

**FLOOD RISK ASSESSMENT FOR
RESIDENTIAL REDEVELOPMENT AT
WHARF STREET, SUTTON BRIDGE, Lincs**

FINAL REPORT

GEOFF BEEL CONSULTANCY

DECEMBER 2011

GCB/SWANN EDWARDS

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CONTENTS

- 1.0 INTRODUCTION
- 2.0 LOCATION
- 3.0 THE SITE
- 4.0 EXISTING FLOOD ALLEVIATION MEASURES
- 5.0 POTENTIAL SOURCE OF FLOODING
- 6.0 EXTENT OF KNOWN FLOODING
- 7.0 PROBABILITIES AND TRENDS OF FLOODING
- 8.0 IMPACTS OF FLOODING
- 9.0 RESIDUAL RISKS – EXTREME EVENTS
- 10.0 CONCLUSIONS AND RECOMMENDATIONS

- Fig 1 - Location Plan – OS Map
- Fig 2 - Floor Plans, Site Plan and Location Plan –
Swann Edwards drg. no. SE-026-10
- Fig 3 - Elevations and Sections –
Swann Edwards drg. no. SE-026-11
- Fig 4 - Elevations and Sections –
Swann Edwards drg. no. SE-026-12
- Fig 5 - Planning Advice Note PAN 69
- Fig 6 - Environment Agency Flood Zone Map
- Fig 7 - Environment Agency Tidal Breach Hazard Mapping
1 in 200 year event (2006) - CCN/2010/27350
- Fig 8 - Environment Agency Tidal Breach Hazard Mapping
1 in 200 year event (2115) – CCN/2010/27350
- Fig 9 - South Holland Internal Drainage Board District plan.

1.0 INTRODUCTION

- 1.1 A full planning application is to be submitted by Swann Edwards Architecture on behalf of Mr W Delahoy for proposed residential redevelopment at Studeley House, Wharf Street, Sutton Bridge.
- 1.2 Planning approval requires a Flood Risk Assessment to be submitted to the Environment Agency to meet the requirements of Planning Policy Statement 25 (PPS25) – Development and Flood Risk.

The site is located within Flood Zone 3 'High probability' as detailed on the Environment Agency's Flood Zone Maps. The latest Agency Flood Zone Maps have been created as a tool to raise awareness of flood risk with the public and partner organisations, such as Local Authorities, Emergency Services and Drainage Authorities. The Maps do not take into account any flood defences.

Furthermore, the site is also shown to be within the Tidal Zone 3 of the South Holland Strategic Flood Risk Assessment Maps and located in the South Holland Internal Drainage Board's area.

- 1.3 Geoff Beel Consultancy was appointed on 14th December 2011 to undertake a Flood Risk Assessment.
- 1.4 The site received planning approval for extensions to the previous Studeley House Care Home from South Holland District Council on 6th July 2010 with no objection from the Environment Agency.

2.0 LOCATION

- 2.1 The development site is located at Studeley House, Wharf Street being west of the River Nene tidal defences at Sutton Bridge. The National Grid Reference of the central point of the site is TF48002120.
- 2.2 The position and extent of the site is shown on Fig 1 – Location Plan at the end of the document.
- 2.3 The site, located within the South Holland Internal Drainage Board area is shown within Flood Zone 3 as detailed on the Environment Agency Flood Zone Maps and the Council's Strategic Flood Risk Assessment Flood Zone Maps.

3.0 THE SITE AND SEQUENTIAL TEST

- 3.1 The site is currently a redundant care home facility.
- 3.2 The area of development is approximately 0.16 hectare with existing vehicular access to Wharf Street. Land level at the site is 4.00m aOD.
- 3.3 The proposed site layout consists the creation of 12 residential units from the previous care home facility premises . Six of the units are at existing ground floor level with a common refuge at first floor level, the remaining six units are two-storey with bedrooms at first floor level.
- 3.4 The Sequential Test and Exception Test will require to be applied by the Local Planning Authority but the redevelopment may be permitted as betterment has been incorporated against the previous use of the care home facility meeting the requirements of PPS25 as being protected against both the 1 in 100 year fluvial flood event and the 1 in 200 year tidal flood event.

4.0 EXISTING FLOOD ALLEVIATION MEASURES

- 4.1 The site is within a defended floodplain, as defined in Appendix 1 of the Environment Agency's 'Policy for the Protection of Floodplains' and is considered to be passive until such time as a flood greater than that for which the defences were designed occurs. The likelihood of flooding due to overtopping or failure of a flood defence embankment is considered to be small.

The South Holland Internal Drainage Board area at Sutton Bridge is protected by the west embankment of the River Nene tidal defences.

- 4.2 The site and surrounding areas of development drain in a generally northerly direction to discharge into the tidal River Nene as part of the Westmere catchment of the Internal Drainage Board.
- 4.3 The existing standard of drainage for the South Holland Internal Drainage Board is 1 in 50 years return period, compatible with the Department of the Environment, Food and Rural Affairs target level of service for rural drainage and flood defence works. Freeboard of 900mm is provided to the lowest land levels.
- 4.4 Current maintenance standards within the South Holland Internal Drainage Board and of the Environment Agency tidal defences are generally very good.

During the operation and maintenance of its pumping stations, associated structures and channel systems, particularly those that could affect property, the Board seeks to maintain a general standard capable of providing flood protection to its district. A routine maintenance programme is in place to ensure that the Boards assets are commensurate with the standard of protection that is sought. However, bank slips, blocked culverts etc may occur from time to time and these matters are usually dealt with promptly.

5.0 POTENTIAL SOURCES OF FLOODING

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

- a) local blockages to existing sewerage
- b) local blockages to IDB main drain
- c) storm return period of 1 in 50 years being exceeded
- d) overtopping of River Nene tidal defences at Sutton Bridge

5.2 The probability of flooding from source a) and b) are low due to the maintenance standards already achieved and managed by Anglian Water and the IDB.

The probability of flooding from c) is also low due to the South Holland IDB main drain design standard incorporating a minimum 900mm freeboard to the lowest land level which provides adequate storage in events greater than 1 in 50 years.

5.3 Previous historic rainfall events of 1968 and 1978, estimated to be greater than 1 in 100 year events, caused no flooding to any residential properties at the time and the Boards policy is to provide a standard of drainage which satisfies PPS25 requirements of a 1 in 100 year return period for fluvial protection inclusive of the effects of climate change and development. The Boards policy regarding the connection of future developments to the arterial system enables a flexible approach to be adopted and meet the criteria for "sustainable urban drainage".

5.4 The possible overtopping and breaching of the tidal River Nene defences at Sutton Bridge is also considered to be low. The Environment Agency has carried out the River Nene Strategic Study Report and concluded that the defences provide a level of protection against the 1 in 200 years period tidal event.

5.5 Further hydraulic modelling has been carried out by the Environment Agency of the impacts of a breach occurring to the Sutton Bridge tidal defences. The present day scenario is such the maximum depth of flooding would be up to 0.5m with a low to medium Danger Hazard rating.

By the year 2115, with no further improvements carried out to the Sutton Bridge tidal defences the scenario deteriorates such that the maximum depth of flooding would be up to 2.0m with a High Danger Hazard rating.

5.6 The potential maximum velocity of the floodwaters in 2115 is shown as at least 1.0m/sec and the dwellings will be designed to withstand the hydrostatic pressures resulting from the floodwaters.

5.7 Safe refuge is provided at first floor level for all of the residential units.

6.0 EXTENT OF KNOWN FLOODING

- 6.1 During the preparation of this assessment, evidence was discovered of part of the site being flooded and adjoining properties during the tidal surge event of January 1978 since when tidal defences have been raised and strengthened to a 1 in 200 year standard of protection.

7.0 PROBABILITIES AND TRENDS OF FLOODING

- 7.1 The probability of this development flooding from localised drainage systems is low.
- 7.2 The probability of the site flooding with water from any South Holland main drain is less than 1% because of the standards of the existing flood defence systems, storage within existing drainage channels and the location of the site.
- 7.3 The probability of the site flooding with tidal waters from the River Nene is less than 0.5% because of the standards of the existing flood defences and the location of the site. If the trend of climate change anticipated to occur continues over the next 100 years, the defences are considered adequate to sustain the 1 in 200 year standard of protection.
- 7.4 If under very extreme events, levels of floodwater from the South Holland main drains or arterial systems rose to such an extent that the site was affected, the situation would not be sudden. It is very probable that sufficient time would be available to take precautionary actions to limit the extent and potential impact of flooding.
- 7.5 The water levels in the drainage channels will tend to rise as a result of the impacts of climate change. However the existing systems and defences together with the raising of floor levels above existing ground level will be appropriate for the design life of the development (i.e. 100 years). Flood resilient measures will be incorporated into the redevelopment wherever appropriate.
- 7.6 As compared with the original care home facility, betterment has been incorporated into the redevelopment as follows:
- Numbers of bedrooms at ground floor level reduced
 - Common safe refuge created at first floor level for those units with bedrooms at ground floor level
 - Flood resilient measures incorporated wherever appropriate
 - Age profile of residential occupancy much reduced from care home facility

8.0 IMPACTS OF FLOODING

- 8.1 No significant impacts of flooding are anticipated due to the existing standards of tidal defence, however a precautionary approach has been adopted to protect against the remote possibility of tidal overtopping to the River Nene tidal defences.
- 8.2 Residential floor levels of the development will be above existing ground level with bedrooms of six of the units at first floor level and the remaining units having safe refuge via common staircase to first floor level offering additional protection against impacts arising from any extreme short duration, localised events.
- 8.3 The general location of the site within the catchment is such that if flooding occurred from any of the South Holland main drain systems, then probably 2 to 3 days warning time would be available.
- 8.4 No displacement of water from the site will affect any adjoining properties as being discharged to existing public surface water sewerage.
- 8.5 The developer will ensure that the eventual occupiers of the properties are sufficiently aware of the risk of flooding, and the standard of the existing defences. The Environment Agency provides a Flood Warning Service which includes Flood Warning Codes and uses direct warning methods where the risks and impacts of flooding are high. Indirect warnings are provided to all flood risk areas, even those at low risk of flooding. The main method is media broadcasts via local radio and also by television including teletext.

In addition to direct and indirect flood warnings, the Environment Agency operates a 24 hour a day Floodline Service providing advice and information on flooding, contact tel. no: 0845 988 1188 and the occupiers will be required to register with the Floodline Direct Warning Service to receive any future flood warnings.

- 8.6 A Flood Evacuation Plan will be prepared for approval by the South Holland District Council Emergency Planner. The Plan will identify access to Bridge Road in an easterly direction to land in Flood Zone 1.

9.0 RESIDUAL RISK – EXTREME EVENTS

- 9.1 The residual risk from extreme events is low on this site, because of its location, existing tidal flood defences and the standard of surface water drainage already provided.
- 9.2 Although within Flood Zone 3 according to PPs25 classification, the site actually has a low risk of flooding due to the current standards of drainage and flood defence and land levels. The site is not located within a Functional Flood Plain of any 'main river' or 'main drain' as defined in PPS25. The Environment Agency Flood Zone maps have been produced irrespective of existing flood defences and standards of protection.

- 9.3 South Holland District Council in conjunction with the Environment Agency and the local IDB's within the Council area have carried out a Strategic Flood Risk Assessment of the whole District by appointed Consulting Engineers.

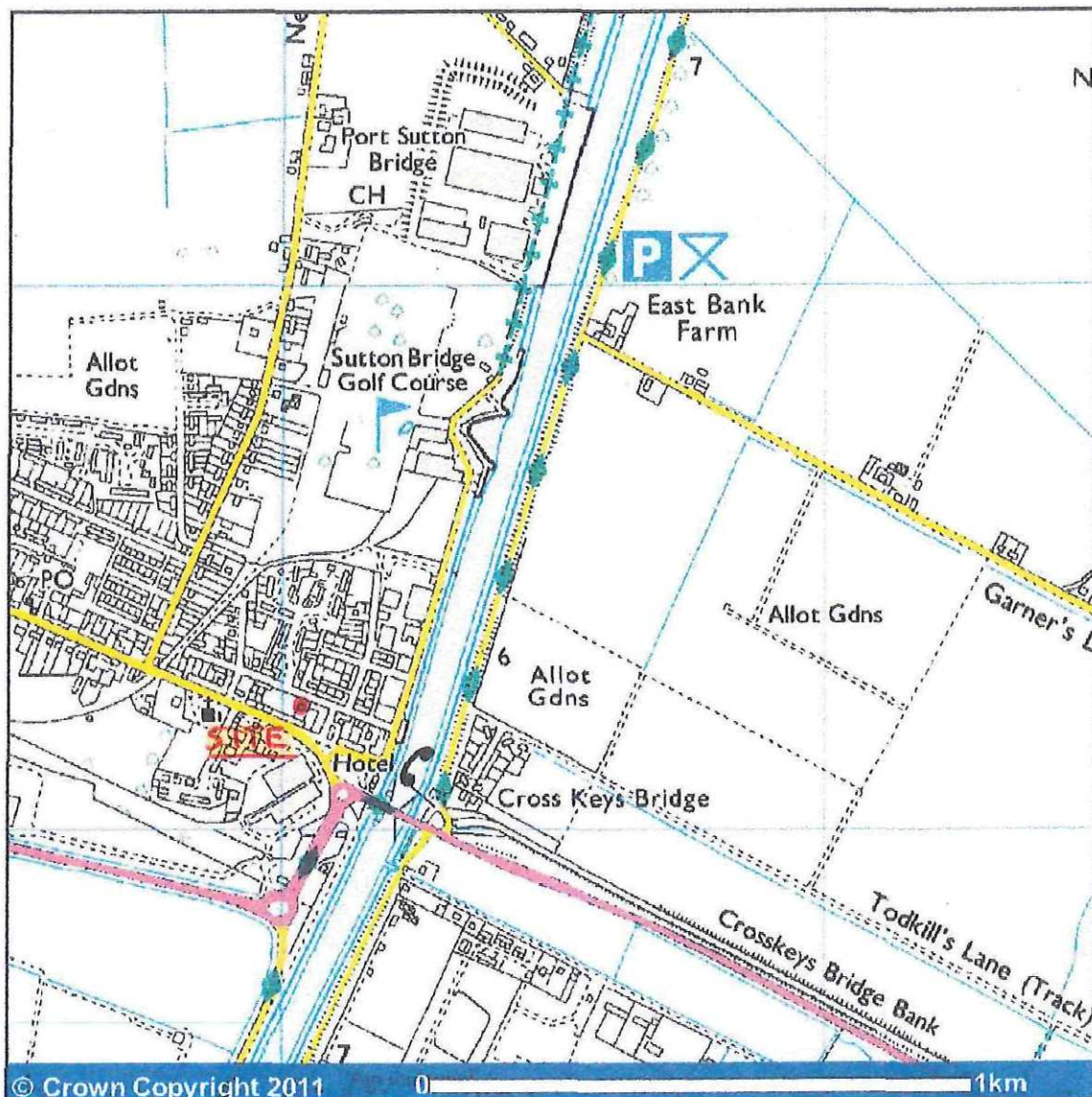
The Strategic Flood Risk Assessment has produced more definitive Flood Risk Maps than those published by the Environment Agency and at the same time has analysed flood return periods of all tidal and fluvial defences for years 2002 and 2052 to account for the effects of climate change.

- 9.4 As a result of the Strategic Flood Risk Assessment the South Holland IDB area has been determined as providing protection against a 1 in 100 year return period event whilst the River Nene tidal defences at Sutton Bridge provide protection against a 1 in 200 year return period event.
- 9.5 The development site is therefore, as a result of the flood risk assessment for the IDB areas, classified as being protected to 100 year standard, putting it in PPS25 Zone 2, unless the land is otherwise affected by potential flooding from main river or The Wash.

10.0 CONCLUSIONS AND RECOMMENDATIONS

- 10.1 As a result of the assessment, the following conclusions have been reached:-

- The proposed development is not in a Functional Floodplain as defined by PPS25. It is located in the Passive Floodplain protected by tidal defences to a 1 in 200 year return period, (0.5%) and fluvial defences of 1 in 100 year return period (1.0%).
- As a result of the South Holland District Council Strategic Flood Risk Assessment the site is in Flood Zone 2 for fluvial flood events and the actual risk of site flooding from any South Holland IDB main drain system is very low.
- Although the site is located within an Internal Drainage District with a minimum standard of drainage of 1 in 50 years, this accords with Defra guidelines for rural development. Freeboard to design water level of 900mm to lowest land level is available for events greater than 1 in 50 years providing further storage within the drainage channels. The Boards policy is to continue to provide a standard of drainage of 1 in 100 year return.
- On site surface water drainage will be discharged via an existing combined sewer of Anglian Water Services Ltd and hence to a South Holland IDB main drain.
- Residential floor levels of the development will be above existing ground levels with safe refuge provided at first floor level or bedrooms created at first floor level.
- Access and egress to and from the site in the event of predicted tidal flooding would be via Wharf Street to Nene Quay and hence the higher ground of Bridge Road.



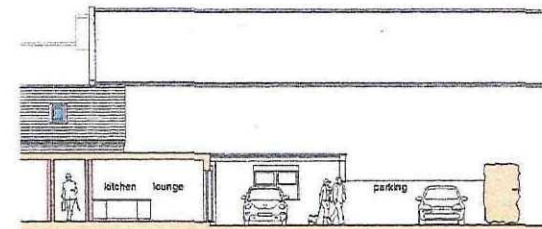
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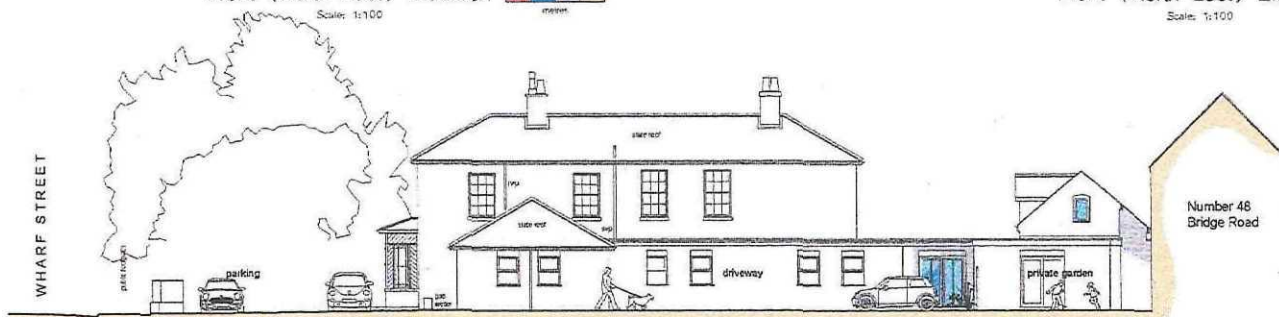
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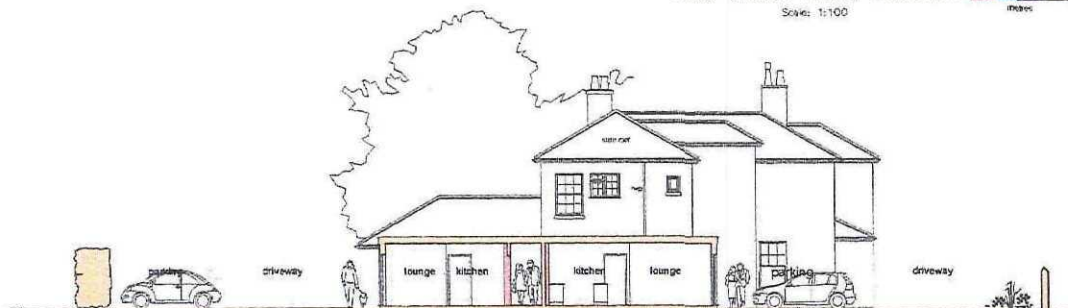
Front (North East) Elevation
Scale: 1:100



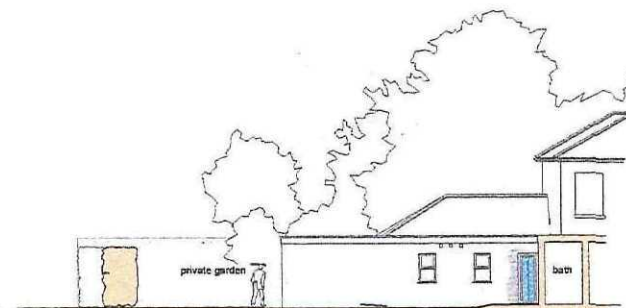
Front (North East) Elevation
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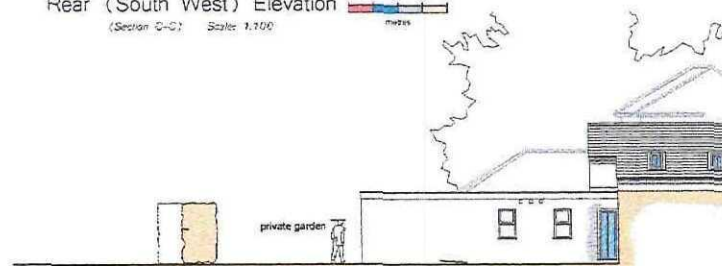
Side (North West) Elevation
Scale: 1:100



Rear (South West) Elevation
(Section D-C) Scale: 1:100



Rear (South West) Elevation
Scale: 1:100



Rear (South West) Elevation
(Section C-C) Scale: 1:100

General Notes:
1. This drawing shall not be used for any other purpose than that for which it was prepared.
2. No dimensions are shown on this drawing.
3. The contractor, subcontractors and suppliers must verify all dimensions on the spot in the absence of any such.
4. This drawing is to be used in conjunction with all relevant approvals and specialist sub-structure drawings and specifications.
5. Any discrepancies are to be brought to the attention of the architect.

SWANN EDWARDS
ARCHITECTURE

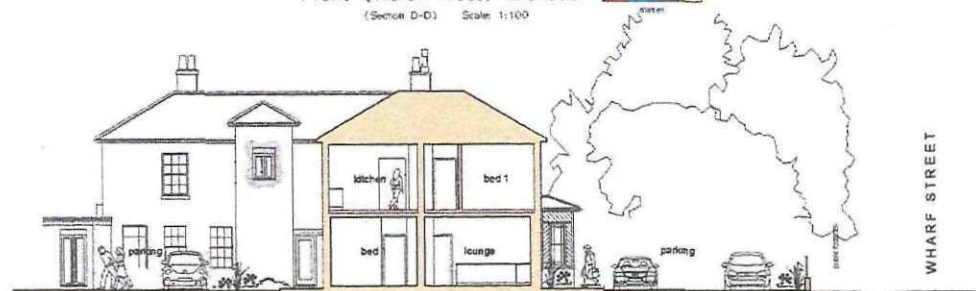
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(In West Dublin a professional address of 100, 101 or 102, 103 or 104, 105 or 106, 107 or 108, 109 or 110, 111 or 112, 113 or 114, 115 or 116, 117 or 118, 119 or 120, 121 or 122, 123 or 124, 125 or 126, 127 or 128, 129 or 130, 131 or 132, 133 or 134, 135 or 136, 137 or 138, 139 or 140, 141 or 142, 143 or 144, 145 or 146, 147 or 148, 149 or 150, 151 or 152, 153 or 154, 155 or 156, 157 or 158, 159 or 160, 161 or 162, 163 or 164, 165 or 166, 167 or 168, 169 or 170, 171 or 172, 173 or 174, 175 or 176, 177 or 178, 179 or 180, 181 or 182, 183 or 184, 185 or 186, 187 or 188, 189 or 190, 191 or 192, 193 or 194, 195 or 196, 197 or 198, 199 or 200, 201 or 202, 203 or 204, 205 or 206, 207 or 208, 209 or 210, 211 or 212, 213 or 214, 215 or 216, 217 or 218, 219 or 220, 221 or 222, 223 or 224, 225 or 226, 227 or 228, 229 or 230, 231 or 232, 233 or 234, 235 or 236, 237 or 238, 239 or 240, 241 or 242, 243 or 244, 245 or 246, 247 or 248, 249 or 250, 251 or 252, 253 or 254, 255 or 256, 257 or 258, 259 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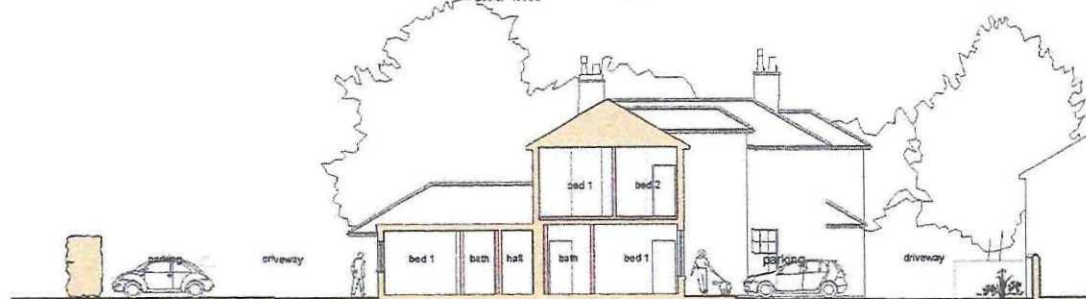
Side (South East) Elevation
Scale: 1:100



Front (North West) Elevation
(Section D-D) Scale: 1:100



Section A-A
Scale: 1:100



Section B-B
Scale: 1:100

General Notes
1. The drawing shall not be used for any other purpose than that for which it was prepared.
2. All dimensions are given in feet unless otherwise stated.
3. The architect, sub-contractors and suppliers must comply with all requirements of the Building Regulations of the day.
4. This drawing is to be read in conjunction with all relevant reports and specialist sub-contractors drawings and specifications.
5. Any discrepancies are to be brought to the attention of the architect.

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ARCHITECTURE

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Client Proposed Conversion of Care Home to Flat to Satisfy House, Wharf Street, Sutton Bridge, for Mr. W. D. Doherty	Date December 2011	Scale 1:100 Main Plan A1
Drawn by Schwinn Edwards Architects	Rev No S2-026	Drawn by RS
	Day No 12	Project

Appendix C

Planning Advice Note PAN 69 Planning and Building Standards Advice on Flooding

WATER RESISTANT MATERIALS AND FORMS OF CONSTRUCTION

80. Water resistant materials and forms of construction may be a material consideration and a requirement of planning permission. Where it is intended to develop in areas that may be at some risk of flooding, guidance on precautionary measures that can be taken is given in 'Design Guidance on Flood Damage to Dwellings, 1996 published by HMSO. This document describes the likely effects of flooding on materials and elements of the building and assesses various forms of construction and measures to reduce the risk of flood damage in dwellings. Although written primarily for dwellings it is also relevant to all small buildings. Further guidance can be obtained from Preparing for Floods, 2002, available free of charge from the Office of the Deputy Prime Minister (www.odpm.gov.uk).

81. This section explains how water affects different materials and forms of construction, and indicates the factors to consider in the choice of materials and how the requirements of the Building Standards can be met.

EFFECTS OF FLOODWATER ON BUILDINGS

82. Floodwater can penetrate buildings rapidly, causing widespread damage to floors, walls, finishes and services, and structural damage in more severe floods. The vulnerability of individual buildings is dependent on construction methods and building materials. For example, poor construction techniques and some common bricks are very porous allowing water to penetrate very quickly to the building interior. Inside the building, gypsum based plasters (e.g. most plasterboard) absorb large quantities of water and distort within minutes of contact with water. Even with measures to flood proof buildings, water will tend to find its way through weak points within the wall such as cracks and voids in the mortar jointing, brickwork or rendering. For semi-detached and terraced houses floodwater may also seep through party walls with neighbouring properties, above or below floor level.

83. The processes and pathways by which water enters a building during a flood depend on the characteristics of the flood - specifically flood depth and duration, and water velocity. Groundwater flooding results in water entering cellars and voids beneath floors causing problems of damp in walls. In general terms:

- Shallow floods will penetrate "weak" points in the building such as air vents and cracks in brickwork, and will overtop doorsteps. The use of flood barriers such as sandbags or proprietary flood proofing systems will merely delay the penetration of water.
- Deeper floods and faster flowing water are likely to penetrate the structure of buildings more quickly. Flood water will enter buildings through a larger number of pathways including drainage pipes from downstairs toilets and baths and even windows that may be broken due to the pressure of water or debris.
- Where flood depths exceed 1m there is a risk of structural damage and collapse, particularly if the water exerts pressure on only one side of a wall.

SECONDARY EFFECTS OF FLOODING

84. There are also secondary effects of floodwater on building structure and the health of the occupants. These impacts include:

- Contamination by sewage and the sediments from both watercourses and blocked drains. Watercourse, coastal and sewer flooding can lead to the contamination of flooded properties. In the case of sewer flooding, raw sewage can be deposited on affected sites. Following a flood, external walls will be dirty and may be permanently stained if not cleaned. Contaminated sediments may be deposited on site and these must be removed.
- Damp conditions following a flood may lead to the growth of moulds that can damage the building and present a health hazard. Buildings with excess moisture, poor ventilation and those exposed to standing floodwater can be breeding grounds for moulds. All moulds have the potential to cause health impacts, such as mild to severe allergic reactions and breathing difficulties for asthmatics.
- Coastal or estuarine flooding can lead to salt water damage such as the corrosion of metal fittings including metal ducting and switch boxes, and steel reinforcement within reinforced concrete.
- Flood damage can also result from the impact of debris, corrosion due to chemical contaminants, changing hydrostatic pressure due to waves, pressure from breaking waves, lift due to the buoyancy of the property and scour undermining the foundations.

FLOOD RESISTANT AND RESILIENT MATERIALS

85. Building design can incorporate materials that are either flood resistant (i.e. unaffected by flood water), such as plastics, or materials that are resilient (i.e. they recover relatively undamaged from flooding). Some materials, such as concrete, can be both resistant and resilient, for example solid concrete floors can provide an effective seal against water rising up through the floor, provided they are adequately designed. In addition solid concrete floors generally suffer less damage than suspended floors and are less expensive and faster to restore following exposure to floodwater.

86. Good workmanship and maintenance will limit the amount of water that can seep through masonry walls. Re-pointing may be needed. Water-resistant coatings applied to porous surfaces will also fill any cracks in the masonry or the joints. To avoid trapping water in the wall however, any such coatings should be micro-porous to allow the wall to 'breathe'.

(2) All materials, services, fittings and equipment used to comply with a requirement of the regulations 9 to 12 must, so far as reasonably practicable, be sufficiently accessible to enable any necessary maintenance or repair work to be carried out.

88. Regulation 8 requires that materials, fittings and components used in the construction of buildings should be suitable for their purpose, correctly used or applied, and sufficiently durable, taking account of normal maintenance practices, to meet the requirements of the building regulations. For example, external timber cladding for low-rise buildings that is readily accessible and replaceable need not be as durable as that which is to be used at a higher level on medium rise buildings.

89. It also implements the intention of the Construction Products Directive, that specification of construction products should not be used to effectively bar the use of construction products or processes from other European countries. The relevant countries are those in the European Union, and those who in the European Economic Area Act of 1993 agreed to adopt the same standards

90. The Technical Handbooks also provide guidance on fitness of materials and workmanship. Traditional constructions, when supported by adequate technical descriptions, may also be appropriate.

91. The EC is introducing durability requirements into European Standards (ENs) for construction products. Durability has been defined by the EC as the ability of a building material, fitting, component, or part thereof to perform its required function over a period of time and under influence of agents. 'Agents' are factors that may affect the durability of a product and include: exposure conditions, temperature, humidity, water, UV radiation, abrasion, chemical attack, biological attack, corrosion, weathering, frost, freeze-thaw, and fatigue.

92. The ABI has recently prepared guidance on flood resilient homes and the cost and effect on future insurance claims of installing flood damage resistant measures. Although prepared in an English context, this information is likely to be relevant UK-wide, and is available at www.abi.org.uk/Display/File/Child/228/Flood-Resilient-Homes.pdf and www.abi.org.uk/Display/File/78/Flood-Resistance-report.pdf

CONSTRUCTION TECHNIQUES

93. There are two basic approaches that may be appropriate for the protection of buildings against the effects of flooding:

- Dry proofing aims to prevent flood water from entering a building. It relies on the use of waterproof barriers integral to the structure, across entrances and non-return valves on drains. Dry proofing a building however can be difficult and is unlikely to work if buildings are subject to flooding for long periods. Simple measures are unlikely to prevent water penetration for more than a few hours while more complex solutions may protect the building for a day or two.
- Wet proofing assumes water will enter the building and is based on the use of water resistant and resilient materials within the building and the raising of electrical wiring and sockets above the maximum flood level. This is the most practical approach and there are a number of ways to limit the damage from flooding. Wet proof construction should also allow water to drain easily from the building following a flood and not retain it in walls, floors and air pockets within the building footprint.

Figure 2: Wet proofing – measures to make the building more resilient to flooding

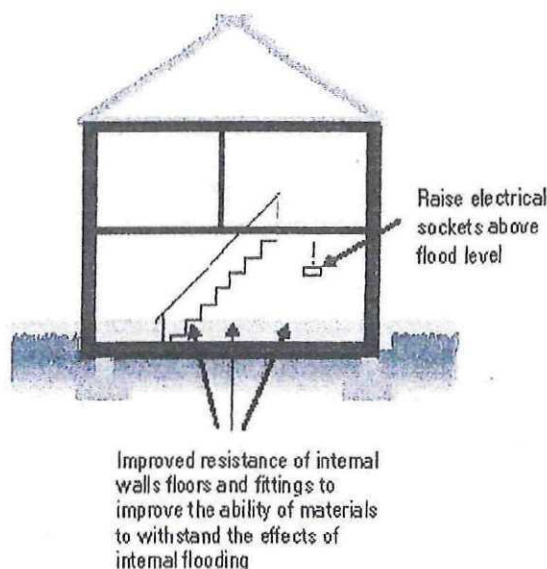
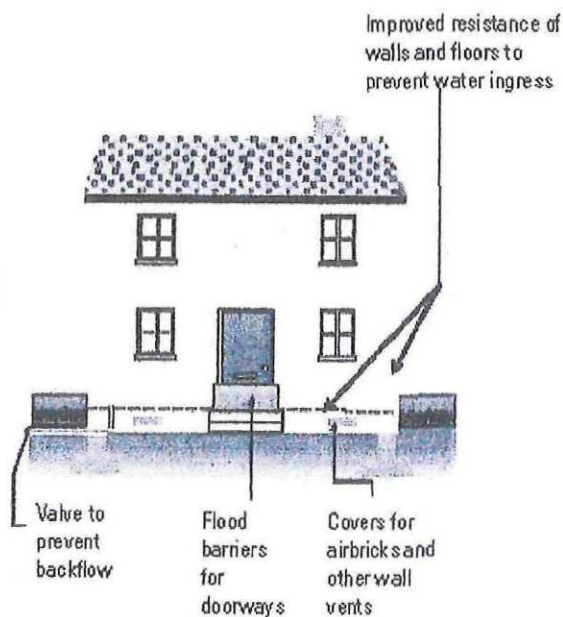


Figure 3: Dry proofing – measures to keep water out of building



94. Further advice on the suitability of different materials can be found in *Preparing for Floods*, February 2002 published by ODPM. Some general comments on suitable and less suitable materials are provided in this Advice Note but the appropriateness of specific measures will depend on site and building characteristics and developers should seek expert advice when flood risk is an issue.

Building components

Component	Most suitable	Suitable	Unsuitable
Flooring	Concrete, pre-cast or in situ	Timber floor, fully sealed, use of marine plywood.	Untreated timber Chipboard
Floor covering	Clay tiles Rubber sheet floors Vinyl sheet floors	Vinyl tiles Ceramic tiles	
External walls (to maximum flood level)	Engineering brick Reinforced concrete	Low water absorption brick	Large window openings
Doors	Solid panels with waterproof adhesives Aluminium, plastic or steel	Epoxy sealed doors	Hollow core plywood doors
Internal partitions	Brick with waterproof mortar Lime based plasters	Common bricks	Chipboard Fibreboard panels Plasterboard Gypsum plaster
Insulation	Foam or closed cell types	Reflective insulation	Open cell fibres
Windows	Plastic, metal	Epoxy sealed timber with waterproof glues and steel or brass fittings.	Timber with PVA glues and mild steel fittings

Box 7

BUILDING AND FLOODING CHECK LIST:

Factors to consider before building in areas where flood risk is an issue

1. Background information

- If flooding is an issue:
- Is the source of floodwater from watercourses, coastal waters, groundwater or sewers?
- If the source of flooding is from watercourses or coastal waters, is the annual probability of flooding greater than 0.5% (1:200)?
- What is the maximum flood level in the 0.5% event?
- Would the site be inundated rapidly, for example due to a breach in a flood defence, or slowly, for example in the case of groundwater flooding?

2. General issues (adapted from ABI, Assessment of the cost and effect on future claims of installing flood damage resistant measures)

- Records of previous flood levels.
- Ground conditions - e.g. permeability and provision of field drains.
- Floodwater pathways into the building - e.g. poorly maintained masonry, ventilation grilles, doors.

3. Floors

- Where possible use dense concrete screeds on solid concrete floor slabs.
- Use treated timber to protect it from rotting if exposed to standing water.
- Use steel joists and wall plates rather than timber.
- Use a damp proofing material around the ends of floor joists.
- Use a sump and pumping system in buildings at risk of groundwater flooding.
- Replace expensive flooring, such as Oak floorboards with treated timber boards.
- Raise floor levels.

4. Walls

- Install air bricks above expected flood level and duct down to solum.
- Use close cell insulation.
- Replace gypsum plaster with more water resistant materials.
- Fix plasterboard horizontally.

5. Interiors

- Replace door hinges with butt hinges that allow door to be removed and placed in a dry area prior to a flood.
- Fit kitchen units with extendable plastic or stainless steel feet so that they will not be damaged by shallow flooding.
- Use raised fitted ovens and fit above highest expected flood level.

6. Services

- Move service meters at least 1 metre (preferably more) above the 0.5% (1:200) flood level if this is known.
- Consider completing electrical wiring from the first floor of the property so it will not require replacement if the property is flooded.
- Can one way valves be placed in drainage pipes to prevent water backing up pipes into the building?

Timber Floors and Insulation

95. Timber joists and floor boards can be treated with preservative to ensure they are more water resistant and to permit them to dry out faster after having been immersed in floodwater. Should joists need to be replaced they can, subject to professional advice, be supported on hangers rather than being built into walls. This can help to minimise the risk of future distortion following wetting and drying.

96. Many suspended timber floors in modern buildings have mineral wool insulation between the timber joists. This material has poor flood resistance closed cell insulation should be used.

Drying out

97. If suspended floors are used, some form of access for inspection and drying out of the underfloor area should be provided. The use of a sump and an identified drainage point where a pump can be installed to drain any flood water should also be considered.

Solid concrete floors

98. In flood prone areas solid concrete floors are generally considered more resistant because they prevent water accumulation beneath the floor level. The concrete has to be of good quality and the damp-proof membrane fully sealed and connected to the damp-proof course rather than just lapped. It may be advisable to raise ground floor levels above the expected flood levels and this could affect other issues such as accessibility. Early discussion with the Planning Authority and Building Standards is encouraged for any site where there may be conflicts between planning and building standards requirements.

TEMPORARY FLOOD BARRIERS

99. Temporary flood barriers will help to reduce the rate at which floodwater comes into a building but will not offer complete protection from flooding and are not an alternative to robust building techniques. Temporary free-standing barriers typically hold water back from a group of buildings or a detached building. In most cases additional pumps may be necessary to remove floodwater that may seep around a barrier. Temporary removable household flood products fitted to individual buildings help prevent water entering through doors, windows, air-bricks and vent covers. Floodwater may be substantially prevented from entering through building fabric with a flood 'skirt' which is designed to wrap around a building. The maximum height for a temporary flood product fitted to a building should be no greater than 1 metre above the ground surrounding the building. Temporary barriers installed across gates or driveways may need planning permission.

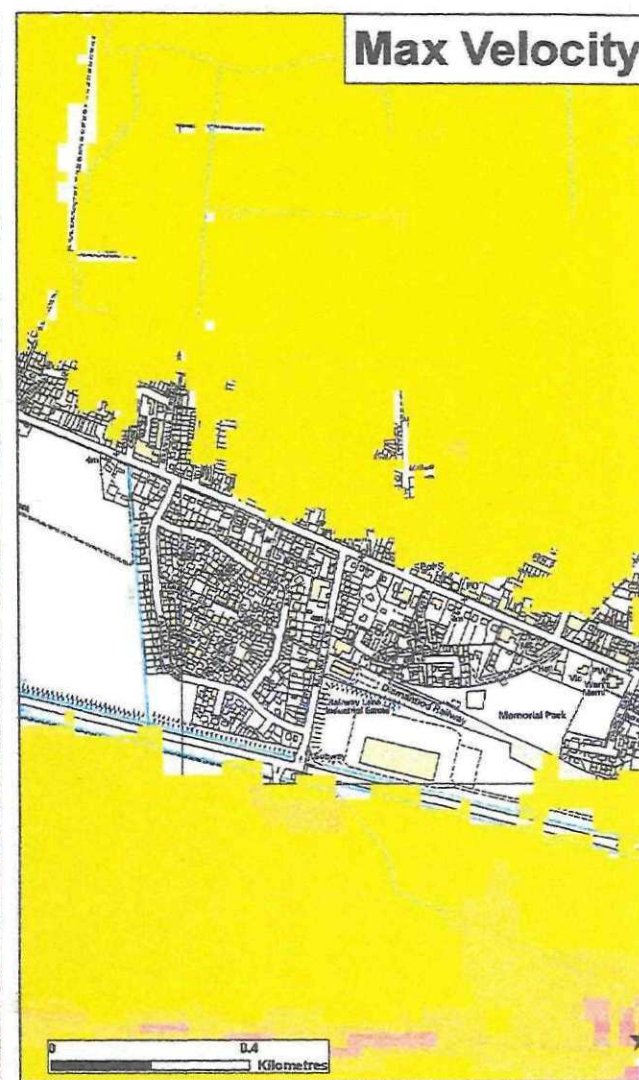
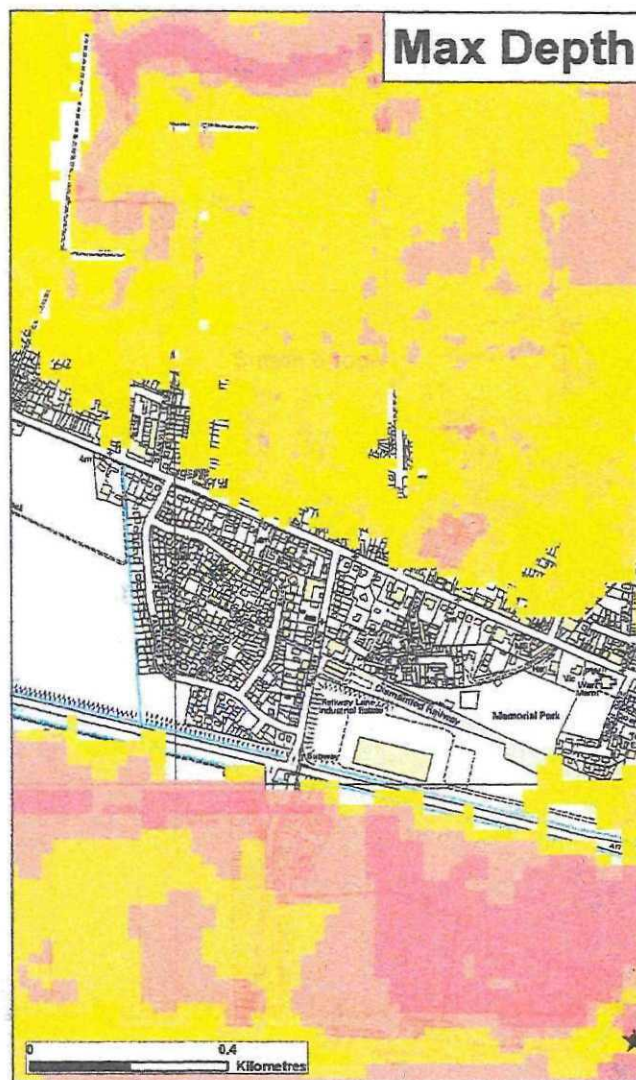
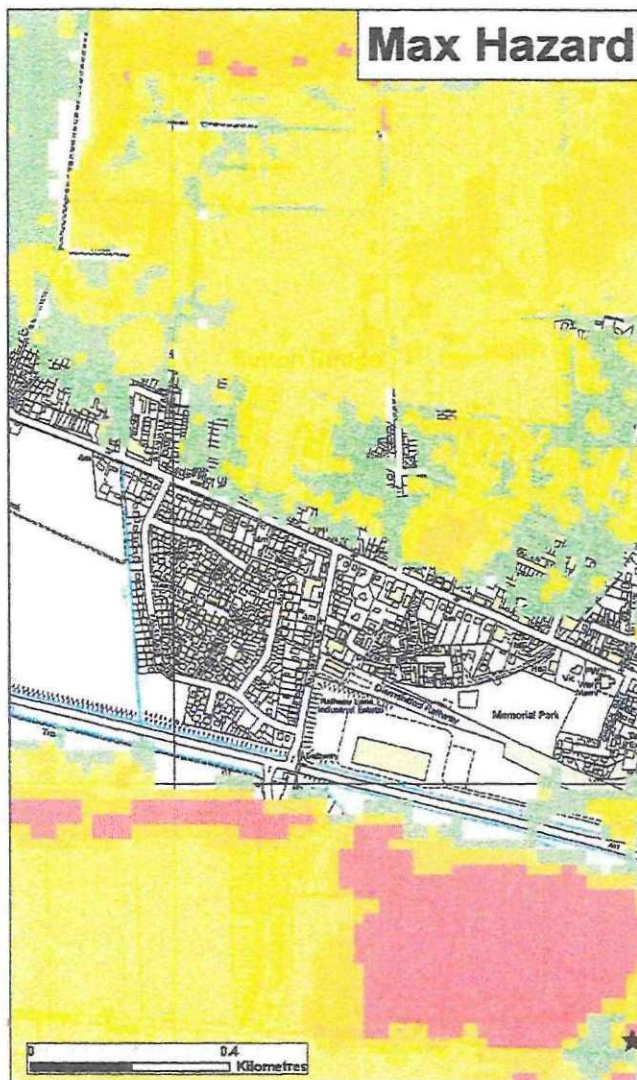
100. It is important that temporary barriers are fitted properly and in good time in preparation for a flood. In upland areas the lead time between flood warning and the flood event may be short so it is important that any barriers are available for rapid deployment and are simple enough to be installed by the home owner. Several temporary flood protection products have successfully achieved national standard performance criteria (BSI 'Kitemark' standard). For information see the SEPA website www.sepa.org.uk/flooding/protection/index.htm

Map of Sutton Bridge, Lincolnshire at scale 1:10,000

Map Legend



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contains Royal Mail data © Royal Mail copyright and database right 2011.



★ **Modelled Breach Locations** - see also the accompanying plan "Location of Modelled Breaches"

Max Hazard (Flood Risk to People : FD2322)		Max Depth (m)	Max Velocity (m/s)
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) 0 - 0.25 0.25 - 0.50 0.50 - 1.0 1.0 - 2.0 2.0 +			
			0 - 0.3 0.3 - 1.0 1.0 - 1.5 1.5 - 2.5 2.5 +
Date Printed	April 2011	Scenario year	2006
		Scenario Annual Chance	0.5% (1 in 200)

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

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

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

Please contact the Environment Agency for further information on emergency planning associated with flood risk in this area.

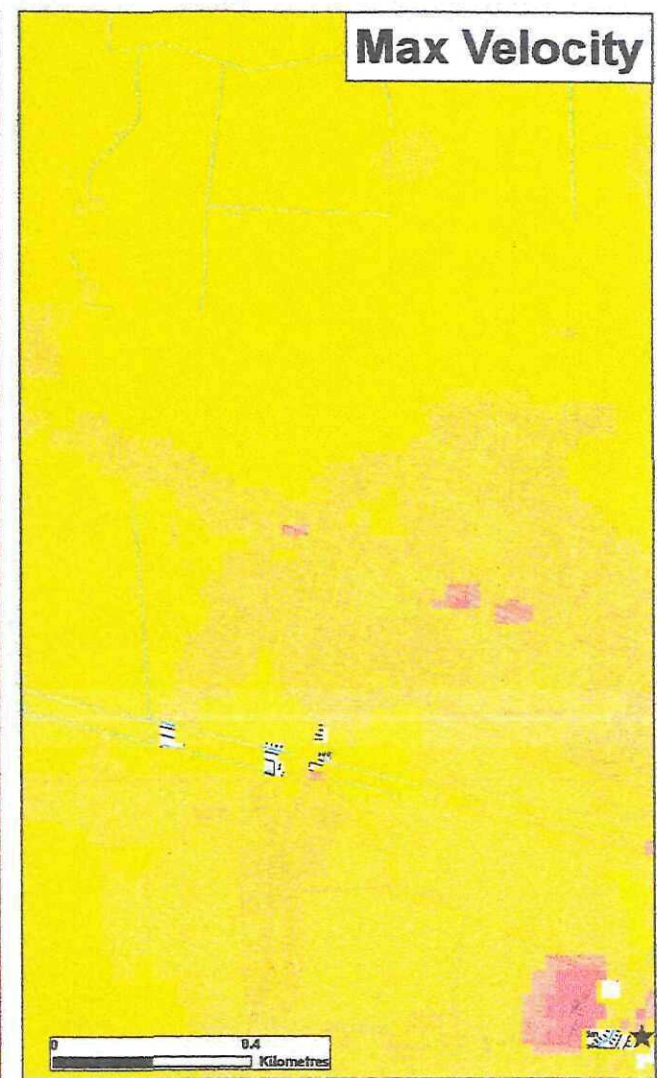
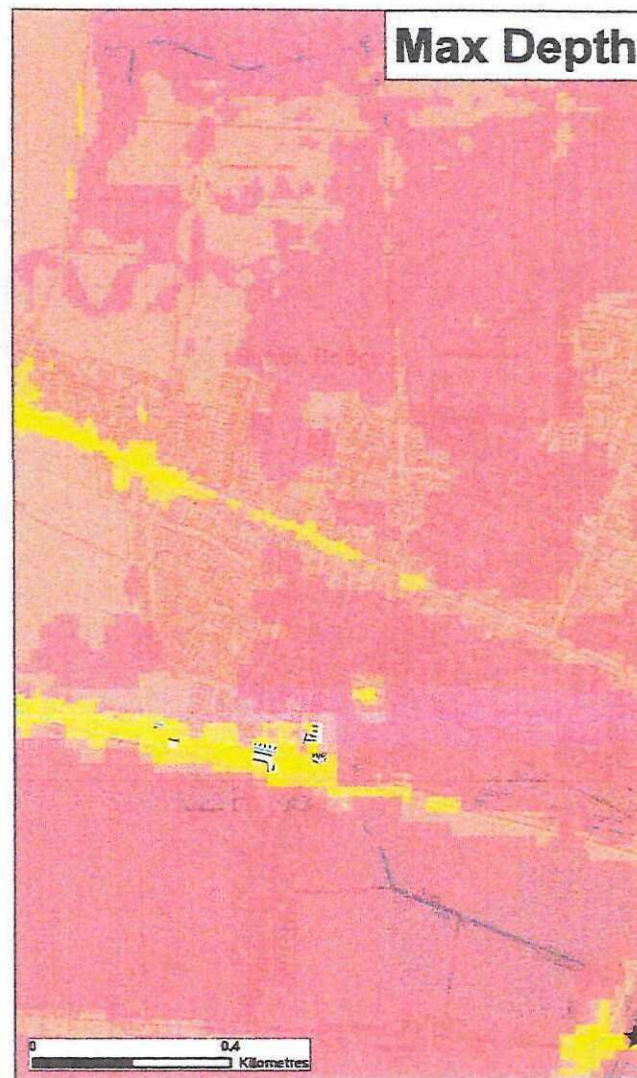
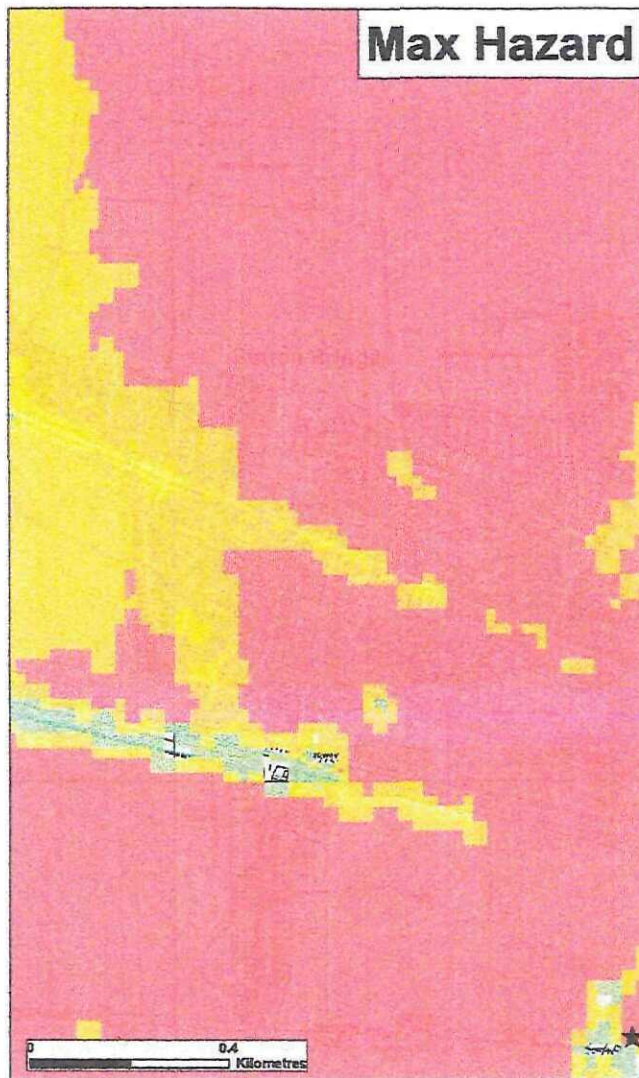
General Enquiries No: 03708 505 506. Weekday Daytime calls cost 5p plus up to 5p per minute from BT Weekends Unlimited. Mobile and other providers' charges may vary.



Northern Area Tidal Breach Hazard Mapping

Map Centered on TF 4731 2148

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★ **Modelled Breach Locations** - see also the accompanying plan "Location of Modelled Breaches"

Max Hazard (Flood Risk to People: FD3320)	Max Depth (m)	Max Velocity (m/s)
Less than 0.75 (Low Hazard)	0 - 0.25	0 - 0.3
Between 0.75 and 1.25 (Danger for Some)	0.25 - 0.50	0.3 - 1.0
Between 1.25 and 2.0 (Danger for Most)	0.50 - 1.0	1.0 - 1.5
Greater than 2.0 (Danger for All)	1.0 - 2.0	1.5 - 2.5
	2.0 +	2.5 +
Date Printed	April 2011	Scenario year
		2115
	Scenario Annual Chance	0.5% (1 in 200)

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

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

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

Please contact the Environment Agency for further information on emergency planning associated with flood risk in this area.

General Enquiries No: 03708 506 505. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary.



Northern Area Tidal Breach Hazard Mapping

Map Centred on TF 4731 2146

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