the floodplain to provide storage.

Where this is not possible, the EA and Lead Local Flood Authority (LLFA) may accept voids, stilts or undercroft parking as options for flood plain storage compensation. These solutions should be discussed at an early stage and may require a management and maintenance plan, as they can become blocked over time leading to a gradual reduction in storage. More information is provided in the EA's "*Framework and Guidance for Assessing and Managing Flood Risk for New Development*" FD2320/TR2 publication (EA, 2005).

Drainage and run-off

Any changes to the existing drainage system will be undertaken in accordance with best practice and that care will be taken to ensure the new development does not overload/block any existing drainage or flow pathways to/from the Site. Based on the topography and low surface water flood risk in the vicinity interference with overland flow paths is considered unlikely.

A Sustainable Drainage Strategy (SuDS) should be developed for the Site, for effective management of surface water runoff over the lifetime of the proposed development.

6. Suitability of the proposed development

The information below outlines the suitability of proposed development in relation to national and local planning policy.

National policy and guidance

The aims of the national planning policies are achieved through application of the Sequential Test and in some cases the Exception Test.

Guidance

Sequential test: The aim of this test is to steer new development towards areas with the lowest risk of flooding (NPPF, 2019). Reasonably available sites located in Flood Zone 1 should be considered before those in Flood Zone 2 and only when there are no reasonably available sites in Flood Zones 1 and 2 should development in Flood Zone 3 be considered.

Exception test: In some cases, this may need to be applied once the Sequential Test has been considered. For the exception test to be passed it must be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that 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.

Suitability of the proposed development, and whether the Sequential and Exception Tests are required, is based on the Flood Zone the Site is located within and the flood risk vulnerability classification of the existing and proposed development. Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

This report has been produced to assess all development types, prior to any development. The vulnerability classification and Flood Zones are compared within Table 4 overleaf (Table 3 of the NPPG (2014)).

As the Site is located within Flood Zone 3a and the proposed development is defined as More Vulnerable; the proposals would be acceptable subject to the Exceptions Test and Sequential Test.

Where the Sequential Test is required it must be demonstrated that there are no alternative reasonably available Sites at lower risk of flooding within South Holland District Council. For a site to be considered to be reasonably available it must be 'deliverable' and 'developable' as defined by the NPPF (2019).

Table 4. Flood risk vulnerability and flood zone 'compatibility (taken from NPPG, 2014)

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1 – low probability	✓	✓	✓	✓	✓
	Zone 2 – medium probability	✓	✓	Exception test required	✓	✓
	Zone 3a - high probability	Exception test required	✓	X	Exception test required	✓
	Zone 3b – functional flood plain	Exception test required	✓	X	X	X

EA Flood Risk Standing Advice for vulnerable developments located in Flood Zones 2 or 3

For all relevant vulnerable developments (i.e. more vulnerable, less vulnerable and water compatible), advice on the following points should be followed:

- Surface water management;
- Access and evacuation; and
- Floor levels.

Surface water management

Plans for the management of surface water need to meet the requirements set out in either the Local Authority's:

- Surface water management plan where available; OR
- Strategic flood risk assessment.

They also need to meet the requirements of the approved building regulations Part H: drainage and water disposal (Section H3 rainwater drainage).

Planning permission is required to use a material that can't absorb water (e.g. impermeable concrete) in a front garden larger than 5 m^2.

Access and evacuation

Details of emergency escape plans should be provided for any parts of a building that are below the estimated flood level:

Plans should show:

- Single storey buildings or ground floors that don't have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- Basement rooms have clear internal access to an upper level, e.g. a staircase;
- Occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings.

Floor levels

The following should be provided:

- Average ground level of the building; and
- Finished floor level of the lowest habitable room in the building.

Ground floor levels should be a minimum of whichever is higher of:

- 0.3 m above the general ground level of the Site; OR
- At least 0.6 m above the estimated river or sea flood level[2].

If you cannot raise floor levels above the estimated flood level, you need to consider extra flood resistance and resilience measures.

Extra flood resistance and resilience measures

Follow the extra flood resistance and resilience requirements for developments in flood risk areas where ground floor levels are lower than the estimated flood level for the Site.

Water depth up to 0.3 m

The design of the building or development should keep water out as much as possible. You should use materials that have low permeability (materials that water cannot pass through, for example, impermeable concrete).

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[2] This is 0.6 m above the 1 in 100 year fluvial or 1 in 200 year tidal flood events. The 0.6 m is split into a 0.3 m freeboard allowance for climate change and 0.3 m allowance for the inaccuracies in the EA's flood modelling. Where the climate change flood level is known, a 0.3 m allowance should be added to the climate change flood level to allow for the inaccuracies in the EA's flood modelling.

Water depth from 0.3 m to 0.6 m

The design of the building or development should keep water out (unless there are structural concerns) by:

- Using materials with low permeability to at least 0.3 m;
- Using flood resilient materials (for example lime plaster) and design (for example raised electrical sockets);
- Making sure there's access to all spaces to enable drying and cleaning.

Water depth above 0.6 m

The design of the building or development should allow water to pass through the property to avoid structural damage by:

- Using materials with low permeability to at least 0.3 m;
- Making it easy for water to drain away after flooding;
- Making sure there's access to all spaces to enable drying and cleaning.

Local policy and guidance

For this report, several documents have been consulted for local policy and guidance and relevant information is outlined below:

South East Lincolnshire Strategic Flood Risk Assessment (South East Lincolnshire Joint Planning Unit, 2017):

Approximately 74 % of the district of South Holland lies within a floodplain, with 68 % in Flood Zone 3 and 6 % in Flood Zone 2. This results in 29, 992 residential properties at fluvial and coastal flooding risk.

The probability of breach events are extremely difficult to determine. Those proposing to develop in flood risk zones must ensure appropriate mitigation is provided for the consequences of defence failure.

Single storey development must include mitigation measures for the 1 in 1000 year event. *The flood level for the 1 in 1000 year is 4.77 mAOD and 4.79 mAOD for the 1 in 1000 year plus 20 % climate change.*

"3. Fluvial and Tidal Hazard Mapping

3.1.1 *This SFRA contains hazard mapping for the parts of the South East Lincolnshire study area, which incorporates both Fluvial and Tidal flood events for Boston, Spalding, Sutton Bridge, Pinchbeck, Crowland and Surfleet (see Appendix A).*

3.1.2 *The hazard mapping includes modelled flooding consequences resulting from both overtopping and breaching of flood defences.*

3.1.3 The failure (or breaching) of flood defences is likely to cause rapid inundation of areas behind flood defences as flow in the river channel or from the sea discharges through the breach. A breach can happen with little or no warning, although they are much more likely to occur when there are extreme tides or river levels and the stresses on flood defences are highest. Flood water flowing through a breach will normally discharge at a high velocity, rapidly filling up the areas behind the defences, resulting in significant damage to buildings and a high risk of loss of life.

3.1.4 The crest (height) of the defences used in all modelling scenarios was based on present defence heights. Each breach was simulated individually. The width of the breach was dependent on the type and location of the defence.

3.1.5 The probability of a breach event is extremely difficult to determine, although overtopping will promote breaching. The modelling therefore only assesses the consequence of breaches; the assessment of the probability of a breach occurring is not required. Also, national planning guidance requires those proposing development in flood risk areas to ensure development and its future users are safe from the harmful effects of flooding therefore SE Lincolnshire SFRA V6 18/12/2017 appropriate mitigation against potential impacts will be required (i.e. the consequences of defence failure).

3.1.6 Overtopping of flood defences occurs when water levels exceed the height of the defence. The worst case occurs when the fluvial or tidal levels are above the defence level as this can lead to rapid inundation and prolonged flooding. Less severe overtopping can occur when flood levels are below defence levels, but wave action causes wave overtopping. Flood defences are commonly designed with a degree of freeboard to provide protection against overtopping from some waves.

3.1.7 Two scenarios were modelled: the 1 in 200 (0.5%) and 1 in 1000 (0.1%). This was undertaken for the 'present' day (2006 baseline) and 2115 (the year to which the final Defra sea level allowances related and allows for a lifetime of development).

3.1.8 The definition of flood hazard used in this hazard mapping follows the definition used by Defra and the Environment Agency which is translated in 'Flood Risk Assessment Guidance for New Development Phase 2, R&D Technical Report FD2320/TR2'. The classification is split into four categories, defined by the depth and velocity of flood waters and the related ability of people to evacuate the area once a flood occurs. Please refer to the table below for further information on flood hazard.

3.1.9 In addition to the areas of danger, there is also an area classified as low hazard (shown in green) on the hazard mapping. This area represents the outer extent of where flood water would reach during the breach or overtopping scenario, but should not pose a hazard to people. This represents the white boxes shown above in Table 13.1, where depths could be between 0.05m and 0.3m."

7. Resilience and mitigation

Based on the flood risk identified at the Site, the national and local policies and guidance and proposed development, the mitigation measures outlined within this section of the report are likely to help protect the development from flooding.

Sea (coastal/tidal) flood mitigation measures

As the Site is not identified as being at risk of flooding from the sea, mitigation measures are not required.

Rivers (fluvial) flood mitigation measures

The Site is located within an area which is affected by flooding from rivers, the following table confirms the flood depths associated with the area proposed for development.

Ground levels in areas for building development (mAOD)	In-channel Modelled Flood Levels (mAOD)			
	1 in 20 year	1 in 100 year	1 in 100 year plus 20% CC	1 in 1000 year
Between 1.95 and 2.76	4.60	4.76	4.79	4.77
Height of flood defence	Between 5.94 and 5.99			
	No flooding anticipated from overtopping			

In order to confirm the impacts of climate change on the flows within the watercourse, the 35 % and 65 % growth above the 1 in 100 year event are required. However it is difficult to form a relationship between the modelled flows and levels, to interpolate the 35 % and 65 % growth, as the flows reduce and the flood levels rise in response.

As the flood embankments are raised between 5.99 mAOD and 5.94 mAOD, flooding would not overtop the defences and flow into the floodplain.

In the absence of detailed breach modelling, the 2115 Residual Flood Hazard Map extents were compared with LiDAR elevation data (obtained for the Site to a 1 m resolution with a vertical accuracy of ±0.15 m) to interpolate a maximum breach flood level for the Site (Figure 9). A breach flood level of 2.1 mAOD has been interpolated.

Raising minimum floor levels

The vulnerability classification of the Site and the Flood Zone means proposals for the Site fall under the EA's Flood Risk Standing Advice (FRSA) for More Vulnerable developments.

Current best practice indicates that the minimum Finished Floor Level (FFL) should be set at least 0.6 m above the 1 in 100 year plus allowance for climate change breach flood level of 2.1 mAOD (i.e., following a breach event) to 2.7 mAOD.

Additional Mitigation

A water exclusion strategy for flood depths up to 0.3 m in line with the EA's Standing Advice is appropriate for the Site given the unknown consequences of a breach event and single-storey nature of the Site. A water exclusion strategy, using avoidance and resistance measures, is appropriate where floods are expected to last for short durations. Potential water exclusion strategies include:

- Passive flood door systems;
- Temporary flood barriers;
- Air brick covers (manual or automatic closing);
- Non-return flap valves on sewer outfalls.
- Sustainable Drainage Systems (SuDS) to store/intercept flood water.

Avoidance and resistance measures are unlikely to completely prevent floodwater entering a property, particularly during longer duration flood events. Therefore, it is recommended that the following flood resilience measures are also considered.

- Flood resilient materials and designs:
    - Use of low permeability building materials up to 0.3 m such as engineering bricks (Classes A and B) or facing bricks;
    - Hard flooring;
    - The use of internal lime plaster/render or where plasterboards are used these should be fitted horizontally instead of vertically and/or using moisture resistant plasterboard at lower levels;
    - Water, electricity and gas meters and electrical sockets should be located above the predicted flood level;
    - Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage.

A Flood Warning and Evacuation Plan (FWEP) is recommended, and occupants should be signed up to receive EAs Flood Alerts and Warnings.

Surface water (pluvial) flood mitigation measures

As the Site is not identified as being at risk of pluvial flooding, mitigation measures are not required.

Groundwater flood mitigation measures

As the Site is not identified as being at risk of groundwater flooding, mitigation measures are not required.

Reservoir flood mitigation measures

The Site is considered to be at risk of flooding from the Rutland Water, Empingham and Crowlands Cowbit Washes Reservoirs, located over 6 km south and over 27 km south west respectively of the Site, where flood depths are between 0.3 and 2 m and speed of flooding below 0.5 m/s could impact the Site.

There would be a relatively high rate and onset of flooding associated with a reservoir breach, it is therefore unlikely that safe access could be achieved unless a long warning period was provided.

Other flood risk mitigation measures

As the Site is not identified as at risk from other sources, mitigation measures are not required.

Residual flood risk mitigation measures

The risk to the Site has been assessed from all sources of flooding and appropriate mitigation and management measures proposed to keep the users of the development safe over its lifetime. There is however a residual risk of flooding associated with the potential for failure of mitigation measures if regular maintenance and upkeep isn't undertaken. If mitigation measures are not implemented or maintained, the risk to the development will remain as the baseline risk.

Further flood mitigation information

More information on flood resistance, resilience and water entry can be found here: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

www.knowyourfloodrisk.co.uk

Emergency evacuation - safe access / egress and safe refuge

Emergency evacuation to land outside of the floodplain should be provided if feasible. An area of safe refuge should be sufficient in size for all potential users and be reasonably accessible to the emergency services.

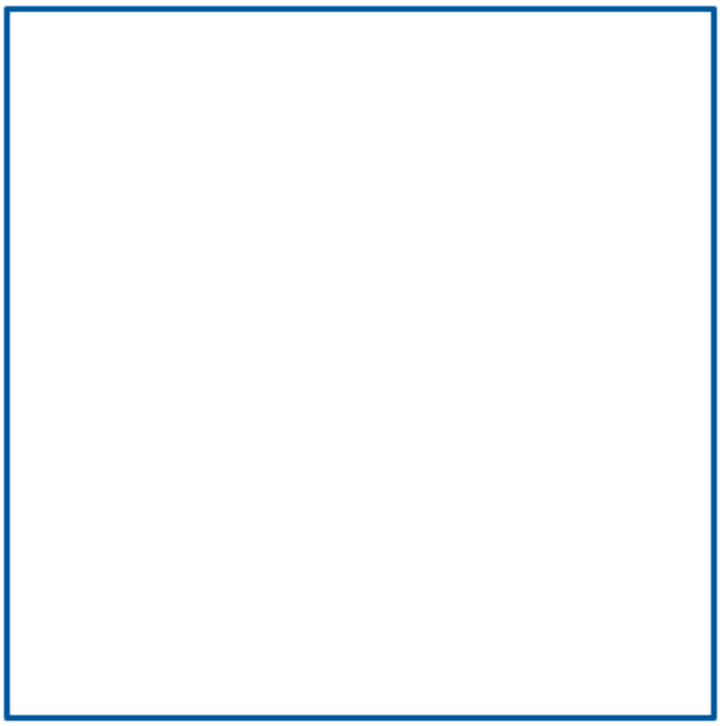
Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

Flood warnings

The EA operates a flood warning service in all areas at risk of flooding; this is available on their website: https://www.gov.uk/check-flood-risk. The Site is located within an EA Flood Alerts/Warning coverage area (ref: 055FWTWELL4B) so is able to receive alerts and/or warnings (Figure 14). All warnings are also available through the EA's 24 hour Floodline Service 0345 988 1188.

The EA aims to issue Flood Warnings 2 hours in advance of a flood event. Flood Warnings can provide adequate time to enable protection of property and evacuation from a Site, reducing risk to life and property.

Figure 14. EA Flood Warning Coverage for the local area (EA, 2021).



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Emergency evacuation

Where possible, a safe access and egress route with a 'Very Low' hazard rating from areas within the floodplain to an area wholly outside the 1 in 100 year flood event including an allowance for climate change should be demonstrated.

If FFL are to be raised 0.6 m above the 1 in 100 year plus allowance for climate change flood level of 2.1 mAOD (i.e., following a breach event) to 2.7 mAOD, refuge could be taken on-Site. If FFL cannot be raised to the above, it is recommended that residents prepare to evacuate as soon as an EA Flood Warning is issued in order to completely avoid flood waters.

Based on the EA's Flood Zone Map the closest dry evacuation area within Flood Zone 1 is c.5.5 km north east – direct measurement. It should be noted that this is a dry island. It is advised that evacuation from the premises would be the preferred option in a flood event if safe to do so.

Other relevant information

A Flood Warning and Evacuation Plan (FWEP) is recommended, and occupants should be signed up to receive EAs Flood Alerts and Warnings.

Registration to the Environment Agency's flood warning scheme can be done by following this link: https://www.gov.uk/sign-up-for-flood-warnings.

It is recommended that main communication lines required for contacting the emergency services, electricity sockets/meters, water supply and first aid stations and supplies are not compromised by flood waters. Where possible these should all be raised above the extreme flood level.

8. References and glossary

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Glossary

General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 100 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is ±0.25m for estimating flood levels at particular locations.

OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.
SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council
SuDS	A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a Site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).

Aquifer Types

Principal aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
Secondary A aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Secondary B aquifer	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
Secondary undifferentiated	Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

NPPF (2019) terms

Exception test	Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that 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.
Sequential test	Aims to steer new development to areas with the lowest probability of flooding.
Essential infrastructure	Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.
Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

Data Sources

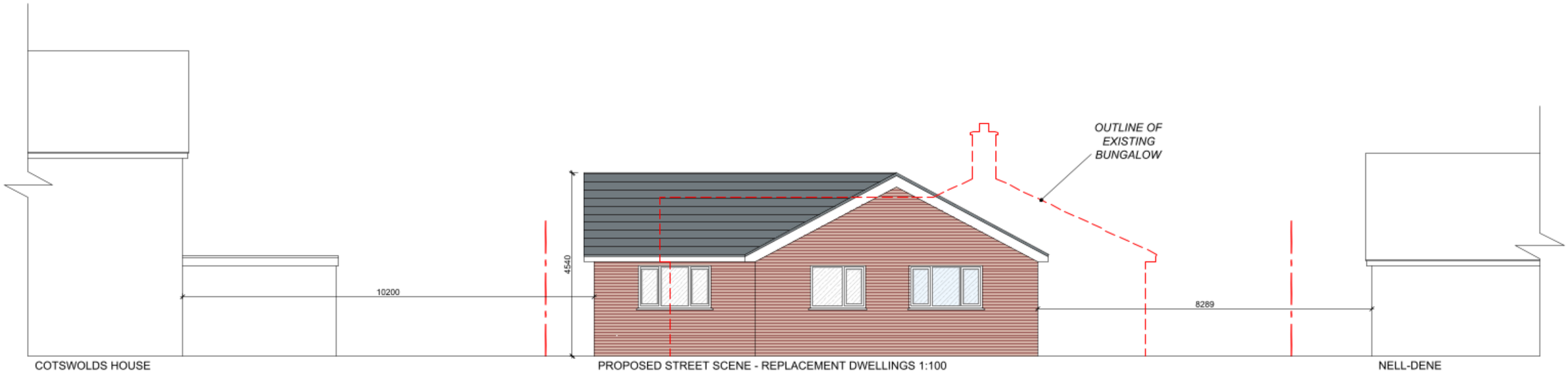
Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2021 BlueSky copyright and database rights 2021
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2021 Ordnance Survey data © Crown copyright and database right 2021
Flood Risk (Flood Zone/RoFRS/Historic Flooding/Pluvial/Surface Water	Environment Agency copyright and database rights 2021 Ordnance Survey data © Crown copyright and database right 2021

Features/Reservoir/ Flood Alert & Warning)	
Flood Risk (Groundwater)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2021) Contains British Geological Survey materials © NERC 2021 Ordnance Survey data © Crown copyright and database right 2021
Location Plan	Contains Ordnance Survey data © Crown copyright and database right 2021
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2021 Environment Agency copyright and database rights 2021

9. Appendices

Appendix A

Site plans



PROPOSED STREET SCENE - REPLACEMENT DWELLINGS 1:100



Location Plan 1:1250



Block Plan 1:500

1:100
0m 1m 2m 3m 4m 5m

PLEASE NOTE THAT ALL DIMENSIONS ARE TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORKS

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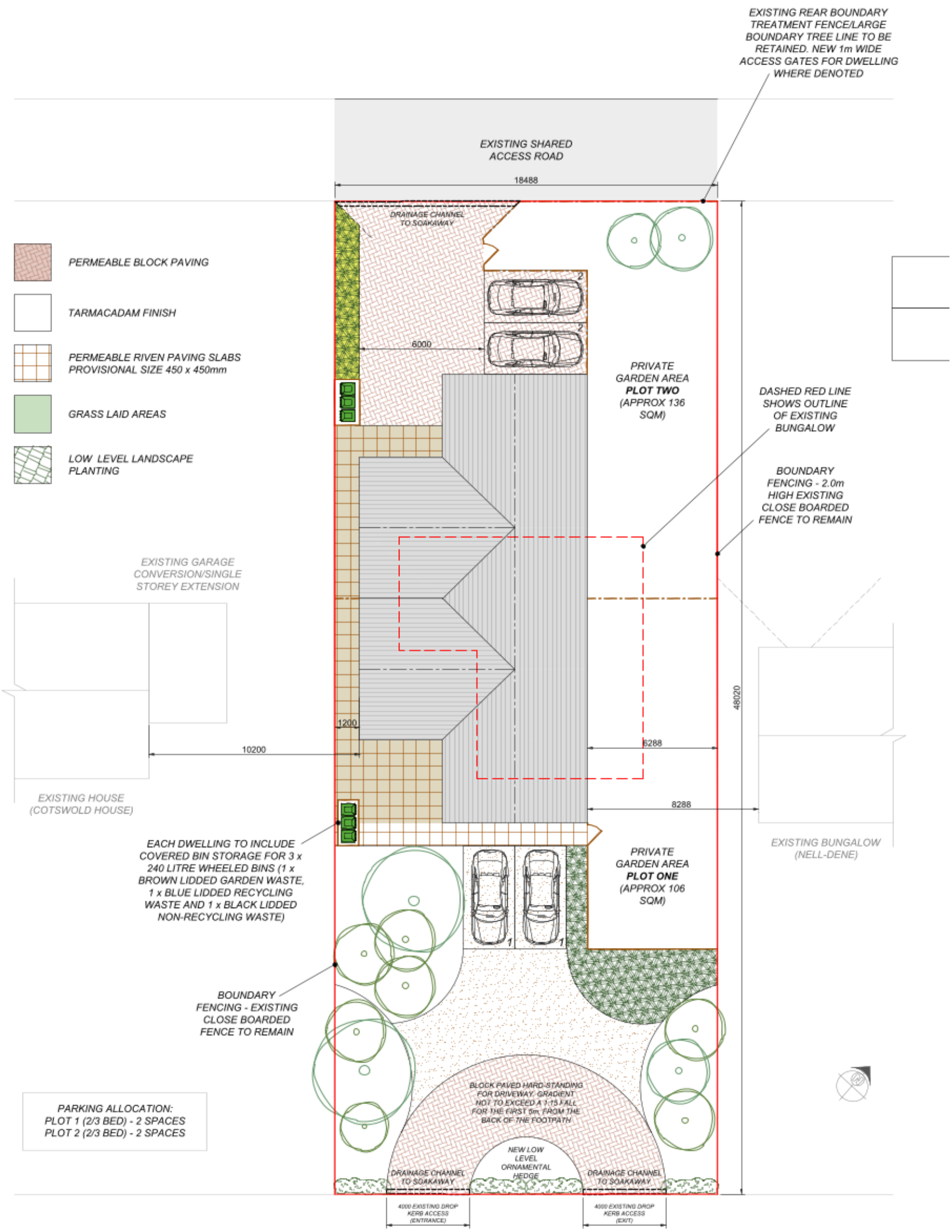
The contractor is to comply with all current Building Legislation whether or not specifically stated on this drawing. This drawing must be read with and checked against all relevant Engineers drawings and all other specialist information provided. ANY DISCREPANCIES TO BE REPORTED TO AVENUE ARCHITECTURAL DESIGN LTD IMMEDIATELY.
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Project Worx
Six Penny Piece, Campaign Lane
Spalding, PE11 3EX

Street Scene, Site Location and Block Plan
A20 - 102 - 006 Rev B
Scale 1:100, 1:1250, 500 @ A3

Old Church Chambers, 23-24
Sandhills Road, St James
Northampton, NN5 5LH

Telephone 01604 684 986
susan@aadesign.ltd



PARKING ALLOCATION:
PLOT 1 (2/3 BED) - 2 SPACES
PLOT 2 (2/3 BED) - 2 SPACES

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1:100
0m 1m 2m 3m 4m 5m

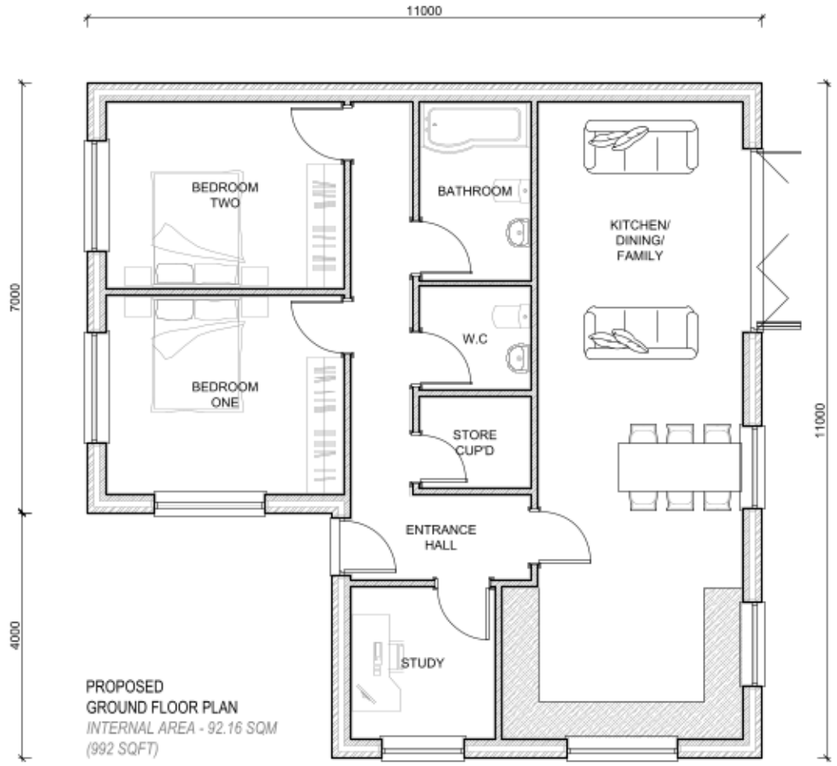
PLEASE NOTE THAT ALL DIMENSIONS ARE TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORKS

Project Worx
Six Penny Piece, Campaign Lane
Spalding, PE11 3EX

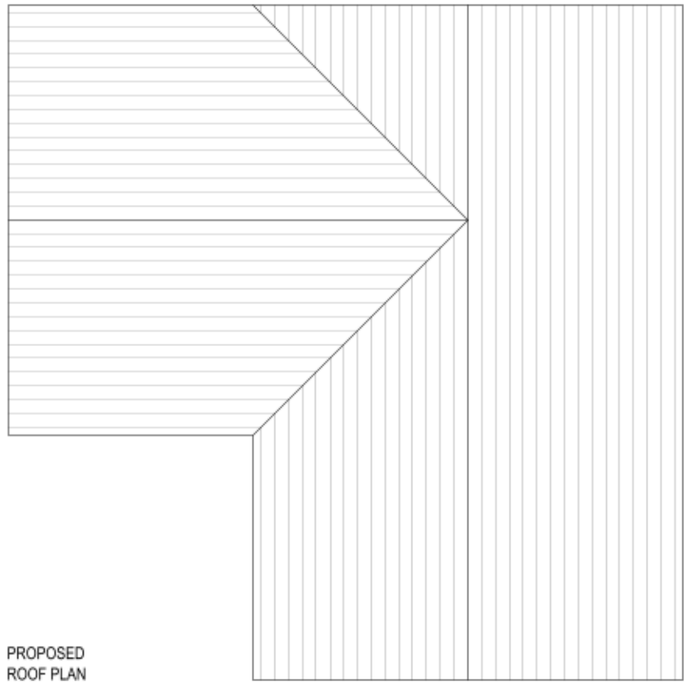
Site/Block Plan
A20 - 102 - 005 Rev C
Scale 1:200 @ A3

Old Church Chambers, 23-24
Sandhills Road, St James
Northampton, NN5 5LH

Telephone 01604 684 986
susan@aadesign.ltd



PROPOSED
GROUND FLOOR PLAN
INTERNAL AREA - 92.16 SQM
(992 SQFT)



PROPOSED
ROOF PLAN

1:100
0m 1m 2m 3m 4m 5m

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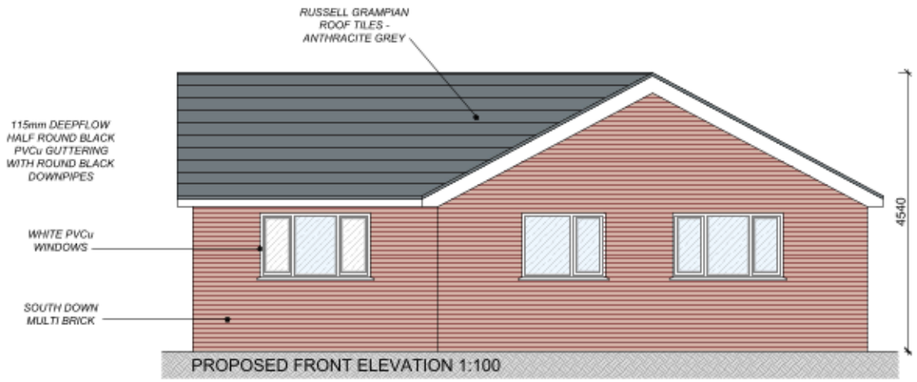
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Spalding, PE11 3EX

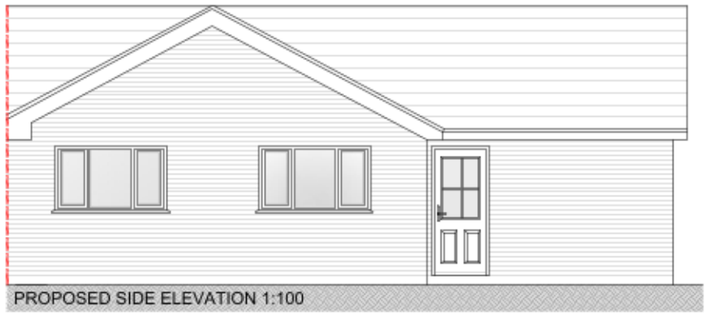
Proposed Plan - 2/3B Bungalow
A20 - 102 - 001 Rev B
Scale 1:100 @ A3

Old Church Chambers, 23-24
Sandhills Road, St James
Northampton, NN5 5LH

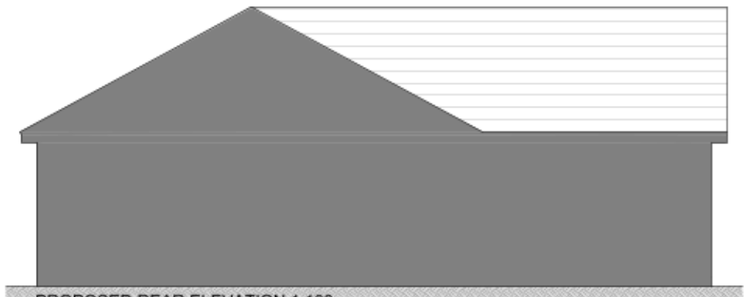
Telephone 01604 684 986
susan@aadesign.ltd



PROPOSED FRONT ELEVATION 1:100



PROPOSED SIDE ELEVATION 1:100



PROPOSED REAR ELEVATION 1:100



PROPOSED SIDE ELEVATION 1:100

1:100

0m 1m 2m 3m 4m 5m

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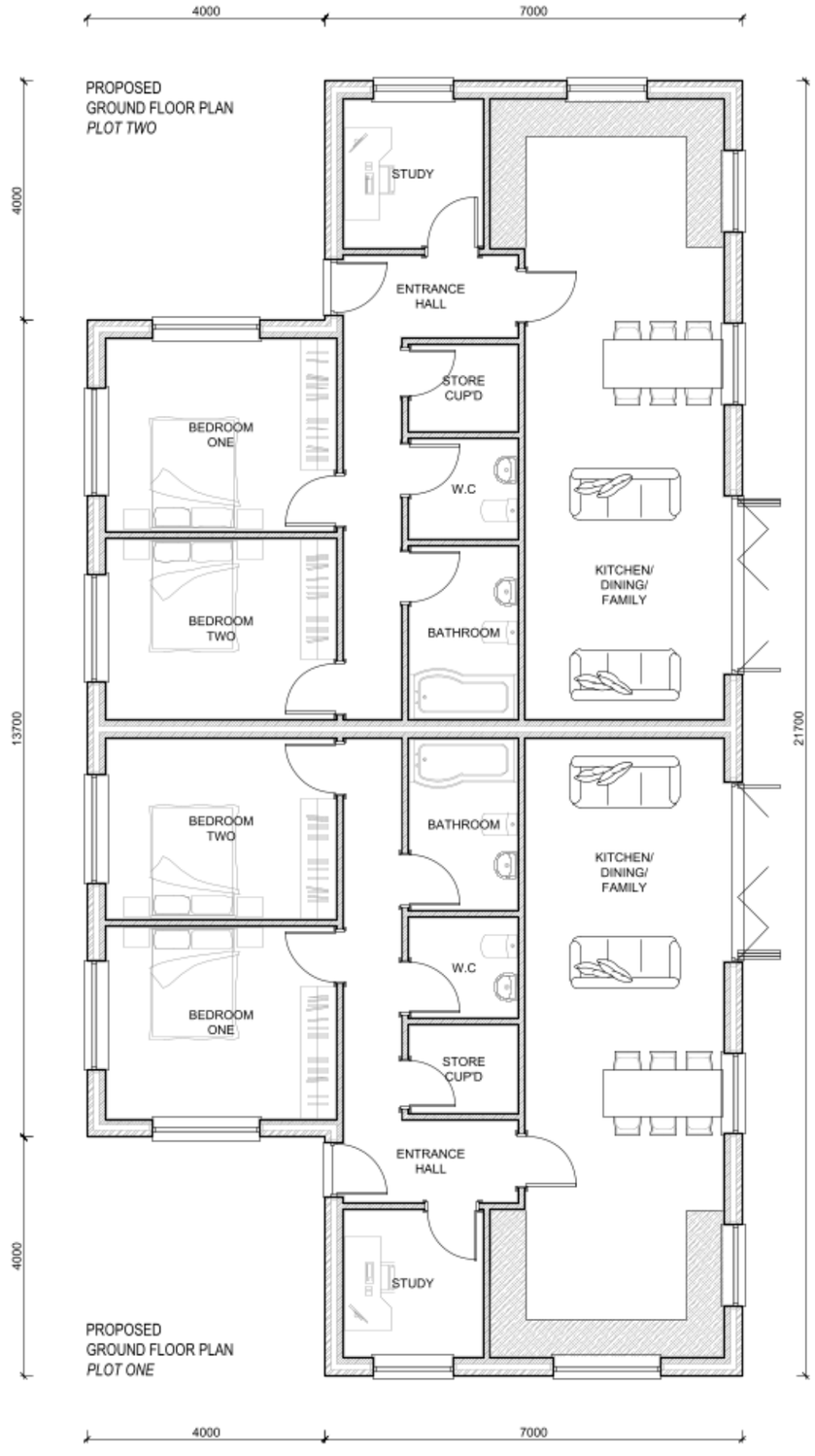
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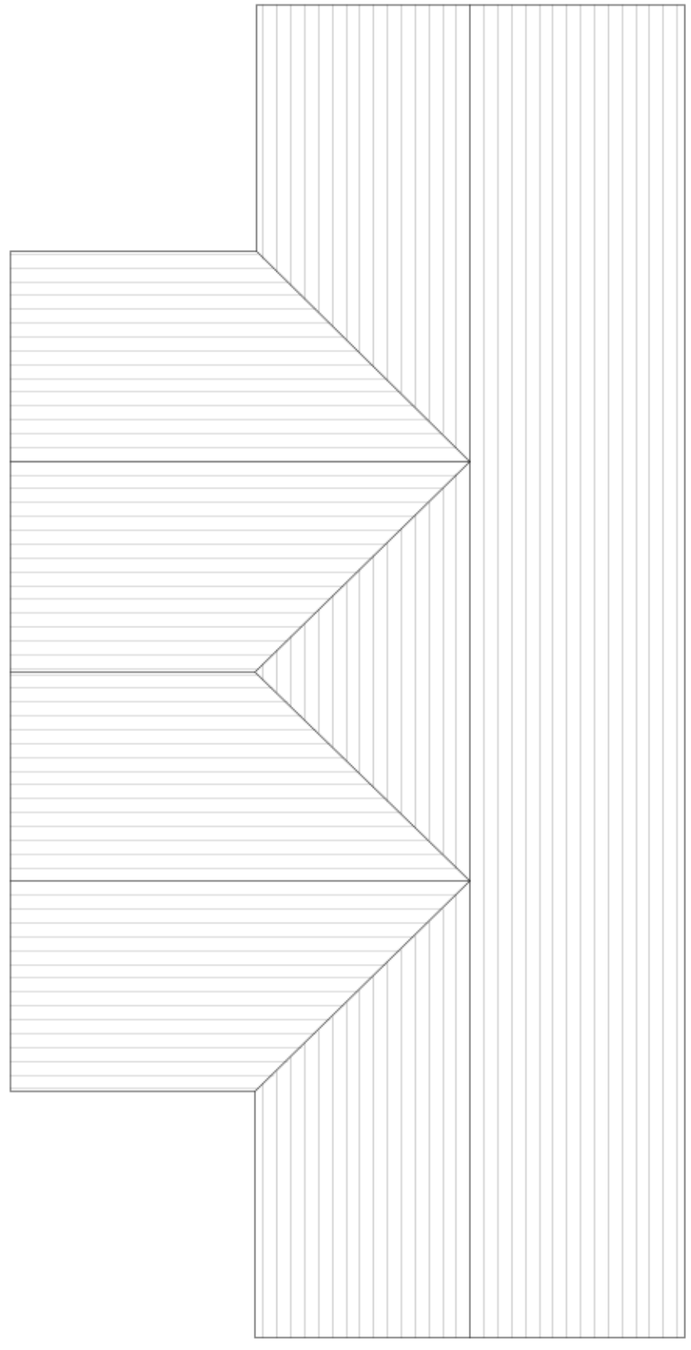
Project Worx
Six Penny Piece, Campaign Lane
Spalding, PE11 3EX

Proposed Elevations - 2/3B Bungalow
A20 - 102 - 002 Rev B
Scale 1:100 @ A3

Old Church Chambers, 23-24
Sandhills Road, St James
Northampton, NN5 5LH

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1:100

0m 1m 2m 3m 4m 5m

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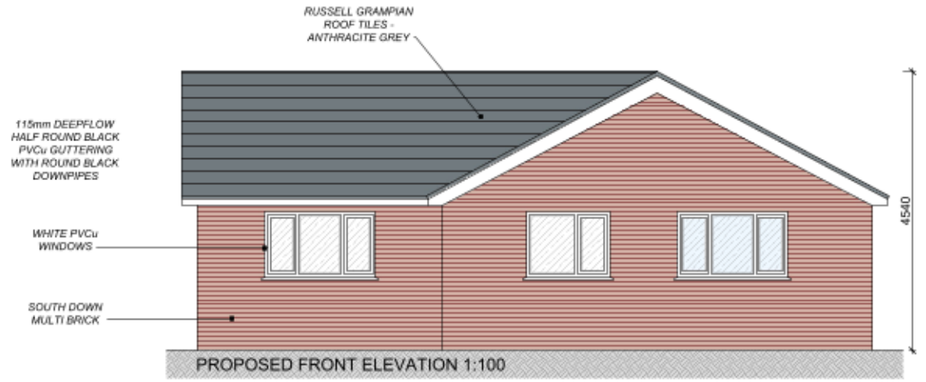
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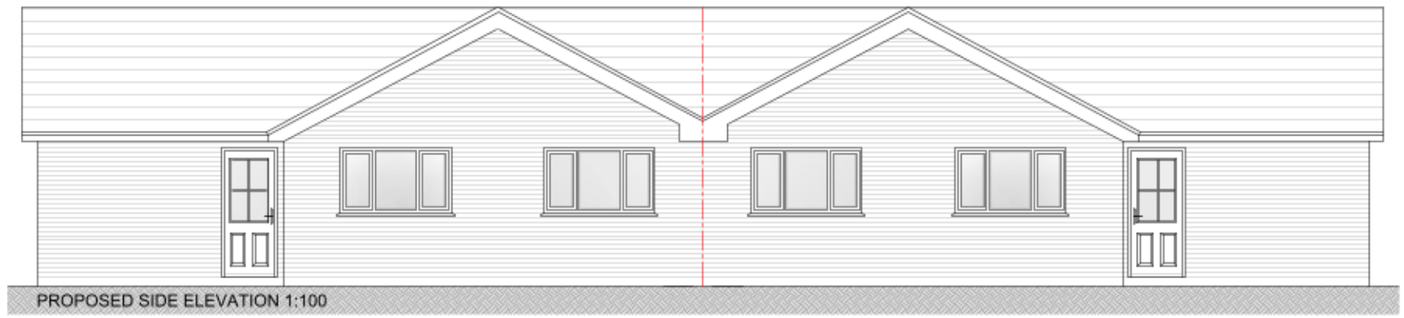
Proposed Plans - Plots 1 & 2
A20 - 102 - 003 Rev B
Scale 1:100 @ A3

Old Church Chambers, 23-24
Sandhills Road, St James
Northampton, NN5 5LH

Telephone 01604 684 986
susan@aadesign.ltd



PROPOSED FRONT ELEVATION 1:100



PROPOSED SIDE ELEVATION 1:100



PROPOSED REAR ELEVATION 1:100



PROPOSED SIDE ELEVATION 1:100

1:100

0m 1m 2m 3m 4m 5m

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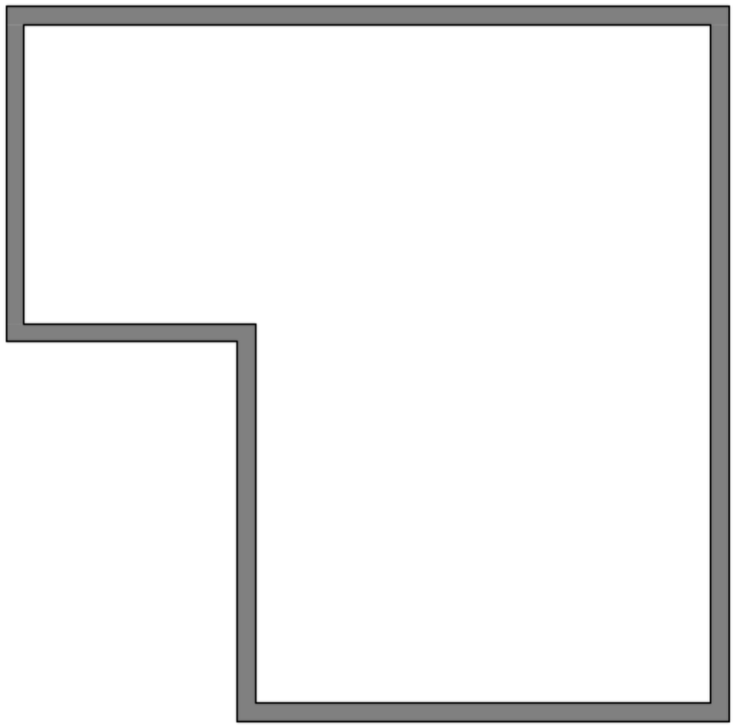
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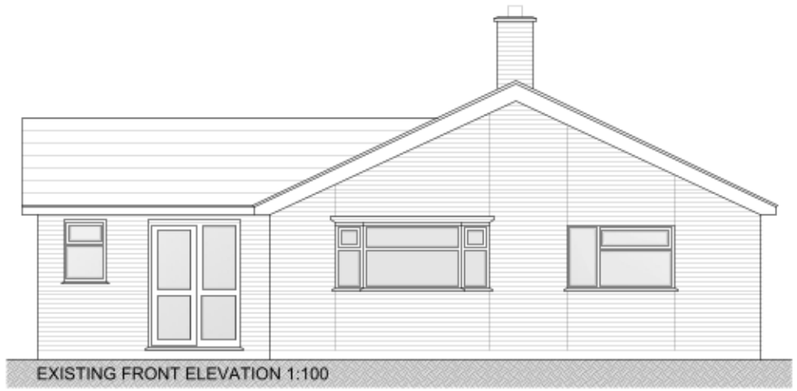
Proposed Elevations - Plots 1 & 2
A20 - 102 - 004 Rev B
Scale 1:100 @ A3

Old Church Chambers, 23-24
Sandhills Road, St James
Northampton, NN5 5LH

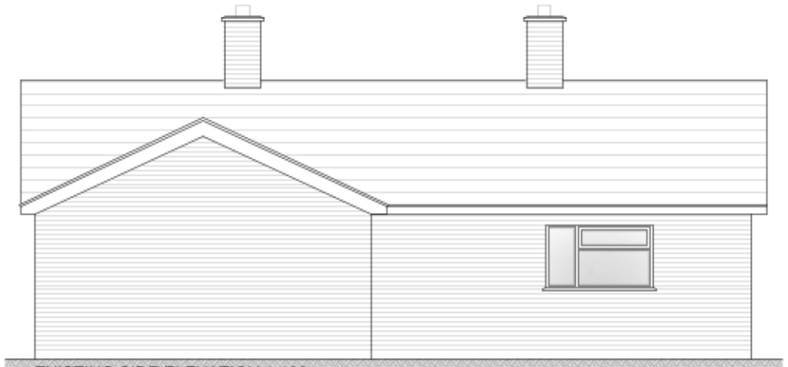
Telephone 01604 684 986
susan@aadesign.ltd



EXISTING
GROUND FLOOR PLAN
INTERNAL AREA - 101 SQM
(1087.15 SQFT)



EXISTING FRONT ELEVATION 1:100



EXISTING SIDE ELEVATION 1:100



EXISTING REAR ELEVATION 1:100



EXISTING SIDE ELEVATION 1:100

1:100
0m 1m 2m 3m 4m 5m

PLEASE NOTE THAT ALL DIMENSIONS ARE TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORKS

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Project Worx
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Spalding, PE11 3EX

Existing Plan & Elevations
A20 - 102 - 007
Scale 1:100 @ A3

Old Church Chambers, 23-24
Sandhills Road, St James
Northampton, NN5 5LH

Telephone 01604 684 986
susan@aadesign.ltd

Appendix B

Environment Agency data

Jasmine Spender-Jones
JasmineSpender@geosmartinfo.co.uk

Our ref: CCN-2021-215394

Date: 21 May 2021

Dear Jasmine

Provision of Flood Risk Information for Campaign Lane, Spalding.

Thank you for your request to use 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 (ie 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

4.1 Fluvial Defence Information

The existing fluvial defences reducing the risk of flooding to this site consist of earth embankments and upstream flood storage reservoirs. 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 3.1 for details of any ongoing capital projects to reduce the flood risk to this site.

4.2 Fluvial Modelled Levels and Flows

Available modelled fluvial flood levels and flows for the model nodes shown on the attached map are set out in the data table attached. This data is taken from the model named on the data table, which is the most up-to-date model currently available.

Please note these levels are "in-channel" levels and therefore may not represent the flood level on the floodplain, particularly where the channel is embanked or has raised defences.

Our models may not have the most up to date climate change allowances. In time we will update our models for the latest allowances. You should refer to 'Flood risk assessments: climate change allowances' to check if the allowances modelled are appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

4.3 Fluvial 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.

Modelled Hazard Mapping

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/south-east-lincolnshire-strategic-flood-riskassessment-march-2017

5. Tidal Flood Risk Information

This site is not considered to be at risk from tidal flooding.

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 February 2016. 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 (ie 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 James Beckett using the email address below.

Yours sincerely,



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

Enc.
Flood Map
Modelled Fluvial Levels and Flows Data Sheet

Flood Map centred on TF 21647 16567 - created May 2021 [Ref: CCN-2021-215394]



Scale 1:10,000

N

Legend

- Main River
- Raised Defences
- Flood Storage Areas
- Area 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.

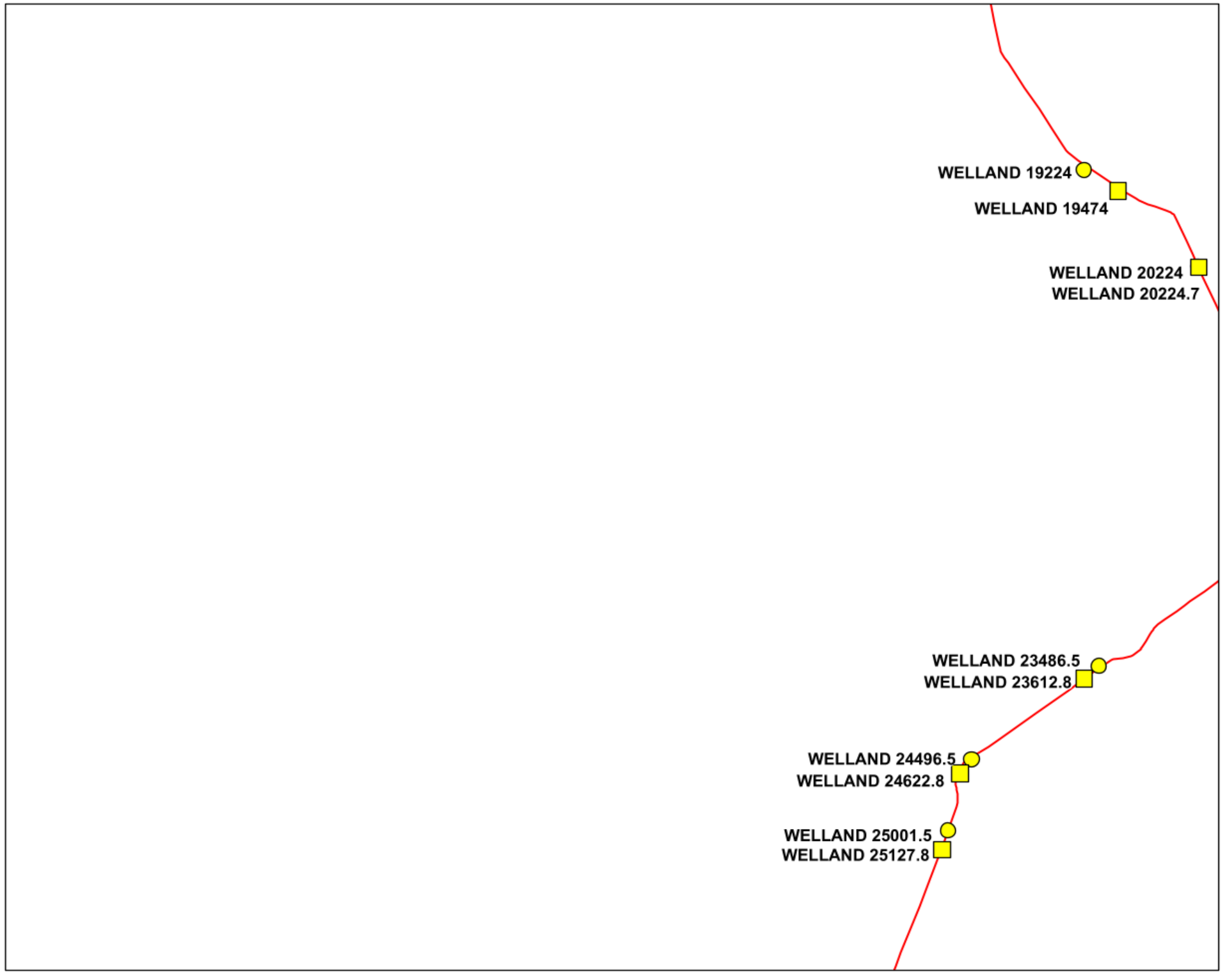
These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

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

Nodes Point Map centred on TF 21503 15679 - created May 2021 [Ref: CCN-2021-215394]



Scale 1:25,000

N

Legend

- Modelled Node - Flows
- Modelled Node - Levels
- Main River
- Raised Defences
- Flood Storage Areas
- Area 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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Datasheet [Ref: CCN-2021-215394] Model: Welland Catchment Strategic Model Date 2016

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

			Annual Exceedance Probability - Maximum Water Levels (mODN)										
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
WELLAND 19224	524514	317698	3.72	4.01	4.23	4.47	4.55	4.56	4.56	4.65	4.57	4.57	4.65
WELLAND 20224	525241	317081	3.73	4.03	4.24	4.49	4.58	4.59	4.59	4.67	4.60	4.60	4.67
WELLAND 23486.5	524610	314538	3.77	4.09	4.31	4.56	4.68	4.70	4.71	4.74	4.71	4.71	4.75
WELLAND 24496.5	523799	313944	3.78	4.11	4.33	4.58	4.71	4.73	4.74	4.77	4.74	4.75	4.77
WELLAND 25001.5	523648	313490	3.79	4.12	4.34	4.60	4.73	4.75	4.76	4.79	4.77	4.77	4.79

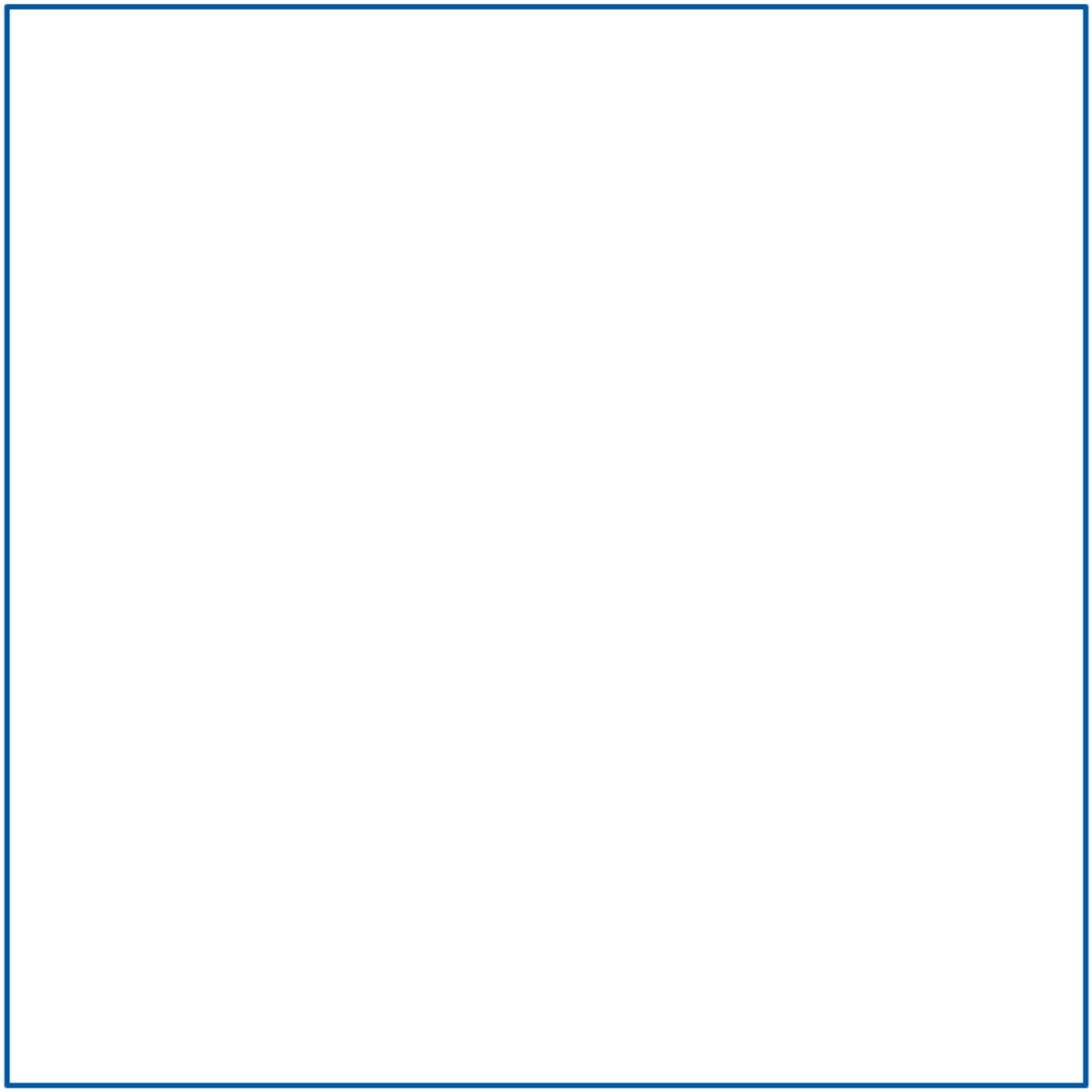
Fluvial Flood Flows (m^3/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m^3/s).

			Annual Exceedance Probability - Maximum Flows (m^3/s)										
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
WELLAND 19474	524728	317568	56.15	72.11	82.65	96.59	112.95	114.74	116.40	116.26	117.33	115.79	115.80
WELLAND 20224.7	525241	317080	55.32	71.37	81.80	95.81	113.09	114.99	117.36	116.64	117.92	116.20	116.23
WELLAND 23612.8	524512	314459	51.70	67.79	77.78	94.44	114.32	116.89	122.97	119.48	121.77	118.62	124.62
WELLAND 24622.8	523721	313857	50.17	66.29	76.17	94.06	117.56	121.58	125.68	124.37	125.34	124.02	127.61
WELLAND 25127.8	523605	313372	49.80	65.93	75.78	94.11	117.54	121.58	126.01	124.44	125.58	124.05	128.35

Appendix C

Environment Agency LiDAR ground elevation data



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Appendix D

Stage Discharge Graph

Appendix E

SFRA Mapping

South East Lincolnshire Strategic Flood Risk Assessment (SFRA) (South East Lincolnshire Joint Planning Unit, 2017)

N

The Wash

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

Map Legend

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)
- 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 Flood Hazard
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

The Wash

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

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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

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)
- Functional Floodplain
- South Holland District Boundary

REV	DATE	REMARKS
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UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Flood Hazard
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:

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The Property Ombudsman scheme

Milford House

43-55 Milford Street

Salisbury

Wiltshire SP1 2BP

Tel: 01722 333306

Fax: 01722 332296

Email: admin@tpos.co.uk

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- Provide a final response, in writing, at the latest within 40 working days of receipt.
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Alan White

Operations Manager

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