Flood Risk Assessment



Site:
Cheal House Farm, Cheal Road, Gosberton Fen,

Applicant:
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INTRODUCTION

This is a Flood Risk Assessment to accompany a planning application for the above proposed site. The requirement for the flood risk assessment is based on the whole of the site being contained within a Flood Zone 3. The approach to flood risk is set out in the National Planning Policy Framework (NPPF), refer to Appendix A with more local planning policy set out in Policy 4 of the South East Lincolnshire Local Plan (SELLP), refer to Appendix B. This Flood Risk Assessment assesses the site in accordance with the policy requirements of the NPPF and SELLP.

FINDINGS

RISK OF FLOODING FROM RIVERS AND SEAS

Flood Zone

The site is mainly contained within Flood Zone 3 and is at risk of flooding from an event exceeding 1% flood chance. The location of the proposed house will be position in flood zone 2.

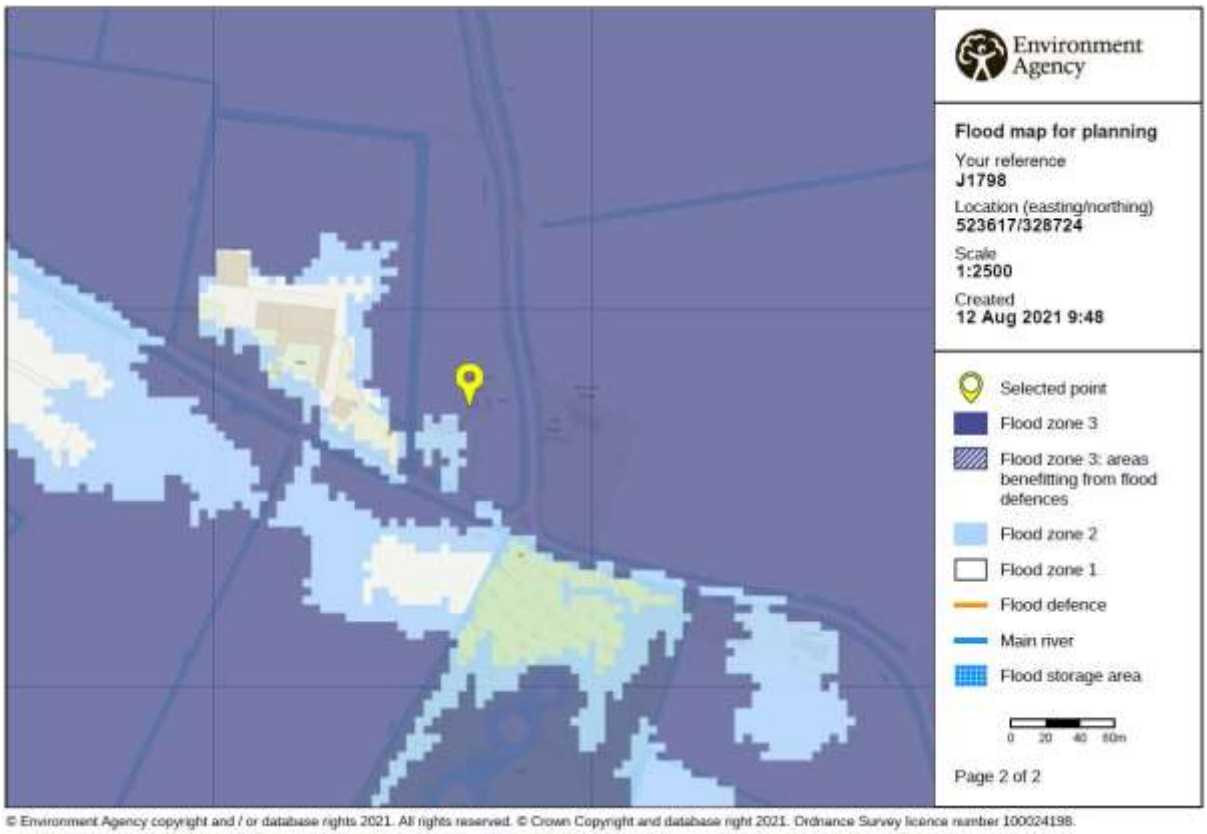


Figure 1: Flood zone map (the site is marked with a yellow marker).

Historic Flooding

There is no record of the site having flooded according to Environment Agency records, refer to Appendix D.

Sequential & Exception Test

The proposed use for the building is residential and is undergoing a change of use from agricultural. The proposal will result in one, two storey dwelling on the site. Therefore, flood risk is considered on this basis.

The residential use is classified as "more vulnerable" and the agricultural use is classified as "less vulnerable" in accordance with Table 2 – Flood Risk Vulnerability Classification. Based on the change of use there is an increase in flood risk.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Figure 2 – Table 3 – Flood Risk Vulnerability and Flood Zone Compatibility (www.gov.uk)

In accordance with Table 3 where a site is located in a Flood Zone 3a with a vulnerability classification of "more vulnerable" development is not considered to be compatible without the sequential or exception test being required to demonstrate the suitability of the land.

The proposal is for a new dwelling and thus a sequential test would naturally be required. However, the application should be judged in light of the Class Q approval allowing development for the conversion of the existing agricultural building. This scheme whilst proposing to demolish the existing building and build new does not elevate flood risk from a sequential viewpoint. It is simply the substitution of one dwelling for another. Accordingly, we consider the scheme to pass the sequential test. It should also be noted that a new build will not have the same constraints as an existing building and in this sense can ensure a reduction in flood risk compared to a conversion scheme which is only obliged to provide mitigation measures in line with those required for new build development of the same type, as far as this is practicable.

Site Levels

No topographical survey had been undertaken prior to the writing of this FRA. Site levels do not significantly vary. The site rises towards its highest point near the larger building on site. The site is part of a wider landscape of fenland that is characterised as low-lying flat land. OS maps show that levels on Cheal Road near to the site are approximately +3mAODN.

Fluvial Flood Sources

There is a single fluvial source identified as affecting the site. This is the River Glen located approximately 2.6km southeast of the site. The site is protected by manmade raised earth embankment defences, and these are in a fair condition and offer a level of protection of 1:100.

There remains a residual risk of overtopping and a breach of the flood defences. A simple breach analysis can provide a basic assessment of potential flood depths on site and is included with this flood risk assessment.

Fluvial Flood Level

Where possible all habitable floors should be above the 1 in 100-year flood level plus climate change where the accommodation is proposed to be two storey. In the case where a single storey building is proposed habitable floors should be above the 1 in 1000-year flood level. In both cases a safe point of refuge can be established and therefore provide protection to the habitants of the building.

In this case it is proposed to create a two-storey dwelling. The 1 in 100-year flood level for fluvial sources will be calculated respectively for each design scenario.

Data from the Environment Agency includes in channel data for the River Glen, refer to Appendix D. It does not contain Hazard mapping for modelled breaches or overtopping which may affect the site.

A simplistic breach model using the in-channel levels of the River Glen offer the best way to establish a 1:100-year flood level including climate change for the site. The nearest node to the site is GLEN3910 from the River Glen. The simplistic model only

considers an oncoming wave depth and assumes the land forward of the breach to be taken down to 2m. Depending on where a breach were to occur would dictate the height of land forward of the breach however 2m is typical of land levels in this area.

Global warming is now recognised that it is likely to affect the frequency and severity of extreme events such as both tidal and fluvial flooding. The climate change allowances in the NPPF Guidance were updated on the 19th February 2016 and again on 17th December 2019. The site lies within the Anglian River Basin and allowances for climate change should be made on the following basis. For a worst-case scenario, the site shall be considered to be in a Flood Zone 3a and the use classification is 'more vulnerable' therefore Peak River flows use the higher central and upper end to assess a range of allowances.

The adjustments for peak flows can be seen in the table below. For simplicity, for design a 35% increase to peak flow will be used to determine the 1 in 100-year and 1 in 1000-year flood level plus climate change and the design will be tested for sensitivity using a 65% increase to peak flows for the 1 in 1000-year event only.

River basin district	**Allowance category**	**Total potential change anticipated for the '2020s' (2015 to 2039)**	**Total potential change anticipated for the '2050s' (2040 to 2069)**	**Total potential change anticipated for the '2080s' (2070 to 2115)**
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	20%

Figure 3 - Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)

A flow discharge curve can be established using the increase in flow to calculate and establish in-channel levels of the Car Dyke for the climate change scenarios.

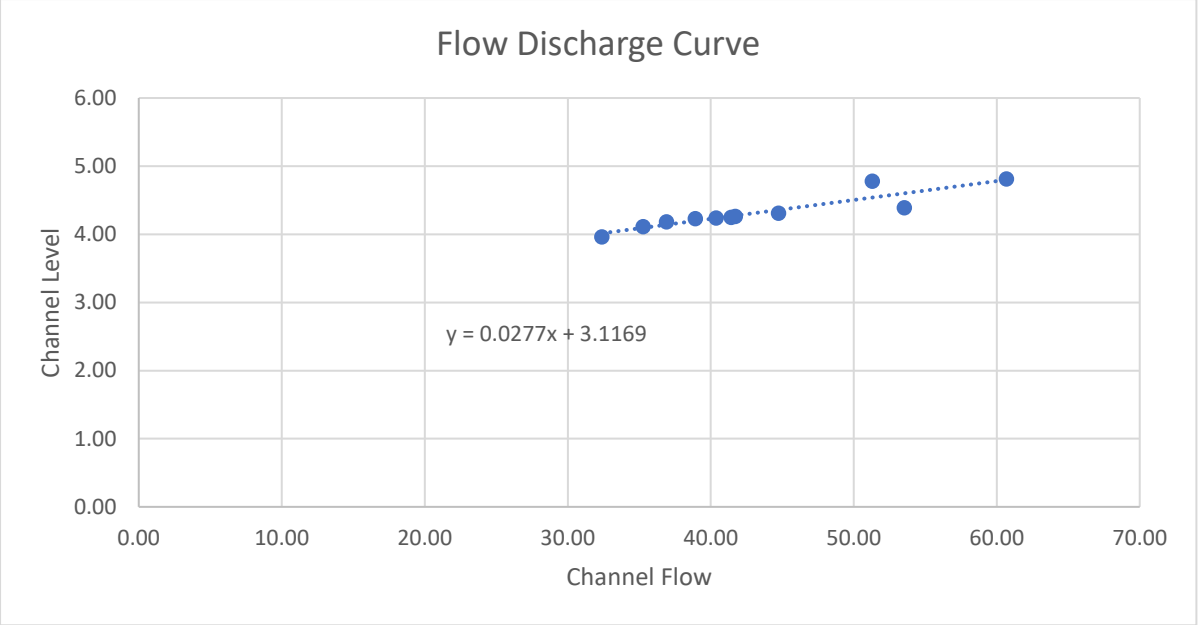


Figure 4 – Flow discharge curve

Event & Climate Change (%)	Flow (m^3)	Level (m)
1% +35%CC	58.48	4.74
1% +65%CC	72.85	5.13

Figure 5 – Calculated Levels For Climate Change

A breach analysis using data from this node is contained in Appendix C and the 1:100-year level including 35% climate change for the building is +0.209m above existing ground level of the site. The 65% climate change scenario produces a depth of +0.236m.

Tidal Flood Sources

The site is not at risk from flooding from tidal sources of flooding.

Floor Levels

Habitable floor levels are to be set at minimum of 300mm above the existing ground level which is above the predicted 1 in 100-year flood level (including climate change) in line with EA standing advice. This provides sufficient freeboard for the worst case predicted flood depth.

RISK OF FLOODING FROM SURFACE WATER

The risk of flooding from surface water is very low. The following map shows the Environment Agency's Risk of Flooding from Surface Water map:

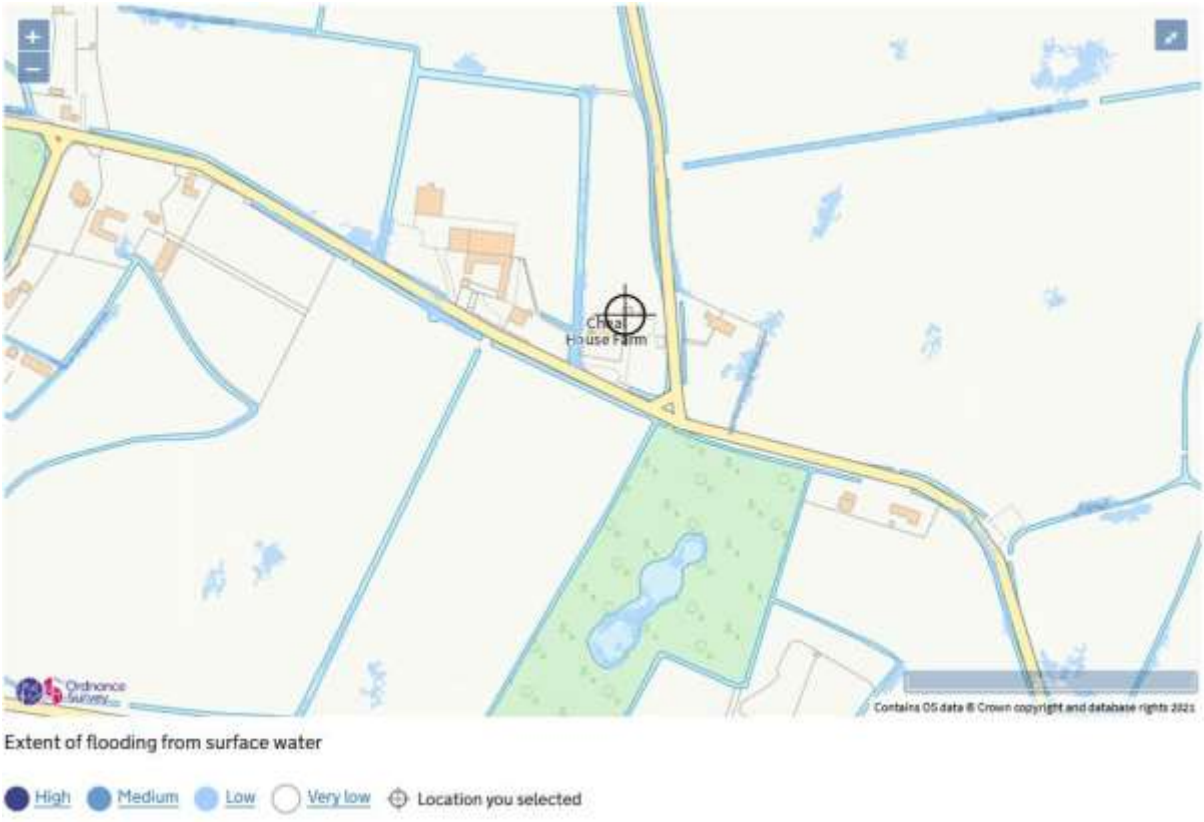


Figure 6: Surface Water Flood Map (www.gov.uk)

No further action is required.

RISK OF FLOODING FROM RESERVOIRS

The risk of flooding from reservoirs is low. The following map shows this on the Environment Agency's Risk of Flooding from Reservoirs map:



Figure 7: Reservoir Flood Map (www.gov.uk)

No further action is required.

RISK OF FLOODING FROM SEWERS

There are no existing surface water and foul water sewers that currently exist on the site. All new infrastructures to service the building shall be appropriately designed to the relevant standards to ensure failures do not present a problem.

SAFE ACCESS & EGRESS

The proposed ground floor is above the calculated 1:100-year flood level, as such it will provide a safe refuge for the dwelling. It may not be possible to access or egress the site during times of fluvial or tidal flooding depending upon the severity of the event.

CONCLUSION

The site is contained mainly in Flood Zone 3.

The site is protected by adequate fluvial flood defences which are maintained by the Environment Agency. These currently are in fair condition and provide a 1 in 100-year level of protection. A residual risk to breaching of these defences exist.

The residential use falls within "more vulnerable" uses of land in Table 2 Flood Risk Vulnerability Classification and Table 3 shows that developments of this nature are appropriate in flood zone 3a subject to passing the Sequential and Exception Test. This scheme should be viewed considering the previously approved Class Q and accordingly it is considered that the development passes the sequential test. Flood risk betterment is also achievable

The calculated flood level 1:100-year flood level including allowances for climate change is +0.209m above the existing site ground level. On this basis the ground floor is to be set at +0.300m above the existing ground level in accordance with EA standing advice.

Flood resilient construction to a height 300mm above the finished floor level shall be installed.

At the detailed design stage of the development advice contained in "Improving the Flood Performance of New Buildings - Flood Resilient Construction" should be followed.

Further to this the property will register to Floodline to receive advance warning of potential flooding.

All new foul and surface water drains will be designed to the relevant standards.

APPENDICES

APPENDIX A – NATIONAL PLANNING POLICY FRAMEWORK

PLANNING AND FLOOD RISK

155. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

156. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

157. All plans should apply a sequential, risk-based approach to the location of development–taking into account the current and future impacts of climate change[49] Except for applications for the repowering of existing wind turbines, a proposed wind energy development involving one or more turbines should not be considered acceptable unless itis in an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

    a) applying the sequential test and then, if necessary, the exception test as set out below;
    b) safeguarding land from development that is required, or likely to be required, for current or future flood management;
    c) using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and
    d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

158. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk

assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

159. If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.

160. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and
b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

161. Both elements of the exception test should be satisfied for development to be allocated or permitted.

162. There planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-making stage, or if more recent information about existing or potential flood risk should be taken into account.

163. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[50]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
b) the development is appropriately flood resistant and resilient;
c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and
e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

164. Applications for some minor development and changes of use[51] should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.

165. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a) take account of advice from the lead local flood authority;
b) have appropriate proposed minimum operational standards;
c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
d) where possible, provide multifunctional benefits.

APPENDIX B – SOUTH EAST LINCOLNSHIRE LOCAL PLAN

POLICY 4: APPROACH TO FLOOD RISK

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

1. It can be demonstrated that there are no other sites available at a lower risk of flooding (i.e. that the sequential test is passed). The sequential test will be based on a Borough or District wide search area of alternative sites within the defined settlement boundaries, unless local circumstances relating to the catchment area for the development justify a reduced search area, i.e. there is a specific need for the development in that location. The sequential test is not required for sites allocated in the Local Plan, minor development1or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site).
2. It can be demonstrated that essential infrastructure in FZ3a & FZ3b, highly vulnerable development in FZ2 and more vulnerable development in FZ3 provide wider sustainability benefits to the community that outweigh flood risk.
3. The application is supported with a site-specific flood risk assessment, covering risk from all sources of flooding including the impacts of climate change and which:
    a) demonstrate that the vulnerability of the proposed use is compatible with the flood zone;
    b) identify the relevant predicted flood risk (breach/overtopping) level, and mitigation measures that demonstrate how the development will be made safe and that occupants will be protected from flooding from any source;
    c) propose appropriate flood resistance and resilience measures (following the guidance outlined in the Strategic Flood Risk Assessment), maximising the use of passive resistance measures (measures that do not require human intervention to be deployed), to ensure the development maintains an appropriate level of safety for its lifetime;
    d) include appropriate flood warning and evacuation procedures where necessary (referring to the County's evacuation routes plan), which have been undertaken in consultation with the authority's emergency planning staff;
    e) incorporates the use of Sustainable Drainage Systems (SuDS) (unless it is demonstrated that this is not technically feasible) and confirms how these will be maintained/managed for the lifetime of development (surface water connections to the public sewerage network will only be permitted in exceptional circumstances where it is demonstrated that there are no feasible alternatives);
    f) demonstrates that the proposal will not increase risk elsewhere and that opportunities through layout, form of development and green infrastructure

have been considered as a way of providing flood betterment and reducing flood risk overall;

g) demonstrates that adequate foul water treatment and disposal already exists or can be provided in time to serve the development;
h) ensures suitable access is safeguarded for the maintenance of water resources, drainage and flood risk management infrastructure.

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

Change of use of existing buildings will be supported providing they do not pose an increase in risk to people. Change of use that would result in self-contained ground floor residential accommodation in areas of hazard rating 'danger for some', 'danger for most' and 'danger for all' will not be supported. In these areas unrestricted access to a habitable room above the flood level and an emergency evacuation plan will be required.

Caravans, mobile homes and park homes intended for permanent residential use will not be permitted in areas at risk of flooding. Caravan, chalet, log cabin, camping and touring sites at risk of fluvial flooding where there is a 'danger for most' and 'danger for all' will not be permitted. Occupancy of caravan, chalet, log cabin, camping and touring sites at risk of tidal flooding will not be permitted to open between 1st November in any one year and the 14th March in the succeeding year.

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

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

APPENDIX C – BREACH ANALYSIS

Defence Crest Levels (h1)	4.74	m
Average Ground Level behind defences (h2)	2	m
1 in 100 year flood level plus climate change (h3)	4.74	m
Assumed length of breach (B)	40	m
Max head over breach (h)	2.74	m
Peak flow (Q) = $1.7xBxh^{3/2}$	308.4	m^3s^{-1}

Peak flow (Q)	308.4	m^3s^{-1}
Assuming Energy Grad (S)	0.001	-
Assume % obstructions to flow	0	-
Assuming mannings (n)	0.03	-

	Scenario					
	1	2	3	4	5	6
Distance from breach	0	250	500	750	1000	1250
Perimeter of Flood Wave (Assumed Channel Width)	40	825.5	1611	2396.5	3182.0	3967.5
Effective perimeter (P)	40	825.5	1611	2396.5	3182.0	3967.5
Normal Depth y = $((Qn/(b \times S^{0.50}))^{0.6}$	3.300	0.537	0.359	0.283	0.239	0.209

Time to Reach Development

Distance from breach above plus 1.0m	1	251	501	751	1001	1251
Perimeter of Flood Wave (Assumed Channel Width)	43.1	828.6	1614.1	2399.6	3185.1	3970.6
Normal Depth y = $(Qn/(bxS^{0.5}))^{0.6}$	3.154	0.535	0.359	0.283	0.239	0.209
Volume in Additional 1.0m	136.1	443.7	579.3	678.9	760.3	830.4
Speed to cover additional 1.0m (m/s)	2.27	0.70	0.53	0.45	0.41	0.37
Average time to reach radius (secs)	-	325.0	847.0	1487.9	2221.0	3031.5
Average time to reach radius (mins)	-	5.4	14.1	24.8	37.0	50.5

Defense Crest Levels (h1)	5.13	m
Average Ground Level behind defenses (h2)	2	m
1 in 1000 year flood level plus climate change (h3)	5.13	m
Assumed length of breach (B)	40	m
Max head over breach (h)	3.13	m
Peak flow (Q) = $1.7xBxh^{3/2}$	376.6	m^3s^{-1}

Peak flow (Q)	376.6	m^3s^{-1}
Assuming Energy Grad (S)	0.001	-
Assume % obstructions to flow	0	-
Assuming mannings (n)	0.03	-

	Scenario					
	1	2	3	4	5	6
Distance from breach	0	250	500	750	1000	1250
Perimeter of Flood Wave (Assumed Channel Width)	40	825.5	1611	2396.5	3182.0	3967.5
Effective perimeter (P)	40	825.5	1611	2396.5	3182.0	3967.5
Normal Depth $y = ((Qn/(b \times S^{0.50}))^{0.6}$	3.720	0.605	0.405	0.319	0.269	0.236

Time to Reach Development

Distance from breach above plus 1.0m	1	251	501	751	1001	1251
Perimeter of Flood Wave (Assumed Channel Width)	43.1	828.6	1614.1	2399.6	3185.1	3970.6
Normal Depth $y = (Qn/(bxS^{0.5}))^{0.6}$	3.555	0.604	0.405	0.319	0.269	0.236
Volume in Additional 1.0m	153.4	500.2	653.0	765.3	857.1	936.1
Speed to cover additional 1.0m (m/s)	2.46	0.75	0.58	0.49	0.44	0.40
Average time to reach radius (secs)	-	300.1	782.0	1373.7	2050.6	2798.9
Average time to reach radius (mins)	-	5.0	13.0	22.9	34.2	46.6

Defense Crest Levels (h1)	6.33	m
Average Ground Level behind defenses (h2)	2	m
1 in 1000 year flood level plus climate change (h3)	6.33	m
Assumed length of breach (B)	40	m
Max head over breach (h)	4.33	m
Peak flow (Q) = $1.7xBxh^{3/2}$	612.7	m^3s^{-1}

Peak flow (Q)	612.7	m^3s^{-1}
Assuming Energy Grad (S)	0.001	-
Assume % obstructions to flow	0	-
Assuming mannings (n)	0.03	-

	Scenario					
	1	2	3	4	5	6
Distance from breach	0	500	1000	1500	2000	2600
Perimeter of Flood Wave (Assumed Channel Width)	40	1611	3182	4753	6324.0	8209.2
Effective perimeter (P)	40	1611	3182	4753	6324.0	8209.2
Normal Depth y = $((Qn/(b \times S^{0.50}))^{0.6}$	4.982	0.542	0.361	0.283	0.239	0.204

Time to Reach Development

Distance from breach above plus 1.0m	1	501	1001	1501	2001	2601
Perimeter of Flood Wave (Assumed Channel Width)	43.1	1614.1	3185.1	4756.1	6327.1	8212.3
Normal Depth y = $(Qn/(bxS^{0.5}))^{0.6}$	4.761	0.542	0.360	0.283	0.239	0.204
Volume in Additional 1.0m	205.4	874.6	1147.8	1347.5	1510.4	1676.5
Speed to cover additional 1.0m (m/s)	2.98	0.70	0.53	0.45	0.41	0.37
Average time to reach radius (secs)	-	643.6	1687.7	2971.0	4439.7	6405.4
Average time to reach radius (mins)	-	10.7	28.1	49.5	74.0	106.8

APPENDIX D – ENVIRONMENT AGENCY DATA