Client: Mr. Martin Matthews,

Blackberry Lodge, Nene Terrace, Crowland Flood Risk Assessment





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1 Executive Summary

This report provides a Site-specific Flood Risk Assessment for the proposed development of 8-nr semi and linked-detached houses at Blackberry Lodge, Nene Terrace, Crowland.

The proposed site is on the boundary of the Peterborough and South Holland Strategic Flood Risk Assessments (SFRA) and whilst the site is within Flood Zone 3, once the flood defences are taken account of neither SFRA identifies any risk of flooding at the site.

In accordance with the National Planning Policy Framework, this flood risk assessment includes a Sequential Test, which is deemed to be passed.

The Flood Risk Assessment has concluded that there is very low risk of flooding from potential sources.

The nature of the development, being two storey houses, is inherently resilient to flooding. Opportunity exists to include SuDS features to mitigate any increase to flood risk elsewhere.

In conclusion, flood risk should not present a reason for objection to the development.

Disclaimer: *This study is a risk based assessment of the proposal based on the information that was available to Parsons Consulting Engineers Ltd. and is intended for the sole purpose of supporting the Outline Planning Application for the proposed development at Blackberry Lodge. If either further information is found that contradicts the basis of this report or that alterations are made to the development or the water management in place then the conclusions of this report would be invalidated and Parsons Consulting Engineers Ltd would accept no liability whatsoever.*

2 Introduction

2.1 The Brief

Parsons Consulting Engineers Ltd has been commissioned by Mr Martin Matthews, of Blackberry Lodge, Nene Terrace to prepare a Flood Risk Assessment (FRA) to accompany the outline planning application for construction of eight semi and/or link-detached houses at the property.

2.2 Context and purpose of a Flood Risk Assessment

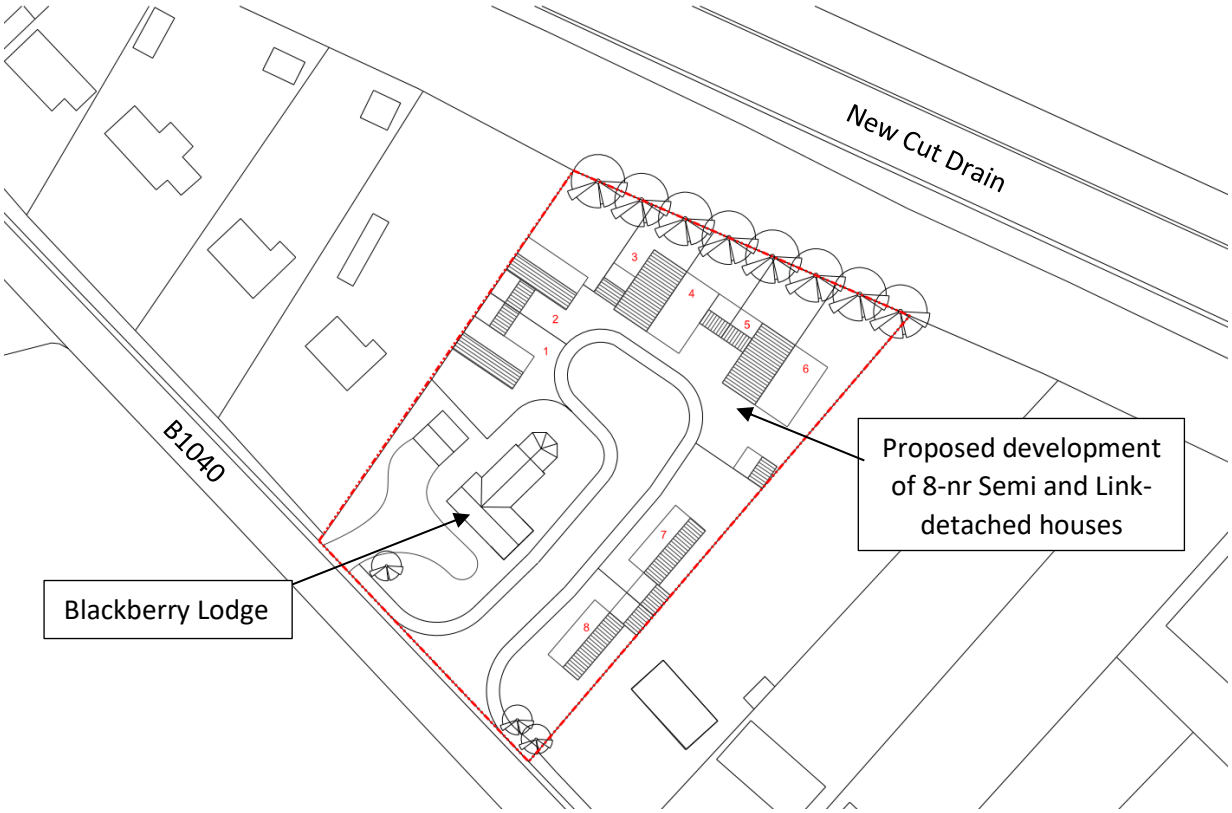
The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied, including policy on appropriate consideration of flood risk for new developments. In addition to this, the National Planning Policy Framework – Technical Guidance (NPPF-TG) provides additional guidance on planning policy for the development of sites at risk of flooding. The general objective is to favour developments in areas with the lowest risk of flooding.

Local Planning Authorities have the authority to control development in accordance with their local plans, which are required to incorporate the policy and guidance from the NPPF and NPPF-TG.

2.3 The Site and Proposed Development

The site is at Blackberry Lodge, 187 Nene Terrace, in the Fens, approximately 2-miles south-east of the town of Crowland and 2-miles north-west of the village of Thorney. The postcode for the site is PE6 0LD and the approximate centre of the site is National Grid Reference TF25800806. The site is just within the county of Lincolnshire.

The extract of drawing 017-004 rev A below shows the proposed development.



2.4 Existing Drainage and Watercourses

Immediately to the rear of Blackberry Lodge is the 'New Cut Drain'. This is one of a network of man-made channels that drain water from the Fens. Water in this channel flows eastwards, connecting to the New South Eau Drain to the east of Nene Terrace and subsequently the North Level Main Drain to the east of Throckenholt.

The North Level Main Drain is a significant drainage channel that flows to Tydd Pumping Station (approx. 4-miles north of Wisbech). Managed by the North Level District Internal Drainage Board, Tydd Pumping Station was originally constructed in 1937/39 with a capability to lift 800,000 l/min into the River Nene using 4-nr 48"-dia diesel powered pumps. However, following catastrophic floods in 1947, when the Wash Bank north of Crowland breached, a further pump was installed in 1950. A sixth pump was then added in the mid-1980's and the pumping station was converted to electric power, with the diesel engines providing a secondary power source. The current capacity of the pumping station is 1,276,000 l/min (over 21,000 l/s). The pumping station serves an area of 15,380 hectares protecting agricultural land, industrial units and residential properties[1].



Figure 1: Tydd Pumping Station

The Environment Agency monitors river levels at Wisbech and report the highest predicted water level of the River Nene at that location to be 4.31m AOD[2].

The River Nene is tidal up to the Dog-in-the-Doublet sluices (north of Whittlesey). Flows discharging to the river are managed upstream of the Dog-in-the-Doublet Sluice by diversion into the Whittlesey Washes (created in the 1930's when the River Nene Catchment Board was formed[3]), which is a very large managed flood storage reservoir stretching for over 20-km on the southern side of the River Nene. This flood storage regulates both the upstream water levels and flows into the tidal section, protecting a vast area of farmland as well as hundreds of homes, roads and railways. The flood storage reservoir is made up of two banks, the Cradge Bank and the South Barrier Bank. When the reservoir operates, it stores more than 25,000 cubic metres of water above surrounding ground levels. Due to this, it is routinely inspected by an independent engineer as part of the Reservoirs Act 1975. Between 2013 and 2016, the Environment Agency undertook a major scheme to strengthen the banks. The work involved reshaping the slope of the bank and placing extra material at the base of it.[4]

2.5 Flood History

Despite draining eastwards to the River Nene, the most notable incidence of flooding recorded in the region occurred in 1947, when the River Welland breached to the north of Crowland causing widespread flooding to large areas of the Fens, as far south as the A47.

Since then, considerable investment has been made to improve the standard of protection. The River Welland between Peakirk and Spalding is protected by fluvial embankments as part of the Environment Agency 'main river' under the terms of the Water Resources Act 1991. The Crowland and Cowbit Washes

[1] Reference North Level District Internal Drainage Board website: http://www.northlevelidb.org/engineering/catchment-pumping-station-map/cross-guns-pumping-station

[2] Reference Environment Agency website

[3] Historic information relating to the construction of the Whittlesey Washes has been obtained from Fenland District Council – Level 1 Strategic Flood Risk Assessment, prepared by Scott Wilson in July 2011

[4] Reference Government website: https://www.gov.uk/government/publications/whittlesey-washes-south-barrier-bank-flood-defence-scheme/whittlesey-washes-south-barrier-bank-flood-defence-scheme

are also located alongside the River Welland and combined together offer a protection of 1 in 100 year return period plus climate change. The embankment of the Washes is a designated structure under the Reservoirs Act 1975.

3 Requirement for Flood Risk Assessment

In accordance with Table 1 in NPPF-TG (contained in Appendix A) and with reference to the Environment Agency on-line flood maps, Blackberry Lodge is in a small area of Nene Terrace that is classified Flood Zone 2. However, parts of the proposed site and all surrounding areas are within Flood Zone 3a and as such this will be taken as the case for this assessment. Figure 1 below shows an extract of the Flood Map.

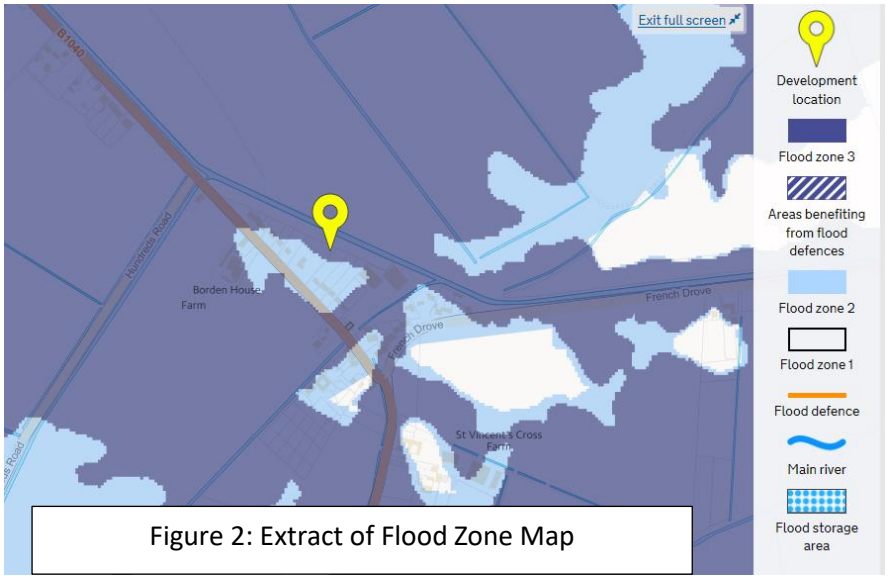


Figure 2: Extract of Flood Zone Map

It should be noted that the Flood Zone designations provided by the Environment Agency ignore the presence of Flood Defences, which serve to mitigate and considerably reduce the risk of flooding from rivers and the sea.

Being a development of dwellings, the proposed development is classed as 'More Vulnerable', which being in Flood Zone 3a requires a Flood Risk Assessment to be carried out.

This Flood Risk Assessment provides an evidenced assessment of the risk of flooding to the site from rivers, surface water, reservoirs and any other localised source. The objective is to allow the Planning Authority to determine whether the mitigations proposed are adequate to manage the risk of flooding to the development and any consequences elsewhere.

3.1 Strategic Flood Risk Assessment

The site is on the boundary between the Strategic Flood Risk Assessments undertaken for Peterborough and South Holland. Both of these Flood Risk Assessments take account of the flood defences that are in place.

The Peterborough Strategic Flood Risk Assessment (SFRA) Level 2 considers flood risks to Peterborough and the surrounding area, with particular emphasis on development opportunities around the city and flood risks along the River Nene, east of the city. Flood risk maps in this SFRA do not identify the site as being at risk of flooding.

The development site is at the very southern tip of the area considered by the South Holland Strategic Flood Risk Assessment. Maps within this SFRA show the area of Nene Terrace to be Flood Zone 1. Tables within the SFRA also show that in proximity to Crowland the River Welland has 0.43m free-board available for a 1 in 200-year event (including provision for Climate Change to the year 2115) and will not be over-topped by a 1 in 1000-year event.

4 Flood Risk Assessment

4.1 Potential Sources of Flooding

Four potential sources of flooding have been identified as a result of this assessment:

1. Local blockages to New Cut Drain
2. Storm return period of 1 in 50-years being exceeded
3. Failure of the Tydd Pumping Station
4. Breaching of the fluvial flood embankments of either the River Nene or River Welland

4.1.1 Flood risk to the development from New Cut Drain

New Cut Drain is approximately 20m wide and 5m deep. The banks of the channel are maintained by the Internal Drainage Board as part of their annual programme. Figure 3 shows the first bridge over New Cut Drain downstream of the site (to the east of Nene Terrace).

The risk of sufficient debris accumulating to cause blockage at either this bridge or in an open section of New Cut Drain is considered to be extremely low.



Figure 3 – Bridge along French Drove

4.1.2 Flood risk due to rainfall in excess of 1 in 50-year probability

The standard of protection of the IDB systems, including the ordinary watercourses and related infrastructure is known to be at least 1 in 50 (2%) i.e. the watercourses are not expected to overtop in an event of lower probability than this. This standard is generally quoted for the whole system and does not identify any site specific circumstances.

In the case of Blackberry Lodge, the adjacent drainage channel (New Cut Drain) is of significant proportions, with more than 2m free-board to the proposed development site.

In addition to this, the agricultural land to the west and north of Nene Terrace is at a slightly lower level to the proposed development site and provides additional flood plain protection.



Figure 4: View of New Cut Drain looking eastwards where it passes to the rear of the proposed development site

As such, the risk of flooding of the site from over-topping the capacity of the channel is considered to be extremely low.

4.1.3 Failure of Tydd Pumping Station

It is noted that the drainage of the Fens relies on pumping stations. However, these pumping stations are well maintained and provided with emergency power supplies and monitoring equipment. In addition, the proposed development site is many miles from Tydd Pumping Station and it is therefore considered that the likelihood of flooding as a consequence of this type of failure is nil.

4.1.4 Breaching of the Fluvial Flood Defences

The risk of the River Nene banks being breached has been considered as part of the Peterborough Strategic Flood Risk Assessment. Model results for catastrophic breaches have shown that flooding would only extend as far as the southern side of Thorney and as such does not present a risk to the proposed development site.

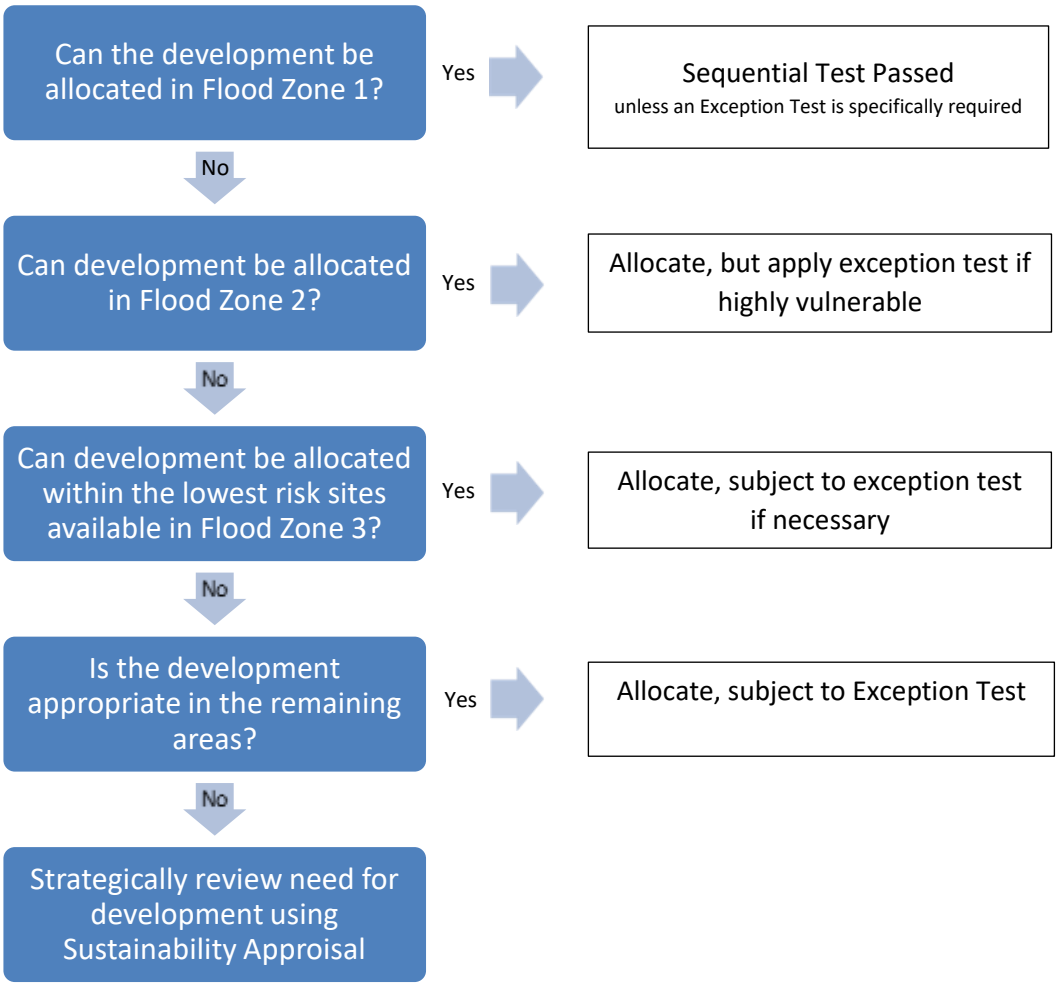
4.2 The Sequential Test

As set out in the National Planning Policy Framework, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. The flood zones are the starting point for this sequential approach. Zones 2 and 3 are shown on the Environment Agency flood map with Flood Zone 1 being all the land falling outside Zones 2 and 3.

Where there are no reasonably available sites in Flood Zone 1, local planning authorities determining planning applications for development at any particular location should consider the flood risk vulnerability of land uses (see Appendix B) and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, considering the flood risk vulnerability of land uses and applying the Exception Test if required.

4.2.1 Sequential Test Flow Chart

The Flow Chart below provides a simple summary of the Sequential Test.



4.2.2 Conclusion of the Sequential Test

The NPPF seeks to position new developments in locations with the lowest flood risk. As a 'More Vulnerable' development, the Sequential Test is passed in either Flood Zone 1 or 2 without further consideration.

Taking account of the Flood Defences, both the Peterborough SFRA and South Holland SFRA place the site in Flood Zone 1 (very low risk of flooding). Indeed, the fact that the proposed development site is situated on the very boundary between the two SFRA's suggests that it is in the area least likely to flood. It can therefore be considered that the Sequential Test is passed.

In addition, the proposed development does maximise the use of the lowest risk area (to the front of the property) by inclusion of two dwellings (Plots 7 and 8) within this zone.

By reason of the above, the Sequential Test must be considered to be passed.

4.2.3 Impact of Climate Change

Paragraph 13 of the NPPF-TG requires that the impact of climate change on flooding from land, rivers and sea be considered. Table 5 in the NPPF-TG (contained in Appendix C) provides guidance as to the increase in key climatic parameters that should be considered for project life-times.

The development is proposed to have a 100-year lifetime. Both the Peterborough SFRA and South Holland SFRA take account of the increase in sea, river and rainfall levels and as such these are inherently included in this assessment.

4.2.4 Impact upon flood risk elsewhere

The proposed development site is not within Flood Zone 3b and is not considered likely to increase any flood conditions downstream.

SuDS principals can be incorporated into the development to attenuate any rainfall to green-field run-off rates.

5 Design considerations to mitigate residual flood risks

5.1 Residual Risks

Residual risks are those remaining after applying the sequential approach and taking mitigating actions. It is the responsibility of those planning development to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

For Blackberry Lodge the residual risks are:

1. Localised flooding from surface water drainage on the site
2. Failure of building services or roof leakage causing internal flooding

5.2 Managing Residual Flood Risk

5.2.1 Site Specific Flood Mitigation Measures

The nature of the development, being two storey dwellings, is inherently resilient to flooding and provides a place of refuge in the highly unlikely event that widespread flooding of the region was to occur.

The risks to flooding from localised surface water flooding will be managed by normal design measures in accordance with Building Regulations (ie; damp proof courses and thresholds above surrounding ground levels).

Principles of Flood Resilient buildings (as described below) will be adopted to mitigate against all other risks.

5.2.2 Flood Resilient Buildings

Flood-resilient buildings are designed to reduce the consequences of flooding and facilitate recovery from the effects of flooding sooner than conventional buildings. This may be achieved by using water-resistant materials for floors, walls and fixtures and the siting of electrical controls, cables and appliances at a higher than normal level.

5.2.3 Flood Alerts

The Environment Agency provides a Flood Warning Service which includes Flood Warning Codes and uses direct warning methods (such as email, text or phone) where the risks and impacts of flooding are high. Flood Warning sirens are operated in Kings Lynn. Indirect warnings (via media broadcasts on local radio and television) are provided to all flood risk areas, even those at low risk of flooding.

In addition to direct and indirect flood warnings, the Environment Agency operates a 24 hour a day Flood-line Service providing advice and information on flooding contact: tel 0345 988 1188.

The occupiers of each dwelling should register with the Environment Agency Flood-line Warning Service to receive any future flood warnings (www.gov.uk/sign-up-for-flood-warnings).

6 Conclusion

The proposed development involves the construction of 8-nr semi and link-detached properties. The site is near the upper end of the North Level IDB area and on the boundary of both Peterborough and South Holland Strategic Flood Risk Assessments.

Whilst the site is defined as being partly within Flood Zone 3, the Environment Agency explain that the flood maps do not take account of the existing flood defences, which in the case of the Fens provide an effective and well-maintained barrier against flooding. Neither Peterborough SFRA, nor South Holland SFRA identify any risk of flooding to the site once the effect of the Flood Defences is taken into account.

Consideration of potential sources of flooding has been considered and in all cases the risk is assessed to be very low.

Appendix A – NPPF-TG Table 1 – Flood Zones

Flood Zone 1 – Low Probability
Definition This zone comprises land having less than 1 in 1000 annual probability of river or sea flooding (<0.1%). **Appropriate Uses** All uses of land are appropriate in this zone. **Flood Risk Assessment requirements** For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention. **Policy Aims** In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Flood Zone 2 – Medium Probability
Definition This zone comprises land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year. **Appropriate uses** Essential infrastructure and water-compatible, less vulnerable uses, and more vulnerable uses as set out in Table 2 (NPPF-TG), are appropriate in this Zone if the Exception test is passed. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed. **Flood risk assessment requirements** All development proposals in this zone should be accompanied by a flood risk assessment. **Policy aims** In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Flood Zone 3a – High Probability
Definition This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. **Appropriate uses** The water-compatible and less vulnerable uses of land set out in Table 2 (NPPF-TG) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential Infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in time of flood.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage

Flood Zone 3b – Functional Floodplain

Definition
This zone comprises land where water has to flow or be stored in times of flood.

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. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses
Only the water-compatible uses and the essential infrastructure listed in Table 2 (NPPF-TG) that has to be there should be permitted in this zone. It should be designed and constructed to:

- Remain operational and safe for users in times of flood;
- Result in no net loss of floodplain storage;
- Not impede water flows; and
- Not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

Table 1: Flood Zones (Partial reproduction of Table 1 within NPPF-TG)

Appendix B – NPPF-TG Flood Risk Vulnerability Classification

Essential Infrastructure
• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations, and water treatment works that need to remain operational in times of flood • Wind turbines
Highly Vulnerable
• Police stations; ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use[5] • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classed as "essential infrastructure").
More Vulnerable
• Hospitals • Residential institutions such as care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan.*[6]
Less Vulnerable
• Police, ambulance and fire stations which are not required to be operational during a flood. • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water Compatible
• Flood control infrastructure • Water and sewage transmission infrastructure and pumping stations • Sand and gravel working • Docks, marinas and wharves • Navigation facilities • MoD defence installations • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring waterside location. • Water-based recreation (excluding sleeping accommodation) • Lifeguarding and coastguard stations • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, *subject to a specific warning and evacuation plan.*

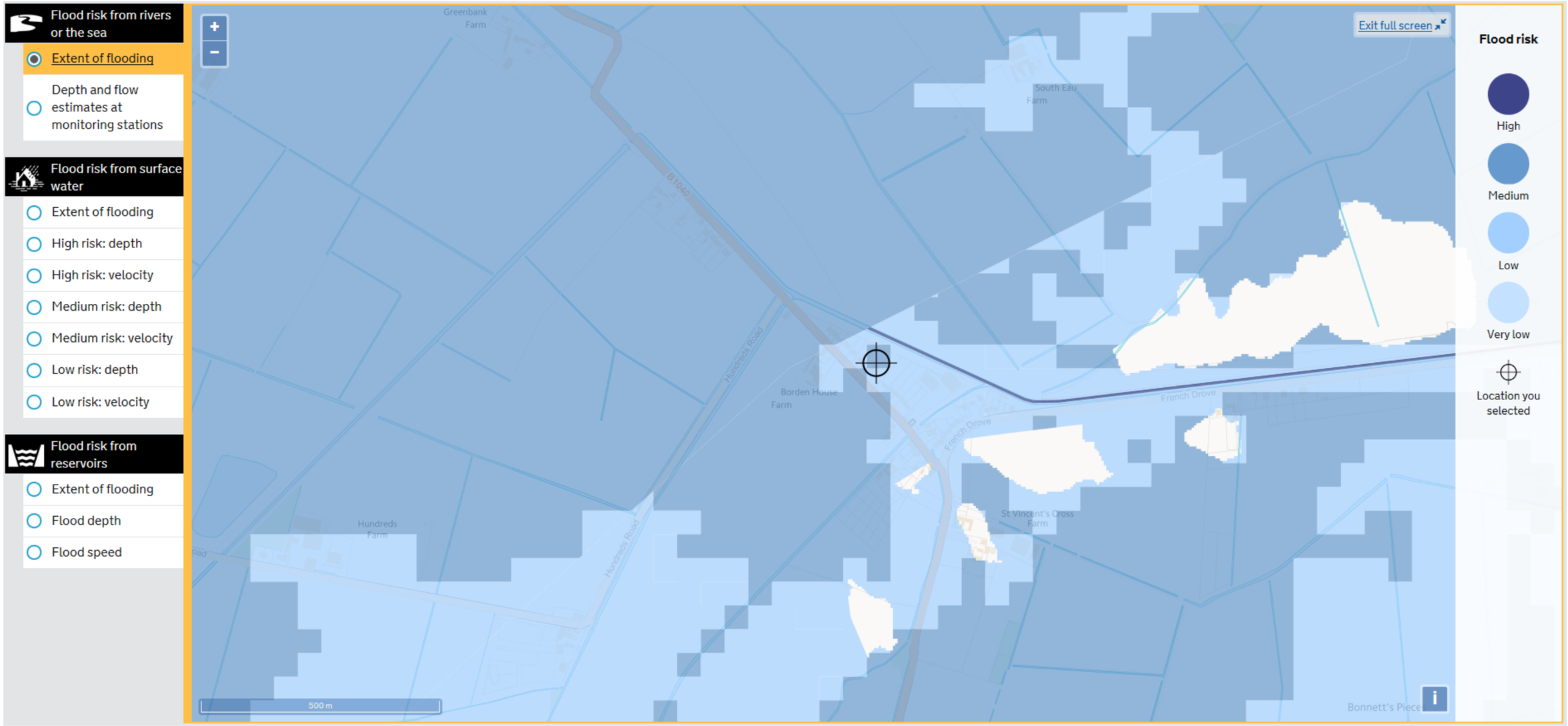
[5] NPPF-TG states that: For any proposal involving a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

[6] As Footnote 1

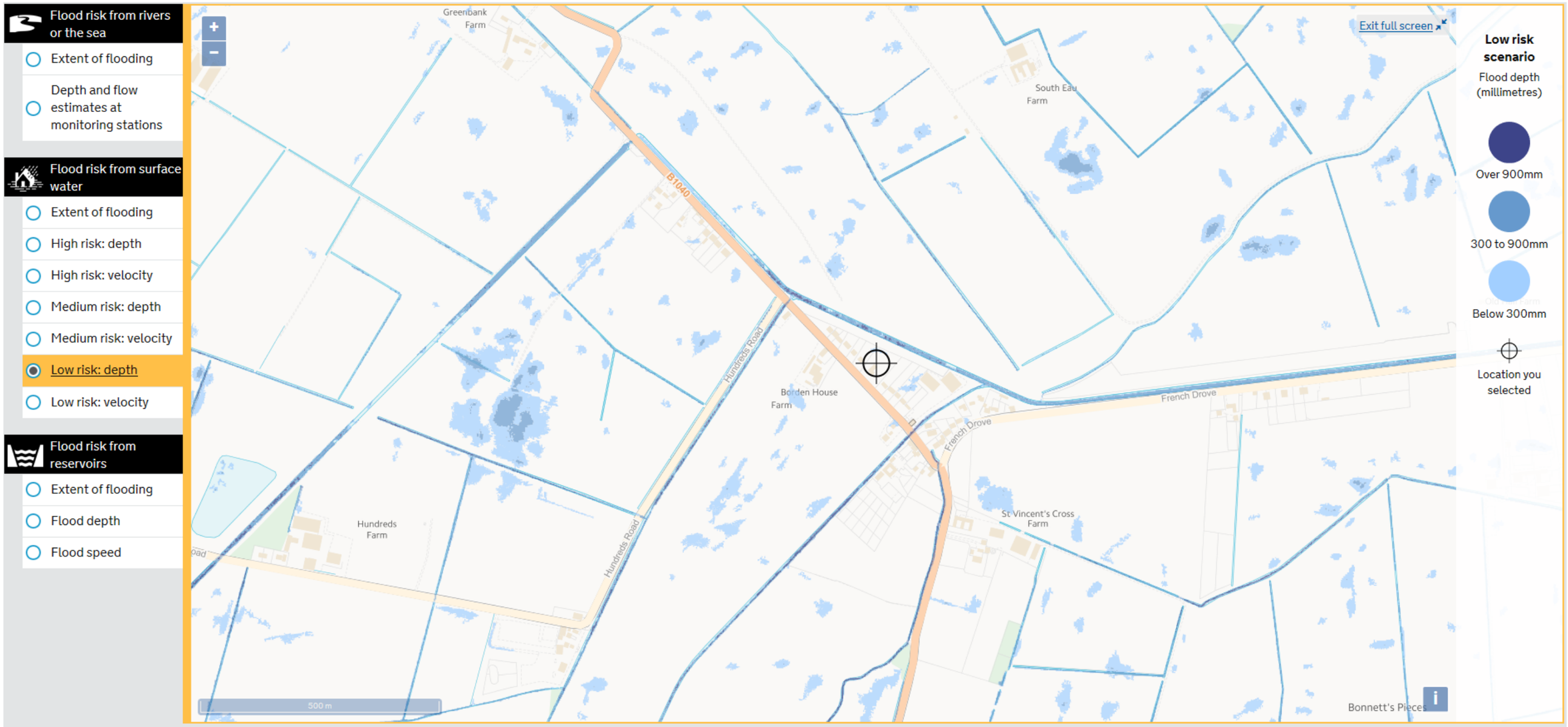
Appendix C – NPPF-TG Table 5: Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, off-shore wind speeds and wave heights

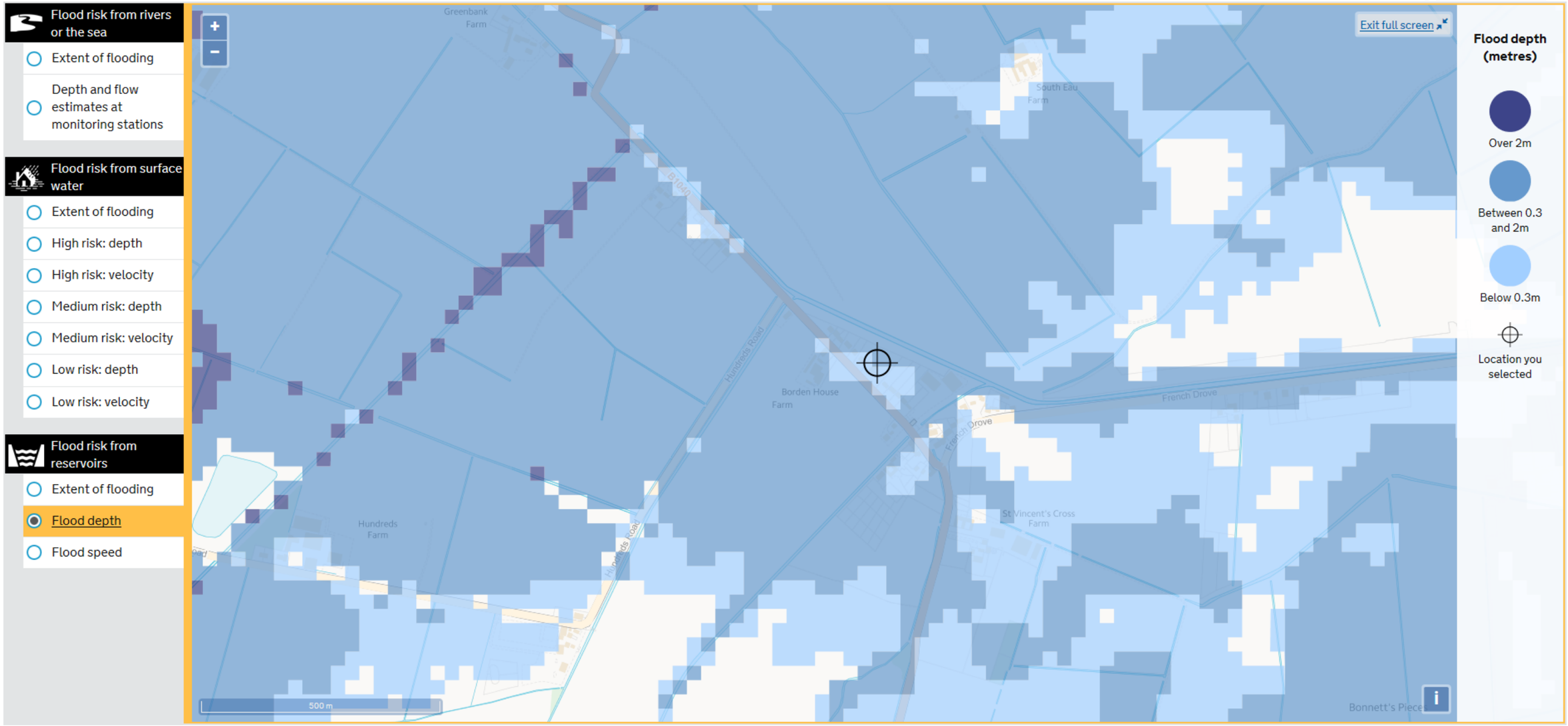
Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Off-shore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

Appendix D – Flood Risk Maps



The above map shows a 'Low' risk of flooding from Rivers or Sea. Low Risk is defined as less than 1 in 100 year annual likelihood. As explained elsewhere the risk is actually lessened by virtue of the active drainage and flood defence measures that are operated by the North Level Internal Drainage Board.


Flood risk from rivers or the sea
Extent of flooding
Depth and flow estimates at monitoring stations
Flood risk from surface water
Extent of flooding
High risk: depth
High risk: velocity
Medium risk: depth
Medium risk: velocity
Low risk: depth
Low risk: velocity
Flood risk from reservoirs
Extent of flooding
Flood depth
Flood speed
Exit full screen
Low risk scenario
Flood depth (millimetres)
Over 900mm
300 to 900mm
Below 300mm
Location you selected
Greenbank Farm
South Eau Farm
B1040
Hundreds Road
Borden House Farm
French Drove
St Vincent's Cross Farm
Hundreds Farm
500 m
Bonnett's Pieces


Flood risk from rivers or the sea
Extent of flooding
Depth and flow estimates at monitoring stations
Flood risk from surface water
Extent of flooding
High risk: depth
High risk: velocity
Medium risk: depth
Medium risk: velocity
Low risk: depth
Low risk: velocity
Flood risk from reservoirs
Extent of flooding
Flood depth
Flood speed
Exit full screen
Flood depth (metres)
Over 2m
Between 0.3 and 2m
Below 0.3m
Location you selected
Greenbank Farm
South Eau Farm
Borden House Farm
Hundreds Road
French Drove
St Vincent's Cross Farm
Hundreds Farm
B1040
500 m
Bonnett's Piece