DEVELOPMENT AND FLOOD RISK SUPPLEMENTARY PLANNING DOCUMENT

IPSWICH
BOROUGH COUNCIL

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www.ipswich.gov.uk

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Issue & Version List

Date	Version	To
1 November 2012	9 following review by Strategic planning	IBC Building Control
	11follows comments received. Quick guide added.	IBC Strategic Planning
7 Dec 2012	12 standard SPD front / back covers +typos corrected.	Will Todd @EA, Ali Moseley SFRS, Jason Burgess IBC Dev Management, Karen Chambers SRF.
12 Dec 2012	13 with amendments for SFRS	To SRF, Will Todd, Ali Moseley
14 Jan 2013	14 new link to Suffolk Local FRM Strategy &, amendments following comments from SRF, EA and Ipswich Building Control	Helen Pluck with draft Exec Report for 5 Feb 2013. Public consultation Feb- March 2013
15 August 2013	15 with amendments following public consultation, revised barrier completion date.	Consultees for Exec Report for 17 th September 2013. Council Approved this SPD on 18th Sept 2013
1 October 2013	16 "Draft" removed, SAB added to glossary, hyper-links checked and updated.	IBC Website
2 May 2014	17 Links updated , refs to PPS25 removed, expected SAB date, links to EA	IBC Web site

Limitations

It is the responsibility of the developer to ensure that all risks relevant to a particular property development are fully considered.

Information contained or used has been gathered from a range of different sources, the providers of such information should be contacted before making any irreversible decisions based upon it.

Ipswich Borough Council provides no warranty as to the accuracy, completeness, or suitability for any purpose of the information contained herein.

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CONTENTS

(Page numbers and cross references are navigable)

1 ABBREVIATIONS & GLOSSARY

AEP = Annual Exceedance Probability. The probability associated with a return period. Thus an event of return period 50 years has an AEP of 1/T or 0.02 or 2%.

AOD = Above Ordnance Datum

ASTSWF = Areas Susceptible to SW Flooding (ignoring underground drainage, buildings or walls)

AW =Anglian Water

CFMP =Catchment Management Flood Plan (for East Suffolk)

DEFRA = Department for the Environment, Food and Rural Affairs

EA = Environment Agency

FDMS = Flood Defence Management Strategy (for Ipswich - tidal and fluvial).

FMfSW = Environment Agency's Flood Map for Surface Water

FREEBOARD = An allowance that reduces risks due to potential inaccuracies in flood prediction such as waves, settlement of defences and errors in levels i.e. the difference in level of defences and the design flood.

FRM = Flood Risk Management –e.g. Flood defences, SUDS, other drainage, emergency plans, resilient designs etc.

FRMP = Flood Risk Management Plan

GIS = Geographic Information System. A software framework that captures, stores, analyses, manages, and presents data that is linked to location

IBC = Ipswich Borough Council

IDB = Internal Drainage board

LP = Local Plan –Ipswich BC's planning framework – was the Local Development Framework (LDF) or Local Development Plan (LDP).

LiDAR = Light Detection and Ranging. Methods for collecting high-resolution topographic data (ground levels).

PFRA = Preliminary Flood Risk Assessment – for Suffolk undertaken by SCC

RBMP = River basin Management Plan (Anglian - Environment Agency)

RP =Return Period – average time between reoccurrences

SAB= SuDS Adoption / Approval Body

SCC = Suffolk County Council

SRF = Suffolk Resilience Forum - Principle mechanism for multi agency cooperation under the Civil Contingencies Act, Members include EA, NHS, Police, Fire & Rescue Service, E England Ambulance service, SCC & District Councils.

SFRA = Strategic Flood Risk Assessment

SFRMP = Suffolk Flood Risk Management Partnership

SuDS = Sustainable Drainage Systems – for surface water runoff

SuDs Train = A series of SUDS features linked together.

SW = Surface Water

SWMP = Surface Water Management Plan

Ipswich Waterfront

2 INTRODUCTION AND POLICY

This is one of a number of Supplementary Planning Documents within the Ipswich Local Plan. It aims to assist developers and their agents in submitting appropriate flood risk and flood risk management information with planning applications.

Section 4 of this SPD explains some small developments can proceed without planning permission. Section 6 explains some other types of development are not permitted in certain flood risk areas.

IBC's Core Strategy Policy DM4 (Development and Flood risk) states:

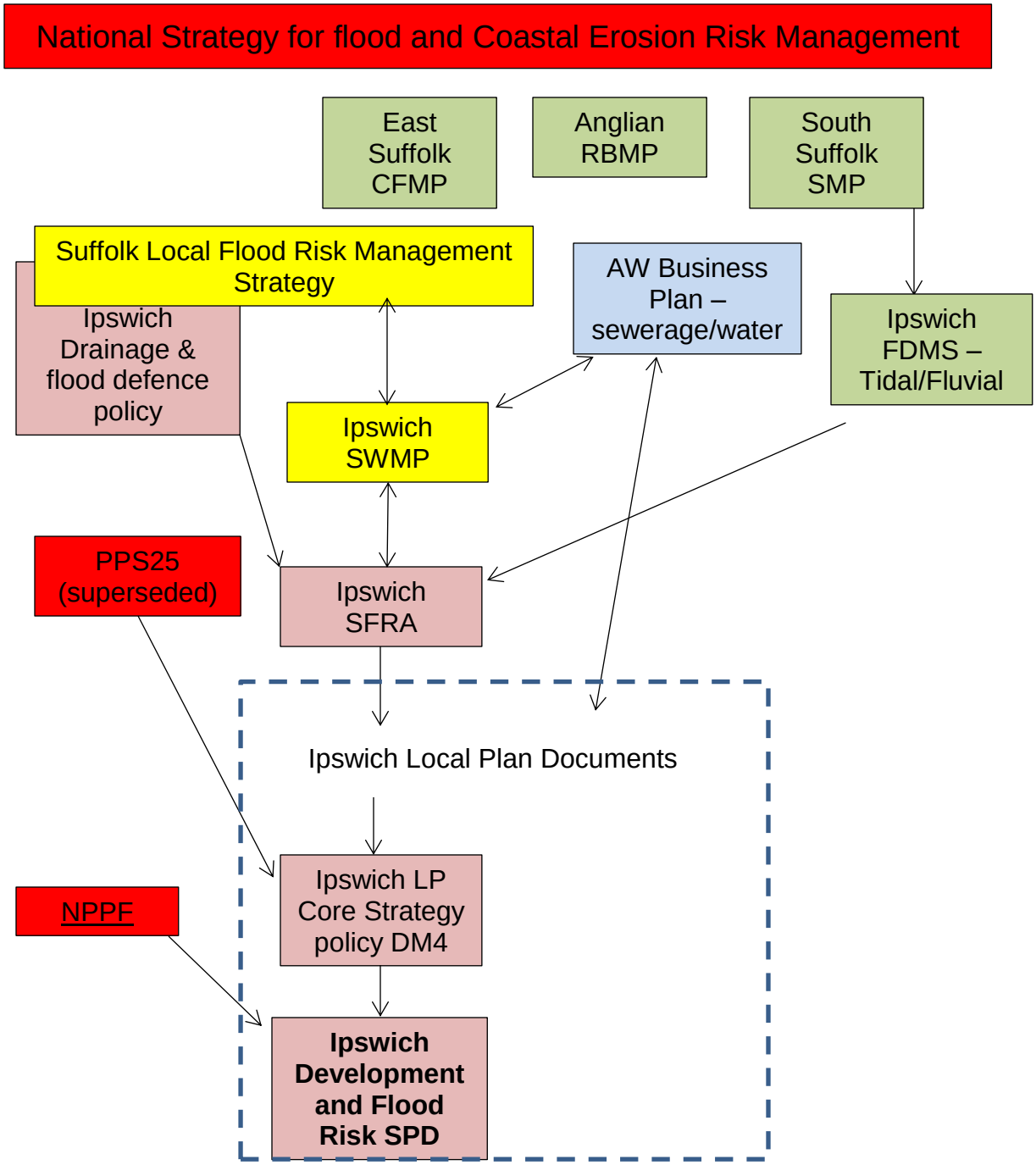
> **Development will only be approved where it can be demonstrated that the proposal satisfies all the following criteria:**
>
> **a. It does not increase the overall risk of all forms of flooding in the area through the layout and form of the development and appropriate application of Sustainable Urban Drainage Systems (SuDS);**
>
> **b. It will be adequately protected from flooding in accordance with adopted standards wherever practicable;**
>
> **c. It is and will remain safe for people for the lifetime of the development; and**
>
> **d. It includes water efficiency measures such as rainwater harvesting, or use of local land drainage water where practicable.**

The Council will apply the following hierarchy for managing flood risk:

Assess
Strategic Flood Risk Assessment (SFRA produced by IBC) and site-specific Flood Risk Assessment (FRA) produced by developers.
Avoid
Layout should be designed so that the most vulnerable uses are restricted to higher ground at lower risk of flooding, with more flood-compatible development (parking, open space etc.) in the highest risk areas. Use Sustainable Drainage Systems (SuDS) at source.
Substitute
Apply the sequential approach to locate more vulnerable development in lowest risk areas.
Control
Use SuDS and implement Surface Water Management Plans (SWMP) to manage and reduce risk.

The SPD includes maps from the SFRA, the SWMP and the EA to help developers identify flood risks and provides information needed by developers to enable them to produce site specific FRAs, and avoid increasing flood risk.

The SPD and the Local Plan (LP) fit in a wider national and local framework of policies as shown below:



Chapter 10 of The National Planning Policy Framework (NPPF) replaced PPS25 in March 2012 and is a “distillation” of the essential elements of PPS25.
The NPPF together with the NPPF Planning Practice Guidance should be read in conjunction with this SPD.

The Strategic Flood Risk Assessment (SFRA) was published by IBC in 2011 but is unaffected by the change to the NPPF. The SFRA informed the Local Plan Documents.

The SWMP, published in May 2012, includes some new flood maps for Surface Water (SW) which are not in the SFRA but are now included in this SPD.

The Floods and Water Management Act is bringing many changes, including:

- Suffolk County Council is now the Lead Local Authority for SW flooding and is required to have a Local Flood Risk Management Strategy in place. The first edition was approved by SCC’s Cabinet in December 2012 and formally approved by Ipswich Borough Council on 15 January 2013.
- Alterations to structures and new culverts, dams or weirs in minor water courses now require approval of SCC.
- SuDS Adoption Body (SAB) to be set up, probably in October 2014. Functions will include enforcing National SuDS standards for all surface water drainage in parallel to planning applications.

Current standards for SuDS are described in The Ipswich Drainage and Flood Defence Policy. This will probably need to be reviewed when the National Standards come into force and SCC’s arrangements for the SAB are finalised.

The National SUDs standards are expected to encourage the use of open swales and basins for storing water from public highways, private paving and roof areas. SuDS “trains” will probably be required and there will be more emphasis on improving water quality and controlling volume of runoff. SuDS draining more than one property are expected to be adopted by the SAB.

Documents used to create this SPD are listed in the reference section 10

This document was produced by Ipswich Borough Council’s Drainage Engineering team, who developed and operate the Council’s Drainage and Flood Defence policy. Ipswich BC has an array of records used to develop the SFRA, SWMP and this SPD.

3 QUICK GUIDE

Is planning permission needed? Go to Planning Portal (internet access required)
Planning permission is not needed for paving less than 5 sq m of front garden.
If paving does not comply with the requirements for Paving more than 5 sq m of front garden, then contact IBC for advice.

Will the planned construction work affect the ability of land to absorb rainwater? e.g. Patios or new buildings and so have drainage implications. If so SAB approval may be required (probably after October 2014). See 5

Is site in tidal or fluvial flood risk zones 2 or 3? See map 9.7
If not go to "All sites" box below.

Sites in Flood zone 2 or 3
Requirements for residential extensions and outbuildings (excluding development that would create a separate dwelling) non-residential extensions with a footprint less than 250sqm, or development that does not increase the size of a building (scroll down webpage)
If development complies stop here and go to "all sites" box below.

Has the development proposal site passed the sequential test? 6

Is the site in functional flood plain – see map. 9.9
Determine "flood risk vulnerability classification" for the development proposal from NPPF Planning Practice Guidance Table 2

Is that "classification" unacceptable in that flood zone? See NPPF Planning Practice Guidance Table 3

If so stop here, contact IBC for advice.

If the classification is "water compatible development", then requirements for safety are at: 8.3.9

Is a safe access available? 8.3.1
If not can it be provided? – contact IBC for advice.

Minimum requirements for safe development (to comply with exception test) - floor levels, safe refuges, flood resilience, emergency plans, requirements & information for emergency services. 8.3

All Sites
Is a FRA required? 7 FRA contents 8
SUDS, layout & form of development. 8.1 Permeable paving guidance. 8.2

4 IS PLANNING PERMISSION NEEDED?

Some developments can proceed without a planning consent. These include small extensions and paving of front gardens, or around commercial buildings; but only if the paving is permeable, or if runoff is drained to appropriate SuDS.
The planning portal provides more guidance…..
http://www.planningportal.gov.uk/wps/portal/portalhome/unauthenticatedhome/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjtxBnJydDRwMLbzdLA09nSw_zsKBAIwN3U_1wkA6zeHMXS4gKd29TRwNPI0s3b2e_AGMDAwOIvAEO4Gig7-eRn5uqX5CdnebogKgIAGUwqho!/dl3/d3/L2dBISEvZ0FBIS9nQSEh/

For paving of front gardens go to:
http://www.planningportal.gov.uk/permission/commonprojects/pavingfrontgarden

5 IS SAB APPROVAL NEEDED?

Probably from October 2014, major developments which include surface water drainage will also require approval from the SuDS Approving Body or SAB (SCC) before construction can commence.

There may be a phased implementation, starting with either large or small sites.

DEFRA propose that SAB approval will not be required for the first 12 months:

- for development already granted planning permission before commencement; or
- for developments with one or more reserve matters where an application for approval of reserved matter(s) is made; or
- for which a valid planning application has been submitted.
- The SAB would also be responsible for adopting SuDS which serve more than one property, where they have been approved.

Highways authorities will be responsible for maintaining SuDS in public roads.

Developers may submit a joint SAB and planning application to IBC or:
Submit the planning application (including, where appropriate a FRA) to IBC and the drainage application to the SAB. SAB applications received by IBC will most likely be passed to SCC, together with any comments. The SAB will also consult relevant bodies. Precise arrangements remain to be decided.

The following text applies only if you need planning permission.

6 THE DEVELOPMENT MANAGEMENT PROCESS

The NPPF describes the sequential test which needs to be applied and passed for developments in flood zones 2 and 3. Site and land use allocations in the LP were made following the sequential approach. The same approach should be applied at site level. i.e. locate the most vulnerable types of development in areas at lowest risk.

For some forms of development in flood zones 2 and 3 the exception test (described in the NPPF) also needs to be applied and passed.

For sites not allocated in the Local Plan the developer will be required to undertake a sequential test and, when required, the exception test. Contact IBC's Development Management Team for advice.

Table 1 of the NPPF Planning Practice Guidance explains flood zones, and assigns flood vulnerability classes to various forms of developments in Table 2 . (e.g.: Dwelling houses, student halls of residence are "more vulnerable")

Table 3 of the NPPF Planning Practice Guidance summarizes which flood risk vulnerability classes of development may be appropriate in the various flood zones.

This is similar to the table presented in PPS25 and the SFRA.
Flood zone maps are included in this SPD see 9.7, 9.8, and 9.9

Highly vulnerable development will not be permitted in flood zone 3a or 3b.

Basement dwellings are not permitted where the floor level is below the 0.1% AEP tide level predicted in 100 years' time (map 9.8) or in Areas Susceptible to SW flooding. (Map 9.1)

For large sites and those in flood risk areas, applicants must submit a site specific flood risk assessment (FRA) with their planning application,

Section 7 of this SPD explains when FRA's are required and sets out requirements for contents. Further advice can be obtained from IBC's Drainage Engineering team.

FRA's which contain errors or are incomplete may lead to refusal or delayed decisions.

For larger sites, in particular, layouts will be affected by flood risk considerations developers should therefore involve appropriate consultees at the earliest stage in order to address any flood issues.

The most likely consultees who may have interest in flooding are listed below:

- **Anglian Water** – foul, combined and surface water sewers. Responsibility now includes all lateral drains under highway and all ex private sewers serving >1 property.
- **The Environment Agency** - Strategic overview, tidal and fluvial flooding in Flood Zone 3, works or operations in the bed of or within 20m of the top of a bank of a main river, development within 9m of a main river or formal defence, pollution of water and ground water, sites>1 Ha.
- **IBC Drainage Engineering Team** – IBC's drainage and Flood defence Policy, Local knowledge, records of flooding and drainage, SuDS and soakaways (pre SAB), SFRA, IBC owned drainage, safety of development in flood plan.
- **Suffolk County Council Highways** – Highway drainage, including prevention of highway runoff entering homes or runoff from driveways crossing footways.
- **Suffolk County Council** - lead local authority for local flood risk- consents to alter or build structures in ordinary watercourses, probably from October 2014 SCC will act as SAB and all SW drainage will need to be approved by SCC.
- **Suffolk Resilience Forum (SRF**) – Police, Fire & Rescue, Ambulance, SCC and District Councils – emergency planning. The SRF will only comment on developments that need to pass the exception test.
- **Network rail** – especially where drainage such as soakaways may affect the stability of the side slopes of cuttings or railway drainage or culverts or drainage needs to cross railways.
- **Internal Drainage Board** - Watercourses in IDB area – adjacent to River Gipping - very unlikely in Ipswich.

The Council accepts that developers may be reluctant to produce detailed drainage designs until planning permission is granted. In this circumstance, if sufficient information to demonstrate the proposed drainage or FRM strategy is achievable is submitted, then a conditional approval or outline consent may be granted. Typically the information required will include a site layout, levels, infiltration rates, storage volumes, discharge rates and location of features to demonstrate there is adequate space to accommodate the required SW drainage features.

Details of the FRM measures would then normally need to be submitted and approved as reserved matters or to satisfy planning conditions before construction can commence. (Note SAB approval will also be needed as described above.)

It is possible planning permission may be granted but SAB Approval not granted. The developer should therefore ensure applications are consistent and complementary.

For very large sites where development, drainage and detailed planning applications are phased, a master plan for drainage will be required as part of the outline planning application. Developers are advised to involve the appropriate consultees at the earliest possible stages to contribute and agree the contents.

7 IS A FLOOD RISK ASSESSMENT NEEDED?

For residential extensions and outbuildings (excluding development that would create a separate dwelling) in Flood Zones 2 & 3 (map 9.7), non-residential extensions with a footprint less than 250sqm, or development that does not increase the size of a building, a very simple FRA (which provides floor levels and, if appropriate, details of flood resilience or resistance measures) would be required. The link below provides further information.

https://www.gov.uk/planning-applications-assessing-flood-risk

A more detailed FRA will be required for the following proposals:

- Development within a critical drainage area* or Flood Zones 2 & 3a, 3b.
- Development on sites of 1ha or greater; or
- Development or changes of use to a more vulnerable class that may be subject to land, groundwater, sewer or canal flooding.
- Development in areas shown on SW flood maps. 9.1
- Basements and lowered ground levels.
- Land raising where it impacts on surface water flood risk. No raising of ground levels should be permitted around the Wet Dock that would impede surface water flood paths from Bridge Street, Key Street, Fore Street and Coprolite Street to the Wet Dock.
- Holywells Road area - FRA's to consider canal embankment failure & risk of overtopping (outlet often blocks), defective unrecorded highway drainage, sewer flooding, runoff from frontage development as well as tidal flooding.
- Sites adjacent to roads with no drainage e.g. Humber Doucy Lane (Site 30), Parts of Whitton Church Lane - drainage and flooding of highway to be resolved as part of the development

*At November 2012 the EA had not notified Ipswich BC of any "critical drainage areas" in FZ1. However there are requirements for FRAs for development in areas shown on SW flood maps in this SPD.

Flood maps on pages 36 to 50 are the first step enabling developers to decide risks affecting their sites and whether a site specific FRA is required.

8 FLOOD RISK ASSESSMENT OBJECTIVES & CONTENTS

The key objective of a Flood Risk Assessment (FRA) is to identify and evaluate the risks and show how the development will remain safe over its lifetime. In addition it will need to show how SW flood risks beyond the site will be reduced or not increased.

The FRA should describe existing flood risk management (FRM) measures including drainage systems and proposals for SuDS and other FRM measures. These need to be consistent with other parts of the planning application such as design statements, artist impressions, details of landscaping, highways etc.

The EA provides advice on the contents of a Site Specific FRA for many of the above listed situations:

https://www.gov.uk/planning-applications-assessing-flood-risk

For other situations, advice on FRA contents can be provided by either, the EA or IBC (contact 01473 432854).

FRAs need to consider the effects of climate change over the lifetime of the development. Sea levels are predicted to rise about 1m and peak rainfall intensities increase by 30%.over the next 100 years The SFRA and NPPF provide more information.

Lifetimes are normally 100 years for residential or 75 years for commercial developments, including hotels and halls of residence. Contact IBC to determine an acceptable figure.

The FRA will need to demonstrate how any key surface water flood paths, watercourses or other areas at risk of flooding are to be safeguarded for the future by protecting them from development and obstruction. Drainage designs may need to take account of water flowing into the site from elsewhere.

The most common requirements for FRA's and flood risk management (FRM) measures to be documented in the FRA follow.

8.1 SW Drainage, SuDS, Layout and Form of Development

The NPPF Planning Practice Guide states “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”.

Main issues affecting layout of development

Layout and form of buildings and roads must be designed around SuDS, bearing in mind SuDS should be sited in lower areas, but preferably close to source, making use of topography. In addition infiltration systems must be sited at least 5m from buildings, 5m from adopted highway kerb lines (this might be reduced for shallow lightly loaded infiltration systems) and 10m from railway boundary fences.

SuDS should be sited as close to the source as possible – this reduces depth, excavations & disposal and space requirements.

Side slopes to swales and basins need to comply with standards.

SuDS should not be sited too close to trees or hedgerows. Excavations can damage trees or hedges, some may have preservation orders.

Trees should not be planted too close to underground SuDS or other drainage features as roots and leaf litter can damage SuDS or pipes. Anglian Water have set requirements for clearance between new sewers and trees/shrubs (See Sewers for Adoption ref 23) these will normally be applied to underground SuDS.

FRAs normally need to include ground levels (to ordnance datum) preferably as contours on plans showing SuDS layouts, key flood paths, areas at risk of SW flooding and floor levels.

FRAs need to demonstrate the layout of the development incorporates sufficient, appropriate space for SuDS.

Appropriate SuDS and other drainage measures should aid Core Strategy Policy CS1 & NPPF objectives for reducing carbon dioxide emissions, incorporating water conservation and recycling. Normally designs must avoid pumping of surface water.

SuDS may be “infiltration” type, which soak water into the ground or attenuation systems, which drain controlled flows into sewerage systems or watercourses.

Ground conditions primarily dictate the type of system used:

	Infiltration type SuDS	Attenuation type SuDS
Soil permeability >10mm/Hr.	OK	Use Infiltration in preference
Soil permeability <10mm/Hr.	No	OK
High water table	Base of SuDS must be at least 1m above maximum anticipated ground water level.	May be OK, permanent water possible
Filled land	No	
Contaminated land	Probably Not	OK
Ground water source protection Outer Zone	Subject to Pollution control measures… not directly to aquifer strata	OK
Groundwater protection Inner Zone	OK for Roof water	Ok

The preference is to use infiltration drainage wherever appropriate.

Map 9.6 shows areas where infiltration systems are most likely to be possible (subject to soakage tests). These are areas expected to have sands and gravels that are outside the flood plain, above spring lines and outside known filled areas (which may possibly be contaminated). Inner groundwater protection zones are also shown.

Soils outside the area might be found to be suitable for infiltration systems and in such cases infiltration systems should be used.

Experience shows that even in the Kesgrave sands and gravels, soakage rates may not be high enough for infiltration systems. Soakage rates measured in accordance with BRE365 can vary from less than 1mm/Hr to about 100 mm/Hr depending on the depth and location of the test pit.

Soakage tests carried out in bore holes or small pits are often inappropriate, very inaccurate and not normally acceptable for planning purposes.

For developments, where sufficient space exists for some infiltration drainage, FRAs need to include details of soakage tests (undertaken following BRE365 in pits rather than boreholes) and design calculations.

Some other factors that affect whether SuDS can be used or are needed are:

- Attenuation systems are normally inappropriate for draining small areas where small throttles (<100mm) would be prone to blockage.
- Attenuation systems may be inappropriate in very low-lying areas where sewers are likely to overflow into the storage system.
- Attenuation systems need a suitable outfall with adequate capacity - not a piped or intermittent watercourse or land drain.
- Maintenance/adoption.
- SuDS would not be required to limit flows discharged from developments alongside the Orwell; however the EA has required them to limit flows discharged to the Gipping.
- Infiltration systems should not be used where they could threaten stability of steep slopes.

If an outfall to a sewer is required then preference should be given to draining SW to Anglian Water's SW sewers rather than combined sewers.

Rainwater harvesting systems are encouraged, however these cannot be relied on as a drainage measure unless water usage is guaranteed constant.

SUDS have been promoted by IBC since 2002 via the Council's Drainage and Flood Defence Policy document:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/Ipswich_Flood_Defence__Drainage_Policy_rev_Aug_20091.pdf .

Section 13 of the document provides minimum design standards for SuDS in Ipswich, including requirements for relative levels of gardens, roads and building floors, and side slopes of various SUDS.

IBC's guidance on permeable paving is included in section 8.2.

These standards will be followed until the National Standards are in force.

National SuDS Standards and a SuDS adoption Body (SAB) will probably be implemented from April 2014. Draft standards were in a consultation draft document:
http://www.defra.gov.uk/consult/files/SuDS-consult-annexa-national-standards-111221.pdf

The following link is to DEFRA's summary of responses:
http://www.defra.gov.uk/consult/files/SuDS-consult-sum-resp.pdf

IBC have produced an interim guide - "Guiding Principles for SUDS and SW drainage master plans, with SuDS examples and Lessons". This is available on request.

CIRIA's "Planning for SuDS – making it happen" (2010) also provides some guidance on master planning for SuDS.

In 2011 Anglian water published a SuDS adoption guide "Towards Sustainable Stewardship".
http://www.anglianwater.co.uk/_assets/media/AW_SUDS_manual_AW_FP_WEB.pdf
AW may in certain circumstances also adopt SuDS following their standards.

CIRIA's Publications C532 and C697 C582, (refs 25, 26, & 27) provide more guidance on various forms of SUDS.

SuDS measures must normally be shown on all relevant plans submitted as part of detailed planning applications, in order to demonstrate how SuDS integrate with planned public open spaces, landscaping, roads, trees and buildings. Plans should identify multifunctional SUDs e.g. those which enhance biodiversity or improve water quality.

Some Examples of SUDS in Ipswich

Shallow Infiltration basin drains road via 1:10 grassed side slope which controls erosion. There are no gullies or pipes. Minimal excavation, road has no longitudinal fall.

Flood storage basin and play area, with soakaways beneath. Designed to flood every 30 Years and fill every 100 years. Sited at low point of development. If road gullies block, runoff flows directly to basin without flooding homes.

Landscaped shallow infiltration basin with a soakaway below, at low point on road, close to source – sited on inside of bend in visibility splay. Posts keep vehicles out

Multifunctional shallow basin provides capacity for exceedance flows and is a play area. Soakaways under the surface store runoff from storms up to a 30-year return period. The basin is dry most of the time.

Informal infiltration basin without underground soakaways - encourages greater biodiversity, helps sustain soakage rates, and maintenance is safer and reduced.

8.2 Permeable or Pervious surfaces

Pervious surfaces allow rainfall to permeate through into a porous sub base, which temporarily stores runoff when rainfall exceeds the rate at which it can soak away into the subsoil.
(Permeable surfaces according to CIRIA C582 are formed of impervious materials with voids in the surface to allow water to pass through).

Both the surface of pavement and the subsoil tend to clog and eventually the system may lose its permeability.

Construction of adjoining buildings, or even the pavement itself, will entail excavation and plant movements, which are likely to compact and reduce the permeability of the formation (sub soil). Exposure of the formation to weather is also liable to cause further deterioration of permeability.

Once constructed it will be necessary to ensure the surface is not mistreated by storing soil, oil or other substances, which seal the surface.

As a result, pervious pavements are unlikely to work as expected unless such problems are carefully addressed.

<u>Pervious surface should not be constructed until all other building work is completed.</u>

Infiltrometer or soakage tests repeated across the surface, after excavation down to the anticipated formation level, should provide representative design data. The required thickness of the sub-base can then be determined following CIRIA's Report 156 Infiltration Drainage - Manual of Good Practice or the CIRIA's report C582 - Source Control using constructed pervious surfaces.

Pervious surfaces should be sufficiently low and flat to ensure runoff is kept within the paved area in a 100 year return period storm - based on an appropriate soakage rate and factor of safety to allow for deterioration. Normally there should be no surface flooding in a 30 year return period storm. However standards may be reduced when the depths or duration of flooding are small and there is no inconvenience caused to the user.

Once constructed, the pervious surface will need regular maintenance to avoid problems resulting from clogging.

Where a pervious surface forms, for example private shared car parking areas, special provision may need to be made to ensure the required maintenance takes place. Adjacent trees or other vegetation will increase maintenance needs.

Recommended Specification for Sub base under permeable paving.

The sub base must be free from fines that would clog the base and also strong enough to support anticipated loads as well as being chemically inert and insoluble as follows:

Source table 4.4 CIRIA report C582 – from BS882:1992

	Percentage passing		
Sieve size (mm) nearest UK equivalent	Coarse aggregate 40mm to 5mm	Coarse Aggregate 20mm to 5mm	Single Size aggregate 5mm
50	100	-	
37.5	90 to 100	100	
20	35 to 70	90 to 100	
14	25 to 55	40 to 80	
10	10 to 40	30 to 60	100
5	0 to 5	0 to 10	45 to 100
2.36	-	-	0 to 30

The material should be rough & angular, with a high surface friction, have a CBR of at least 30% and a maximum flakiness index of 25%.

Crushed rock, concrete (with >90% fracture faces) or blast furnace slag is required to achieve this.

Sands and gravels with rounded particles are not acceptable.

Uniformly graded materials are unacceptable since they are liable to move when construction equipment or vehicles pass over it.

Type 1 sub base from the "Specification for Highway works" is not suitable. Large amounts of fines will wash through and quickly clog the base of the pavement.

Recommended Specification for Geotextile fabrics under permeable paving.

Two layers are normally required. The top layer prevents fine bedding or detritus from migrating down into the coarser sub base. The bottom layer prevents soil migrating up into the sub base and helps reduce deformation of the subgrade under load.

The pore size of the geotextile layers must be small enough to prevent soil or debris migrating into the sub base and coarse enough not to quickly clog from the inside or restrict the passage of water.

For soils with <50 % passing the 75 micron sieve

O_{95} < 600 micron (95 % of pores>0.6mm)

For soils with >50% passing the 75micron sieve

O_{95} < 300 micron (95 % of pores>0.3mm)

8.3 Tidal & Fluvial Flooding - Zones 2&3

The EA's Flood Defence Management Strategy for Ipswich, which includes the proposed Flood Barrier, is the most important single FRM measure, expected to help make many developments in flood zones 2 and 3, safe and viable in the future.

The Flood Barrier will have no impact on the Belstead Brook valley or the East bank of the Orwell downstream of the recently constructed East bank defences. Detailed descriptions of the barrier and defences can be found in the SFRA.

The barrier is expected to be operational in early 2017.

Site Specific FRAs must clearly state the frequency of flooding in and around the site taking into account existing defences. Alternatively a FRA could be presented, assuming the barrier is in place, however any planning permission will be conditioned to prevent construction until the final stage of the barrier is under construction.

Maps 9.10 and 9.11 show the frequency of flooding assuming there are no failures or breaches, before and after the Flood Barrier becomes operational.

EA flood zones ignore the presence of defences and in the past some FRAs have erroneously stated the probability of flooding in flood zone 3 is 0.5% AEP.

In general, the probability of flooding will vary across flood zones depending on ground elevation and the standard of defences (which may or may not overtop in a 0.5% AEP event). When the barrier is implemented, the probability of flooding upstream will reduce to < 0.1% AEP.

Even with the proposed Flood Barrier in place, there is small chance the defences could fail or be overtopped during a flood. This combination of risk by overtopping and risk by failure will grow as sea levels rise. The probability of such flooding is very small but FRM measures are required to reduce the consequences and thus manage this residual risk at the end of the development's design life (i.e. allowing for predicted sea level rise).

Proposals for managing residual risks and making the site safe need to be included in the site specific FRA and other parts of the planning application.

Ipswich BC have developed a framework of minimum requirements to make a development "safe" (for the purposes of the exception test & development management). This was first proposed in the 2011 SFRA. The framework is considered to offer an appropriate balance between the objectives of protecting public safety and enabling urban regeneration and the re-use of previously developed land. The Council's Executive supported the safety framework as the basis for the consideration of flood risk and safety matters within the planning policy and development control fields and that it should form the basis for discussions with other key players. Discussions with the EA and SRF have resulted in minor modifications now included in this SPD.

The safety framework requires:

- Buildings to structurally resist loads due to moving floodwater.
- Raised habitable floor levels.
- Emergency plans for flood warning and evacuation arrangements for users of buildings.
- Temporary Refuges for people who may remain in buildings.
- "Safe" access/escape routes for building users which will also assist emergency services.
- Special measures to further assist emergency services.
- Flood resilience measures.

Even if a development complies with the framework there remains a small probability that a flood will occur, putting people at risk. Developers are therefore encouraged to improve on the following minimum requirements.

8.3.1 "Safe" Access

Developers should consider the following "safe" access requirements first, before proceeding further with the other aspects of the framework.

The safe access requirements effectively dictate what types of development may be appropriate - even with the barrier in place.

The SFRA lists and provides comments on safe access requirements for each site allocated by the LP in Flood zone 3.

To determine whether any site has safe access refer to the appropriate hazard map in this SPD:

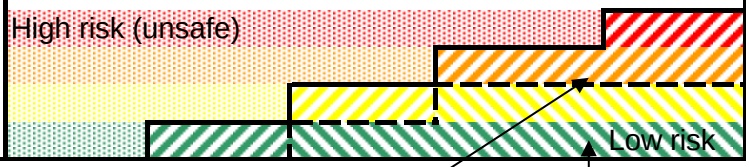
- for the existing defences - map 9.12
- with the proposed barrier - map 9.13

The table below shows what hazards are acceptable on at least one access or escape route from the site to higher ground (where local facilities including shops, schools, doctors' surgeries and buildings likely to be used as places of assembly during flooding are available).

The probability of overtopping is obtained from the appropriate map - either 9.10 or 9.11

Acceptability of Hazards on Access or Escape Routes - In areas protected by defences.

Probability of flooding by Overtopping (% AEP)	< 100 to 20	< 20 to 2	< 2 to 0.5	< 0.5 to 0.1	< 0.1
Return period	> 1 to 5	> 5 to 50	> 50 to 200	> 200 to 1000	> 1000
Flood Hazard based on 200 year event & defence breach or failure					
Danger for all people					
Danger for most people					
Danger for some (eg: Children)					
Caution					



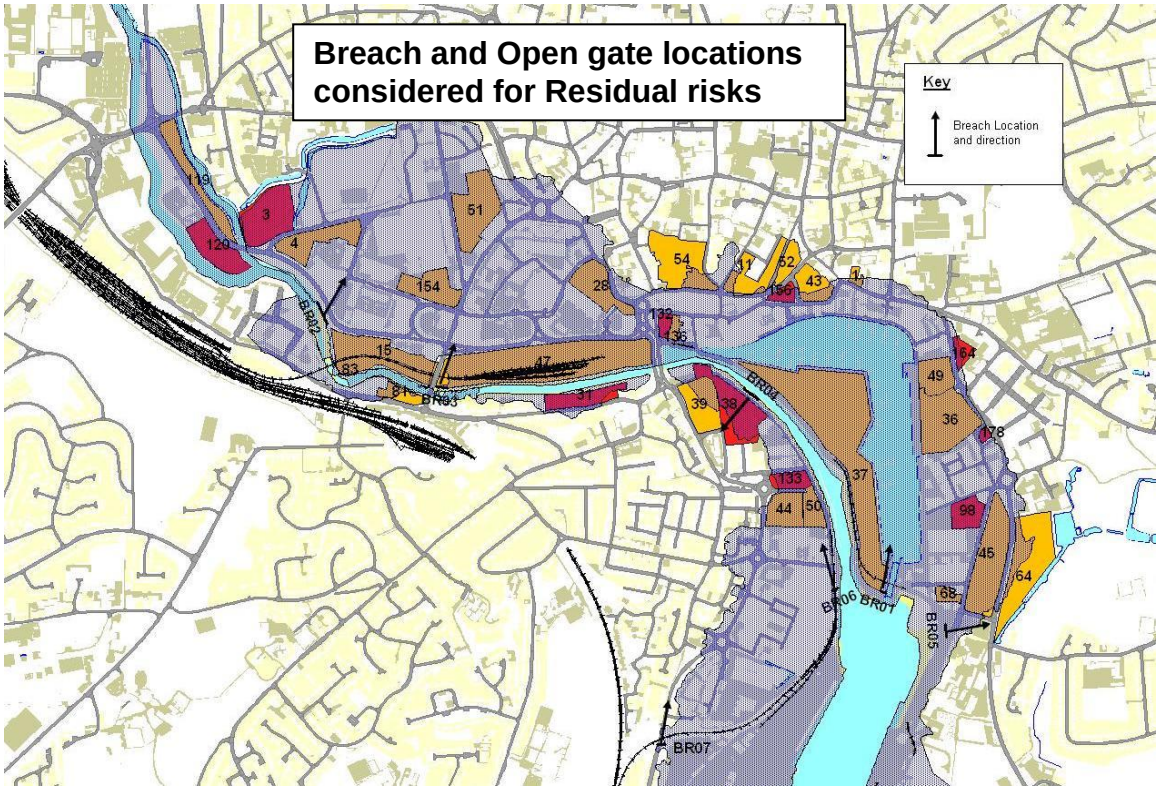
Acceptable hazard for commercial below solid line

Acceptable hazard for Residential or commercial below dashed line.

The exception would be water compatible development -see 8.3.9

It should be noted:

- Safety needs to be considered as a development nears the end of its lifetime so lower access routes may be possible for developments with a design life expiring before 2110. However IBC only have hazard maps for 2010 and 2110.
- If development is proposed close to defences, where breaches have not been considered in the SFRA, then the site specific FRA will need to infer hazard ratings or undertake new 2d Modelling. For further advice contact IBC or the EA.
- The locations of the breaches considered in the SFRA are shown on the following map. The flood hazard maps for the "with barrier" scenario assume a breach at BR05 or BR07. Gates at BR06, BR01 and the barrier are assumed to be fully closed; failure is considered very unlikely.
- The SFRA considered and identified some sites where land raising may be an acceptable way of achieving safe access.



This is a high resolution image, zoom in to view detail.

Developers should consider the safe access requirement first, before proceeding further with the other aspects of the framework

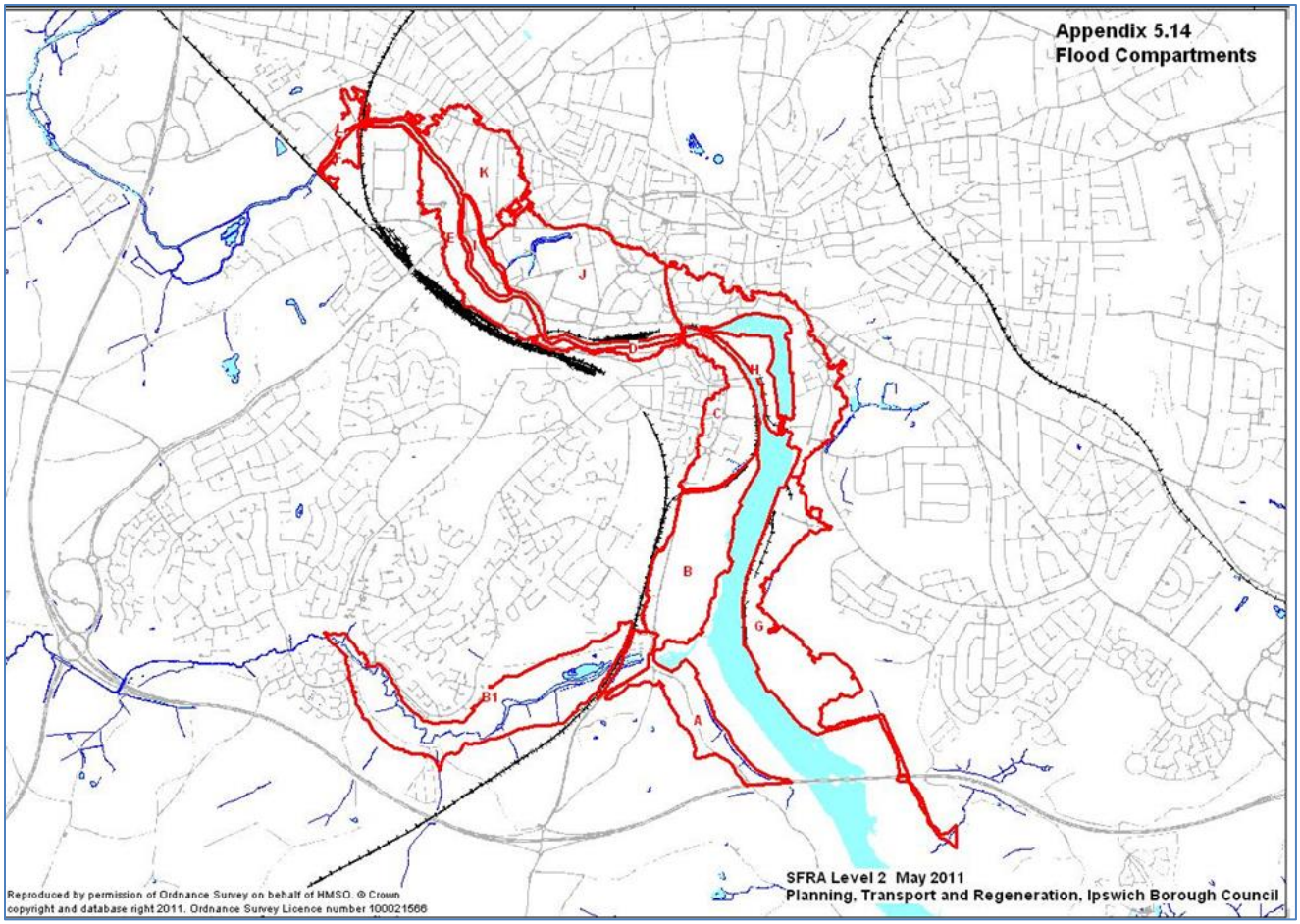
8.3.2 Floor Levels for Habitable Rooms

Habitable rooms include kitchens, living rooms, dining rooms and bedrooms but not garages or utility rooms.

Floor levels must normally be above the 0.5 %AEP flood level in 100 years' time plus a 300mm allowance for freeboard.

Before the new Flood Barrier, this level is 5.3m +300mm freeboard (all existing defences would overtop.)

After the barrier is implemented the design floor levels should be 300mm above the predicted flood level resulting from a breach. The design level varies considerably depending on the flood compartment and will be highest closest to the breach location (see the following map and table).



Use Zoom to view more detail or Download:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.14%20Flood%20Compartments.pdf

Flood compartment	Maximum flood level reached in 0.5% AEP event with breach 05 or 07 with Barrier.
A	5.3 m AOD
B	5.3 m AOD
C	Mostly 3.5m AOD but locally up to 5.3 close to breach07 (future gate across Wherstead Rd) **see map** 9.16
D	4 m AOD - No relevant breach modelled - this is the maximum water level in the Orwell upstream of the barrier before flooding into compartment H occurs. The IFDMS is designed to prevent this in a 300 year RP event
E	No relevant breach modelled. Either model or use 4m AOD as suggested above.
F	Not currently in flood zones 2 or 3, Contact EA regarding fluvial levels
G	5.3 m AOD
H Wet Dock area	Mostly 4m AOD but locally up to 5.3 close to breach05, **see map 9.17 .**
I Island @West End Rd	Most of the island at West End Road has ground levels between 5.5m AOD and 4 m AOD. The 0.1% AEP fluvial level is 3.95m AOD. Habitable floors to be above ground and >4mAOD.
J “Village” / Portman Rd	3.6 m AOD ignoring backflow through sewers from compartment H – safe to assume 4 m AOD but 3.6 m AOD is consistent with Hazard map, **see map 9.17.**
K	At time of writing SFRA was not in Fz3. GL is >4mAOD and <5.3 m AOD

It is anticipated the lower parts of buildings should be used for commercial or car parking uses. Green walls or other measures should be used to improve the appearance of buildings with car parking at ground floor level.

8.3.3 Commercial Floor Levels

Commercial floor levels should be at least high enough to avoid SW flooding in a 1% AEP rainfall event.

With no flood barrier, a minimum floor level may also be required to help businesses obtain insurance. Based on guidance (@2010) from the Association of British Insurers (ABI), flood cover would appear to be available in areas defended against a 1.3% AEP (75year RP) event. Floor levels would therefore need to be above the 1.3%AEP flood level as follows;

Year	Approximate 1.3%AEP tide level
2010	4m
2085	4.6
2110	5.1

DEFRA's "Obtaining flood insurance in high risk areas", July 2012 provides more information - see reference 28 in section 10.

8.3.4 Temporary refuges

A temporary "safe refuge" - is any place where individuals trapped by floodwater can remain for a short period in relative safety whilst awaiting rescue. Safe refuges play a role in reducing the overall risk of flooding; they do not in themselves make a development safe.

Temporary refuges are needed for most developments within the floodplain. They should be above the 0.1% AEP event tide level at the end of the development's life (5.7m AOD by 2111). They would most likely to be needed if there was no time to evacuate, i.e. for sudden breach.

The quality of refuge (provision of facilities, communications, warm clothes, etc.) required must be suitable and sufficient for the likely duration of flooding assuming there is no mains power or telephone services. Landings and stairwells are not suitable for planned temporary refuges.

Plan 9.15 shows how the duration of flooding varies across flood zone 3.

Access routes for residential development complying with 8.3.1 would typically flood for 1-2 hours. Similarly access routes for some commercial developments in the lowest areas could be flooded up to 12 Hours.

Similar durations apply for any new developments that would be permitted in accordance with this SPD before the barrier is operational.

An exception might be commercial developments which are much less likely to be occupied during a flood event and users would be most likely to have responded to flood warnings. However the risk remains in the event of unexpected flooding.

8.3.5 Structural Safety of Buildings

Because the consequences of collapse would be severe, all buildings should remain standing and resist moving floodwater.

Structural design to resist floodwater may be related to flood resistance or resilience measures. For example structural damage might be avoided by allowing water to enter and pass through buildings.

FRA's need to confirm the flood depths and velocities that buildings will be subject to and designed to resist.

Conventional designs for small buildings with masonry walls should be able to resist shallow depths (600mm to 1m) of water where velocities are <1m/sec .

Example of recent flood against a typical home:

Flood level.

No structural damage.

For large buildings or greater depths of water, structural design should take into account water velocities and depths resulting from the worst-case breach/open gate scenario for an event of 0.1% AEP @ 2110 with an additional 300mm allowance for freeboard added to depths.

Flood depth and velocity information for various breach and open gate scenarios is provided in Appendices 5.31 & 5.32 of the SFRA see:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.31%20Flood%20Depth%20Plans%200.1%25%20AEP%202110.pdf
and:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.32%20Floodwater%20Velocity%20Plans%200.1%25%20AEP%202110.pdf

On some sites it may be appropriate for developers to undertake specific breach modelling or include additional detail such as constrictions between buildings in order to ensure buildings remain structurally safe.

8.3.6 Flood resilience measures

Resilient designs minimise damage caused by floodwater by for example: the use of water resistant building materials, decorative finishes, the location of electricity meters and sockets, and readily repairable designs.

Flood resistance, or dry proofing measures intended to stop water entering a building are unlikely to be fully successful and cannot be used in isolation as a mitigation measure.

In flood zones 2 & 3 all new buildings should be "flood resilient" below the 0.5% AEP tide level in 100 years' time (or to higher levels).

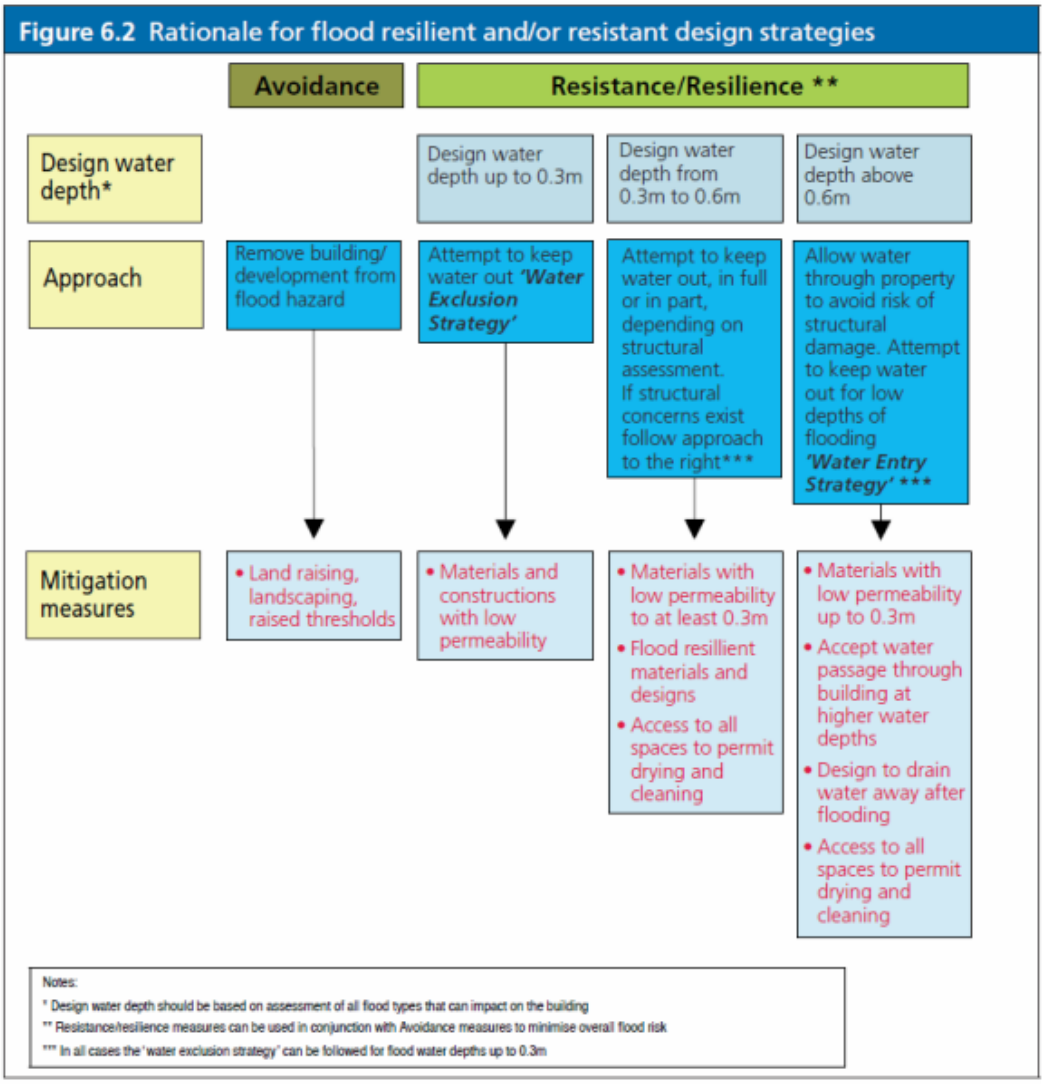
FRA's and planning application details /plans should show appropriate resilience measures from the guidance below:

Guidance can be found in:

- "Improving the Flood Performance of New Buildings - Flood Resilient Construction", DCLG, London. (2007)
  http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

- RIBA's guide "Designing for Flood risk 2nd edition". (2009)
  http://www.architecture.com/Files/RIBAHoldings/PolicyAndInternationalRelations/Policy/Environment/2Designing_for_floodrisk.pdf

- The following table from the former PPS25 Practice Guide:



Source: Adapted from Communities and Local Government 2007 Improving the Flood Performance of New Buildings, figure 4.1) http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

8.3.7 Special Measures and Information to Assist Emergency Services

Emergency services are concerned that development in flood risk areas does not impose additional risks on their staff, or additional demands on their services. They are required to plan for “reasonably foreseeable” emergencies, but the term “reasonably foreseeable” is not clearly defined in terms of probability.

No matter what standards are adopted for flood defences, safe access, or safe working environments there is a chance that some residential or commercial developments may not always be safely accessible by emergency services. Even developments outside Flood zones 2/3 could become inaccessible for short periods during a very extreme and rare flood.

However the proposed Barrier will provide an extremely high standard of defence. The design incorporates factors of safety and back up mechanical systems. Failure is considered to be very unlikely.

The SFRA considered likely demands on emergency services looking over a long time period, taking into account common events, where flooding would be prevented, as well as very rare events when defences would be overtopped:

> **Without the proposed barrier**; risks and demand for emergency services are predicted to increase due to predicted sea level rise. New residential or commercial development would only be permissible around the edges of the flood zones – where safe access is possible. Emergency evacuation plans now need to be activated every 50 years on average, but by 2110 evacuation would be needed annually.
>
> **When the barrier is operational**; risk and demand for emergency services will reduce considerably, even with the anticipated rise in sea level and anticipated increased population due to development. Evacuation plans would initially need to be activated on average every 1,000 years. By 2110 evacuation would be necessary on average every 300 years.

The requirements for safe access to new developments described in 8.3.1 are based on limiting flood hazards to people resulting from a sudden collapse of 20m of defence to ground level, at high tide, during a 0.5% annual exceedance probability event with the sea level 1m higher than in 2010.

The event probability was chosen to highlight how flood risk varies in flood zones and thus enable more vulnerable developments to be allocated to areas less vulnerable to flooding. Such a collapse somewhere, is foreseeable but very unlikely.

The categories of flood hazard rating shown on the Table in 8.3.1 ("Danger to all", "Danger to some" etc.) are from the EA / DEFRA research project, "Flood Risks to People" (2006) 10 described in the SFRA. The requirement for safe access will also reduce the risks to emergency services' personnel but will not make it "safe" for them in all imaginable extreme events.

For the event described above, the duration of flooding (up to 500mm depth) on safe access routes serving planned residential development in the Waterfront area, will be 1- 2 Hours, as shown on map 9.15. Flooding in the Portman road area would take 8-12 hours to drain away but the lack of safe access routes would prevent new residential development here unless a new raised access is provided.

Power supplies are likely to fail during a flood and not everybody will evacuate in advance, so there will be an increased risk of fire in residential properties.

Special measures should be taken to reduce fire risk in flood zones. These should be identified in FRA's and shown on planning application details.

Whilst every effort will always be made by SFRS to respond to fires and rescues, due to the nature and scale of tidal flood events a dynamic risk assessment may determine that FRS resources are unable to respond normally along flooded routes where the depth of flood water at any point is greater than 20cm. This may prevent or delay emergency response. Strategic and tactical risk assessments and resource limitations may also cause response times to vary significantly from normal operating procedures. These issues may also arise for any other type of significant / wide scale flooding event.

The Building Regulations Approved Document B5 'Access and Facilities for The Fire & Rescue Service' includes guidance for provision of areas of suitable hard standing for the fire appliances, as well as specific requirements for access around buildings and building designs to assist with rescue and fire fighting.

Such hard standings and access routes need to be as high as reasonably practicable to reduce the possibility of emergency services being unable to gain access or becoming trapped by flood water but will need to be compatible with floor levels and surrounding street levels (as set out in this framework).

The Fire & Rescue Service is unable to use floodwater or fire hydrants that are submerged for fire fighting. Large building designs should therefore include at least one fire hydrant in the hard standing. This will normally be a raised pillar style fire hydrant with the outlets above ground level. .
A clearly marked secure premises information box should be provided in a safe and accessible location (Agreed with SFRS) containing any special equipment which may be required for operating a pillar fire hydrant.

In addition life safety fire sprinkler systems, designed to be resilient and operate in flood conditions should be considered. Fire extinguishers and alarms should be installed (in compliance with relevant standards) for all developments in Flood zones 2 and 3.

Developers are advised to contact the Suffolk Fire and Rescue Service regarding these requirements before finalizing building designs and FRA's. They are consultees and may require further measures for specific developments.

8.3.8 Emergency Plans and Flood Warning Arrangements for Users of Buildings

A FRA must include an appropriate Emergency Flood Management Plan (FMP) and application drawings are required showing signage and evacuation routes.

Advice should be sought from emergency services when producing an FMP.

The aim will be to self-evacuate on receipt of appropriate advance warnings received via the EA's national system. Severe flood warnings are normally issued at least 2 hours before flooding.

The Environment Agency has recently worked with telephone companies to automatically add households and businesses to their flood warning service. Those with landlines now receive automated flood warning messages. The service can be extended to include warnings via text messages, mobile phones or email. However residents may also choose to opt out.
See: http://www.environment-agency.gov.uk/homeandleisure/floods/38289.aspx

However no warnings would be received for a sudden breach (collapse of defences) when tide levels are significantly below defence levels. In such an unlikely event, evacuation is unlikely to be achievable; in fact it might be more hazardous.

The FMP should advise occupants to use the safe refuge if flooding is imminent or occurring and monitor the situation via local TV or radio, the internet, or mobile phone.

The FMP needs to detail the provision of flood emergency kit(s) for building users, to include information, warning of the dangers of using portable heaters, (carbon monoxide and fire), fuel storage and candles etc. during potential utility failures, dangers of walking in floodwater, flood warning codes and actions, information about the EA's flood warning system, the nearest Ipswich BC Rest Centre location and information on flood insurance. DEFRA's "Obtaining flood insurance in high risk areas", July 2012 provides guidance - see reference 28 in section 10. The SRF can provide fact sheets on candle safety and carbon monoxide poisoning.

Particular attention should be given to the communication of warnings to vulnerable people including those with impaired hearing or sight and those with restricted mobility. The police are responsible for evacuations; they may be able to assist but cannot normally force people to evacuate.

Consideration should be given to informing appropriate response organisations, such as the council's Ipswich HEARS service and Social Services, about any elderly or vulnerable people who may require assistance.

The FMP should deal with potential difficulties involved in immediate evacuation which may need to be carried out in inclement weather and require the provision of transport to reach local authority designated rest centres.

Developers are strongly encouraged to liaise with the developers of any nearby sites in the drafting of their FMP to co-ordinate procedures and so minimise confusion during an incident

Ipswich Borough Council emergency advice web site contains further information and links to the EA's web site
https://www.ipswich.gov.uk/content/emergencies-latest-information

For further guidance contact the Emergency Planning officer at Ipswich BC telephone 01473 433431

Suggested structure for Emergency Flood Management Plans

1.0 Introduction
1.1 Describe the location of the site fully and accurately
1.1.1 Attach a site plan to help identify the location and size of the site
1.1.2 State the size of the development including the number and type of properties within the development.
1.1.3 Define the access and egress arrangements for the site, the height of proposed buildings and the rescue or re-supply points for those instructed not to evacuate.
1.2 State the likelihood of flooding. How big is the risk?
1.3 State who will be responsible for reviewing and implementing the FMP.
2.0 Warning arrangements
2.1 How will occupants be informed if a flood is likely to occur?
2.2 Do you intend to register the site with the Environment Agency's flood warning service 'Floodline'?
2.3 What procedure will you follow in responding to any flood warnings received from the Environment Agency?
3.0 Instructions to occupants in the event of a flood warning
3.1 How will occupants be instructed on the procedures to follow in the event of a flood or flood warnings?
3.2 What will these instructions cover?
3.3 Procedure for passing on information to new occupants?
4.0 Instructions to commercial tenants in the event of a flood warning
4.1 How will commercial tenants be instructed on the procedures to follow in the event of a flood or flood warnings?
4.2 What will these instructions cover?
4.3 When commercial tenants leave, how will new commercial tenants be informed of the flood evacuation procedures?
5.0 Advice and information from developers
5.1 List useful telephone numbers and websites

5.2 Provide residents/tenants with information on the Environment Agency's Floodline Warnings Direct service.

8.3.9 Water Compatible Development

Ideally the above approach should be followed, however it is recognised that providing safe access, raised floor levels and temporary refuges is likely to be impracticable. The operators of docks, marinas and wharves will be familiar with flood risk and so flood warnings are very likely to be followed. Therefore the only requirements are:

- Structural Safety of buildings.
- Emergency plans for evacuation and flood warning arrangements for users of buildings
- Emergency plans for actions by Emergency responders
- Flood resilience measures

9 MAPS

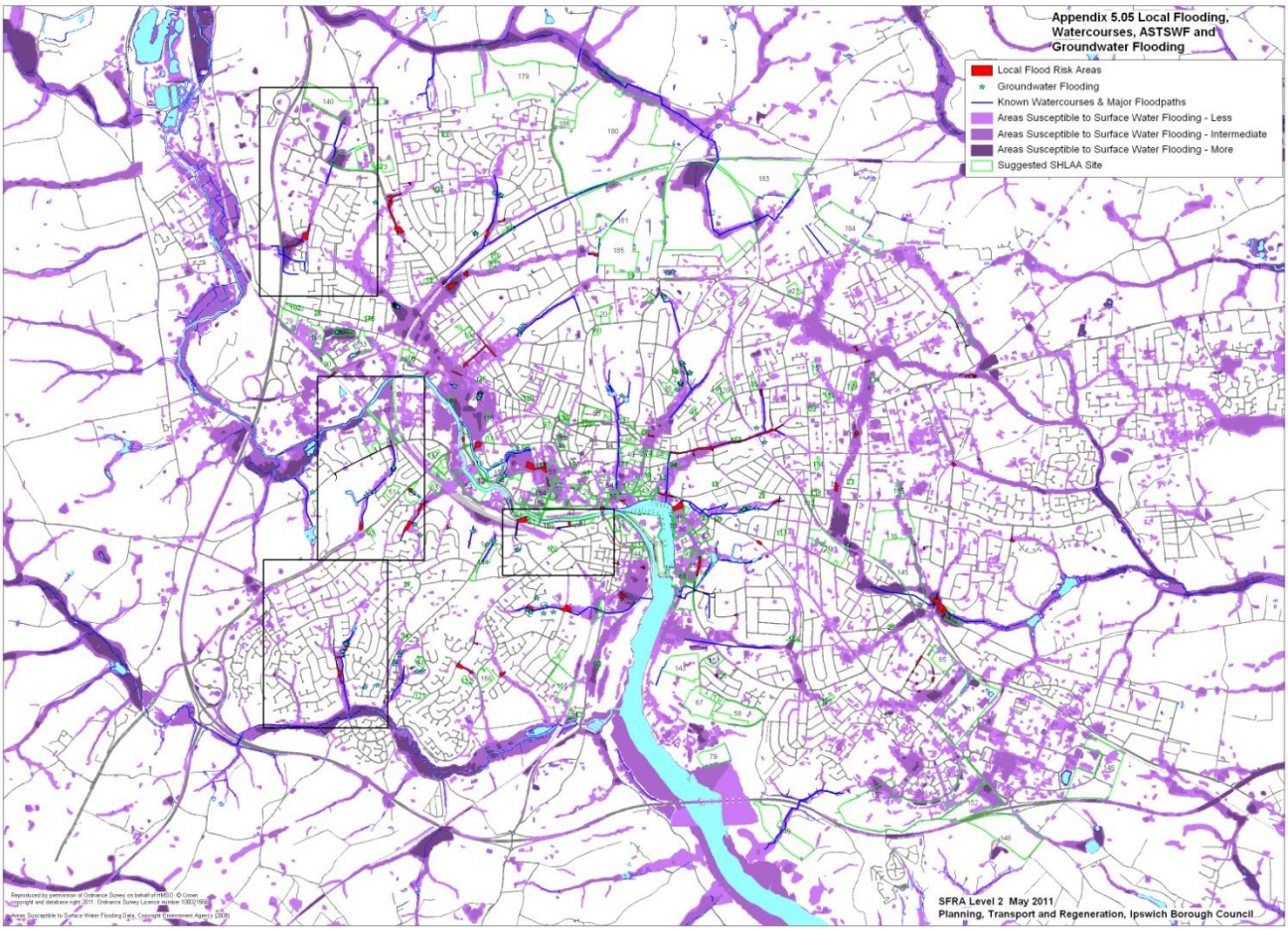
Surface water & ground water flooding maps are followed by tidal & fluvial maps.

Use “zoom in” to view more detail or download SFRA documents where links are provided.

AO or A1 paper copies can be supplied on request (there will be a charge).

9.1 SW Flood Map

This shows the EA’s map “Areas Susceptible to SW Flooding” (ASTWF) together with IBC’s historic local flood map (in red) which also shows approximate locations of reported ground water flooding, watercourses and major flood paths.



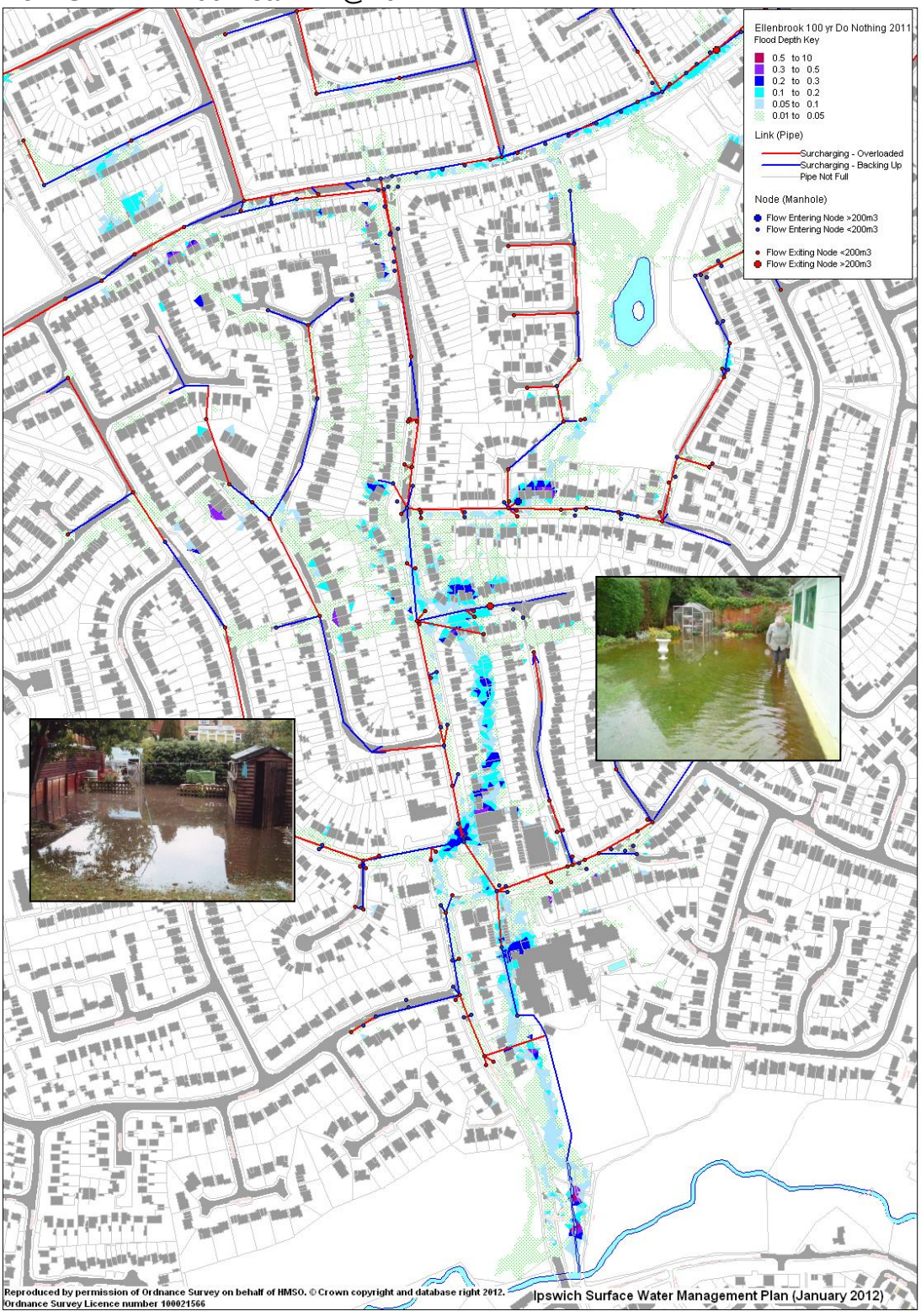
ASTWF may be subject to refinement by FRA’s. The SWMP has already refined the ASTWF map in the 4 locations indicated by the rectangular boxes – maps for parts of these areas follow.

Assumptions made in producing the ASTWF map are described in the EA’s document.

http://www.environment-agency.gov.uk/research/planning/129324.aspX

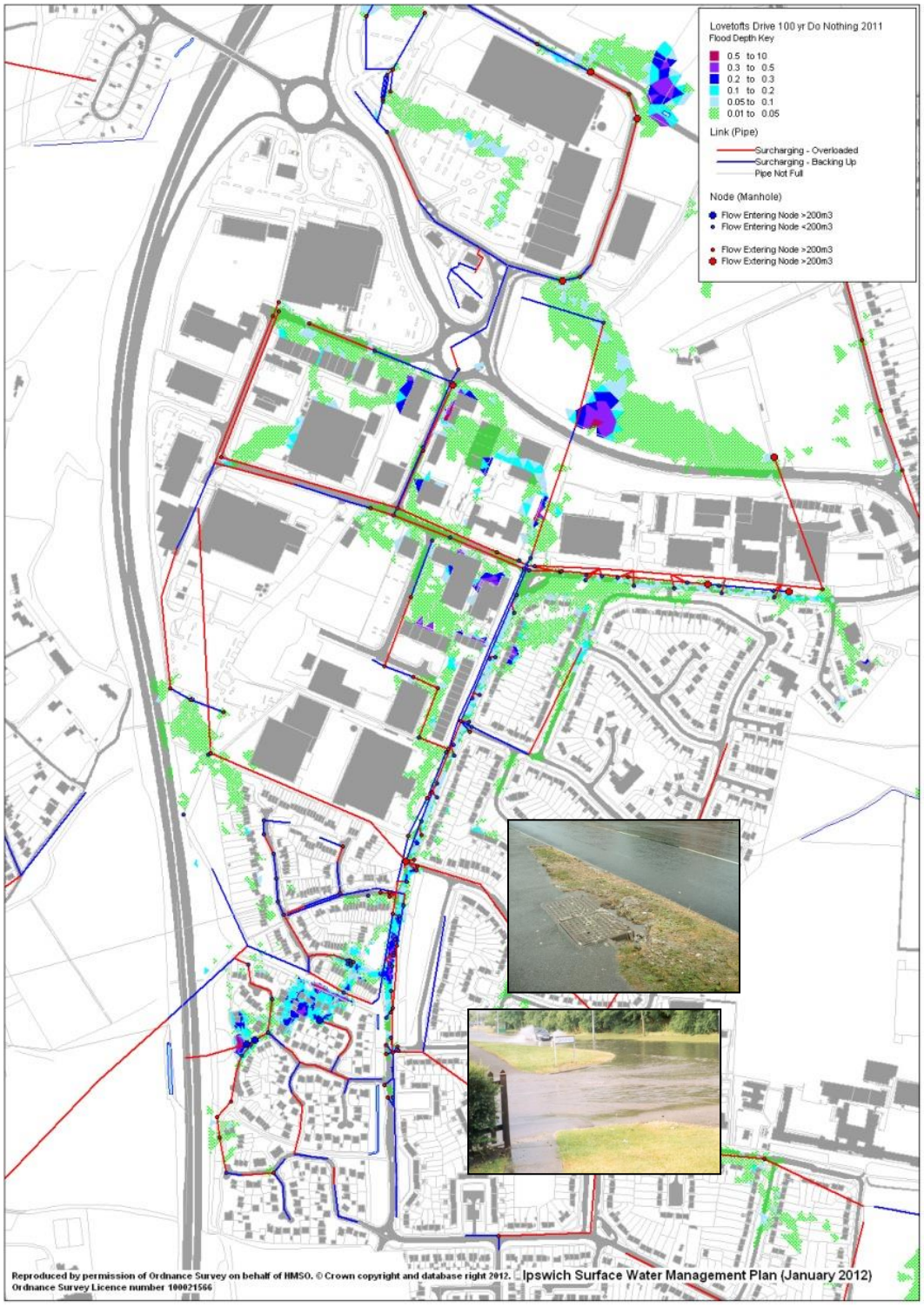
9.2 SW Flood map for Worsely Close / Ellenbrook

From SWMP – 100 Year RP @2011



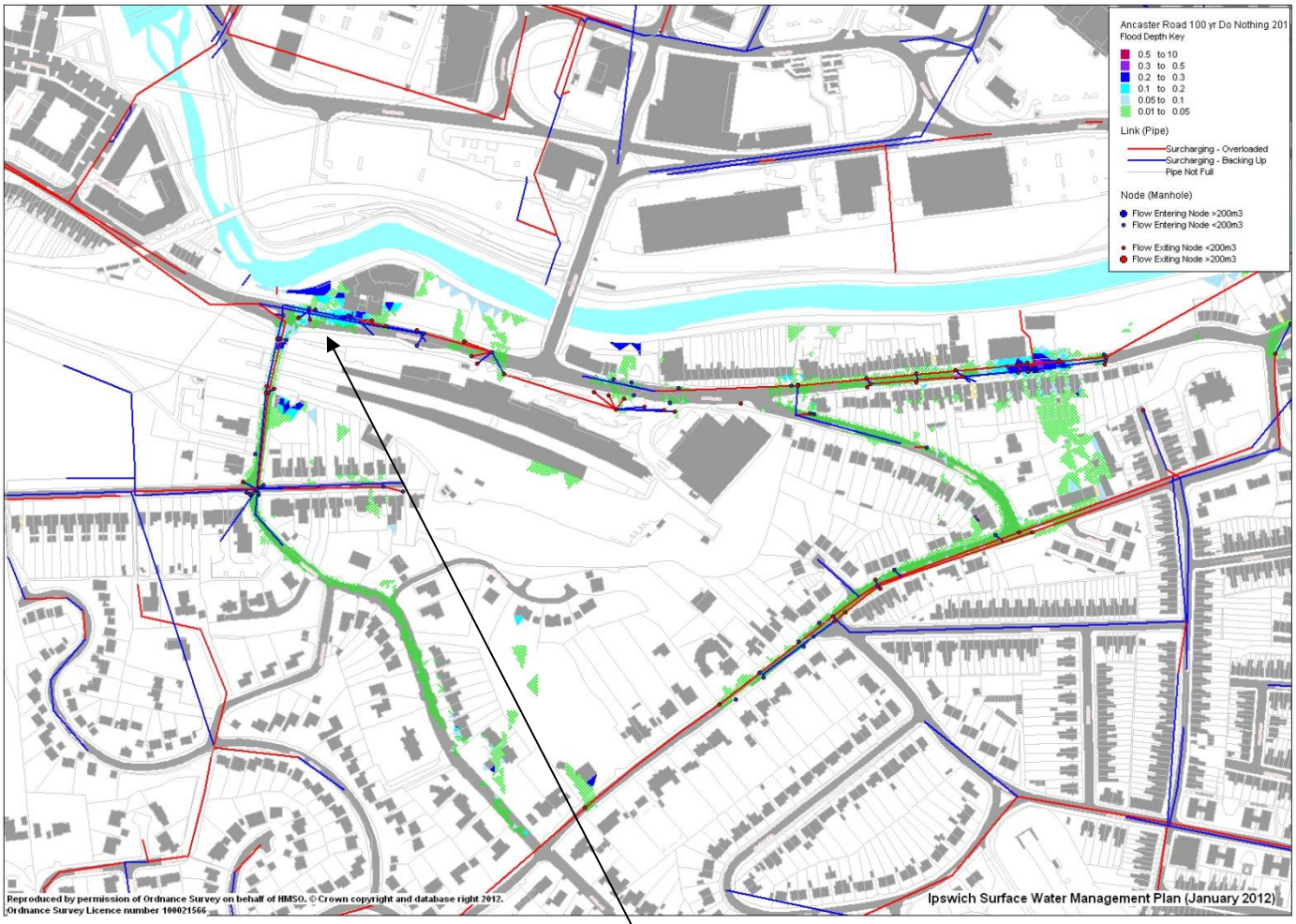
9.3 SW Flood map for Lovetofts Drive area.

From SWMP – 100 Year RP @2011



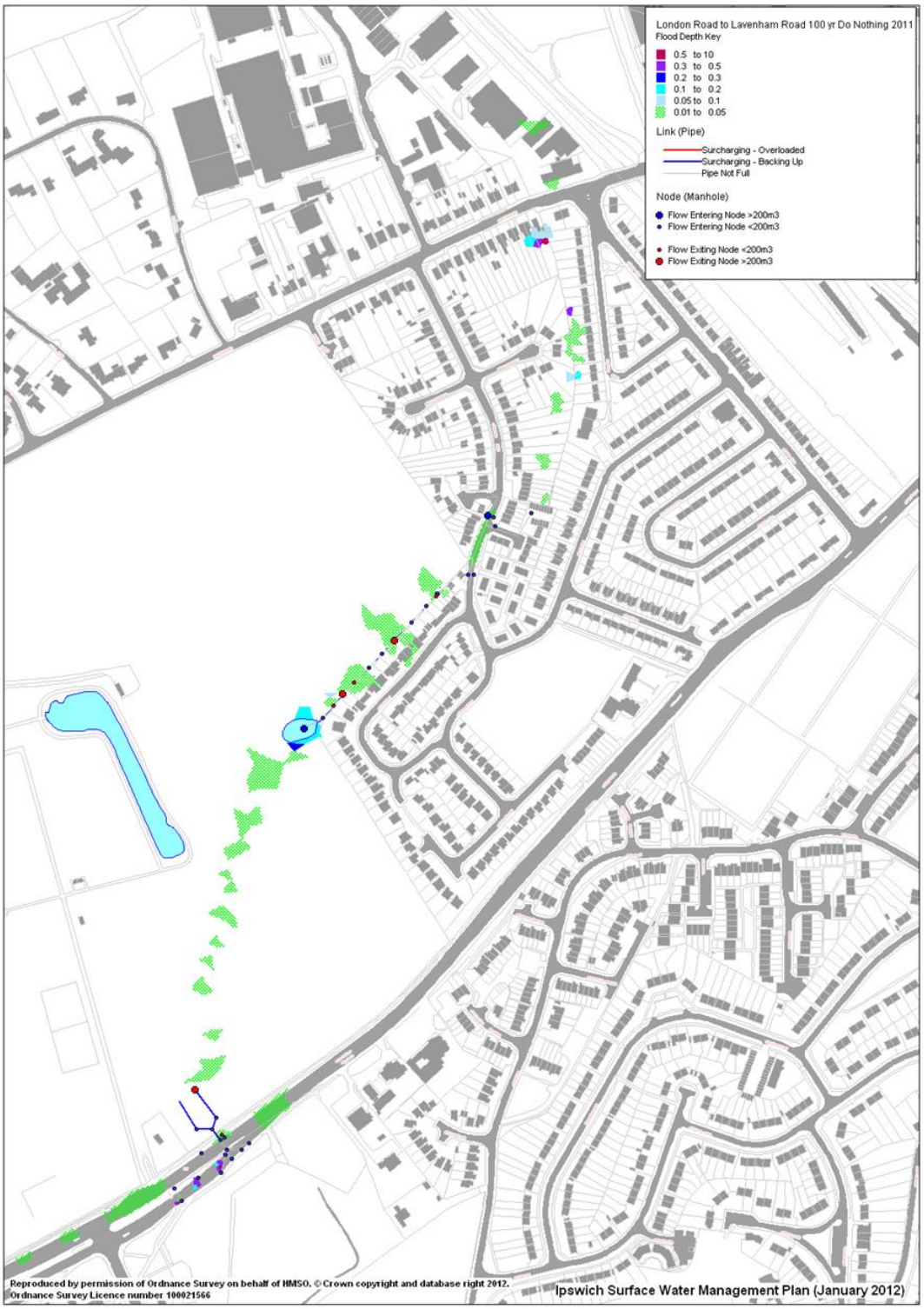
9.4 SW Flood map for Ancaster Road / Burrell Road.

From SWMP – 100 Year RP @2011



9.5 SW Flood Map for London Road & Hadleigh Road.

From SWMP – 100 Year RP @2011



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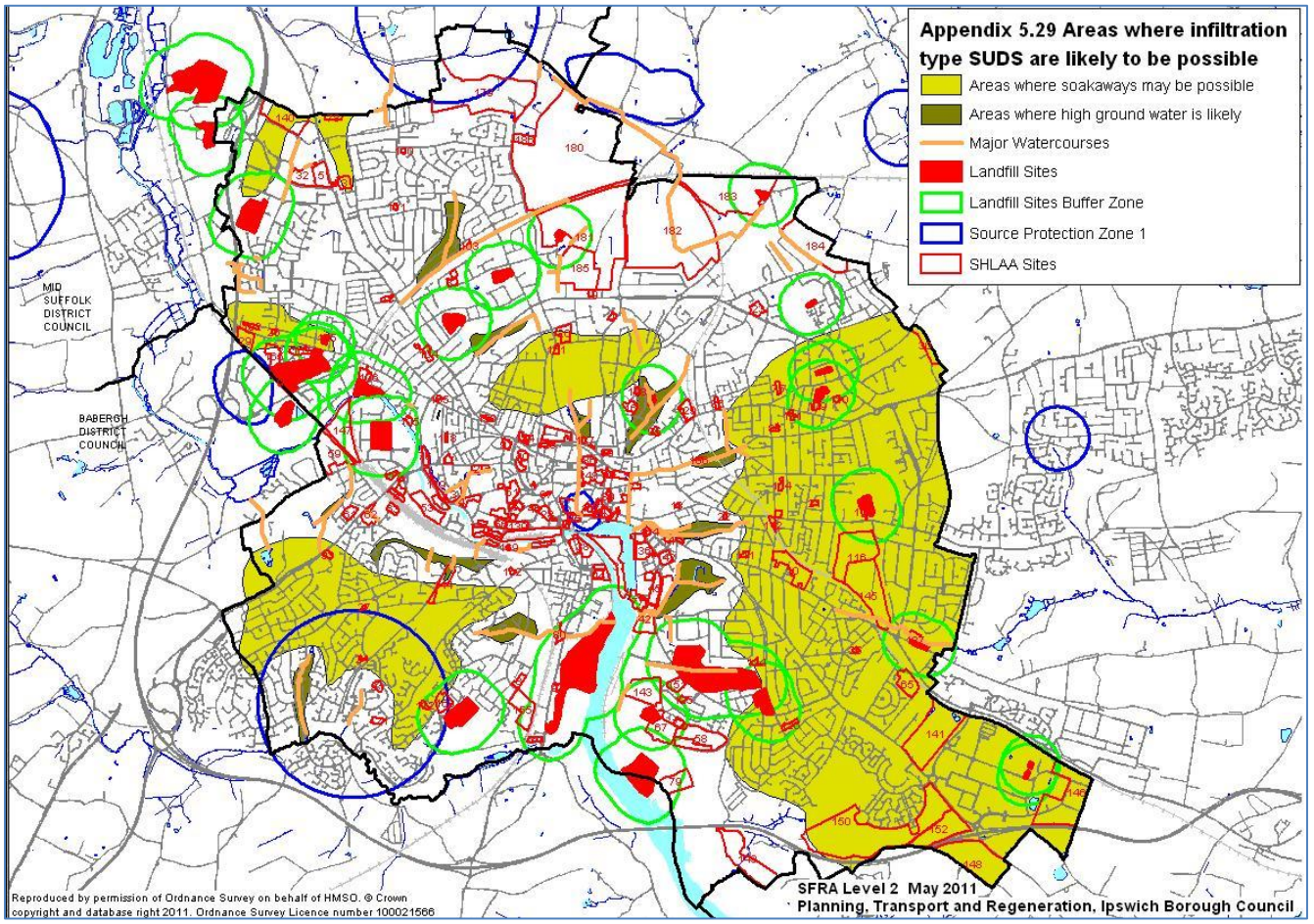
9.6 Infiltration Drainage Constraints Map

This map shows in yellow, areas where infiltration type SUDS are most likely to be possible. These are areas expected to have sands and gravels that are outside the flood plain, above spring lines and outside known filled areas (which may possibly be contaminated).

Pollution prevention measures may be needed for infiltration systems in source protection zones. Infiltration type drainage will not be permitted in landfill sites but may be possible in landfill site buffer zones subject to EA approval. The EA's "Ground Water Protection: Principles and Practice" (Nov 2012), policies G12 & G13 provide more guidance. 10

Soils outside the yellow area might be found to be suitable for infiltration systems and in such cases infiltration systems should be used. Soakage tests to BRE365 are required for most sites.

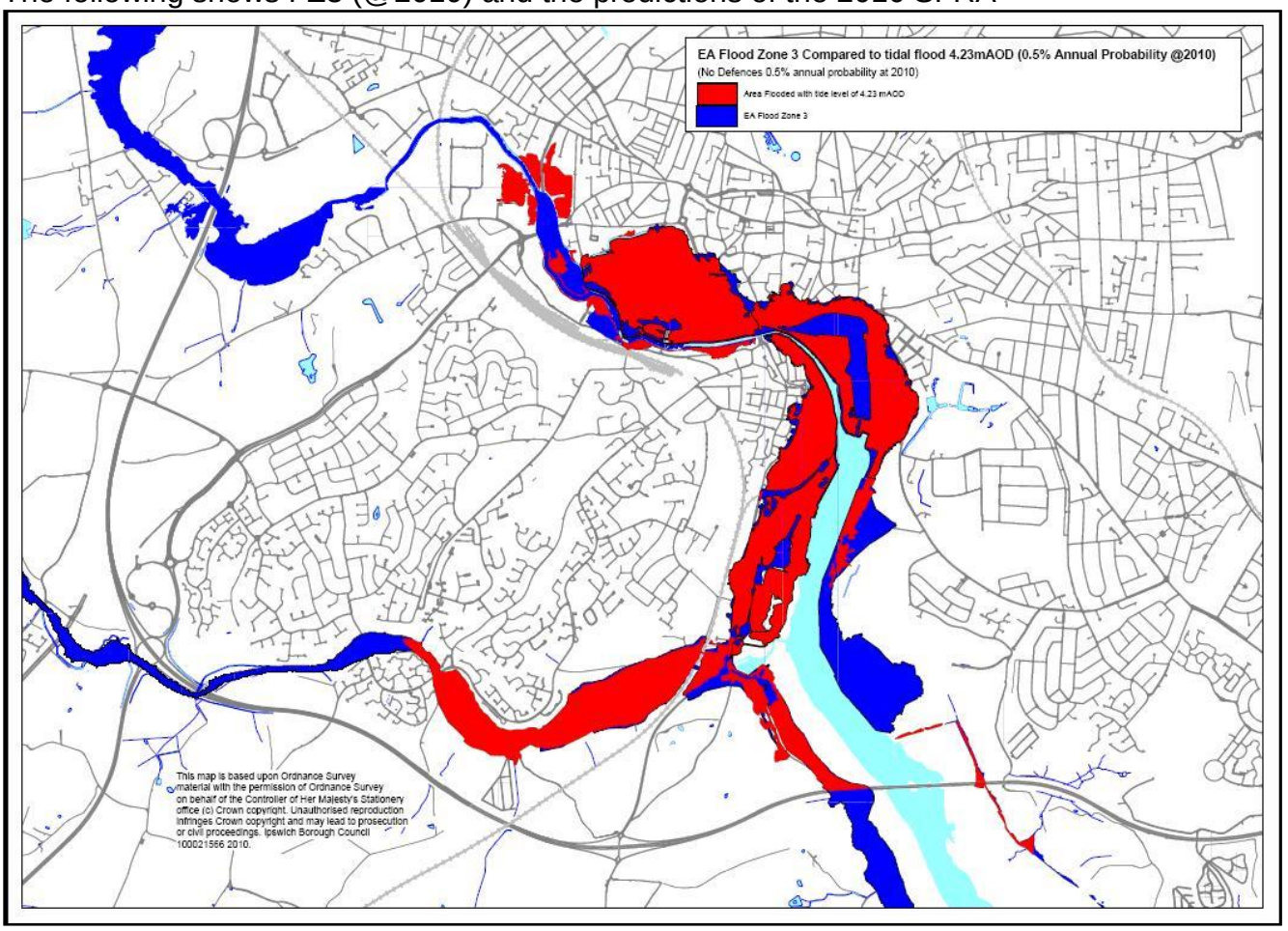
Downloadable full size version
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.29%20Areas%20where%20Infiltration%20type%20SUDS%20are%20likely%20to%20be%20pos.pdf



9.7 Tidal and Fluvial Flood Zones 2 & 3

The EAs web site shows the location of FZ3
http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

The following shows FZ3 (@2010) and the predictions of the 2010 SFRA

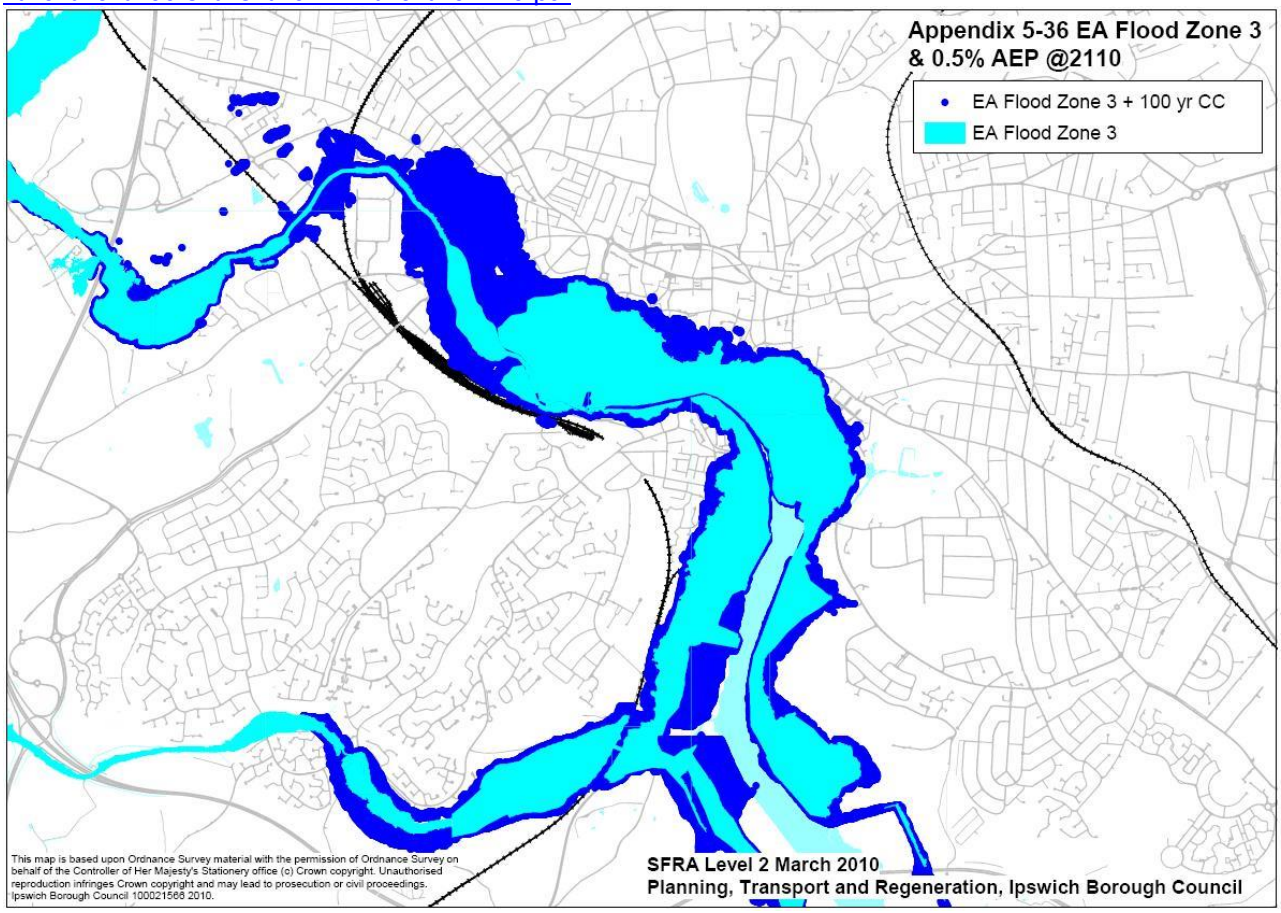


Note Fz3 would not be affected by the planned Tidal Flood Defence Barrier, although this will make development safer.

Climate change is expected to increase the area of FZ3 as follows in section 9.8.

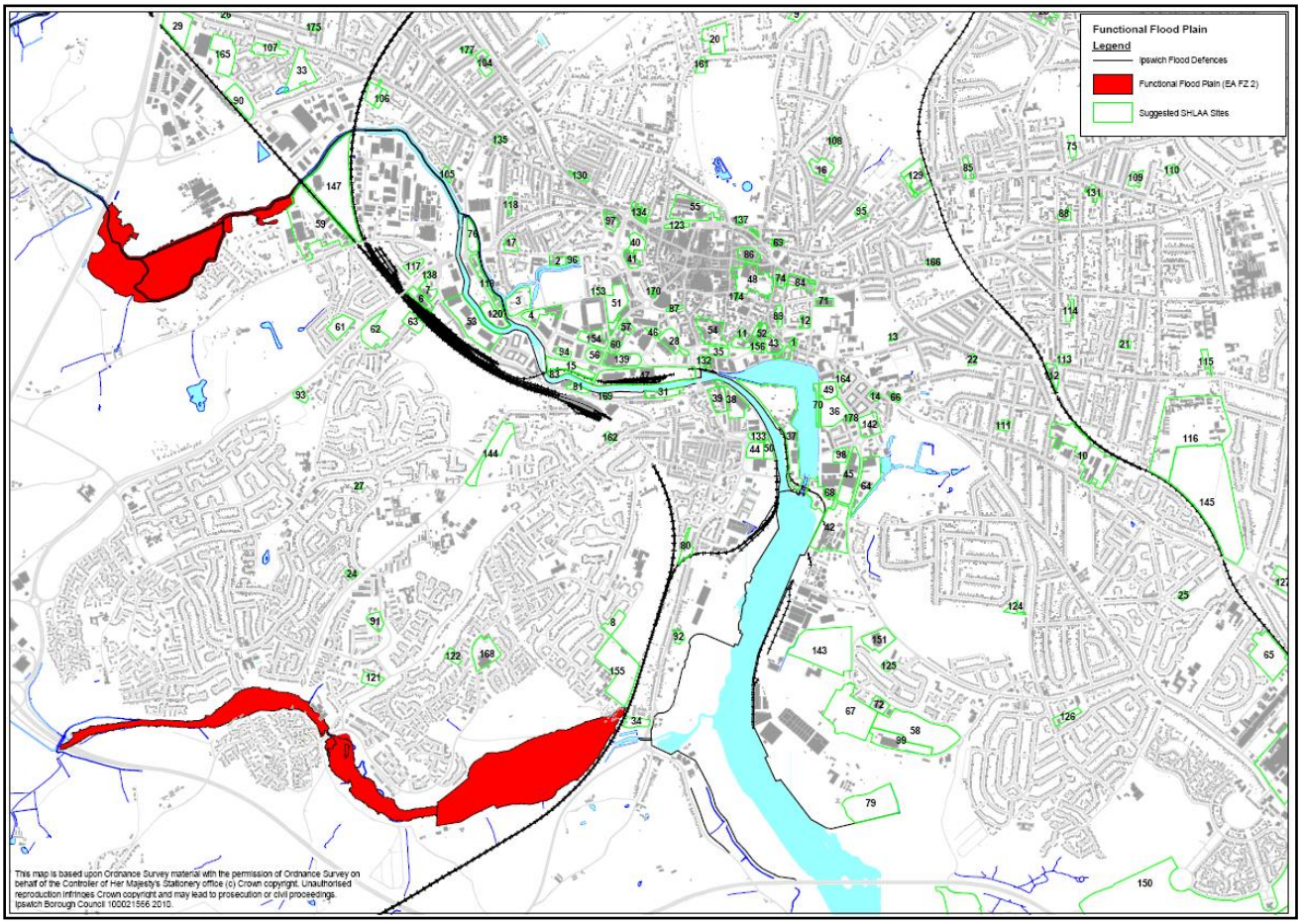
9.8 Tidal and Fluvial Flood Zone 3 + 100 Years Climate change

Downloadable full size version
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.36%20EA%20Flood%20Zone%203%20%26%200.5%25%20AEP%20%402110.pdf



9.9 Functional Flood Plain (Flood Zone 3b)

Areas designated as functional flood plain are shown below:



Functional floodplain is defined as land where water has to flow or be stored in times of flood.

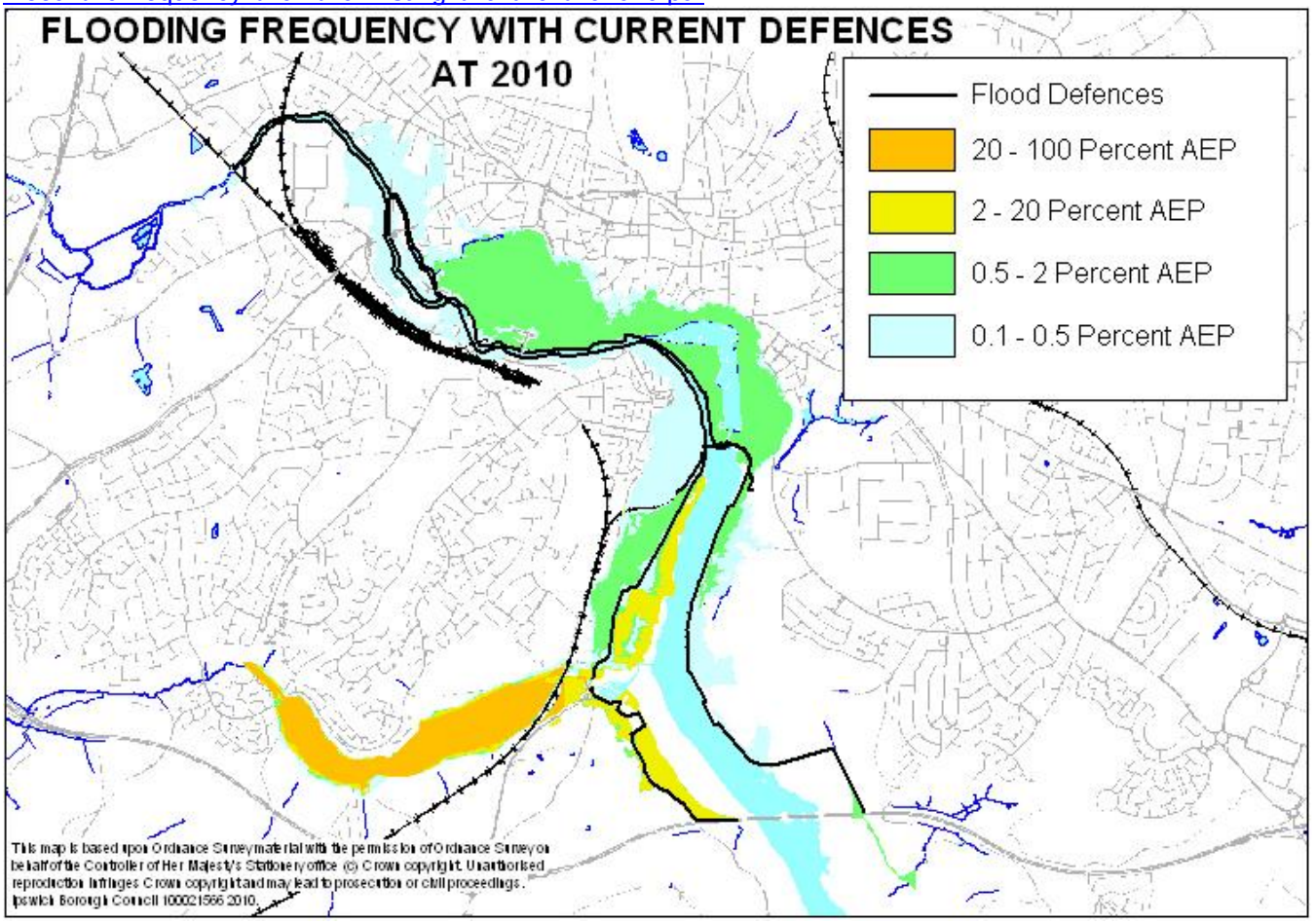
These are areas that if infilling or development were allowed to occur, flood storage would be reduced causing flood levels and severity of flooding to increase. Functional floodplain is land which:

- Would flood with an annual probability of 1 in 20 (5% AEP) or greater in any year
- Is designed to flood in an extreme (0.1% AEP) flood.

Most forms of development are restricted in this zone – see table 3 in section 6

9.10 Tidal & Fluvial Flood frequency before Barrier

Downloadable:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.15%20Variation%20in%20Tidal%20Flood%20Frequency%20-%20Existing%20%40%202010.pdf

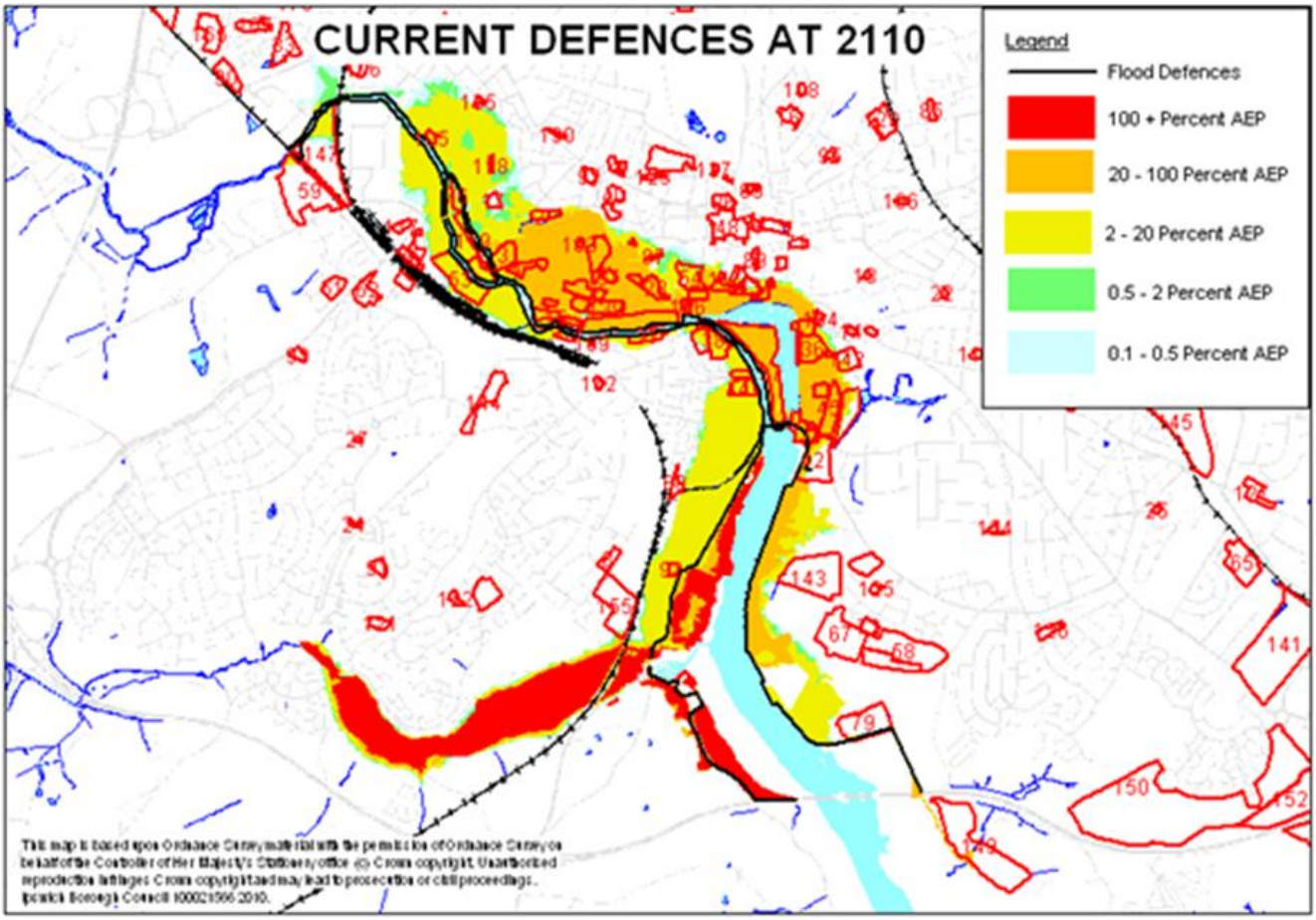


See next page for frequencies at 2110

Flood Frequency before Barrier

Downloadable:

https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.16%20Variation%20in%20Tidal%20Flood%20Frequency%20-%20Existing%20%40%202110.pdf

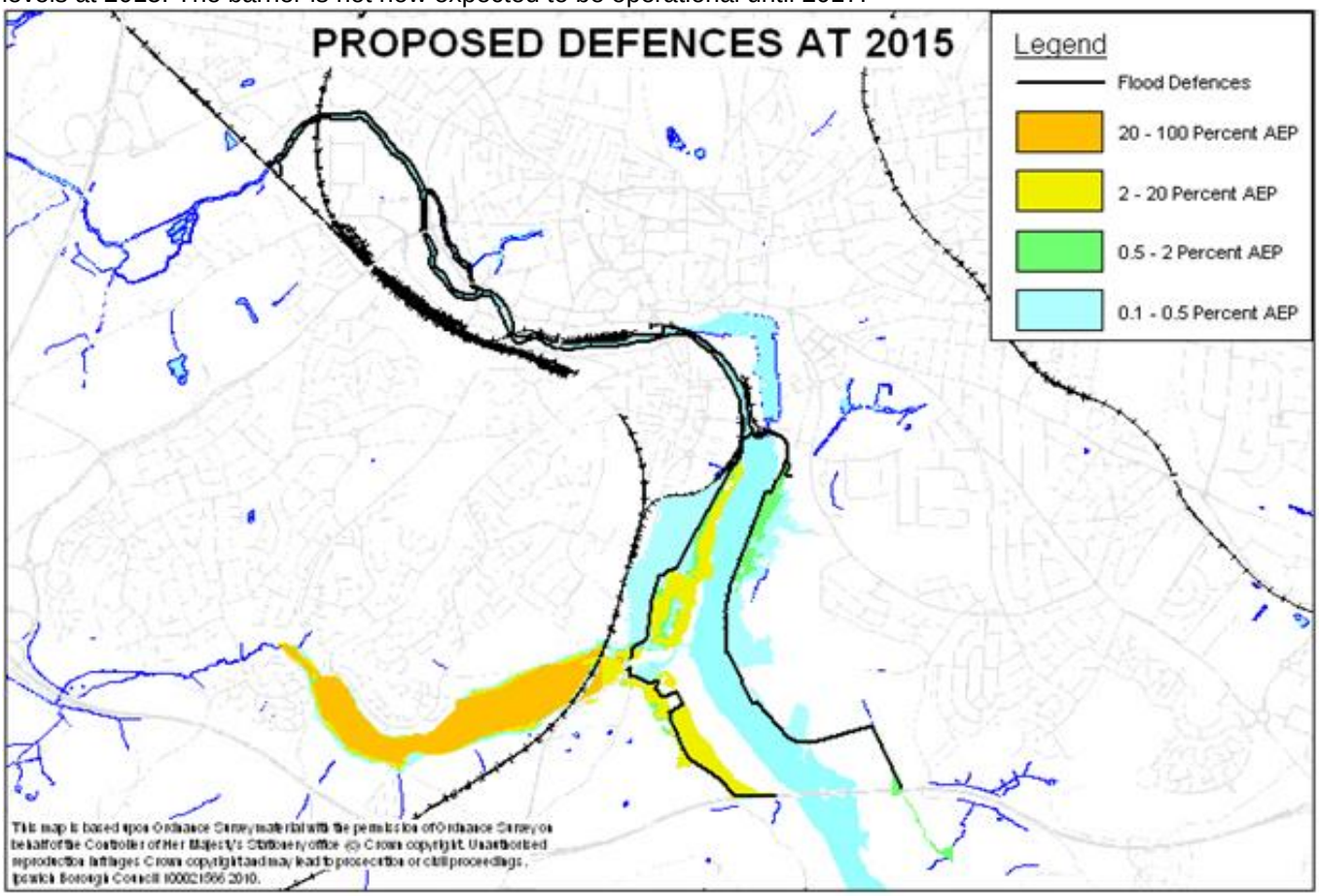


9.11 Tidal & Fluvial Flood Frequency with Barrier

Downloadable

https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.17%20Variation%20in%20Tidal%20Flood%20Frequency%20-%20Proposed%20%40%202015.pdf

This plan shows the effect the flood barrier would have if it was operational with predicted sea levels at 2015. The barrier is not now expected to be operational until 2017.

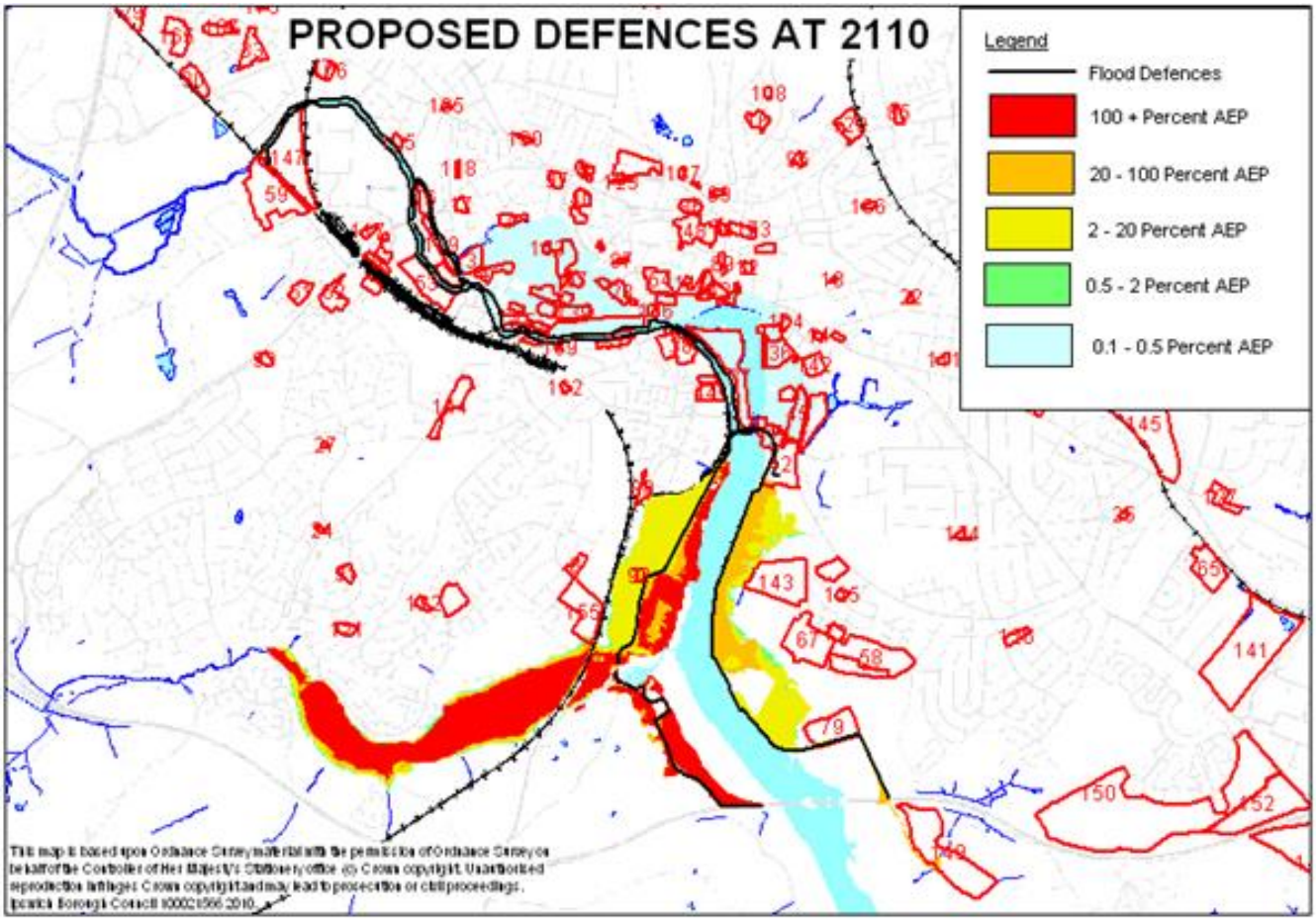


See next page for frequencies at 2110

Flood Frequency with Barrier.

Down loadable full size version:

https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.18%20Variation%20in%20Tidal%20Flood%20Frequency%20-%20Proposed%20%40%202110.pdf

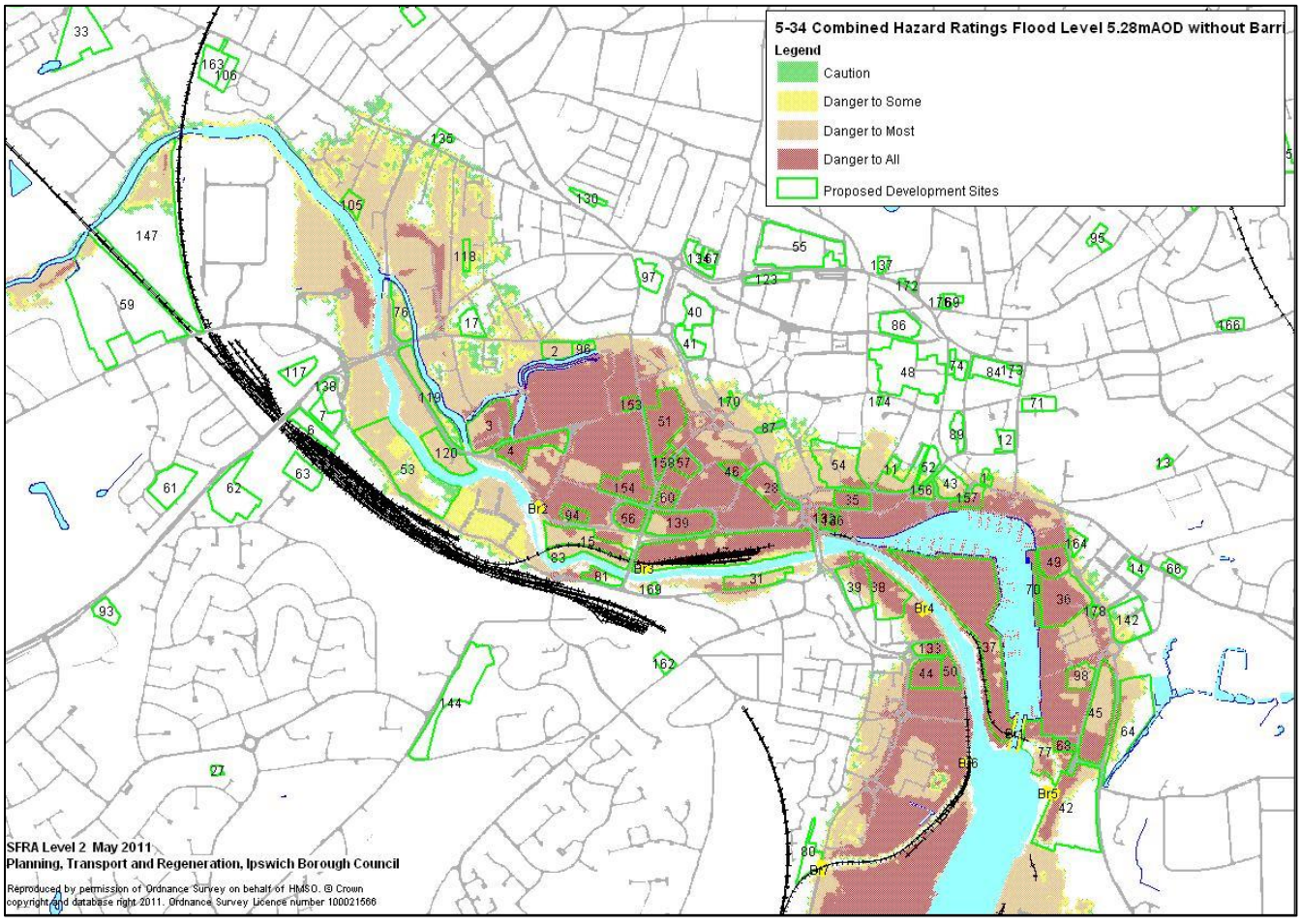


9.12 Tidal & Fluvial Flood hazard map before Barrier

Use this map and the table in 8.3.1 to determine whether safe access for building users exists before the flood defence barrier is operational.

The map shows flood hazards to people due to overtopping or breaches in a 0.5%AEP event, allowing for sea level rise to 2110. The SFRA explains hazard ratings and how they were derived.

Downloadable full size version:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.34%20Combined%20Hazard%20Ratings%20Flood%20Level%205.28mAOD%20without%20Ba.pdf

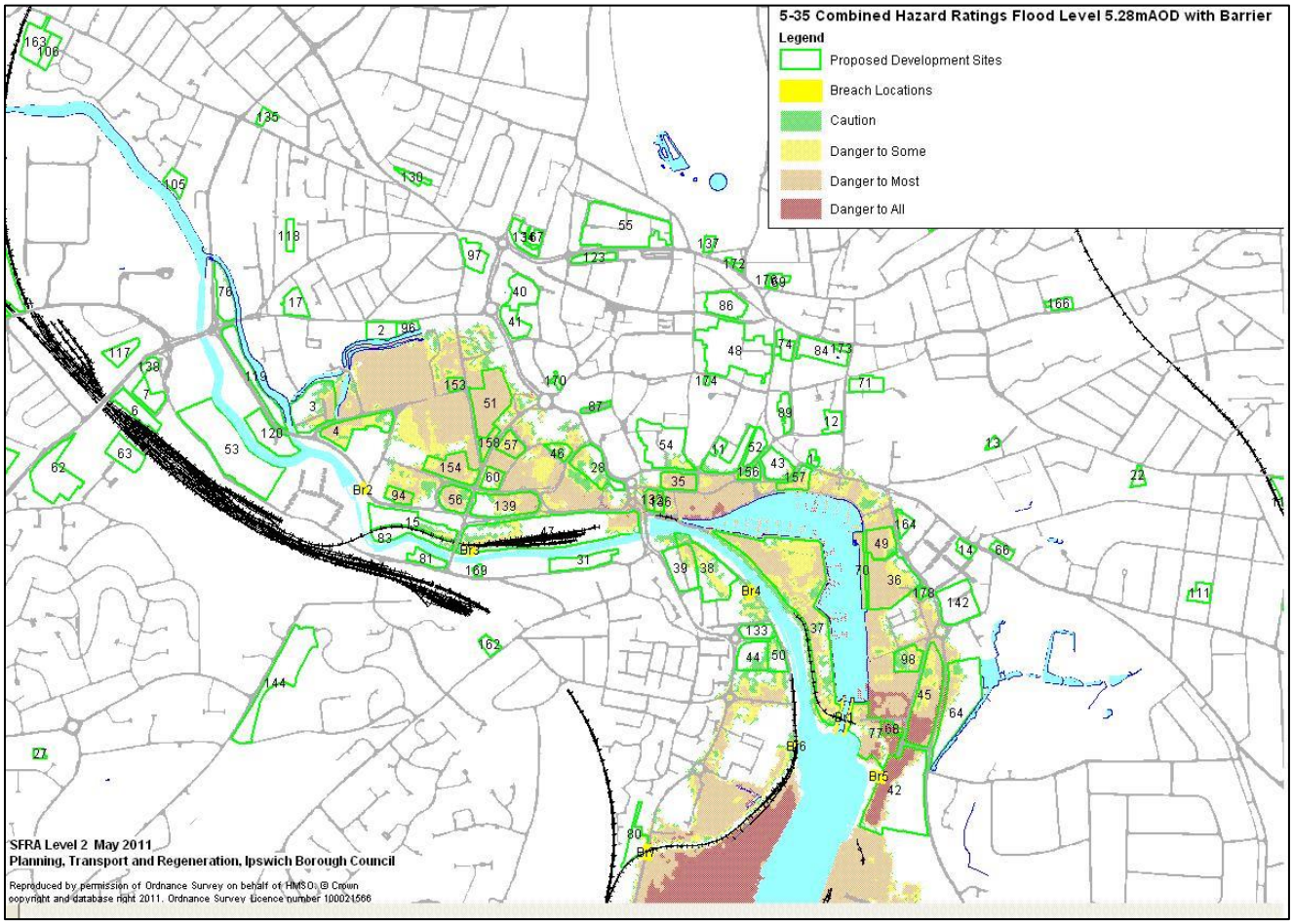


9.13 Tidal & Fluvial Flood hazard map with Barrier

Use this map and the table in 8.3.1 to determine whether safe access for building users exists when the flood defence barrier becomes operational.

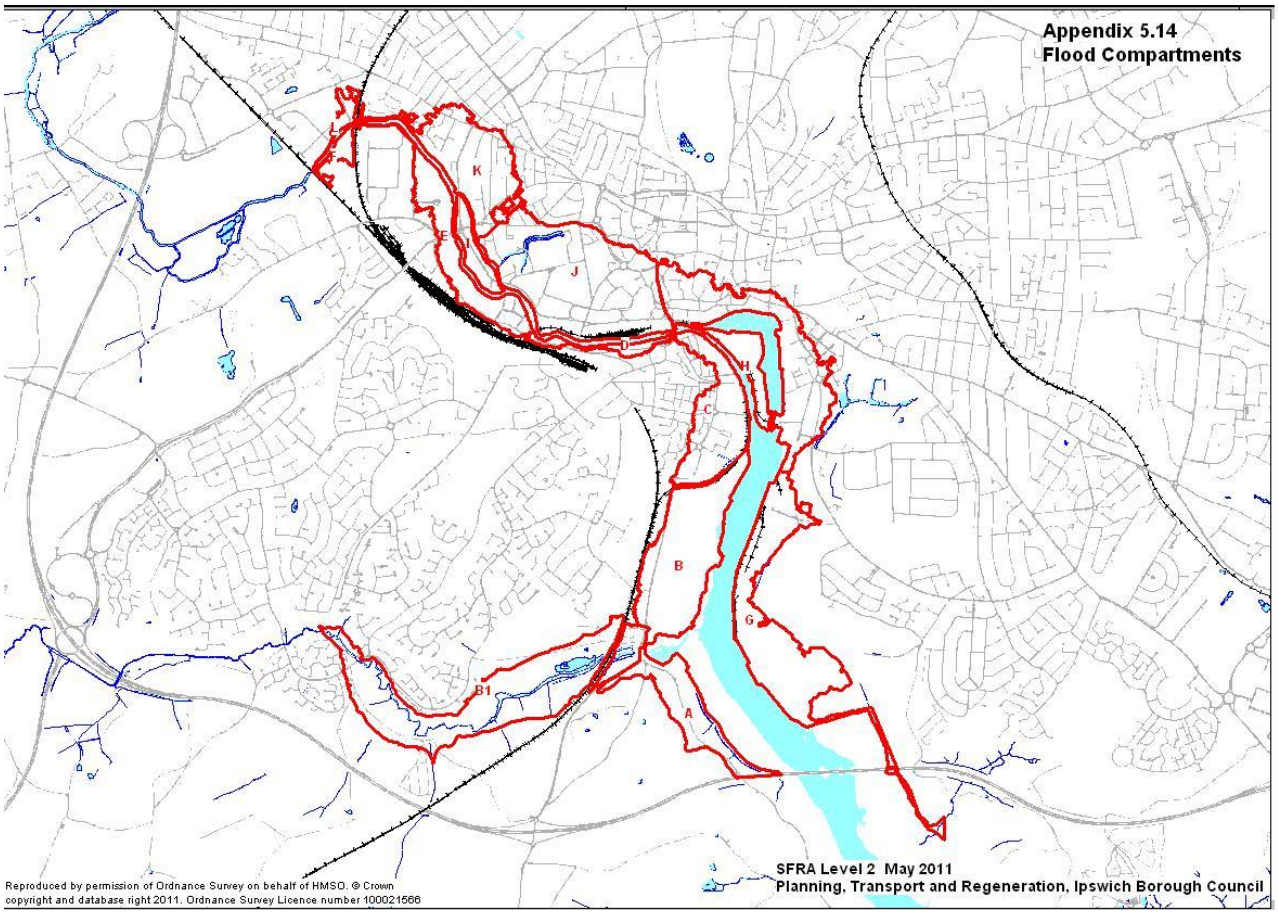
The map shows flood hazards to people due to overtopping or breaches in a 0.5%AEP event, allowing for sea level rise to 2110. The SFRA explains hazard ratings and how they were derived.

Downloadable full size version:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.35%20Combined%20Hazard%20Ratings%20Flood%20Level%205.28mAOD%20with%20Barri.pdf



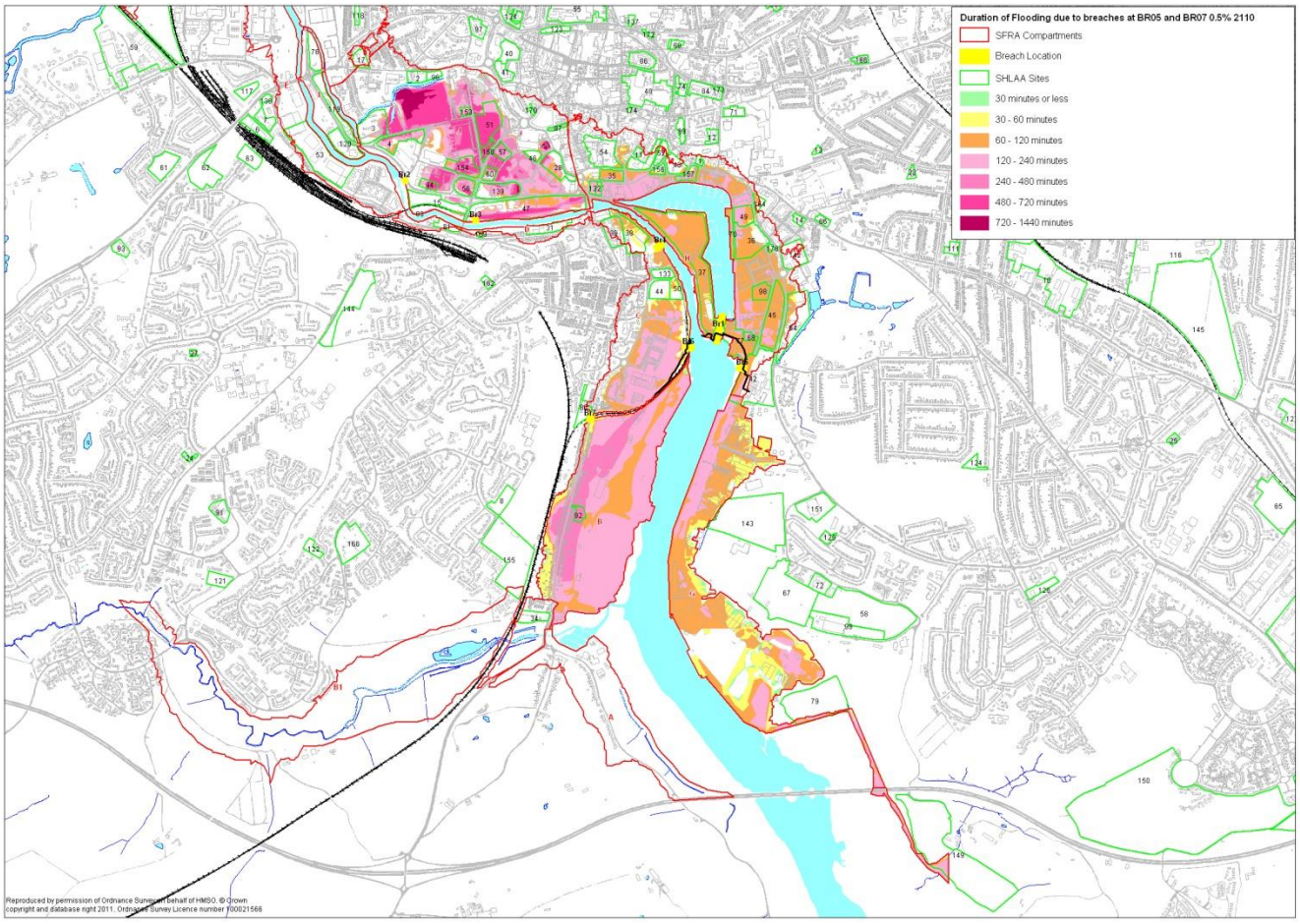
9.14 Tidal & Fluvial Flood Compartments

Downloadable full size version:
https://www.ipswich.gov.uk/sites/www.ipswich.gov.uk/files/5.14%20Flood%20Compartments.pdf



9.15 Tidal & Fluvial Flood Duration

This map shows how duration of flooding varies across Ipswich. It is for the same event as hazard map 9.13 i.e. flooding resulting from a sudden collapse of 20m of defence to ground level, at high tide, during a 0.5% annual exceedance probability event with the sea level 1m higher than in 2010. It assumes the barrier is operational and combines the effects of breach 05 (which floods compartments J&H) and breach 07 (floods compartment C).

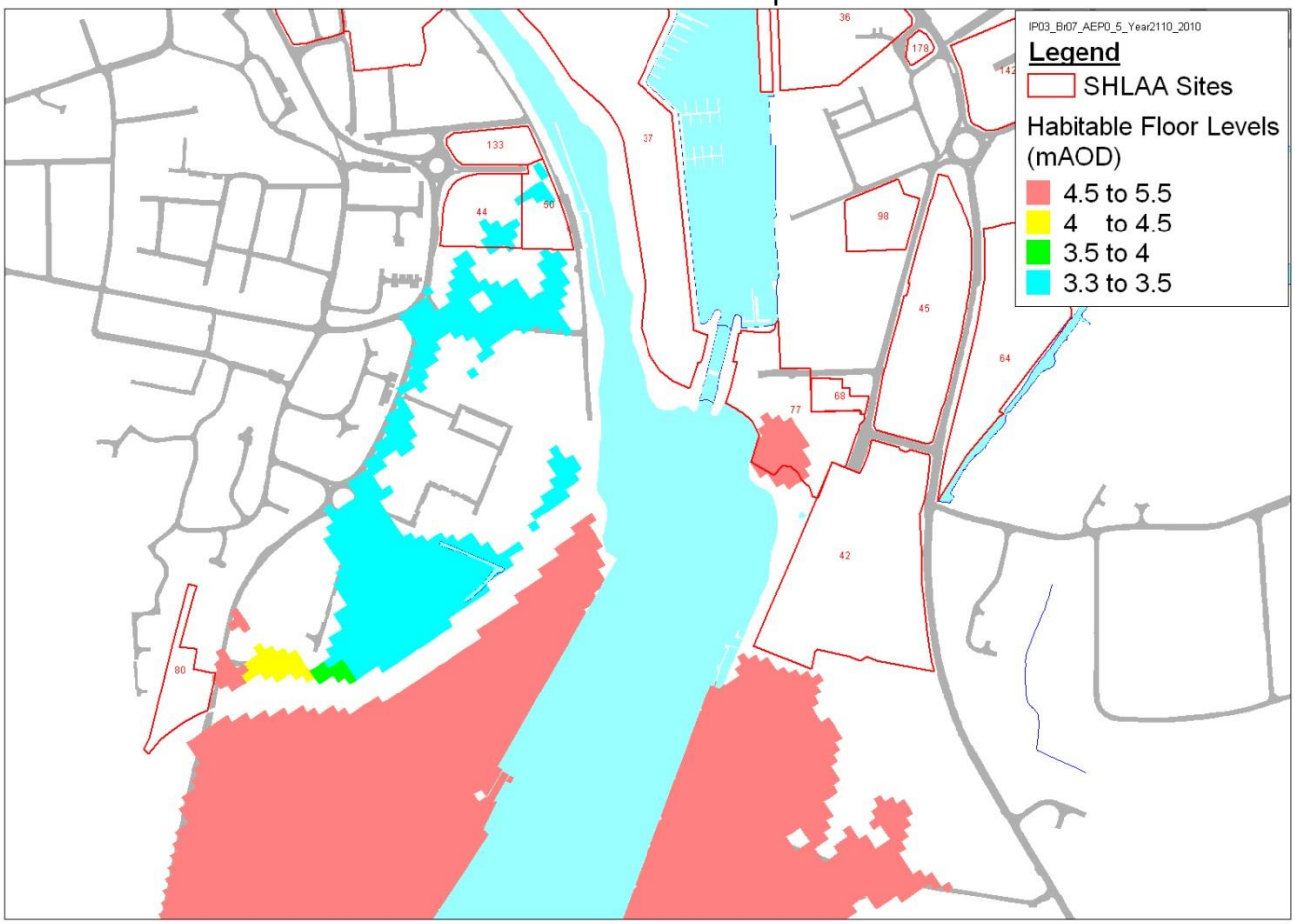


Data used to produce this map is derived from the SFRA. For flood levels above breaches, water level/time data is from 2d modelling which provided data for point locations in each compartment. For flood levels below breaches, water level/time data is from IBC's spreadsheets which simulate final drain down through a simplified drainage system without blockages and assumes dry weather.

For each compartment the two sets of data were spliced together and a graph of flood level v time was created and used to estimate contours corresponding to the range of durations shown.

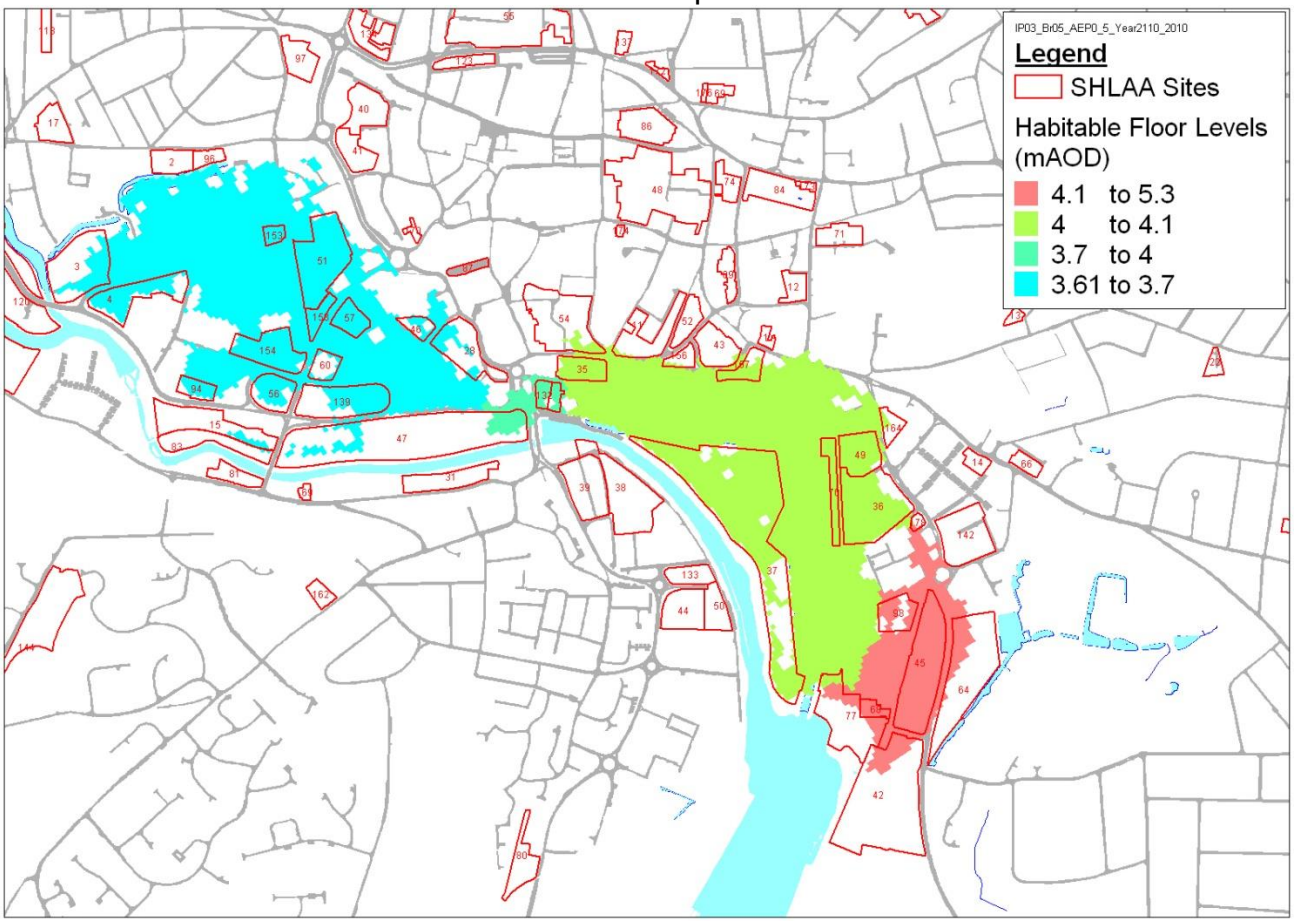
9.16 Design Flood levels for Habitable floors in Compartment C

These levels are for breach 07 with the flood barrier in place.



9.17 Design Flood Levels for Habitable Floors in Compartments H +J

These levels are for br05 with the flood barrier in place and a 0.5% AEP tide.



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