

Suffolk Coastal and Waveney District Councils

Suffolk Coastal and Waveney District Strategic Flood Risk Assessment

Appendix A – Waveney District

Report

February 2008



Prepared for:



Waveney District Council
Serving the Community

Revision Schedule

Strategic Flood Risk Assessment - Appendix A - Waveney January 2008

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1 Non-Technical Summary

1.1 SFRA Background

- 1.1.1 Scott Wilson Ltd was commissioned by Suffolk Coastal and Waveney Districts to undertake a 'Stage 2' Strategic Flood Risk Assessment (SFRA) of these districts. An Inception Report, completed by Faber Maunsell in November 2006, preceded this 'Stage 2' SFRA. The Inception Report located and identified available data and information that would be useful for completion of the SFRA. In addition the report outlined the extents of the study areas, the modelling approach and highlighted various specific flood risk issues within the Suffolk Coastal and Waveney area that should be covered within the main SFRA report.
- 1.1.2 This project was carried out in collaboration with the Environment Agency's Anglian Region, and a draft of the full report was submitted to the Agency for their comments and observations. Mutually acceptable amendments have been incorporated into the final SFRA report.

1.2 SFRA Planning Objectives

- 1.2.1 The primary objective of the study was to enable the two participating local authorities to undertake Sequential Testing inline with Government's flood risk and development policy document - Planning Policy Statement (PPS) 25: Development and Flood Risk - to inform the development of their emerging Local Development Framework (LDF) documents.
- 1.2.2 PPS25 requires local planning authorities to review flood risk across their districts, steering all development towards areas of lowest risk. Development is only permissible in areas at risk of flooding in exceptional circumstances where it can be demonstrated that there are no reasonably available sites in areas of lower risk, and the benefits of that development outweigh the risks from flooding. Such development is required to include mitigation/management measures to minimise risk to life and property should flooding occur.
- 1.2.3 The Strategic Flood Risk Assessment is the first step in this process, assisting in the development of the LDF's by identifying flood risk areas and outlining the principles for sustainable development policies, informing strategic land allocations and integrating flood risk management into the spatial planning of the area. The SFRA thereby forms an essential reference tool providing the building blocks for future strategic planning.

1.3 SFRA Report Layout

- 1.3.1 The main background and methodology information, including guidance on using the figures and potential measures for residual risk management are discussed in the main SFRA report. For the two participating authorities a suitable appendix has been compiled to include background information on that area with regards to flood risk. Additional information requested as part of the SFRA Brief in relation to each respective local authority and associated flood risk mapping for that area is also included.

- 1.3.2 There are two separate appendices. This report, Appendix A reflects the flood risk issues for Waveney District Council. The other Appendix reflects the flood risk issues in relation to Suffolk Coastal District.

1.4 Waveney District Council Considerations

Background

- 1.4.1 The district of Waveney is situated to the south of Great Yarmouth and South Norfolk District, and directly north of Suffolk Coastal District. The inland areas of the district are characterised by agricultural countryside (arable and pasture), the majority of which is very low lying in coastal areas. Marshlands are situated at sea level with surrounding land commonly a few metres above sea level.
- 1.4.2 The principle river in this district is the River Waveney, which runs along the northern boundary of the district and is surrounded by extensive marsh areas in lower stretches. The catchment of the Hundred River is contained within the district and merges into the sea south of Kessingland. The River Blyth flows through the southern areas of the district with the lowland stretches bordered by marshland.
- 1.4.3 Tidal processes affect large areas of the coastline and inland areas through the estuarial systems. There are also a number of coastal Broad's such as Easton Broad, Covehithe Broad and Benacre Broad north of Southwold. Lake Lothing is a large coastal water feature.

Objectives

- 1.4.4 The Waveney District Council Appendix within the Suffolk Coastal and Waveney District SFRA has been undertaken to provide information and guidance to enable the Local Planning Authority (LPA) to apply the Sequential Test within their district and where necessary inform the Exception Test process. It is also intended to provide a robust evidence base for the Local Development Framework process.

The Sequential Test

- 1.4.5 The process of the Sequential Test outlined in PPS25 aims to steer vulnerable development to areas of lowest flood risk. The SFRA aims to facilitate this process by identifying the variation in flood risk across the District allowing an area-wide comparison of future development sites with respect to flood risk considerations.
- 1.4.6 The District of Waveney has been delineated into the Flood Zones outlined in PPS25 as Flood Zone 1, low probability, Flood Zone 2, medium probability and Flood Zone 3a, high probability. In addition, Flood Zone 3b, functional floodplain, has also been mapped. Table D.1 of PPS25 provides information on which developments might be considered to be appropriate in each flood zone, subject to the application of the Sequential Test and the Exception Test with a site-specific Flood Risk Assessment demonstrating safety.
- 1.4.7 In accordance with PPS25 Waveney District Council will use this SFRA to inform their Sequential Test process for their spatial strategy and each of their proposed potential development locations. This identifies the flood risks and development vulnerability in order to

assess the suitability of each development location, and where possible steers more vulnerable developments to areas of lower flood risk.

The Exception Test

- 1.4.8 Where it can be demonstrated by the Local Planning Authority that the Sequential Test is passed, it will also be necessary in some circumstances for the Council to demonstrate that all three elements of the Exception Test are satisfied.

Flood Sources

- 1.4.9 The district of Waveney contains both fluvial and estuarine systems with associated creek networks and marshlands. The eastern boundary of the district is bordered with the North Sea. These sources pose various degrees of risk, dependent on the area of interest. Flood sources that would result in the most significant consequences include tidal flooding and overtopping. The modelling addresses both actual and residual flood risk (depending on the defence standards), identifying the potential consequences as a result of a potential failure in the defences at a particular location.
- 1.4.10 The most significant events in an area, in terms of potential for flooding, tend to be storm surges, coinciding with high spring tides to produce high tidal water levels along the coast and in estuaries. In addition, the rivers within the district pose some fluvial risk.
- 1.4.11 Major rivers have been assessed as fluvial sources of flood risk using both existing and new revised modelling information. These include the River Waveney, Hundred River and River Blyth. Tidal flooding was identified in the inception report as having the most serious of consequences on the area, and as such the SFRA modelling studies have focused on this flood source.
- 1.4.12 Many of the defences in the Waveney area fall below the 1 in 200 year plus climate change standard. As a result these may overtop during an event of this return period. Where defences have been identified as below standard at present, actual flood risk has been assessed, (i.e. overtopping of the existing defence), and in some key areas such as Lowestoft, residual flood risk, (through potential failures in an improved defence), has also been assessed.
- 1.4.13 The inception report identified settlement location areas including potential breach locations in reference to existing and future settlement and development areas. These locations have the potential of experiencing the greatest consequences of tidal flooding in the event of a breach in the existing (or future improved) defences.

1.5 Way Forward

- 1.5.1 The risk of flooding posed to properties within the District arises from a number of different sources including river flooding, tidal flooding and surface water flooding.
- 1.5.2 Many of the settlements within Waveney are situated within close proximity to either main rivers and their associated floodplains (e.g. Beccles and Bungay), or the North Sea (Lowestoft and Southwold). Much of these settlements are within Flood Zones 2 and 3. Therefore a considerable proportion of the proposed potential allocation areas are at risk of flooding.

- 1.5.3 A spatial planning solution to flood risk management should be sought wherever possible. It is necessary for the local authority to consider, through the PPS25 Sequential Test, how to steer vulnerable development away from areas affected by flooding. This should also take into consideration other relevant strategies and studies in the area seeking to reduce flooding to those already at risk within the District. Specific planning recommendations have been provided at the end of this report.
- 1.5.4 Where other planning considerations must guide the allocation of sites and the Sequential Test has been satisfied, further studies can be carried out to assist the local authority and developers to meet the Exception Test.
- 1.5.5 Engagement with the Emergency Planning Team and 'Blue Light Services' is imperative to minimise the risk to life posed by flooding within the District. It is recommended that the Council review their adopted flood risk response plan in light of the findings and recommendations of the SFRA.

1.6 A Living Document

- 1.6.1 The Suffolk Coastal and Waveney SFRA has been completed in accordance with PPS25 and the current guidance outlined in the draft Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft' (Feb 2007).
- 1.6.2 The SFRA has been developed by building heavily upon existing knowledge with respect to flood risk within the District. Ongoing modelling of fluvial systems may significantly improve current knowledge of flood risk within the District over time, and may alter predicted flood extents within the District through improved defence over time (or improved modelling). This may therefore influence future development control decisions within these areas.
- 1.6.3 In summary, it is imperative that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives and an improving understanding of flood risk within the District.

2 Introduction and Background

2.1 Introduction

- 2.1.1 The district of Waveney is an area under pressure from development, outlined in the East of England Plan (Jan 2007), which suggests a housing provision of 508,000 in the region, an increase of 30,000 since the Draft Plan (Dec 2004). It is suggested in the East of England Plan, (Dec 2004) that an annual average of 290 and a total of 5800 dwellings will be built in Waveney between 2001 and 2021. In addition, the East of England Plan (Dec 2004) suggests the provision for 421,500 new jobs in the region¹. These increased targets will generate pressure for the development of new land, possibly on marginal land that is at greater risk of flooding.
- 2.1.2 Scott Wilson was commissioned by Suffolk Coastal and Waveney Districts to undertake a Strategic Flood Risk Assessment (SFRA). The SFRA identifies flood risk issues relevant to both existing and proposed developments within the areas of Suffolk Coastal and Waveney Districts. The SFRA process also aids local authorities to meet the requirements of Planning Policy Statement 25 (PPS25): Development and Flood Risk.
- 2.1.3 This report deals with flood risk areas specific to Waveney District and includes the main mapping deliverables for this area. The scope and objectives for the Waveney District report are addressed in the following section. (Please note, the area of Waveney covered by the Broads Authority has not been included as this will be covered by a separate Broads Authority SFRA)

2.2 Scope and Objectives

- 2.2.1 This report has been undertaken for the local authority of Waveney District Council.
- 2.2.2 The purpose of this report is to:
- Provide information and guidance to enable the Local Planning Authority (LPA) to apply the Sequential Test within their district.
 - Present the detailed results of breach analysis undertaken for the SFRA to provide the LPA with a more comprehensive planning tool specific to their district;
 - Provide a strategic assessment of the flood risk within the potential development areas of: Barnby and North Cove, Beccles, Blundeston, Bungay (2 areas), Carlton Colville, Halesworth (2 areas), Kessingland, Oulton, Wangford, Wrentham, Lowestoft (which should take into account the Lake Lothing Area Action Plan), and Southwold/Reydon. These areas were selected for study as being areas under development pressure, or where existing allocations and/or known brownfield sites occur, in conjunction with a potential flood risk.
 - Produce a tidal embankment breach or overtopping analysis for Lowestoft and Southwold.

¹ Job provision by region as suggested in the East of England Plan (Dec 2004) – Great Yarmouth/Lowestoft sub-region, 4,700 jobs; Haven Gateway (part), 29,400 jobs; Rest of Suffolk (including Bury St Edmunds and The Cambridge sub-region (part)), 17,800 jobs

- 2.2.3 This report is comprised of one volume, which forms an appendix to the main SFRA report:

Appendix A – Waveney District Council

2.3 Waveney District

Background

- 2.3.1 The district of Waveney is situated to the south of Great Yarmouth and South Norfolk District, directly north of Suffolk Coastal District. The inland areas of the district are characterised by agricultural countryside (arable and pasture), the majority of which is below 60m AOD and very low lying in coastal areas. (East Suffolk CFMP: Inception Report, March 2006). Marshlands are situated at sea level with surrounding land commonly a few metres above sea level.
- 2.3.2 The principle river in this district is the River Waveney, which runs along the northern boundary of the district and is surrounded by extensive marsh areas in lower stretches. The catchment of the Hundred River is contained within the district and merges into the sea south of Kessingland. The lower reaches of this river are surrounded by marshland. The River Blyth flows through the southern areas of the district with the lowland stretches bordered by marshland. Tidal processes affect large areas of the coastline and inland areas through the estuarial systems. There are also a number of coastal Broads such as Easton Broad, Covehithe Broad and Benacre Broad north of Southwold. Lake Lothing is a large coastal water feature. There are a number of small private and public ponds and lake present in the area, however there are no major inland surface water bodies/reservoirs within the district.
- 2.3.3 Figure A1 identifies the local water sources within the Waveney District area.

Human Geography/Demographics

- 2.3.4 There are a number of developed areas within the district of Waveney. The largest settlements include greater Lowestoft, Beccles, Bungay, Halesworth, Southwold with Reydon and Kessingland. Redevelopment is proposed in the area of Lowestoft under the Lake Lothing and Outer Harbour Area Action Plan. There are also a number of smaller settlements scattered throughout the District of Waveney.
- 2.3.5 The majority of land use in inland areas is agricultural, mainly arable with a lesser amount of pasture. There are also a number of small forested enclosures situated within the district. Along the coast there are a number of protected areas including SSSI's, NNR's, SAC's, SPA's and Ramsar Sites.

Geology

- 2.3.6 The Craggs (marine deposits) and Chillesford Clay dominate the solid geology of the area. To the west of the district the soil type is mainly classed as slowly permeable, seasonally waterlogged fine loamy soils over clayey soils. These soil characteristics lead to large volumes of runoff during sustained or successive rainfall events. Boulder clays are found in river headwaters and along river corridors, leading to a flashy response of rivers to rainfall. Towards the coast deep well-drained sandy and coarse loamy soils are found overlying The Crag beds, (East Suffolk CFMP: Inception Report, March 2006).

- 2.3.7 The following tables (Table 2-1 & Table 2-2) highlight the main solid deposits, drift geology deposits and solid geology deposits and the appropriate SuDS techniques. In addition, the following maps (Figures A-I & A-II) show the general locations of the main solid and drift geology deposits and possible SuDS techniques. It is anticipated that the following tables, maps and Chapter 8 in the main report are used in conjunction to determine the most appropriate SuDS technique in any particular area.

TABLE 2-1: SPECIFIC DRIFT DEPOSITS TO WAVENEY DISTRICT

	Drift Deposit	Permeability	General Characteristics	Locations	SuDS
	Aldeby Sands and Gravels	Variably Permeable	Part of Lowestoft Formation	This deposit is found along the River Waveney and the Hundred River.	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc
	Alluvium/River Terrace Deposits	Variably Permeable	Sand, silt and clay with some gravel and silt and clay	These deposits are found around the Rivers Blyth, Hundred and Waveney.	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins and ponds, swales and filter strips i.e. a combined system
	Corton Formation	Variably permeable	Mainly sands, some clays and gravels and sandy clays	There is an area of this deposit around Lowestoft in the north of the district.	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc
	Corton Woods Sands and Gravels	Variably Permeable	Part of Lowestoft Formation	There is an area of this deposit situated in the very north of the District	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc
	Kesgrave Formation	Permeable	Sand and gravel	There is a very small area of this deposit situated north of the Hundred River.	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins and ponds, swales and filter strips i.e. a combined system
	Lowestoft Formation	Variably Permeable	Aldeby Sands and Gravels, Haddiscoe Sands and Gravels, Corton Woods Sands and Gravels, Oulton beds – laminated clays and silts, silt, sand and gravel, chalky pebbly sandy clay (till), stony, sandy clay rich in chalk and flint pebbles	This is the dominant deposit in the district.	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc
	Peat	Variably Permeable		There are small regions of peat found north of the River Blyth and around the River Blyth.	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc
	Tidal Flat Deposits	Variably Permeable	Muds, sand and sand and gravel. Marine and coastal zone deposits; depositional environments of shoreface and beach, bank, tidal flat, channel and saltmarshes.	There are small areas of this deposit found around the lower reaches of the River Blyth, the Hundred River and north of the Hundred River	Attenuation systems e.g. basins and ponds, green roofs, tanks, rainwater harvesting etc

TABLE 2-2 SPECIFIC SOLID GEOLOGY TO WAVENEY DISTRICT

	Solid Geology	Permeability	General Characteristics	Locations	SuDS
	The Craggs, (marine deposits) & Chillesford Clay	Permeable	Includes: Mainly fine grained buff to brown, locally shelly, micaceous sands, with local rounded flint gravels. Chillesford Clay – grey silty mudstones. Red Crag-ferruginous shelly sands	This is the most abundant solid geology type found in the district (the map is however very generalised and there are areas of other geology types found in the area)	Infiltration and combined infiltration/attenuation systems and attenuation systems e.g. permeable surfaces, sub surface infiltration, basins & ponds, swales and filter strips i.e. combined system

3 Sources of Flooding in Waveney

3.1 Introduction

- 3.1.1 The main SFRA report covers both districts of Suffolk Coastal and Waveney and as such includes a variety of potential flood risks and sources as required by a broad-scale strategic approach. This appendix provides a summary of the more specific flooding issues for Waveney District. Information regarding the different mechanisms of flooding can be found in the main SFRA.
- 3.1.2 The district of Waveney contains both fluvial and estuarine systems with associated creek networks and marshlands. These sources pose various degrees of risk, dependent on the area of interest. Flood sources that would result in the most significant consequences include tidal flooding and overtopping. The modelling addresses both actual and residual flood risk (depending on the defence standards), identifying the potential consequences as a result of a potential failure in the defences at a particular location.
- 3.1.3 Major rivers have been assessed as fluvial sources of risk using existing modelling information. Tidal flooding was identified in the inception report as having the most serious of consequences on the area, and as such the SFRA modelling studies have focused on this flood source.
- 3.1.4 Many of the defences in the Waveney area fall below the 1 in 200 year plus climate change standard, as a result these may overtop during an event of this return period. Therefore where the defences have been identified as below standard at present both actual flood risk, (i.e. overtopping of the existing defence, and residual flood risk, (through potential failures in an improved defence), has been assessed.
- 3.1.5 The inception report identified settlement location areas including breach locations in reference to future settlement and development areas, and areas most likely to have greatest consequences in the event of a breach.
- 3.1.6 The mechanical or structural failure of localised defence barriers or mechanisms such as demountable flood boards, pumps designed to drain individual properties etc. have not been considered in this report, as it is not appropriate for a district level study. Flood risk associated with smaller localised streams and failure of property specific flood defence systems will require site specific Flood Risk Assessments as and when appropriate.
- 3.1.7 The most significant events in an area, in terms of potential for flooding, tend to be storm surges, coinciding with high spring tides to produce high tidal water levels along the coast and in estuaries. In addition, the rivers within the district pose some fluvial risk.
- 3.1.8 The district of Waveney is an area increasingly at risk of flooding due to rising sea levels and increasing intensity of rainfall.

3.2 Fluvial

Sources

River Waveney

- 3.2.1 The River Waveney forms part of the northern border of the Waveney District. The river runs west to east for 40 km through the settlements of Diss and Bungay and becomes tidal downstream of Ellingham sluice. The river has a gradient of 1 in 2100 so generally has a gentle profile with an associated low carrying capacity and limited ability to alter its course during a flooding event. As areas surrounding the low-lying reach of the River Waveney are fairly flat, the river will spread into an extensive flood plain during times of high flow when the river overtops its banks. This floodplain area will subsequently drain slowly, due to low gradients, and may be boggy and marshy.
- 3.2.2 The source of the River Waveney is found in Redgrave Fen. The main channel of the River Waveney joins the River Yare to the north of Waveney District and discharges into the sea via Breydon Water and Great Yarmouth. A main tributary, the River Dove, joins the main river downstream of the town of Diss. The catchment landscape is rural and relatively flat with floodplains drained by a network of drainage channels flanking the river. The primary land uses in the catchment are agriculture and tourism. There are numerous sluices found along the non-tidal reaches of the river to regulate river levels during low flow conditions, to assist in land drainage and to supply a limited amount of flood storage to the system (The River Waveney Flood Risk Study, March 2006).
- 3.2.3 There are approximately 92 properties at risk of flooding from the 1% annual exceedance probability event, of which 56 are located within the town of Bungay, according to the Flood Zone map, (The River Waveney Flood Risk Study, March 2006). There are 62 flood warning flood risk areas and 11 flood-warning areas. The total number of properties within flood warning areas is approximately 252, accounting for 80% of all floodplain properties within the catchment of the River Waveney. A short section of flood relief channel has been constructed between Earsham and Bungay, along with the creation of two flood-warning areas between Diss and Bungay and Bungay and Ellingham. The majority of land at risk from flooding in this area is agricultural, (The River Waveney Flood Risk Study, March 2006).

Hundred River

- 3.2.4 The Hundred River catchment is approximately 71km² and runs west to east, discharging into the sea via two pipe sluices south of Kessingland. A number of tributaries join the main river along its course. Around the lower reaches of the river are a number of marshlands, specifically Churchfarm Marshes and Beachfarm Marshes. The Hundred River valley forms the northern boundary of the Suffolk Coast and Heaths Area of Outstanding Natural Beauty and the Heritage Coast.

River Blyth

- 3.2.5 The River Blyth catchment is approximately 97km² and runs from west to east. Two stretches of the river make up the border between Waveney and Suffolk Coastal, one area east of Halesworth to Blyford, and the other area from Reydon Marshes to the mouth of the river. The river is joined by a number of tributaries, including the Walpole, Wissett, Spexhall, Chediston and Cookley Watercourses. This river is also host to a number of flood plains surrounding the lower reaches, including Reydon Marshes, Tinker's Marshes and Town Marshes. There is a

sluice present downstream of the confluence of Buss Creek across the main channel. The catchment is predominantly rural and dominated by arable cropping. The settlement of Halesworth is situated in the lower reaches of the catchment and has a history of flooding. There is only one flow gauge located within the catchment but there are four level gauges. These showed a quick response to the October 1993 flood event and flow remained high for a long period of time due to the large number of tributaries that join the main river, (East Suffolk CFMP: Draft Scoping Report, July 2006 EA).

- 3.2.6 A seawall to the north protects the Blyth estuary outlet and marshes. The internal drainage network is a brackish system with overtopping of the seawall and saline intrusion through flood defences. The area is drained by two sluices to the west, which then discharge into the River Blyth via Charity Sluice, (Appendix F East Suffolk CFMP: v1.0, March 2006 EA).

Historical Flooding

- 3.2.7 There was a serious flooding event in 1912 due to torrential rain accompanied by severe winds. The River Waveney burst its banks at Beccles and flooded the surrounding marshland, leaving the railway unusable and hindering work in the local timber and saw mills and tannery. Since then the Waveney catchment has experienced a number of flooding events, including the following:

- 1968 prolonged high rainfall resulted in a railway bridge to be washed away*.
- 1981 high rainfall caused the River Waveney to burst its banks and inundate the floodplain*
- 1993 a tidal surge caused The River Waveney to flood 110 properties*
- 1993 heavy rain flooded and caused damage to 33 properties*

*(Broadland Rivers CFMP: Draft Report, June 2006)

Pathways

- 3.2.8 The main pathway of fluvial flooding is from high flows along rivers such as the River Waveney and the Hundred River resulting in out of bank flows. Flood defences or control structures could potentially fail resulting in flooding of properties. Areas at risk from a potential failure of defences, are classed as being at residual risk of flooding. Detail on the differences between these two flooding pathways are outlined in the main SFRA report.
- 3.2.9 The frequency and/or magnitude of fluvial flooding can be exacerbated under a range of scenarios, such as blocked culverts and bridges within the Rivers or any of the other smaller watercourses within the district.

Receptors

- 3.2.10 The flood mapping in this report is based upon the most up to date information available from the Environment Agency and modelling carried out as part of this investigation. These maps, (see Figures), should be consulted in order to appreciate Flood Zones 2, 3a and 3b within the area of Waveney, both for the present day (PPS25 Flood Zones 2007 maps), and in the future (PPS25 Flood Zones 2107 maps).
- 3.2.11 Tidal floodplains are dominant in the lower reaches of the rivers. Further west, as the rivers extend inland, tidal floodplains reduce and fluvial floodplains dominate. The key settlements

that lie within the Environment Agency floodplain of the River Waveney extents include Beccles, Bungay, Barnby and North Cove.

Functional Floodplain

3.2.12 PPS25 stipulates that functional floodplain is defined as any land that:

- would flood with an annual probability of 1 in 20 (5 per cent) or greater in any year, or at another probability to be agreed between the LPA and the Environment Agency (EA), or;
- is designed to flood in an extreme (0.1 per cent) flood, or at another probability to be agreed between the LPA and the EA.

3.2.13 The functional floodplain is classified as Flood Zone 3b. PPS25 restricts the types of development permitted in this flood zone, and would not permit highly vulnerable, more vulnerable or less vulnerable developments in accordance with the classifications in PPS25 Table D.2.

3.2.14 Flood Zone 3b (Functional Floodplain) has been modelled as part of this study, using revised 1 in 20 year outlines from the River Waveney modelling as part of this study provided by JBA. Outlines have been provided for the River Waveney; these are mapped as Flood Zone 3b in the Figures depicting the current PPS25 Flood Zones for 2007.

To make an allowance for climate change for Flood Zone 3b, the 1 in 20 year event plus a 20% increase in flows was mapped. The model for the Rivers Waveney was re-run by JBA to determine these outlines, which are mapped in the Figures depicting the PPS25 Flood Zones inclusive of climate change. In accordance with PPS25 and Environment Agency guidelines, 100 years of climate change have been mapped appropriate for residential considerations.

3.3 Tidal

Sources

3.3.1 The eastern boundary of Waveney and Suffolk Coastal districts is formed by the land/sea interface from Corton Cliffs in the north to the mouth of Harwich Harbour in the south. This area is very low lying, especially in coastal locations where land has been reclaimed for agriculture and conservation purposes, and can be below current sea level. This coastal stretch is sparsely developed and supports a number of nationally and internationally important conservation sites and habitats. This land will become more prone to flooding from the higher tide levels that will result from future sea level rise.

3.3.2 Tidal flooding constitutes the main form of flooding along this boundary, which forms an exposed but defended coastline. Defence comes in the form of a natural frontage of embankments and cliffs as well as sections of 'man-made' defenses at Lowestoft, Kessingland and Southwold and around the mouth of the River Blyth.

3.3.3 Tidal information for the North Sea from Lowestoft is available from the Admiralty Tide Tables (2006 edition). The reported mean high water spring tide at Lowestoft is +0.9m OD and the reported mean low water spring tide is -1m OD. These figures indicate a tidal range of 1.9m under normal conditions but do not account for waves or storm surge, which increase the water levels significantly.

- 3.3.4 The areas with the greatest potential risk from a 200-year (0.5% annual event probability (AEP)) tidal event, are Southwold and Lowestoft as these settlement areas are generally low lying and situated within close proximity to the coast. In addition, Lake Lothing is located in the middle of the developed area of Lowestoft, providing a significant flood risk to the area. Tide locking of gravity outfalls to Lake Lothing is a source of flooding. The Rivers Hundred and Blyth present a source of fluvial flood risk to the low lying areas of both Kessingland and Southwold respectively, and the situation of these towns on the coast present a source of tidal flood risk to these areas.
- 3.3.5 The main source of flooding considered in the CFMP is tidal as a result of tide-locking conditions. Tide locking occurs when rivers and streams cannot discharge their water load into estuaries or the sea, causing the river/stream water to 'back up' and reach high levels. Tide-locking has the greatest impact when tidal events coincide with high river flows. There are a number of coastal draining rivers in the study area, including the Hundred River. High tide levels also affect rivers discharging into the numerous estuaries in the area.

Standard and Condition of Tidal Defences

- 3.3.6 The following map (Figure A-III) shows the NFCDD database and the location of flood defences in the Waveney area. Flood defences in the area include both man made raised defences and maintained channels. Some of these defences are classified as minor and some are major but all are classified as offering protection from tidal flood sources. The Environment Agency and Waveney District Council are responsible for the tidal flood defences in Waveney District. All defences in this area have a 10-year defence standard. (Information from NFCDD database).
- 3.3.7 The overall condition of these defences is good, although the defences were not originally built to a high specification. Indeed, the defence crest height falls below the 1 in 200 year level and subsequently considerably beneath climate change levels for this stretch of coastline. This suggests that in order to protect any future development in these areas, funding contributions will be required to improve the existing standard of the flood defence in line with increasing water levels.
- 3.3.8 Any improvements in the flood defences or policies regarding the improvement and maintenance of flood defences in light of this investigation should be integrated with defence management plans suggested in the Catchment Flood Management Plan and Shoreline Management Plans in the area. Changes in any fluvial and/or tidal flood defences within this area may have significant impacts on the flooding system, thus an integrated approach should be taken.
- 3.3.9 As a result of low defence standards, overtopping of defences was considered in the SFRA. The existing crest heights were modelled for the 1 in 200 year with the influence of climate change scenario in order to demonstrate the 'Actual Risk' these areas face as a result of poor defence standard. These can be seen in the Results section (Chapter 6) of this report.

Pathways

- 3.3.10 The North Sea and river mouths of the Hundred and Blyth, together with the Lake Lothing entrance at Lowestoft provide the main pathway for tidal flow in the District. In a flood event, the low-lying nature of the District and the presence of drainage channels within the floodplain areas of these watercourses provide pathways for floodwater into the greater floodplain area.

Receptors

- 3.3.11 Based on the methodology presented in the SFRA, areas of interest within Waveney District have been separated into flood cell embayments, defined by topographic features, flooding characteristics and potential flood pathways. Figures A2, A3 and A4 shows the flood cells in the Waveney District.

3.4 Overland Flow

- 3.4.1 Many of the existing settlements and potential growth areas in the district are situated within rural areas, surrounded by agricultural land. The general topography is relatively flat, which aids the ability of the fields to allow rainfall to soak into the ground and reduce the quantity of runoff from rural land onto urban land.
- 3.4.2 Overland Flow incidents could still occur within the area due to the presence of Chillesford Clays that underlie much of the district. Very limited information exists regarding this source. This source of flooding should not be entirely discounted and should be assessed on a site-by-site basis in a Flood Risk Assessment.
- 3.4.3 There is limited historical event history for this source of flooding. In addition, there is limited information surrounding specific drainage networks such as highways drains, drainage ditches or non-main river watercourse that may pose sources of this flood risk within the district. These pathways should therefore be explored as part of a site specific FRA.
- 3.4.4 Flooding from overland flow (or any other source for that matter) does not discriminate on a particular receptor. However, flooding from overland flow is more likely to occur where large hill slopes are situated close to a particular site.

4 Level 1 Assessment

4.1 Level 1 SFRA – Study Area, Flood Source Review and Data Review

- 4.1.1 The objective of the Level 1 SFRA is to collate and review available information on flood risk for the study area. The Inception Report, which is in effect a level 1 report without mapping any growth areas with respect to flood risk considerations, was completed prior to the release of PPS25 draft practise guide. Therefore to ensure this document is consistent with future policy, the Inception Report should be used in conjunction with the Level 1 Assessment tables presented in this section.
- 4.1.2 The Level 1 SFRA addresses Objective 1 (section 2.2) and forms part of the evidence base (Objective 5) for the study area.
- 4.1.3 One of the objectives of a Level 1 SFRA is to identify areas that may require strategic relocation due to current and future flood risks. A number of policy aims, outlined in PPS25 (Table D.1, under Zone 3a), should be addressed in order to achieve this, including
- the reduction of the overall level of flood risk in an area through the layout and form of the development and the appropriate application of sustainable drainage techniques
 - the relocation of existing developments to land in zones with a lower probability of flooding
 - the generation of space for flooding to occur. This can be achieved by restoring functional floodplain and flood flow pathways and by the identification of open space for flood storage.
- 4.1.4 In addition a level 1 SFRA is designed to be sufficiently detailed in order to allow the application of the Sequential Test on the basis of Table D1 of PPS25 and to also identify whether application of the Exception Test is expected to be necessary. Information from this stage can also be used to assess how any environmental objectives relating to flooding, as defined in the sustainability appraisal, may be affected by any additional proposed developments.
- 4.1.5 This stage in the SFRA is primarily a desk-based study, which uses existing information from a number of sources, outlined below.
- Environment Agency Flood Map. These maps show the extent of the floodplain in the absence of any flood defences or other man made structures or channel improvements in place. Dark blue regions indicate areas affected by flooding from rivers (1% or 1 in 100 or greater chance of happening each year) or the sea (0.5% or 1 in 200 or greater chance of happening each year) if there were no flood defences present. Light blue regions show the additional extent of an extreme flood from rivers and/or the sea with a 0.1% (1 in 1000) chance of occurring yearly.
 - Regional Flood Risk Appraisal (RFRA) (including all the sources of data referred to in the guidance provided on their preparation)
 - National Flood and Coastal Defence Database (NFCDD) and National Flood Risk Assessment (NaFRA)

- Any available expert advice from the Environment Agency. This may be in the form of reports containing the results of detailed modelling and flood mapping studies, including critical drainage areas and on historic flood events.
 - Consultation with other flood risk professionals including: IDB's, water companies, highways authorities, local authorities (in their role as statutory drainage (operating authority)), navigation authorities, reservoir operators, and informed local sources
 - Maps of geology and soil. These allow the potential for the implementation of source control and infiltration techniques, groundwater and overland flood risk to be investigated and assessed
- 4.1.6 This information as a whole should be sufficient to inform application of the Sequential Test and subsequently inform the Sustainability Appraisal and any succeeding plan policies.
- 4.1.7 In the event of the Level 1 SFRA demonstrating the potential need of the application of the Exception Test, either due to current levels of flood risk or due to an increase in flood risk resulting from climate change, further data collection and/or analysis will need to be carried out, this should be investigated and incorporated into the Level 2 SFRA.
- 4.1.8 Figures depicting the PPS25 Flood Zones are split into two series of maps, those showing the current Flood Zones in accordance with PPS25 (2007).
- 4.1.9 In accordance with PPS25 and Environment Agency guidance, consideration should be given to flood risk over the lifetime of the development. 100 years of climate change have been mapped for residential development. Therefore the PPS25 Flood Zones 2107 series show the Flood Zones with 100 years of climate change for 2107.
- 4.1.10 The PPS25 Flood Zones for the District of Waveney have been identified in Figures A6-A20, and A46-A47 for PPS25 Flood Zone 1, low probability, Flood Zone 2, medium probability and Flood Zone 3a, high probability. In addition, Flood Zone 3b, functional floodplain and the flood outlines with an inclusion of climate change, have also been mapped. Table D.1 of PPS25 provides information on which developments might be considered to be appropriate in each flood zone, subject to the application of the Sequential Test and either the Exception Test or a site-specific Flood Risk Assessment demonstrating safety.
- 4.1.11 In accordance with PPS25 Waveney District Council will apply a Sequential Test process for their spatial strategy and each of their proposed strategic development locations. This will identify the flood risks and development vulnerability in order to assess the suitability of each development location, and where possible will steer more vulnerable developments to areas of lower flood risk.

4.2 Level 1 Mapping Methodology

- 4.2.1 The strategic mapping of flooding within the Suffolk Coastal and Waveney Districts was undertaken specifically for the purposes of this study. The main method of tidal inundation considered was through overtopping and breaching of the flood defences. For the purposes of this study, twelve growth area locations were considered, within these areas seven breach/overtopping scenarios were modelled to establish actual and residual risk.

Fluvial 2007 and 2107 outlines

- 4.2.2 Flood Zones 2 and 3a have been mapped using outlines from the River Waveney modelling as part of this study provided by JBA for both 2007 and 2107.
- 4.2.3 The River Blyth and Hundred River were not remodelled as part of the SFRA, therefore the existing Environment Agency Flood Zones have been used. Climate change runs were not available for the River Blyth and Hundred River. In the absence of revised modelling, the extent of Flood Zone 2 can be used to represent the extent of Flood Zone 3a with climate change.
- 4.2.4 This is summarised in Table 4-1. All Level 1 maps are provided at the back of this report.

Functional floodplain mapping (Flood Zone 3b)

- 4.2.5 The functional floodplain, Flood Zone 3b, was mapped using revised 1 in 20 year outlines from the River Waveney modelling as part of this study provided by JBA for 2007.
- 4.2.6 To make an allowance for climate change for Flood Zone 3b, the 1 in 20 year event plus a 20% increase in flows was mapped.
- 4.2.7 Functional floodplain outlines are not available for the River Blyth and Hundred River, as the previous Environment Agency flood outlines did not include the functional floodplain.

TABLE 4-1 SOURCE OF FLUVIAL OUTLINES

Watercourse	Flood Zone Data Source					
	2 (2007)	2 (2107)	3a (2007)	3a (2107)	3b (2007)	3b (2107)
River Waveney	EA flood outlines	JBA revised modelling	EA flood outlines	JBA revised modelling	JBA revised modelling	JBA revised modelling
Hundred River	EA flood outlines	Not Available	EA flood outlines	Not Available	Not Available	Not Available
Watercourse that flows through Wrentham	EA flood outlines	JBA revised modelling	EA flood outlines	JBA revised modelling	JBA revised modelling	JBA revised modelling
River Blyth	EA flood outlines	Not Available	EA flood outlines	Not Available	Not Available	Not Available
North Sea	EA flood outlines	Scott Wilson modelling outlines	EA flood outlines	Scott Wilson modelling outlines	Scott Wilson modelling outlines	Scott Wilson modelling outlines

- 4.2.8 Where functional floodplain information is not available, the PPS25 Practice Guide: A Living Draft, advises that all of Flood Zone 3 should be considered as Zone 3b (functional floodplain)

unless, or until, an appropriate FRA shows to the satisfaction of the EA that it can be considered as falling within Zone 3a (high probability).

- 4.2.9 The functional floodplain is mapped considering the presence of defences. The mapped functional floodplain Zone 3b, relates only to flooding from rivers and coastal sources and does not include areas at risk of flooding solely from other sources such as sewer and surface water sources.

5 Level 2 Assessment

5.1 Level 2 SFRA - Main SFRA and Development Sites Assessments

- 5.1.1 The majority of the growth areas are located within close proximity to a river or coastal area and are thus associated with Flood Zones 2 and 3. Through the Sequential Test approach, all development should, where possible, be sited in the areas of Flood Zone 1.
- 5.1.2 The objective of the Level 2 SFRA is to reduce the level of uncertainty regarding flood risk for any development sites that cannot be located in Flood Zone 1 through application of the Sequential Test. This SFRA in addition to the further modelling and hazard mapping is intended as a combined Level 1 and Level 2 SFRA.
- 5.1.3 The further modelling and hazard mapping of tidal flood defence breach scenarios, is intended to provide a greater level of detail for the areas of Lowestoft and Southwold. In addition the fluvial areas of the River Waveney have been mapped to show depth and hazard along the catchment area. This provides additional information on the variation of risk within Flood Zones to facilitate application of the Exception Test to sites in these areas that cannot be located in lower flood risk zones.
- 5.1.4 The assessment has been made at a strategic level and is intended only to inform how the potential strategic development areas may be at risk from these sources. This should therefore form a 'stepping-stone' for a site specific FRA, considering the recommendations discussed throughout the SFRA.
- 5.1.5 The Level 2 results tables are presented at the end of this appendix. At the time of writing this document no site-specific allocations had been finalised, therefore pending the finalisation of these, the growth areas were used to identify the flood risks to potential growth and development areas. If on completion of the preferred options there are any allocations that fall outside these growth areas, then the Sequential Test and potential exception test for these sites will need to be explored at that time.

5.2 Fluvial

- 5.2.1 In total there are 12 settlement areas located within close proximity to the Environment Agency floodplain extents. The extent of the floodplain within each site allocation varies significantly.
- 5.2.2 Site specific FRAs should aim to refine the Environment Agency floodmaps based upon detailed site topography and adjacent modelled flood levels, in addition to considering the implications of residual risk associated with the failure of defences discussed further in the Level 2 tables.

Fluvial Hazard Mapping

- 5.2.3 The fluvial hazard maps are based on 1 dimensional hydraulic models and as such do not have an associated velocity output. Therefore the hazard has been classified as a function of depth,

assuming zero velocity. The Hazard categories have been mapped using the 'FD2320/TR2 – Flood Risks Assessment Guidance for New Development' depths and associated hazard with an assumed zero velocity as shown in Table 13.1 of that document.

Key (depth of flooding in metres assuming a 0 m/s velocity*):	
0.30-0.50	Danger for Some
0.50-1.50	Danger for Most
1.50 +	Danger for All

**Taken from Table 13.1 Defra/ EA Flood and Coastal Defence R&D Programme FD2320.*

5.3 Overland Flow

- 5.3.1 As identified in section 2.3 of this report, the dominant geology in the area is characterised by the Craggs and Chillesford Clays. The dominant soil type in the area is classed as slowly permeable, seasonally waterlogged, fine loamy over clayey soils. It is therefore considered that flooding incidents associated with this particular source are localised in extent to specific areas of more impermeable geology. An assessment should be made from this source for individual site allocations based upon a site visit and the risks explored within a site-specific FRA.

5.4 Tidal Flood Defence Breach Analysis

- 5.4.1 Five breach locations were specified during the scoping stage of the SFRA through consultation with the Environment Agency and Waveney District Council. The following scenarios have been modelled as part of this analysis:

- Overtopping of the existing defences in Lowestoft;
- Overtopping of the existing defences combined with a breach at the North Denes in Lowestoft;
- Breach of assumed improved defences at North Quay in Lowestoft;
- Breach of assumed improved defences at Kirkley Ham in Lowestoft;
- Breach of assumed improved defences at School Road Quay in Lowestoft;
- Overtopping of the existing defences in Southwold;
- Overtopping of the existing defences combined with a breach at Buss Creek in Southwold.

- 5.4.2 The breach locations were determined through consultation with the local authority and Environment Agency. Potential poor defence standard or likelihood of failure was taken into consideration in addition to locations where a failure in defence could have the greatest consequences. In areas where the existing standard of defence was below the 1 in 200 year water level, the flood cells have modelled overtopping inundation i.e. the actual flood risk that would result at present day defence heights- Actual Risk.

5.4.3 Breaches were simulated using the following tidal event scenarios.

- 1 in 20 years (2007);
- 1 in 20 years plus 100 years of climate change (2107);
- 1 in 200 years (2007);
- 1 in 200 years plus 100 years of climate change (2107);
- 1 in 1000 years (2007);
- 1 in 1000 years plus 100 years of climate change (2107);

5.4.4 In accordance with PPS25 and Environment Agency guidelines 100 years of climate change was taken into account for the lifetime of residential development. Commercial development would only need to consider 60 years of climate change, so in that respect the maps present a conservative estimate for future commercial developments in these areas.

5.4.5 Considerable parts of the study area are either urbanised or associated with man-made features (e.g. roads, embankments, walls, bridges) that may strongly affect the free flood flow on the floodplain.

5.4.6 Embankments, flood defences, significant water courses and other linear features that may have been misrepresented due to the resolution of the hydraulic model used, have been incorporated into the hydraulic model by adding break lines (i.e. the mesh orientation is forced to follow the alignment of the features and the localised elevations are amended within the ground model). A detailed modelling methodology is presented in Section 5 of the main SFRA Report.

5.4.7 Smaller linear features and individual buildings have not been included in this model. More specific detailed models could be produced as part of a site specific flood risk assessment to refine the results in specific areas of interest.

5.4.8 It is important to note that a breach may occur at any point of the flood defences. For the purposes of this study the breach locations were focused on potential growth areas, and in areas thought most likely to breach.

Tidal Hazard mapping

5.4.9 The tidal hazard maps, indicate the variation of risk within the PPS25 defined Flood Zones 2 and 3, identifying areas of High, Medium and Low hazard as a result of overtopping and breach scenarios. The hazard maps were produced using the consequence and risk methodology outlined in Chapter 5 of the Main Report.

5.4.10 The 2D breach modelling produces variables for both depth and velocity during the tidal inundation as a result of a breach. The hazard zone methodology on a strategic scale is similar to the Flood Hazard guidance provided in DEFRA/EA R& D publication FD2320/TR2 Table 13.1 but excludes a debris factor. The debris factor cannot be considered on a strategic scale

as the source and volume of debris would vary hugely on a spatial basis resulting in ambiguous results.

- 5.4.11 The hazard zone maps have been produced by calculating the depth and velocity of inundation as a result of overtopping and breach scenarios. It is important to remember that the hazard maps associated with a breach scenario represent the hazard arising from a breach scenario in a specific location and will almost certainly vary spatially should the breach location differ.

6 Results

6.1 General

- 6.1.1 There were 5 breaches and three overtopping scenarios modelled over seven flood cells within the Waveney District. Taking climate change into account future water levels will be higher and the overtopping of existing defences will occur more frequently unless the height of the defences are raised inline with predicted water levels. In Lowestoft where strategic regeneration is proposed, an increased defence height was assumed and modelled to assess the remaining residual risk of flooding in the event of a failure in the defences.
- 6.1.2 Different scenarios in the figures at the back of this report are explained below (X represents an arbitrary number that corresponds to the location, and in this report will either be A i.e. A0 for Lowestoft, or B i.e. B0 for Southwold):
- X0 – existing conditions, where present defence heights are used for overtopping scenarios.
 - X1-4 – signifies the location of a simulated breach in the flood defences with an improved or the simulation of overtopping of flood defences. Future improvements in flood defences are taken into account in these numbered scenarios.
- 6.1.3 Considerable parts of the study area are urbanised or associated with man-made features (e.g. roads, embankments, walls, bridges), characteristics that may affect the flow of flood water on the floodplain. These, and other significant linear features, have been incorporated into the hydraulic model. (See Section 5 of the SFRA report for more information).

6.2 Breach Results

- 6.2.1 The Level 2 breach/overtopping result tables present the findings from the hydraulic modelling at the breach/overtopping locations in Lowestoft and Southwold. Hazard zones of high, medium and low hazard have been identified for each scenario. Figures A25, A30, A35, A40, A45, A52, and A57 include the details of the breach and the results of the different modelled scenarios. The methodology used to distinguish between high, medium and low hazard is included in the main SFRA report, (Chapter 5) and discussed in section 5.4.10 of this report.
- 6.2.2 Each table discusses the hazard zones resulting from a single breach. Breaches in other locations along the defences may result in different hazard zoning. This should be taken into account when determining whether a particular property is within the hazard zone. In addition to this, the hazard zone results for this study were produced at a regional scale, not appropriate for the assessment of whether individual properties on the edge of the zones are within a flood hazard zone or not. A precautionary approach is recommended when using the study results at the fringes of hazard zones.

7 Policy Review

- 7.1.1 National and local policies have been reviewed against the local flood risk issues and objectives identified by the Environment Agency in the CFMP. From these policies the following catchment wide and specific area strategies have been developed under the headings Flood Risk, SuDS, Flood Mitigation and the Water Environment. Integration of these suggested policy considerations into LDF/LDD should ensure that the objectives and aspirations of the EA and national policy are met whilst strengthening the position of the Local Planning Authority with regard to Flood Risk.

7.2 Flood Risk

Catchment Wide Strategies

1. National Policy requires that the Sequential Test is undertaken for all allocations in order to reduce the flood risk to the allocation and ensure that the vulnerability classification of the proposed development is appropriate to the flood zone classification;
2. National Policy also requires that Flood Risk Assessments (FRA) should be undertaken for all developments within Flood Zones 2 and 3 to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area. The FRA should make sure that where floodplain storage is removed, the development should provide compensatory storage on a level for level basis to ensure that there is no loss in flood water storage area;
3. Flood Risk Assessments are required for all developments in Flood Zone 1 that are greater than 1.0ha. However, if a critical drainage problem has been identified on a development in Flood Zone 1 then all developments that may have an impact on the local drainage should have to produce a Flood Risk Assessment or a drainage strategy.
4. Flood Risk to development should be assessed for all forms of flooding;

Area Specific Strategies

1. Areas such as Halesworth (prone to flooding from the River Blyth including inundation of many roads), Beccles, and Lowestoft (low lying areas flood after heavy rainfall), and any other areas where surface water flooding is an issue should be investigated in detail as part of FRAs for future developments located in surface water problem area. In addition, comprehensive surface water runoff calculations should be undertaken to demonstrate post development run-off rates will not exacerbate flooding elsewhere.
2. Tidal flooding pathways should be investigated in detail as part of FRA's for developments located in Southwold, where a number of properties are located on the unprotected side of the Environment Agency's tidal defence line.
3. The area of Lowestoft is at risk from actual flooding, due to informal flood defences of insufficient standard (i.e. not to the 1 in 200 year standard). Therefore the existing defences would be overtopped during current conditions as shown in Figure A21 and A22. In addition the existing defences would be overtopped during the 1 in 20 scenario including

climate change. This places large areas around Lake Lothing as being within Flood Zone 3b when climate change is considered. As a result development of this area may be limited unless strategic defence improvements are carried out.

4. In the event that flood defences are improved either on fluvial or tidal areas, future developments should also consider the residual risk of failure in the defences, and how this affects their development.
5. In accordance with PPS25 and Environment Agency guidance in this area, finished floor levels should be set above the 1 in 200 year flood level plus climate change for the lifetime of the development. Safe egress and access should also be possible from a development during a 1 in 1000 year event including climate change considerations for the lifetime of the development.

7.3 Sustainable Drainage Systems

7.3.1 Sustainable Drainage Policies should address the following issues as:

Catchment Wide Strategies

1. Sustainable Drainage Systems must be included in new developments as a way to manage surface water.
2. PPS25 requires the use of SuDS as an opportunity of managing flood risk, improving water quality and increasing amenity and biodiversity.
3. Flood risk assessments should be undertaken for developments in Flood Zone 1 greater than 1ha in size to ensure that flood risk is not increased to other properties due to increased site runoff;
4. Runoff rates from new developments should not increase following redevelopment, including an allowance for climate change;
5. Runoff rates should be restricted to greenfield runoff rates in areas known to have a history of sewer flooding;
6. Sustainable Drainage Systems should be located in accordance with current restrictions.

Area Specific Strategies

1. Consideration of implementing strategic flood storage areas operated by a single authority in areas such as Halesworth to reduce flood risk to towns and villages;
2. Restriction of greenfield runoff rates should be employed in developments in Halesworth and Lowestoft and any other areas that experience regular flooding, to ease surface water flooding and drainage capacity exceedance;
3. Developments in the locality of Halesworth and Lowestoft should assess whether capacity is available within the system to attenuate their excess site runoff and provide a contribution to the maintenance of the scheme.
4. Ensure that improvements to infrastructure in the district include drainage and considerations of access and egress for emergency planning purposes.

7.4 Flood Mitigation

Catchment Wide Strategies

1. Where an allocation borders an area benefiting from flood defence, opportunities should be sought for the maintenance of these flood defences to be partly funded by the development for its lifetime;
2. Opportunities should be sought to deculvert rivers, where possible, to return them to a natural system, reducing back up of flows and under capacity where this does not exacerbate the flooding elsewhere;
3. River channel restoration should be undertaken where possible to return the river to its natural state and restore floodplain to reduce the impact of flooding downstream;

Area Specific Strategies

1. In areas where flooding to roads is a regular occurrence and waterways are culverted, deculverting should be considered to increase capacity and reduce flooding. For example, Halesworth is prone to road flooding and thus, any culverted waterways should be investigated and the possibility of deculverting considered.
2. Where future development allocations propose road crossing culverts for access, these should be improved by the developer to increase capacity, including an allowance for climate change;
3. River corridors should be reintroduced around Halesworth where development is situated on both sides of the River Blyth;
4. Provide secondary bunds to contain flooding through tide locked outfalls at Beccles where a flood storage lagoon and hydrobrakes have been incorporated but flooding due to tide locking remains problematic,
5. Provide storage areas in Lowestoft where sewers become tidelocked.
6. Ensure maintenance of the Kirkley Brook culvert and consider improved defences to mitigate the flood risk of overtopping, which currently creates widespread flooding in the south of Lowestoft on both east and west sides of the Brook.
7. Lowestoft is divided by Lake Lothing and restricted access points across this waterbody. Therefore in the event of a flood it is essential the emergency plan takes into consideration that the infrastructure across this water body may be flooded, and alternatives will need to be incorporated into the evacuation plans.

7.5 Water Environment

Catchment Wide Strategy

1. Development should not have a detrimental impact on the water environment through changes to water chemistry or resource.

2. All new developments should look to incorporate water efficiency measures, for example, water reuse and minimisation technology;
3. Any development should not be located within 9 metres of the river bank to ensure access for maintenance but also to ensure a riparian corridor for improvement of the riverine environment.

7.5.1 Through integration of all the above suggestions (under Flood Risk, SuDS, Flood Mitigation and the Water Environment), the emerging LDF will comply with PPS25 and the aspirations and policies represented in the following:

- Waveney Local Plan (adopted Nov 1996), Waveney District Council, Policies ENV13, ENV16 and ENV18
- Waveney Interim Local Plan, Waveney District Council, Policy DC16

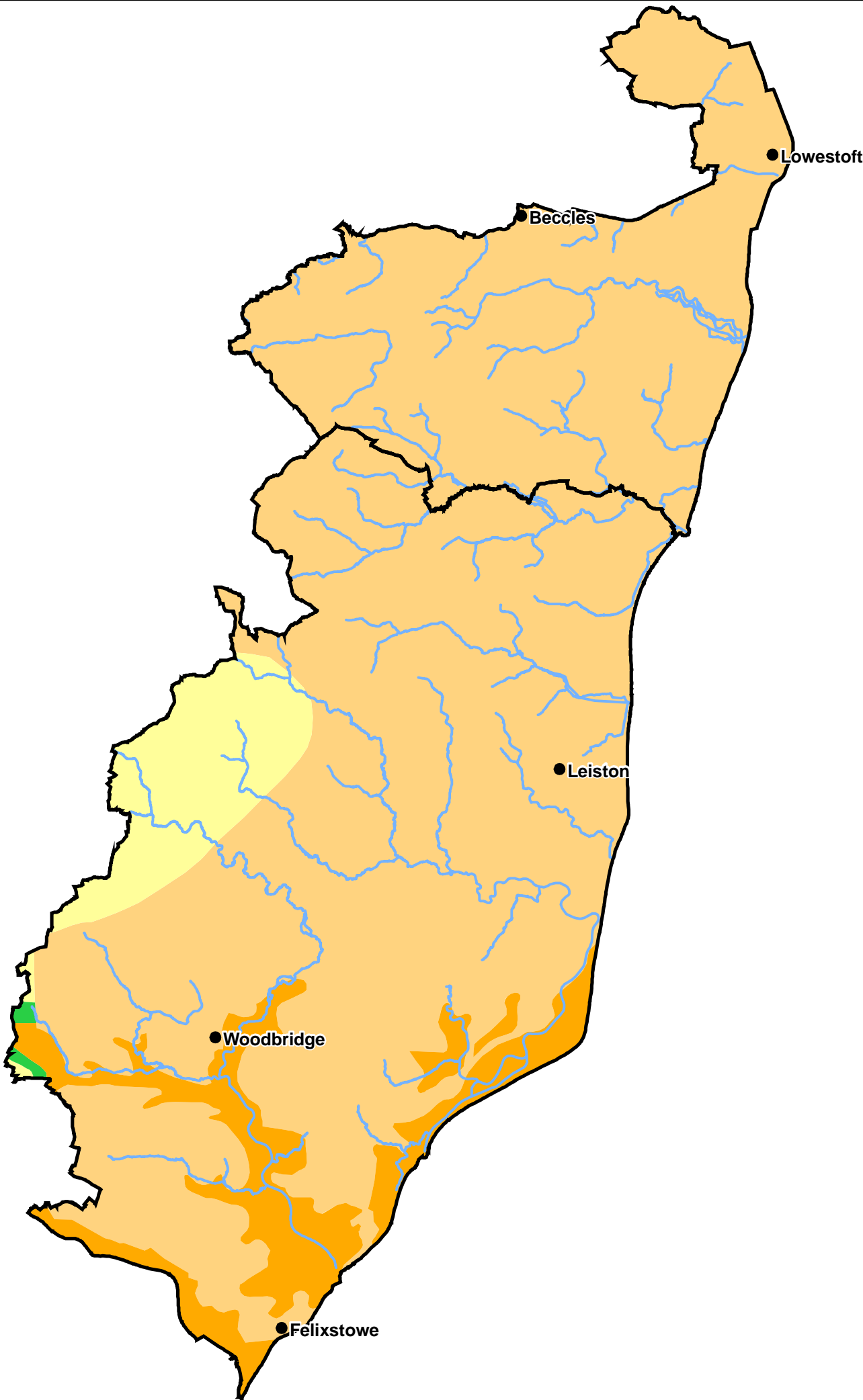
It is intended that the strategies above be integrated with Environment Agency strategies to strengthen the position of the Local Planning Authority.

8 Summary

- 8.1.1 This Strategic Flood Risk Assessment appendix for Waveney District Council has been completed in accordance with PPS25 and the current guidance outlined in the draft Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft' (Feb 2007).
- 8.1.2 Existing knowledge with respect to flood risk in the District of Waveney has been utilised in order to produce this SFRA. Over time, knowledge and extents of flood risk within the District may change, for example with improved defences or flood alleviation measures. This may alter predicted flood extents and associated flood risk classifications within the District, therefore influencing future development control decisions within these areas.
- 8.1.3 It is imperative that this SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives and improved understanding of flood risk within the District.

Waveney Figures Appendix

Plot Date: 18th July 2007
Filepath: L:\BA_Water\Projects & Jobs\0114000 to D114999\011426 4 - Suffolk Coastal and Waveney SFRA\GIS\Tm_Basings\okem\XDS\Finals\Figure A-I Solid Geology.mxd



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NOTES

- Chalk
- Lambeth Group
(shallow marine deposits)
- London Clay
- The Craggs (marine deposits)
& Chilesford Clay
- Main River Centreline

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Revision Details	By	Date	Suffix
	Check		

Drawing Status
FINAL

Job Title
**SUFFOLK COASTAL
AND WAVENEY
SFRA**

Drawing Title
SOLID GEOLOGY

Scale at A3
1:255,000

Drawn	TD	Approved	EC
Stage 1 check	Stage 2 check	Originated	Date

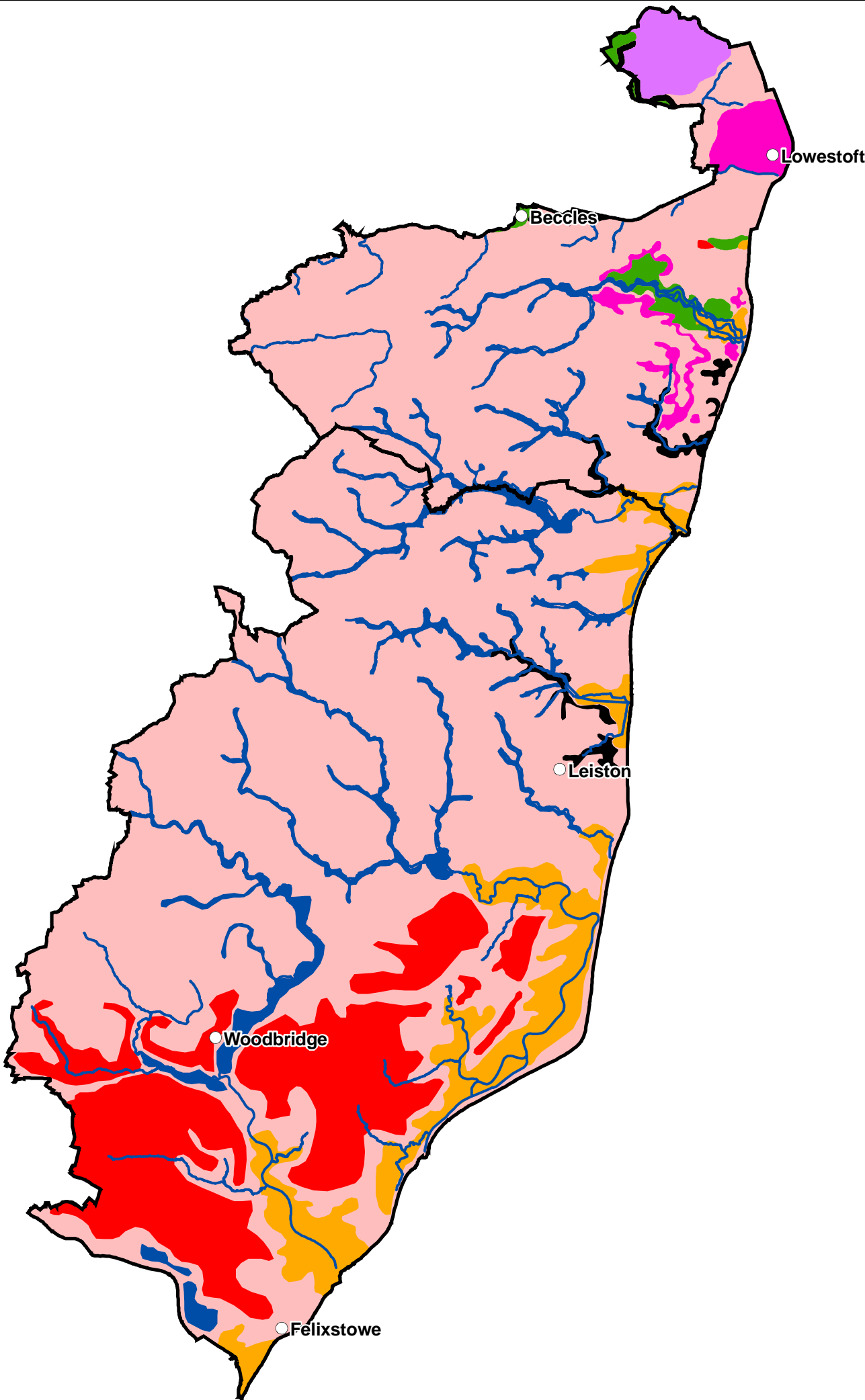
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Drawing Number
A-I

Rev

Plot Date: 18th July 2007
Filepath: L:\BA_Water\Projects & Jobs\D114000 to D114999\D11428 4 - Suffolk Coastal and Waveney SFRA\GIS\Tm_BasingslakeMXD\Final\Figure A-II Drift Geology.mxd



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NOTES

- Aldeby Sands and Gravels
- Alluvium / River Terrace Deposits
- Corton Formation
- Corton Woods Sands and Gravels
- Kesgrave Formation
- Lowestoft Formation
- Peat
- Tidal Flat Deposits
- Main River Centreline

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Job Title

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SFRA

Drawing Title

DRIFT GEOLOGY

Scale at A3

1:255,000

Drawn	TD	Approved	EC
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Stage 1 check	Stage 2 check	Originated	Date
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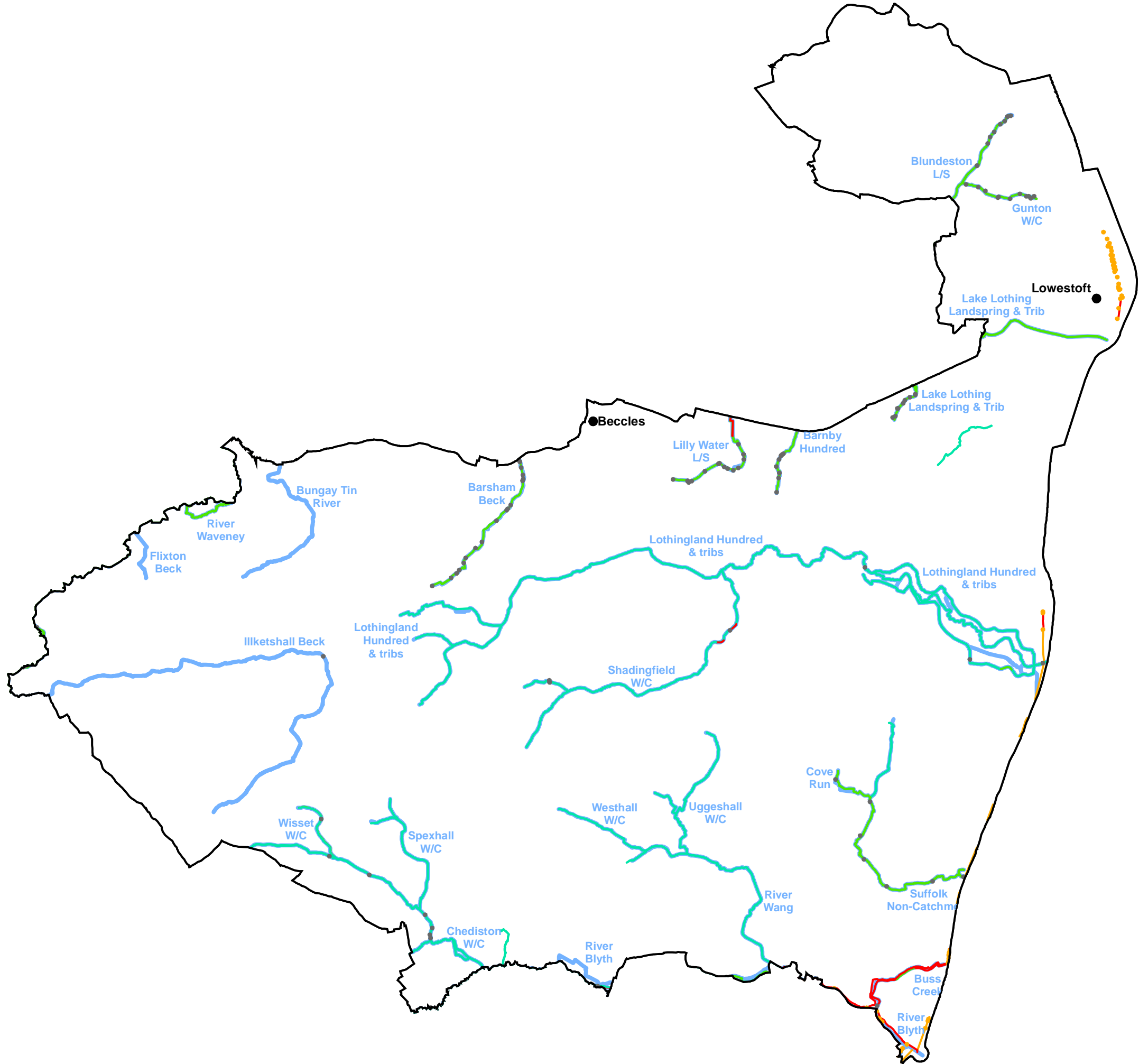
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NOTES

- Main River Centreline
- coastal protection; sea defence
- flood defence structure
- natural channel
- maintained channel
- culverted channel
- flood defence structure
- sea defence (natural)
- coastal protection (man-made)
- non-flood defence structure

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Drawing Title
**WAVENEY
NFCDD**

Scale at A3
1:100,000

Drawn	TD	Approved	EC
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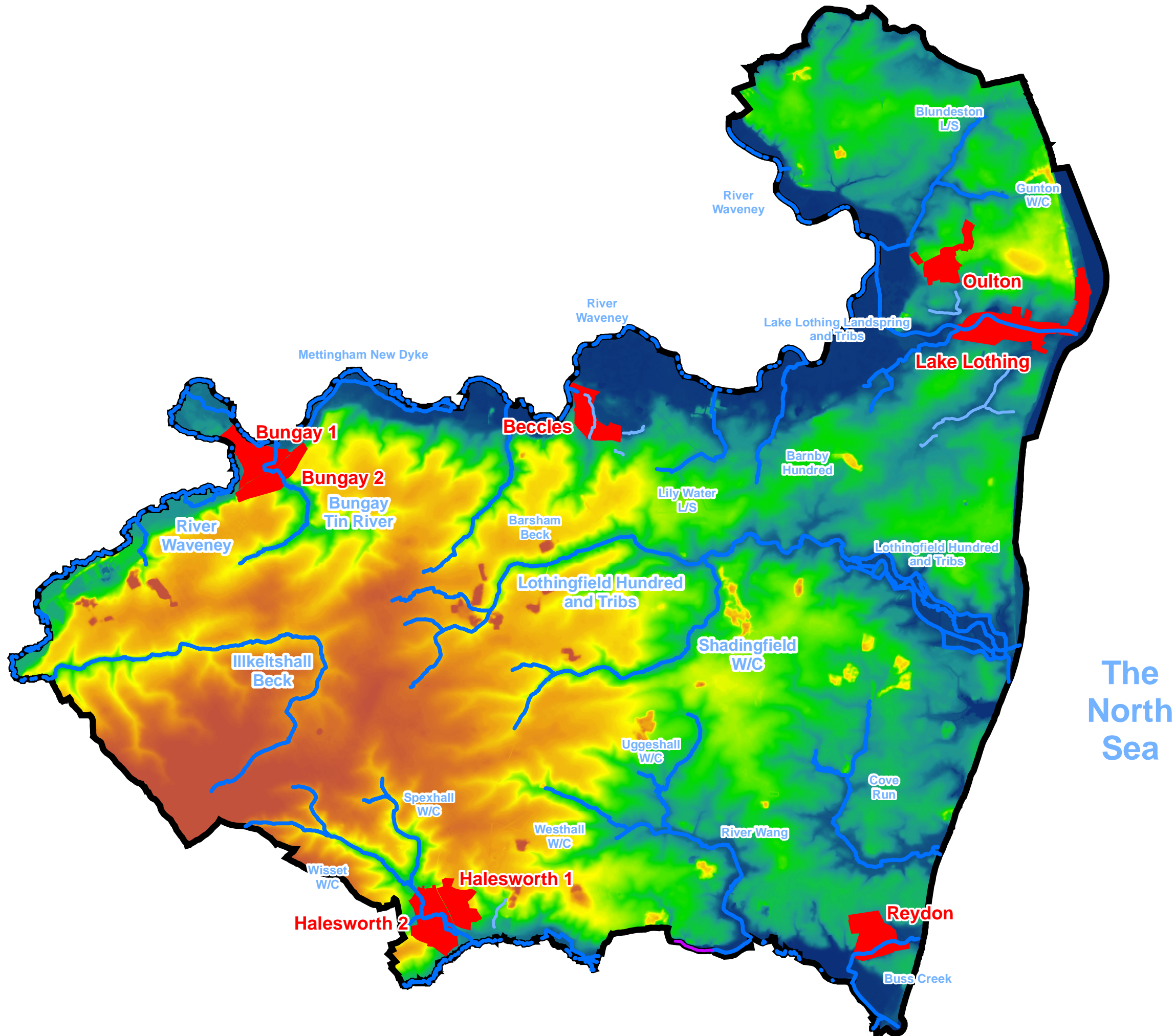
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Filepath: L:\BA_Water\Projects & Jobs\0114000 to D114990\ID114264 - Suffolk Coastal and Waveney SFRA\GIS\Tim_Basings\BokM\XDS\Finals\Figure A1 Waveney Main Settlements and Sources of Flooding.mxd



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NOTES

- Waveney_Boundary
- Main River Centreline
- COWs
- IDB Watercourses
- Potential Development Area

SAR Elevation Data

62.5 m AOD

-1.0 m AOD

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Job Title

SUFFOLK COASTAL AND WAVENEY SFRA

Drawing Title

WAVENEY MAIN SETTLEMENTS AND SOURCES OF FLOODING

Scale at A3

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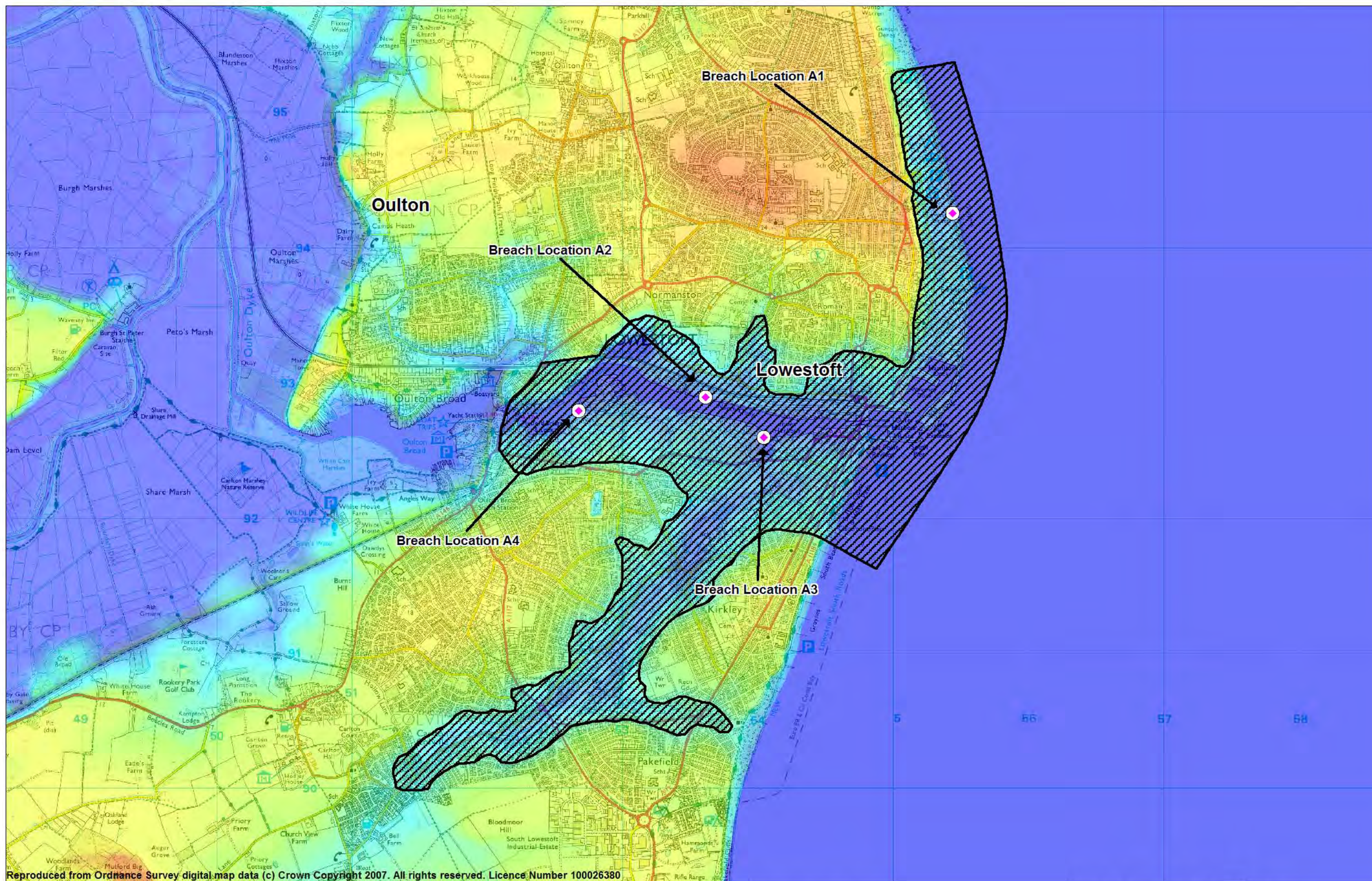
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Drawing Number

FIGURE A1

Rev



Project:
**Suffolk & Waveney
SFRA**

Title:
**Topography Map
of
North East Waveney**

Legend:
 Breach Location
 Floodcell

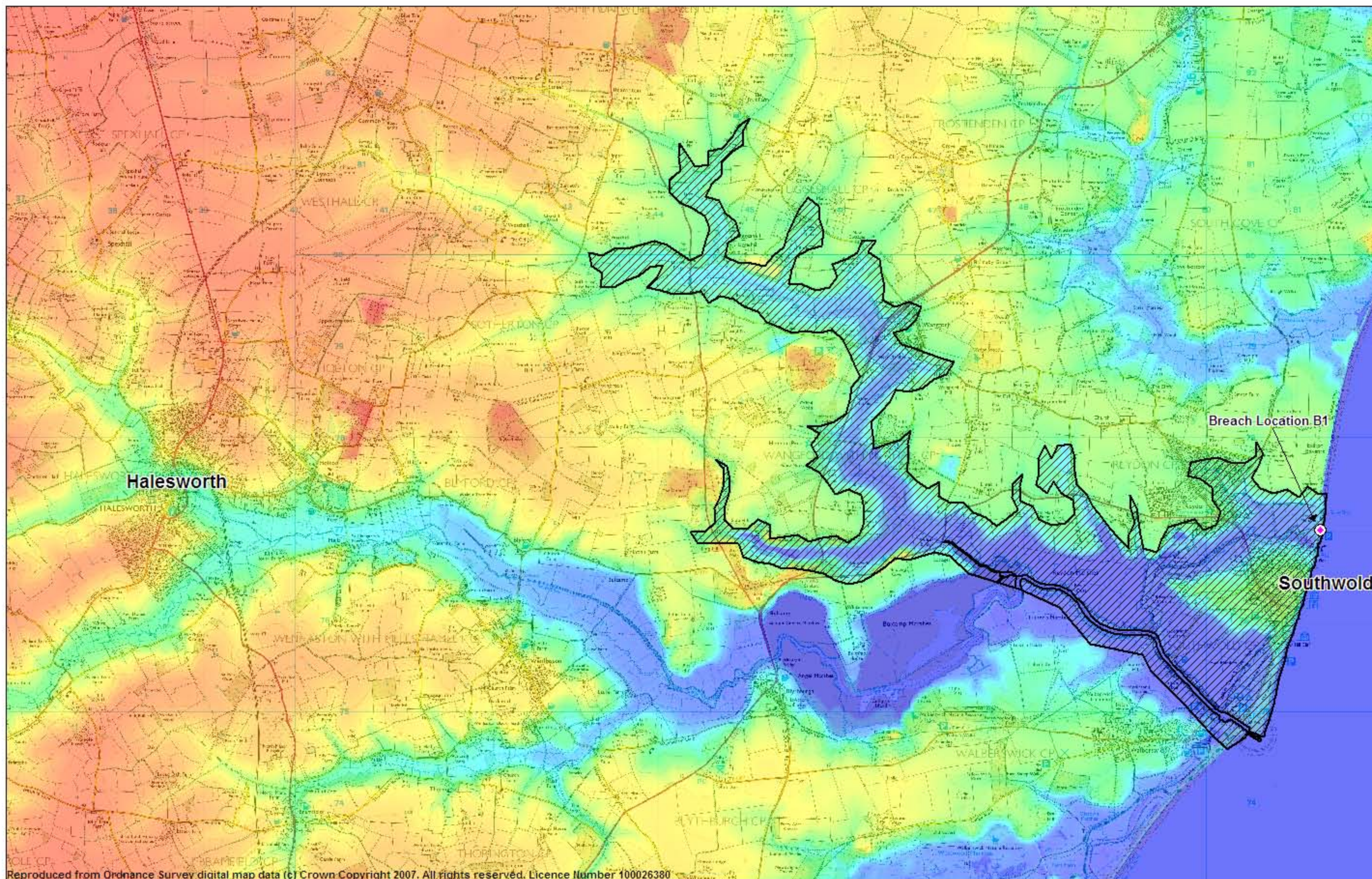
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FIGURE A2

Scale: 1:27000 @ A3
 Drw: AA App: JR
 Chk: LW Date: 14/01/07

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Project:
**Suffolk & Waveney
SFRA**

Title:
**Topography Map
of
South East Waveney**

Legend
 Breach Location
 Floodcell

Elevation [m AOD]

0.0 5.0 10.0 20.0 35.0 50.0 80.0

FIGURE A4

Scale: 1:40000 @ A3

Drw: MK

App: JR

Chk: LW





Date: 07/06/07



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NOTES

-  Waveney District Council Boundary
-  Potential Settlement Area
-  Main River Centreline
-  Environment Agency Flood Zone 3
-  Environment Agency Flood Zone 2

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Job Title	SUFFOLK COASTAL AND WAVENEY SFRA
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Drawing Title	ENVIRONMENT AGENCY FLOOD ZONES
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Scale at A1	1:50,000
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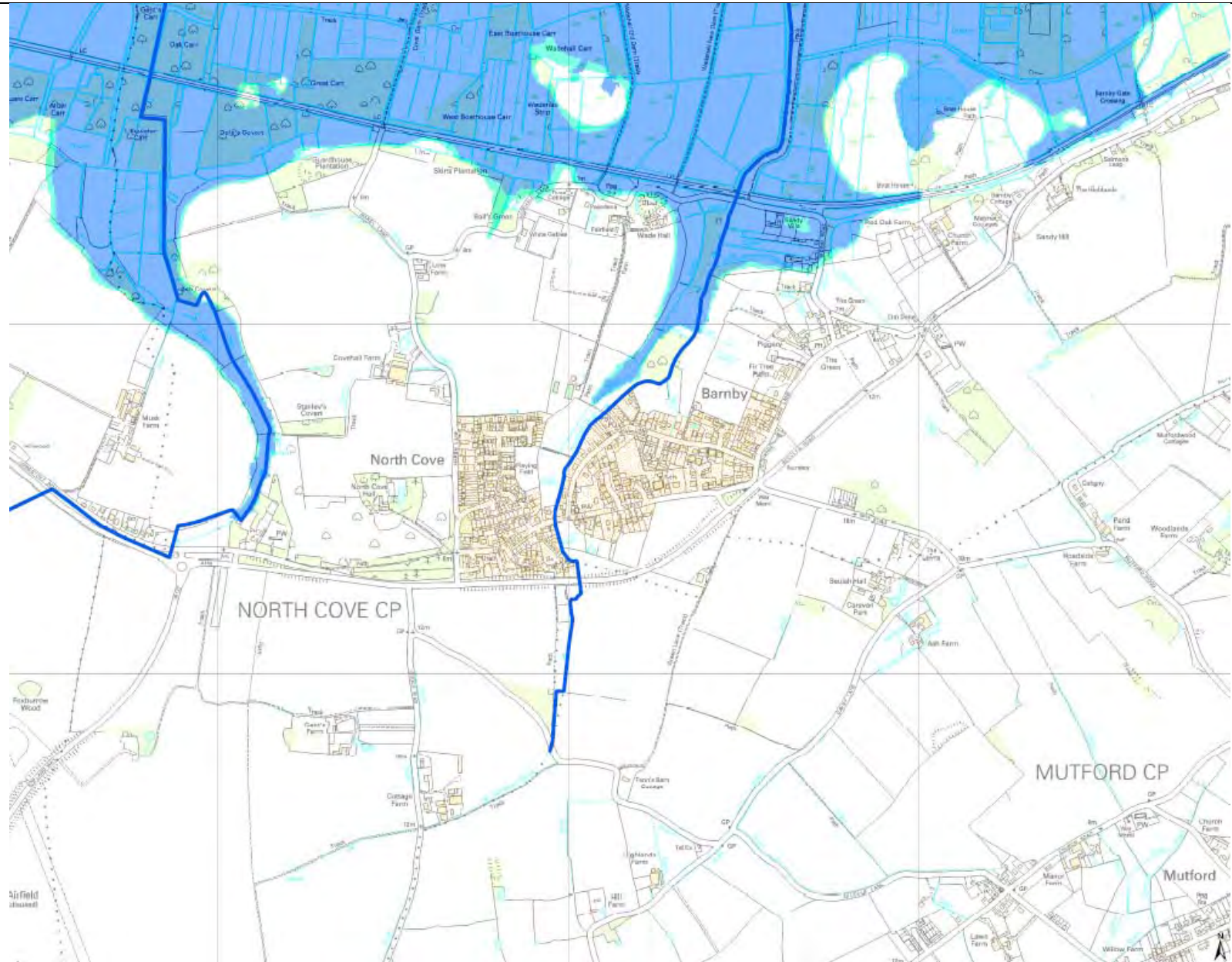


Waveney District Council LDF: Level 1 SFRA

Barnby & North Cove

PPS25 Flood Zones 2007

Figure A6

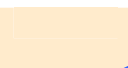



Preliminary Core Strategy Assessment


Flood Zone	1, 2 & 3
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in the area of Barnby and North Cove. Small-scale development could take place in larger villages to aid the local economy and provide affordable housing to meet local needs. Potential new allocations within the LDF Potential Growth Area in Barnby and North Cove could reasonably be accommodated outside Flood Zones 2 and 3.
Potential Employment Allocation	The Core Strategy preferred option (July 2006) aims to provide 5000 additional jobs in the Waveney district by 2021. Potential new employment allocations in the vicinity of Barnby and North Cove could reasonably be accommodated outside Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that there are regions with potential for development outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding.
Main River	The River Waveney runs from west to east, just to the north of Barnby and North Cove and Castle Marsh (a SSSI, SPA and SAC) is situated to the north of Barnby.
Problem drainage areas	Data not available.
Flood Record Information data	Data not available.
Origin of Mapping	Environment Agency tidal outlines
Functional Floodplain	Not Available – Functional floodplain levels for this location at this time are not available


Settlement Level Coarse Assessment

	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	27.12	0.00	0.00
% of Area		0.00	0.00

 Potential Growth Area

 Main River Centreline

 Environment Agency Flood Zone 2

 Environment Agency Flood Zone 3a

Scale @ A3 – 1:10,000

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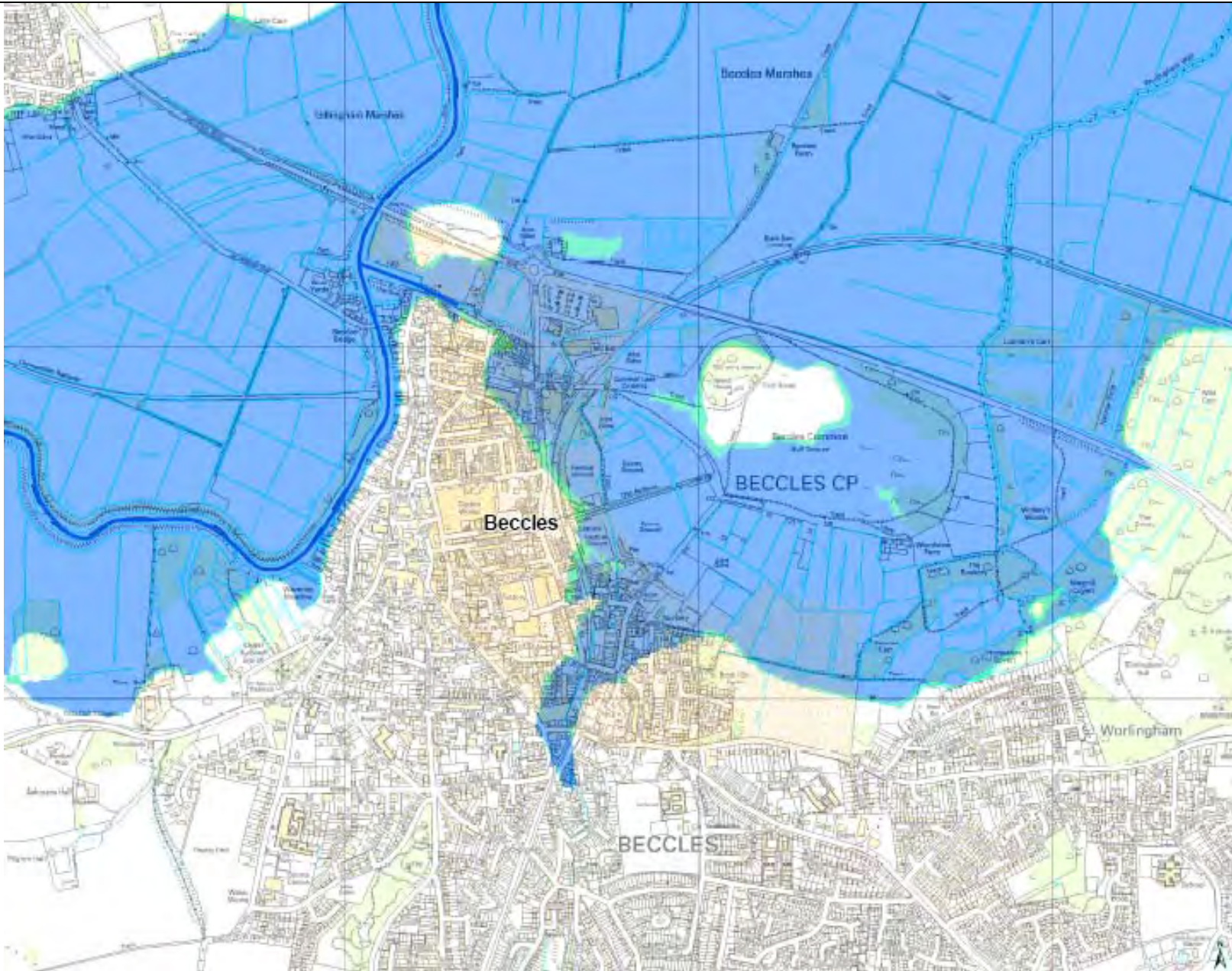
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Beccles

PPS25 Flood Zones 2007

Figure A7



Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in Beccles. The map shows one possible development area. Potential new allocations within the LDF Potential Growth Area in Beccles could reasonably be accommodated outside Flood Zones 2 and 3.
Potential Employment Allocation	Potential new employment allocations within the LDF Potential Growth Area in Beccles could reasonably be accommodated outside Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that there are regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding.
Main River	The River Waveney runs to the west of the development area.
Problem drainage areas	Problems have been experienced in the past in the areas of Darby Road, St Annes Road, Goose Green West and George Westwood Way, associated with the Beccles Drain..
Flood Record Information data	Widespread flooding of property in the catchment has been caused by tide-locking of a surface watercourse, which is an Anglian Water surface water sewer. This system has to be pump-drained when the gravity drainage system to the River Waveney is tide-locked. As a result a flood storage lagoon and hydro brakes have been incorporated into the system but flooding is still a problem in this area.
Origin of Mapping	Environment Agency tidal outlines
Functional Floodplain	Not Available – Functional floodplain levels for this location at this time are not available

Settlement Level Coarse Assessment

	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	97.67	44.25	48.18
% of Area		45.30	49.33

Potential Growth Area
Main River Centreline
Environment Agency Flood Zone 2
Environment Agency Flood Zone 3a
Scale @ A3 – 1:10,000

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Waveney District Council LDF: Level 1 SFRA



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Blundeston

PPS25 Flood Zones 2007

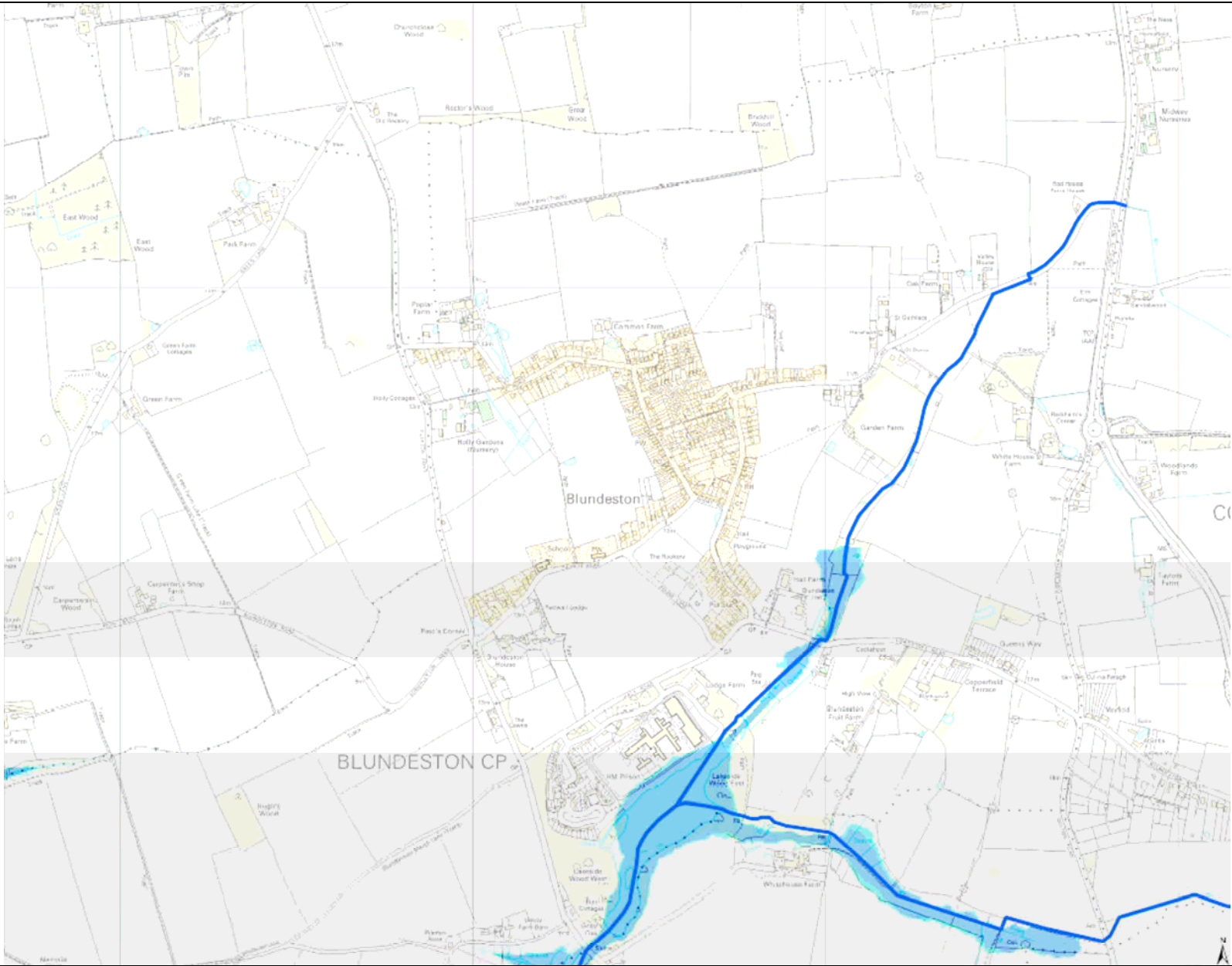
Figure A8

Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in the area of Blundeston. Small-scale development could take place in larger villages to aid the local economy and provide affordable housing to meet local needs. The map shows that new development could reasonably be allocated outside Flood Zones 2 and 3.
Potential Employment Allocation	Potential new employment allocations necessary to achieve the proposed 5000 additional jobs in Waveney could reasonably be accommodated outside Flood Zones 2 and 3.
All Potential Development Allocations	The map illustrates the regions that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding.
Main River	The River Waveney flows in a semi-circle around the western and northern side of Blundeston. Flixton Decoy flows from the east to the south of Blundeston.
Problem drainage areas	Data not available.
Flood Record Information data	Data not available.
Origin of Mapping	Environment Agency fluvial outlines
Functional Floodplain	Not Available – Functional floodplain levels for this location at this time are not available.

Settlement Level Coarse Assessment

	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	28.52	0.00	0.00
% of Area		0.00	0.00



Potential Growth Area
Main River Centreline
Environment Agency Flood Zone 2
Environment Agency Flood Zone 3a
Scale @ A3 – 1:10,000

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Waveney District Council LDF: Level 1 SFRA



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Bungay

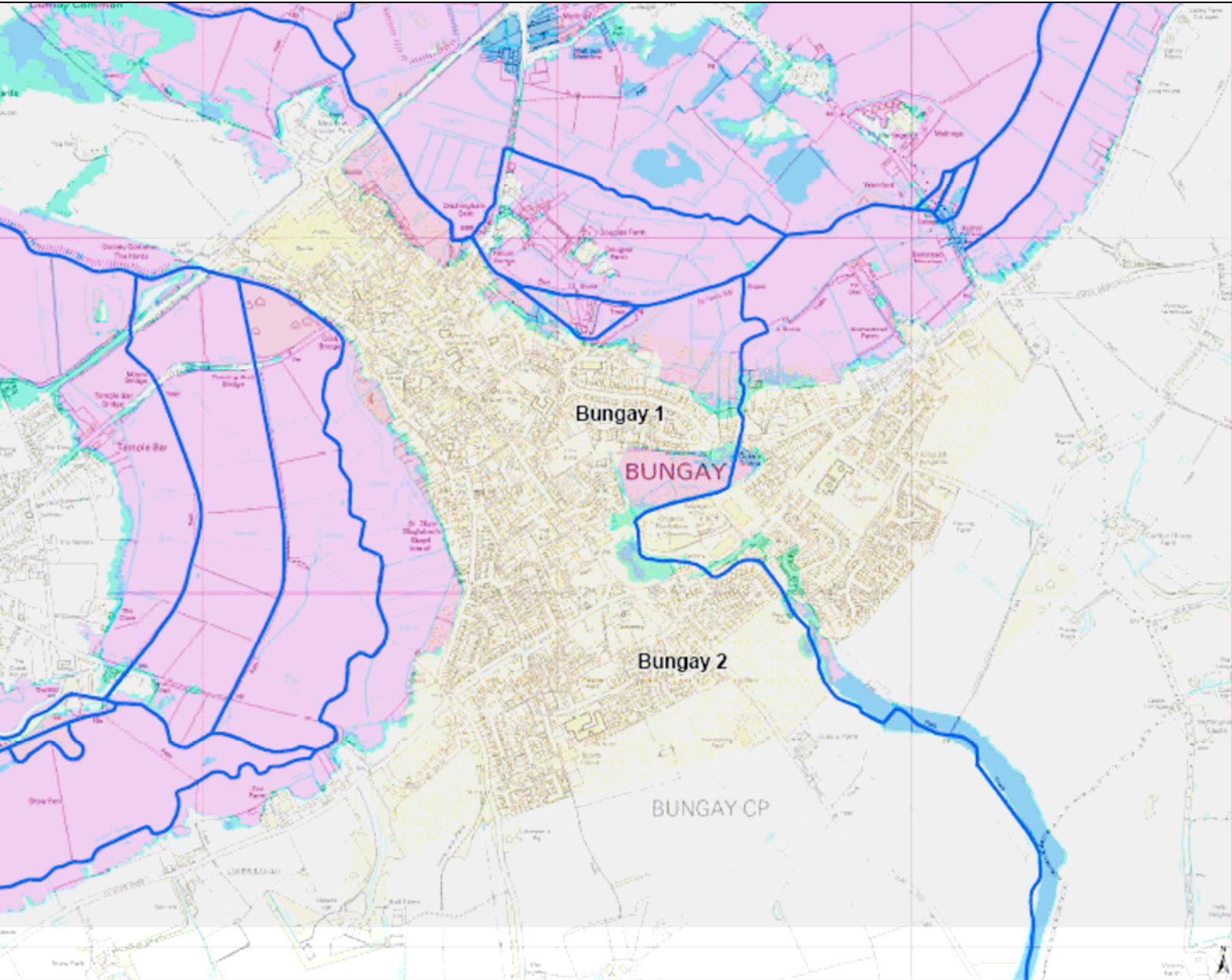
PPS25 Flood Zones 2007

Figure A9

Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3a & 3b
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in the area of Bungay. The map shows two possible broad areas where this development could be located. Potential new development areas within the LDF Potential Growth Area of Bungay (areas 1 and 2) could reasonably be accommodated outside Flood Zones 2 and 3.
Potential Employment Allocation	Potential new employment allocations within the LDF Potential Growth Areas in Bungay (areas 1 and 2) could reasonably be accommodated outside Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that there are regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding.
Main River	The River Waveney runs around the town of Bungay with a tributary of the river running through the development area.
Problem drainage areas	Data not available.
Flood Record Information data	Data not available.
Origin of Mapping	Re-modelled River Waveney outlines
Functional Floodplain	The Functional Floodplain is generally located beyond the extents of both Flood Zone 2 and 3. To the north of Bungay the Functional Floodplain encroaches on residential areas towards Trinity Street and Beccles Road. To the south, the Functional Floodplain extends towards residential properties to the south west of Castle Lane and Boyscott Lane.

Settlement Level Coarse Assessment



Potential Growth Area
Main River Centreline
Scale @ A3 – 1:10,000
Flood Zone 2
Flood Zone 3a
Functional Floodplain
Flood Zone 3b

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	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area 1 (ha)	118.76	19.92	22.79
% of Area 1		16.77	19.19
Area 2 (ha)	88.40	3.36	3.92
% of Area 2		3.81	4.43

Waveney District Council LDF: Level 1 SFRA



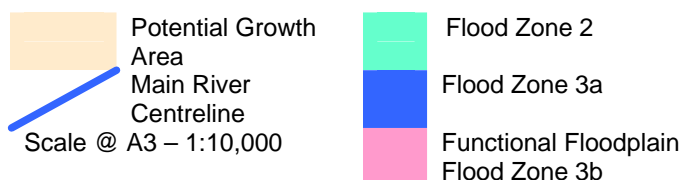
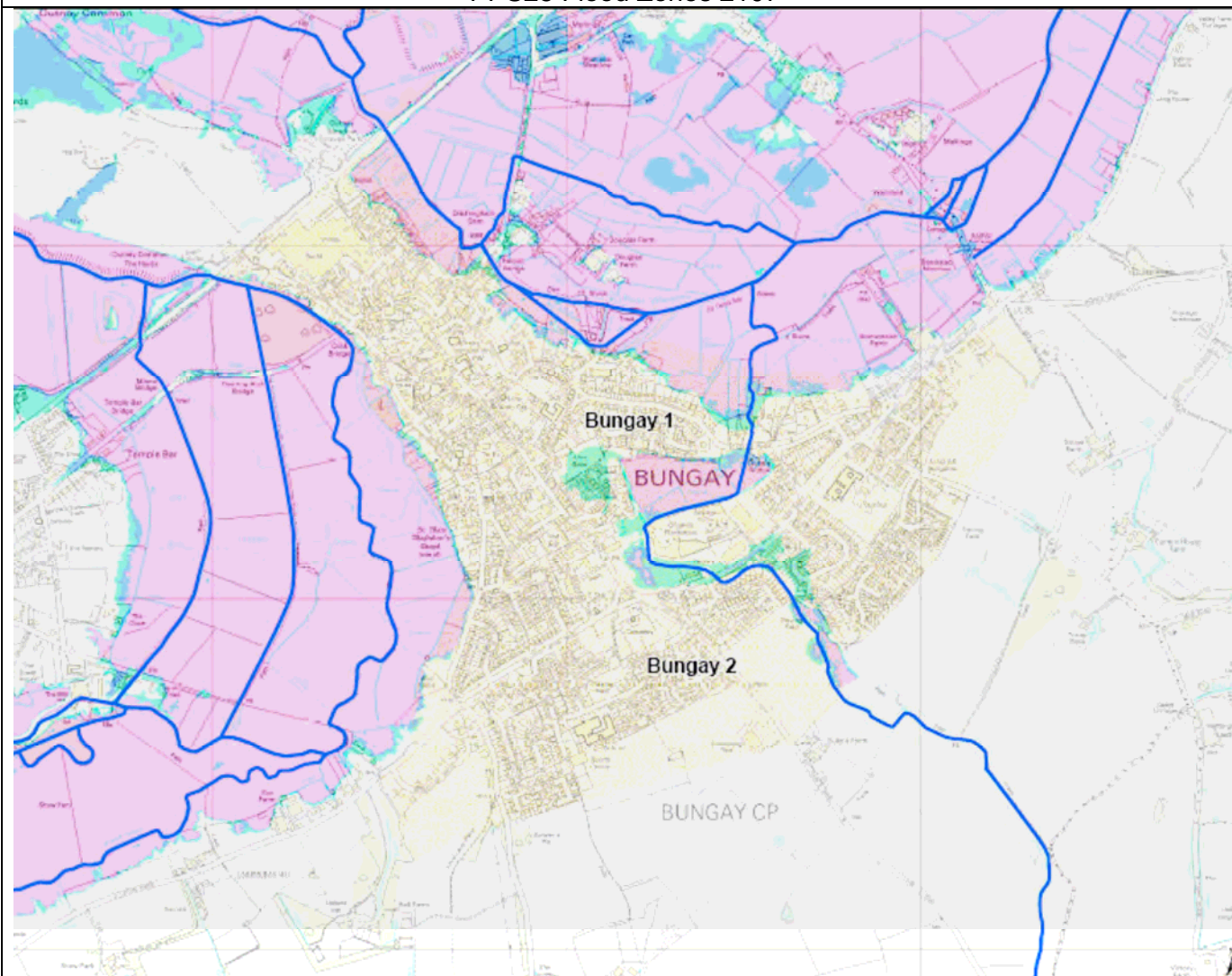
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Bungay

Figure A10

PPS25 Flood Zones 2107



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The delineation of Flood Zones 2, 3a and 3b have been undertaken using outlines from the River Waveney modelling as part of this study provided by JBA. These are mapped in the PPS25 Flood Zones 2007 maps.

To make an allowance for climate change for Flood Zones 2, 3a and 3b, the 1 in 1000, 1 in 100 year and 1 in 20 events plus a 20% increase in flows was mapped respectively. The model for the River Waveney was re-run by JBA to determine these outlines, which are mapped in the above figure, which depicts the PPS25 flood zones inclusive of climate change, PPS25 Flood Zones 2107. In accordance with PPS25, 100 years of climate change have been mapped appropriate for residential development considerations.

Waveney District Council LDF: Level 1 SFRA



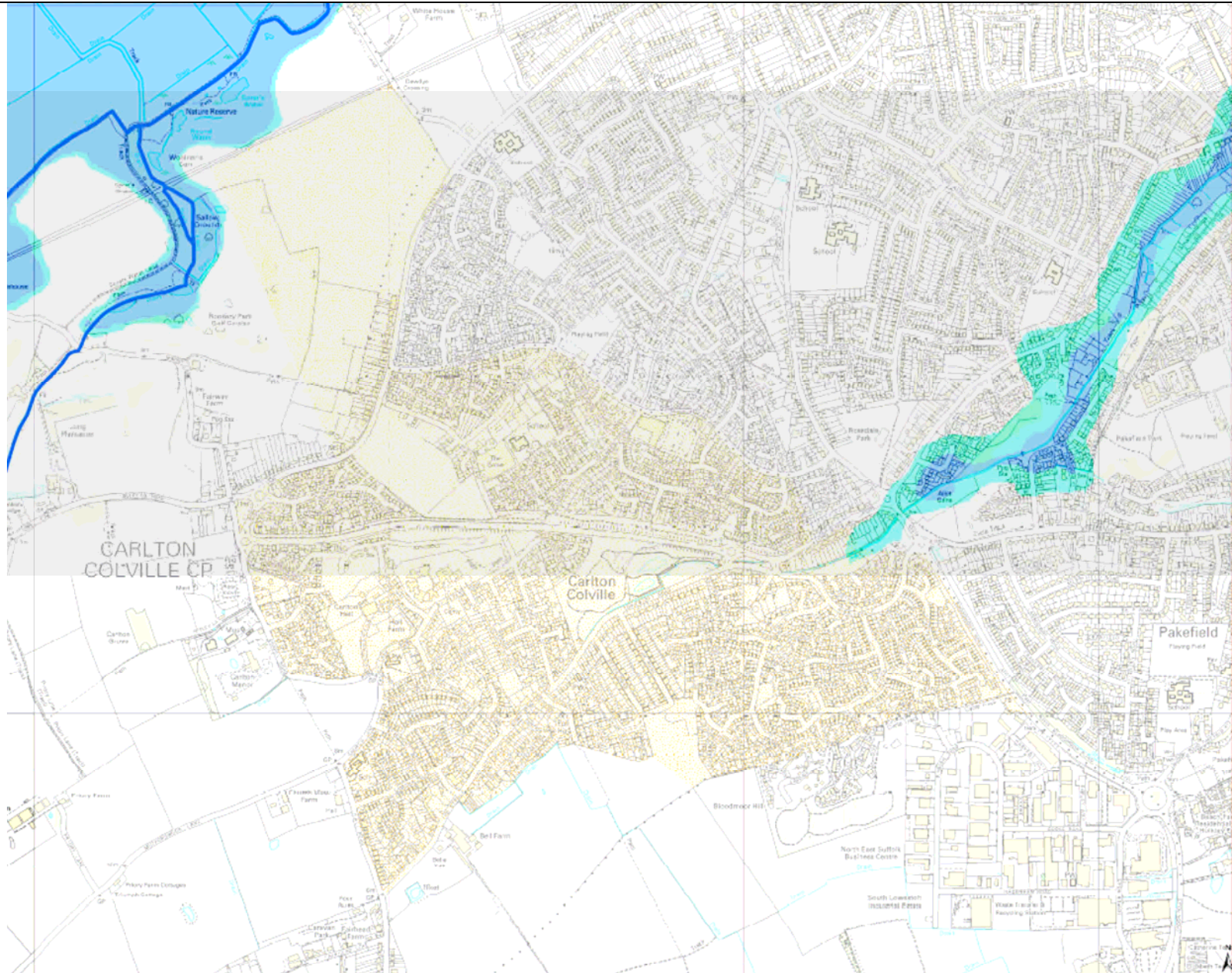
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Carlton Colville

PPS25 Flood Zones 2007

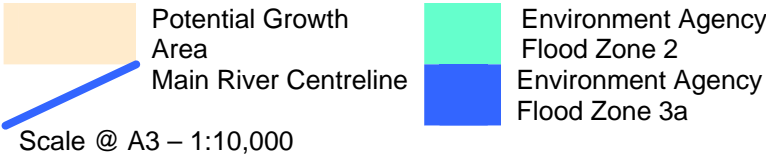
Figure A11



Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Most additional housing is proposed in the main town of Lowestoft (which includes Carlton Colville). The map shows potential growth areas within Carlton Colville, the majority of which is outside Flood Zones 2 and 3.
Potential Employment Allocation	Potential new employment allocations within the LDF Potential Growth Areas in Carlton Colville could reasonably be accommodated outside Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that there are regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding.
Main River	The River Waveney runs northwards to the west of Carlton Colville, heading away from Carlton Colville. Lake Lothing, Oulton Broad and Oulton Dyke are situated to the north of Carlton Colville.
Problem drainage areas	Area adjacent to Kirkley Stream, including The Street, Lowestoft Road and roads to the south east of these.
Flood Record Information data	Data not available.
Origin of Mapping	Environment Agency tidal outlines
Functional Floodplain	Not Available – Functional floodplain levels for this location at this time are not available

Settlement Level Coarse Assessment



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	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	217.15	0.00	0.30
% of Area		0.00	0.14

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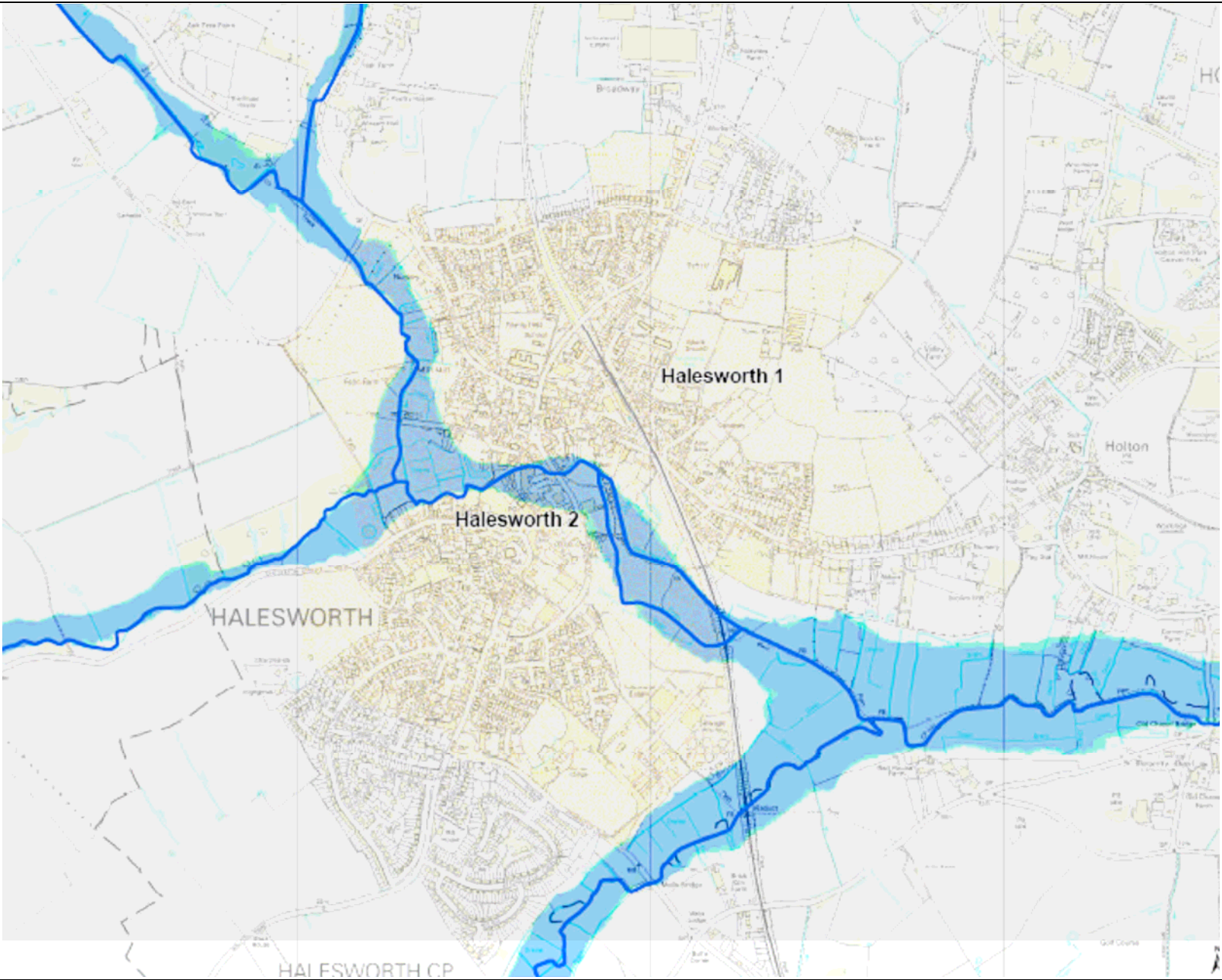
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Halesworth

PPS25 Flood Zones 2007

Figure A12



Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in Halesworth. The map shows two possible growth areas. These represent areas under development pressure, or where existing allocations and/or known brownfield sites occur, in conjunction with potential flood risk. Preliminary assessment shows that any potential new allocations for housing development within Halesworth (area 1 and 2), as outlined in the LDF Potential Growth Area, could reasonably be accommodated outside Flood Zones 2 and 3.
Potential Employment Allocation	Preliminary assessment shows that any potential new allocations for employment within Halesworth (area 1), as outlined in the LDF Potential Growth Area, would not lie within Flood Zones 2 and 3. Potential new employment allocations within the LDF Potential Growth Areas in Halesworth (area 2) could reasonably be accommodated outside Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that there are regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding.
Problem Drainage Areas	Data not available.
Main River	A tributary of the River Blyth runs through Halesworth 2 development area.
Flood Record Information data	Areas of Halesworth have been affected by floodwater from the River Blyth. This town is particularly sensitive to flood events due to high property densities on both sides of the river which runs through the town and the presence of two confluences, one to the west of the town situated in a low lying area and another to the south east. A number of different flood events have hit this area. In 1909 the River Blyth flooded farmland and lead to many roads becoming impassable. In 1968 the River Blyth flooded again leading to the blocking of many roads. Various works have been undertaken in an attempt to improve channel conveyance since this flood but there is still potential for flooding. Indeed, the October 1993 flood affected 46 properties in the area. (East Suffolk Catchment Flood Management Plan – Draft Scoping Report, July 2006)
Origin of Mapping	Environment Agency fluvial outlines
Functional Floodplain	Not Available – Functional floodplain levels for this location at this time are not available

Settlement Level Coarse Assessment

Potential Growth Area
Main River Centreline
Environment Agency Flood Zone 2
Environment Agency Flood Zone 3a
Scale @ A3 – 1:10,000

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	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area 1 (ha)	79.27	0.00	0.00
% of Area 1		0.00	0.00
Area 2 (ha)	145.15	24.41	26.93
% of Area 2		16.81	18.55

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Kessingland

PPS25 Flood Zones 2007

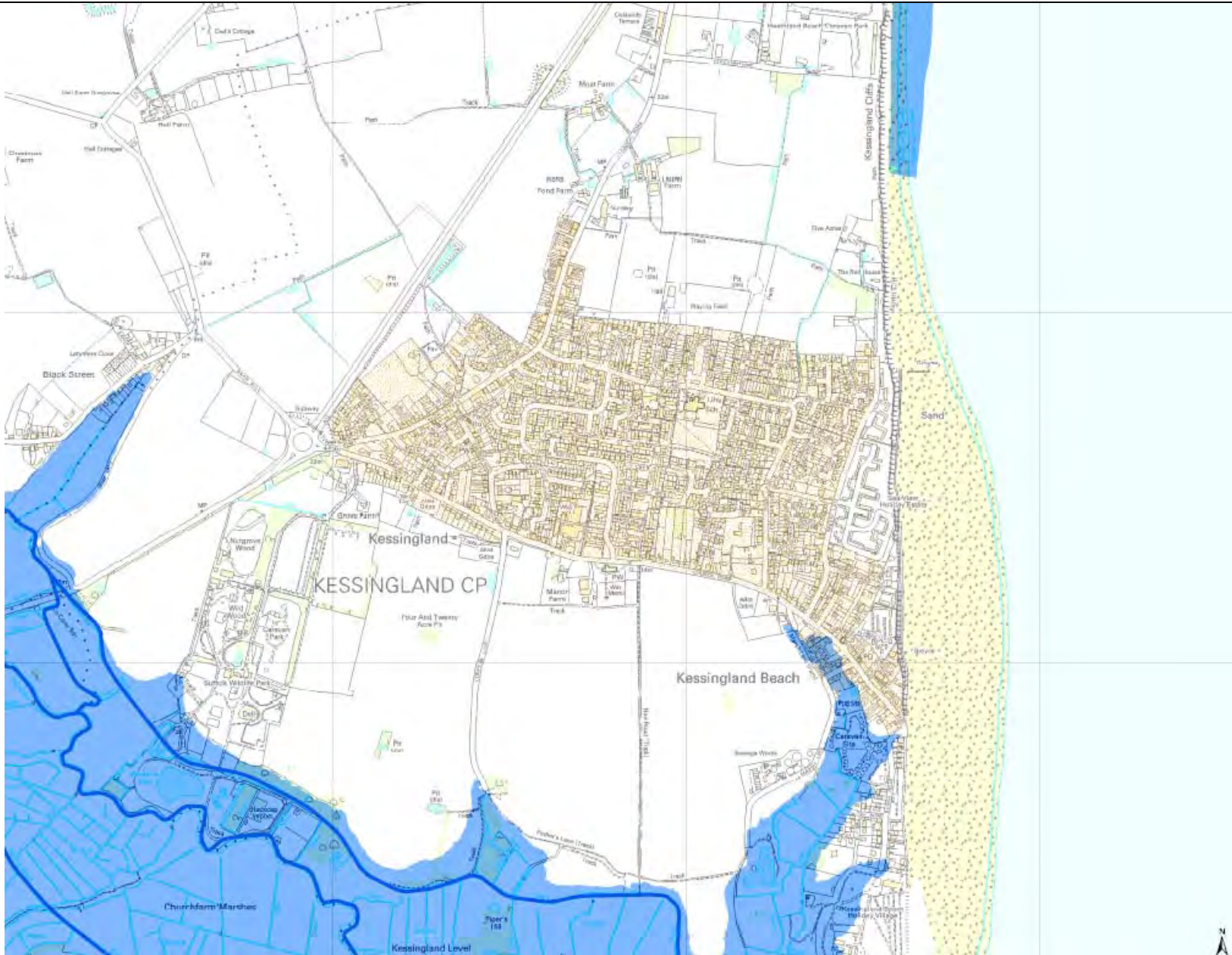
Figure A13

Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in the area of Kessingland. Small-scale development could take place in larger villages to aid the local economy and provide affordable housing to meet local needs. The Interim Waveney Local Plan encourages development of these larger villages rather than smaller settlements. Potential new development areas within the LDF Potential Growth Area of Kessingland could reasonably be accommodated outside Flood Zones 2 and 3.
Potential Employment Allocation	Potential new employment allocations within the LDF Potential Growth Areas in Kessingland could reasonably be accommodated outside Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that there are regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3, to the north, west and south west of Kessingland. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding.
Main River	The Hundred River flows towards the east coast to the south of Kessingland.
Problem drainage areas	Risk of surface water flooding from overloaded drainage systems in Coopers Drive, Church Road, Wash Lane, Turrell Drive, The Nordalls and surrounding areas.
Flood Record Information data	Data not available.
Origin of Mapping	Environment Agency tidal outlines
Functional Floodplain	Not Available – Functional floodplain levels for this location at this time are not available

Settlement Level Coarse Assessment

	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	99.76	1.20	1.20
% of Area		1.21	1.21



Potential Growth Area
Main River Centreline
Environment Agency Flood Zone 2
Environment Agency Flood Zone 3a
Scale @ A3 – 1:10000

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Oulton

PPS25 Flood Zones 2007

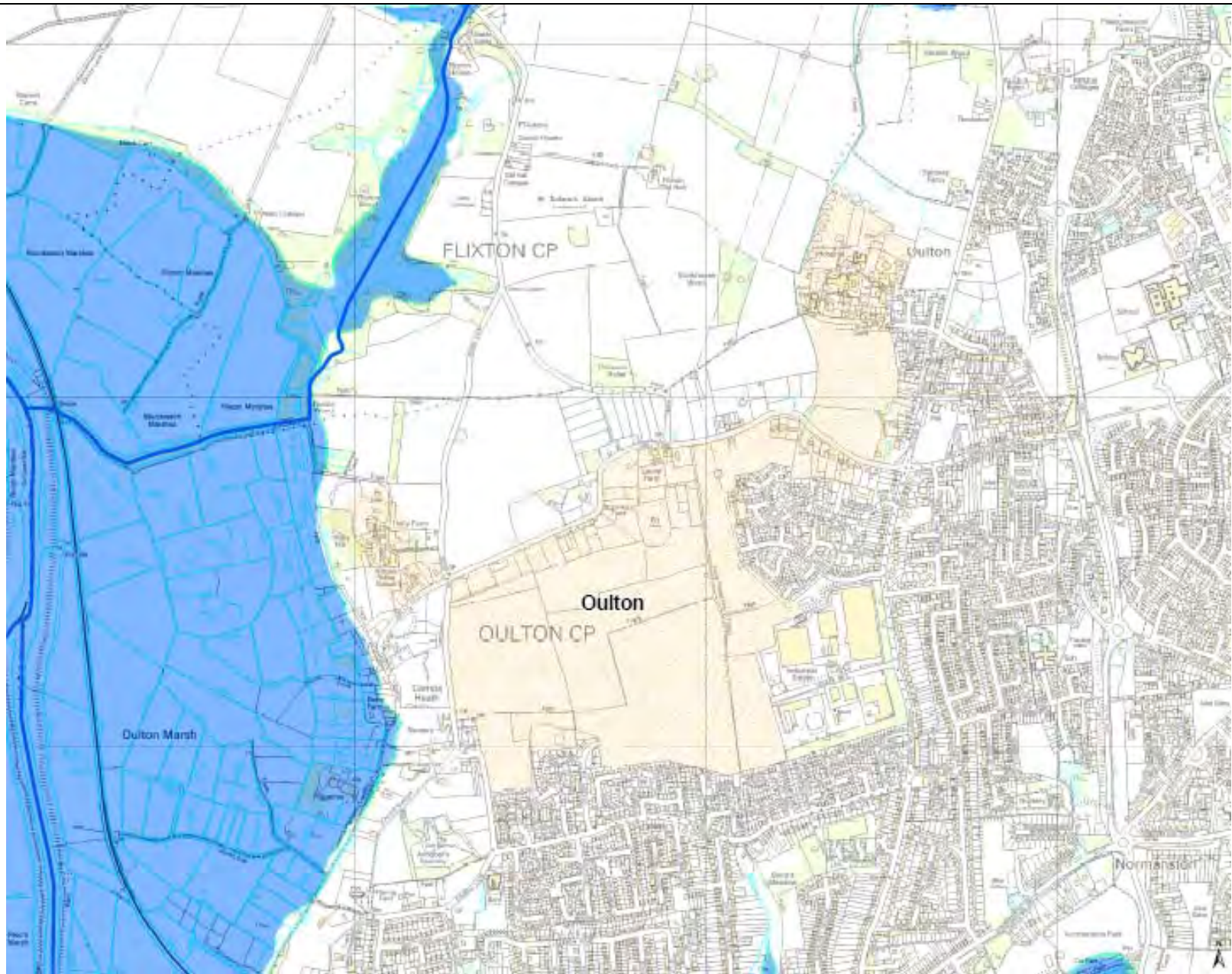
Figure A14

Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in Oulton. The Waveney Local Plan (adopted November 1996) and Waveney Interim Local Plan (May 2004) allocated the area to the north of Sands Lane for 800 dwellings, a country park and other supporting infrastructure. In addition, developers have suggested further land in Oulton to meet the need. Preliminary assessment shows that any allocations for housing development within Oulton, as outlined in the LDF Potential Growth Area, would not lie within Flood Zones 2 and 3.
Potential Employment Allocation	Preliminary assessment shows that any potential new allocations for employment within Oulton, as outlined in the LDF Potential Growth Area, would not lie within Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that the Potential Growth Area is outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. All site allocations can therefore be located outside areas at risk of flooding.
Main River	Oulton Dyke runs to the west of the development area.
Problem drainage areas	Data not available
Flood Record Information data	Flooding was a recurrent issue around Boulevard and Bridge Road on the south side and Caldecott Road on the north side until about ten years ago when the Environment Agency carried out improvements to the flood defences and began to pump sewerage from the south side to the north side. There may still however be a risk of flooding to the area
Origin of Mapping	Environment Agency tidal outlines
Functional Floodplain	Not Available – Functional floodplain levels for this location at this time are not available

Settlement Level Coarse Assessment

	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	97.12	0.00	0.00
% of Area		0.00	0.00



Potential Growth Area
Main River Centreline
Scale @ A3 – 1:10,000
Environment Agency Flood Zone 2
Environment Agency Flood Zone 3a

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Wangford

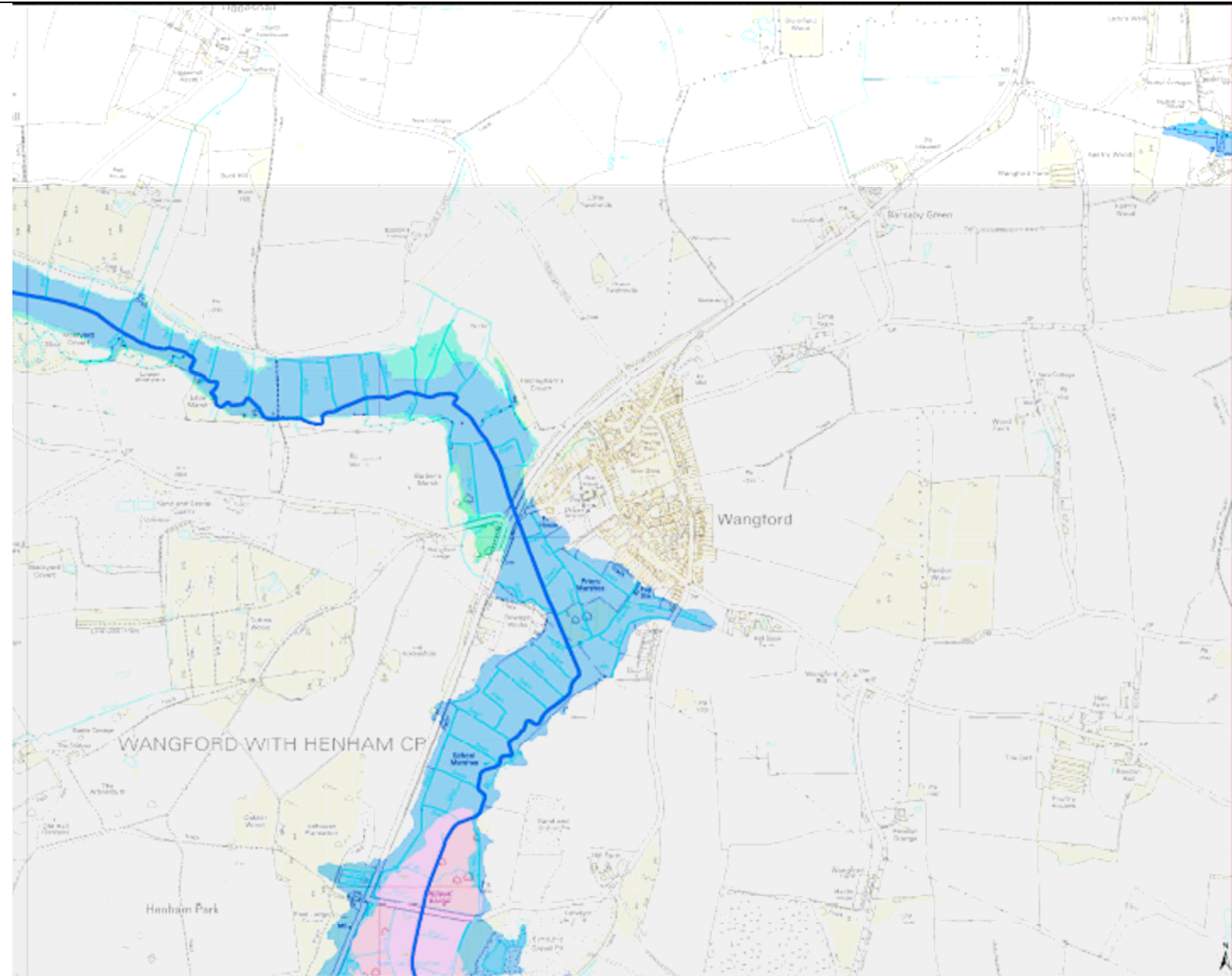
PPS25 Flood Zones 2007

Figure A15

Preliminary Core Strategy Assessment

Flood Zone	1, 2 & 3a & 3b
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in the area of Wangford. Small-scale development could take place in larger villages to aid the local economy and provide affordable housing to meet local needs. The map shows possible directions for the location of development. Potential new development areas within the LDF Potential Growth Area of Wangford (areas 1 and 2) could reasonably be accommodated outside Flood Zones 2 and 3 if located towards the north and east of the current developed area.
Potential Employment Allocation	Potential new employment allocations within the LDF Potential Growth Areas in Wangford could reasonably be accommodated outside Flood Zones 2 and 3, again if steered towards the north and east of the current developed area.
All Potential Development Allocations	The map shows that there are regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding, i.e. towards the south west of the current developed area.
Main River	The River Wang, a tributary of the River Blyth flows to the south west of Wangford and subsequently to the south towards the River Blyth.
Problem drainage areas	Data not available.
Flood Record Information data	Data not available.
Origin of Mapping	Environment Agency fluvial outlines and modelled (overtopping) functional floodplain
Functional Floodplain	The tidal functional floodplain is located to the south of the settlement area,

Settlement Level Coarse Assessment



Potential Growth Area
Main River Centreline
Scale @ A3 – 1:10,000

Environment Agency Flood Zone 2
Environment Agency Flood Zone 3a
Functional Floodplain Flood Plain 3b

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	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	17.15	0.13	0.13
% of Area		0.74	0.74

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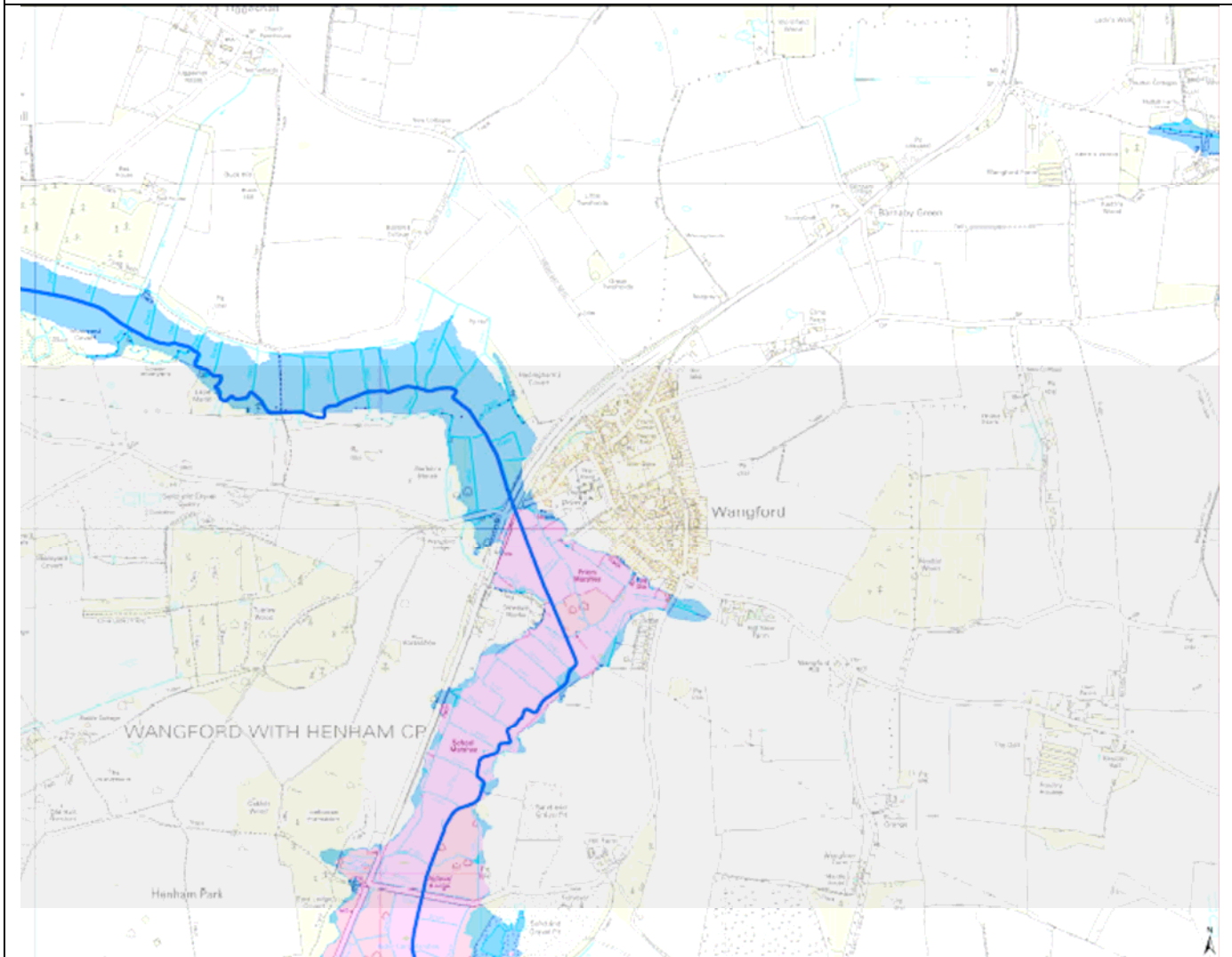
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Wangford

Figure A16

PPS25 Flood Zones 2107



Potential Growth Area
Main River Centreline

Scale @ A3 – 1:10,000

Environment Agency Flood Zone 2 representing Flood Zone 3a in climate change scenario
Functional Floodplain Flood Zone 3b

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The delineation of Flood Zone 3a with the influence of climate change has been estimated from the current Environment Agency Flood Zone 2, i.e. Flood Zone 2 in 2007 is used as a proxy for Flood Zone 3a in 2107. Flood Zone 2 is unavailable for the climate change scenario. Any developments situated within close proximity to Flood Zone 2 in the 2007 scenario will require a Flood Risk Assessment to determine the extent of Flood Zone 2 under climate change conditions.

The functional floodplain in 2107 has been mapped using the 1 in 20 tidal flood extent resulting from the overtopping modelled scenario in Southwold. This has been modelled as part of this SFRA. Functional floodplain extents for 2007 and 2107 are available as a result of tidal modelling.

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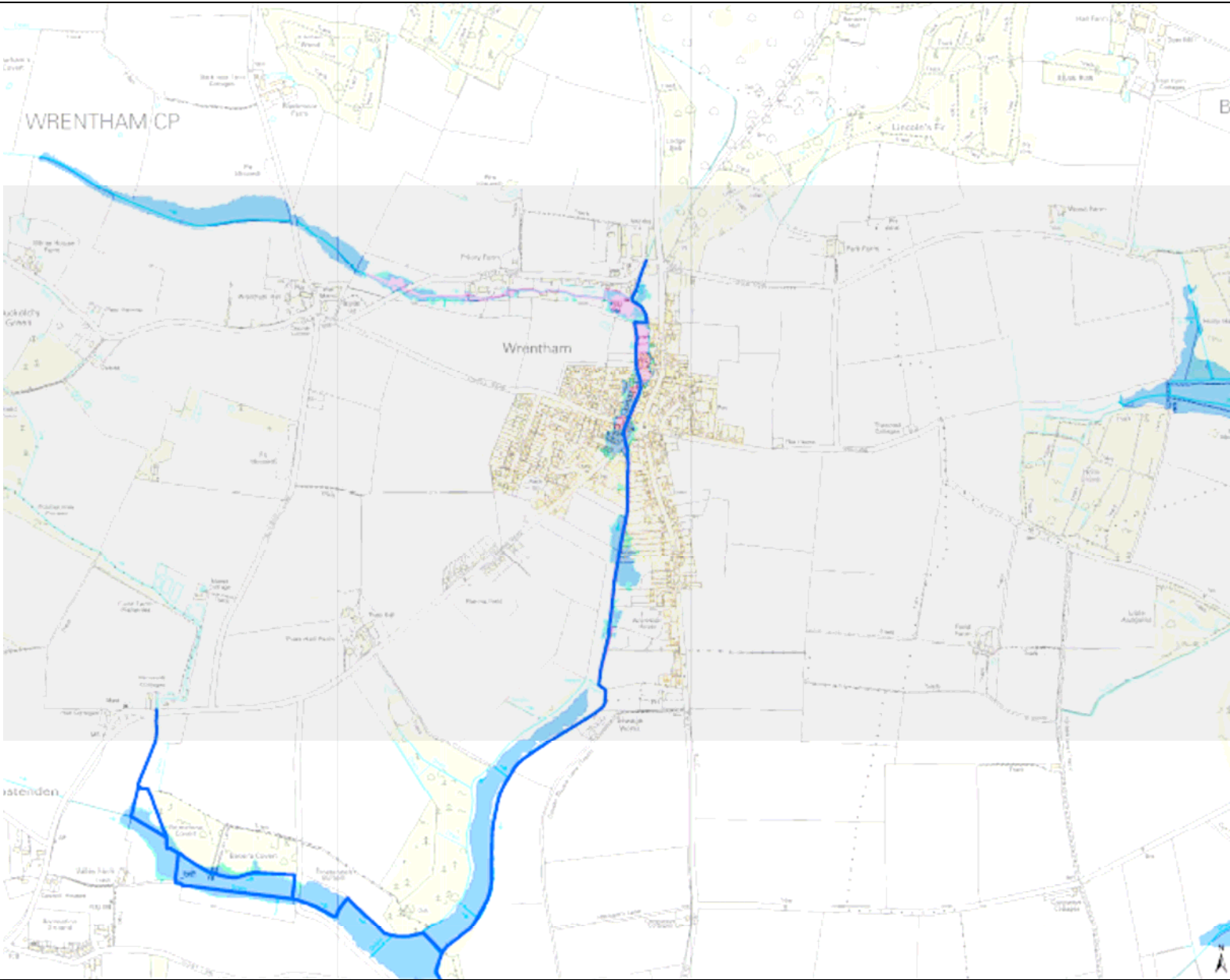
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Wrentham

PPS25 Flood Zones 2007

Figure A17



Preliminary Core Strategy Assessment

Flood Zone	1, 2, 3a & 3b
Potential Housing Allocation	The Waveney Core Strategy preferred option (June 2006) proposes 5,800 new homes to be built in the District by 2021. Some of these homes could be located in the area of Wrentham. Small-scale development could take place in larger villages to aid the local economy and provide affordable housing to meet local needs. The map shows that possible area where this development could be located. Potential new development areas within the LDF Potential Growth Area of Wrentham could reasonably be accommodated outside Flood Zones 2 and 3 if located to the east and west of the current developed area.
Potential Employment Allocation	Potential new employment allocations within the LDF Potential Growth Areas in Wrentham could reasonably be accommodated outside Flood Zones 2 and 3, again if located to the east and west of the current developed area.
All Potential Development Allocations	The map shows that there are regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. Site allocations should therefore be sought in these areas primarily and all options exhausted before sites are allocated in areas at risk of flooding, towards the centre of the current developed area and to the north of Wrentham.
Main River	There is a watercourse running through the centre of Wrentham, flowing from the north to the south. This watercourse discharged into the North Sea via Pottersbridge Marshes, Easton Marshes and Easton Broad.
Problem drainage areas	Data not available.
Flood Record Information data	Data not available.
Origin of Mapping	Re-modelled fluvial outlines
Functional Floodplain	There is a small area of functional floodplain located to the north of the settlement.

Settlement Level Coarse Assessment

	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	26.60	2.20	2.66
% of Area		8.26	10.01

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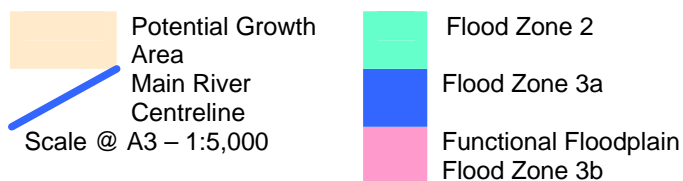
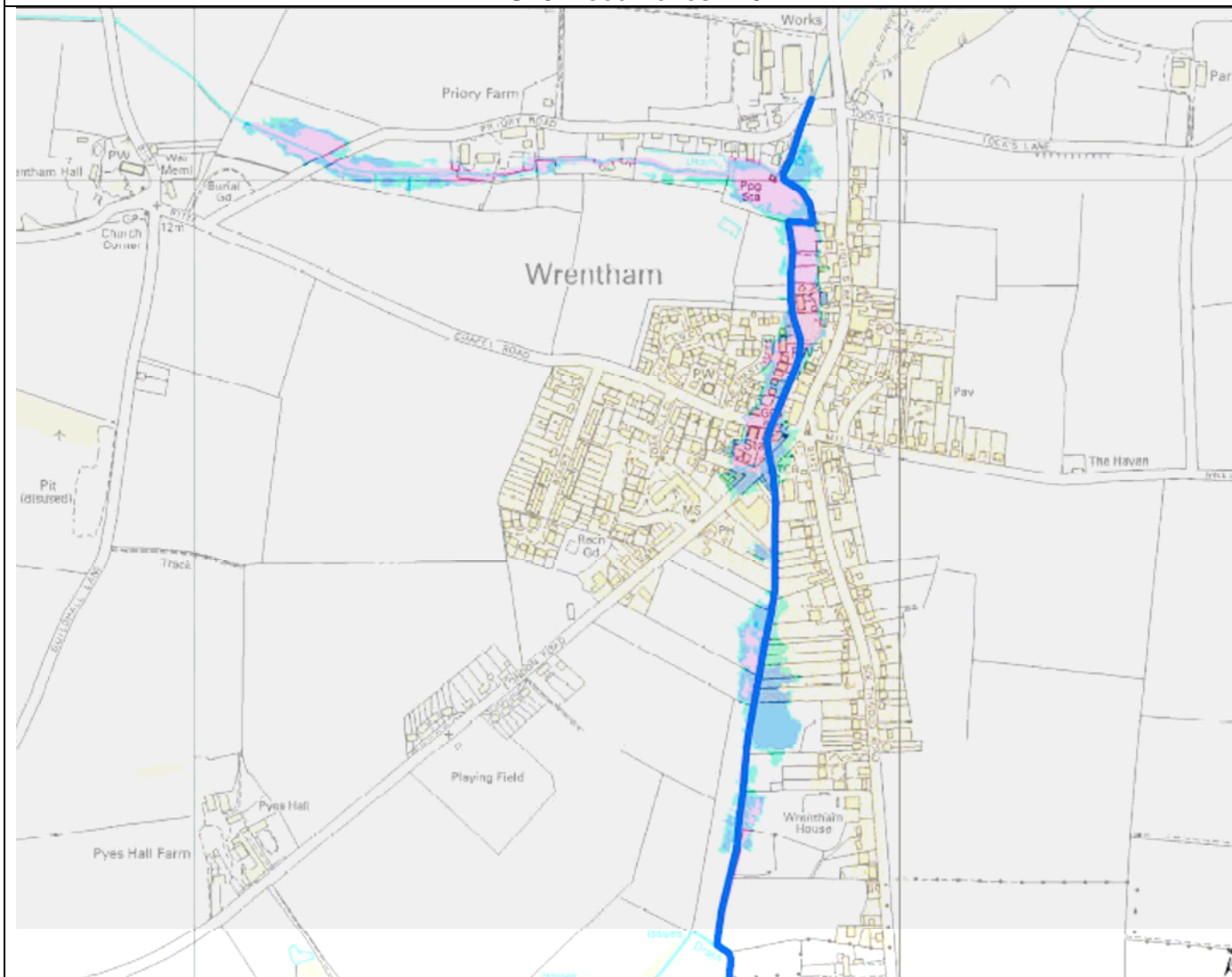
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Wrentham

Figure A18

PPS25 Flood Zones 2107



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The delineation of Flood Zones 2, 3a and 3b has been undertaken using outlines from modelling undertaken by JBA as part of this study.

To make an allowance for climate change for Flood Zones 2, 3a and 3b, the 1 in 1000, 1 in 100 year and 1 in 20 events plus a 20% increase in flows was mapped respectively. The fluvial model for this watercourse was re-run by JBA to determine these outlines, which depicts the PPS25 flood zones inclusive of climate change, PPS25 Flood Zones 2107. In accordance with PPS25, 100 years of climate change have been mapped appropriate for residential development considerations.

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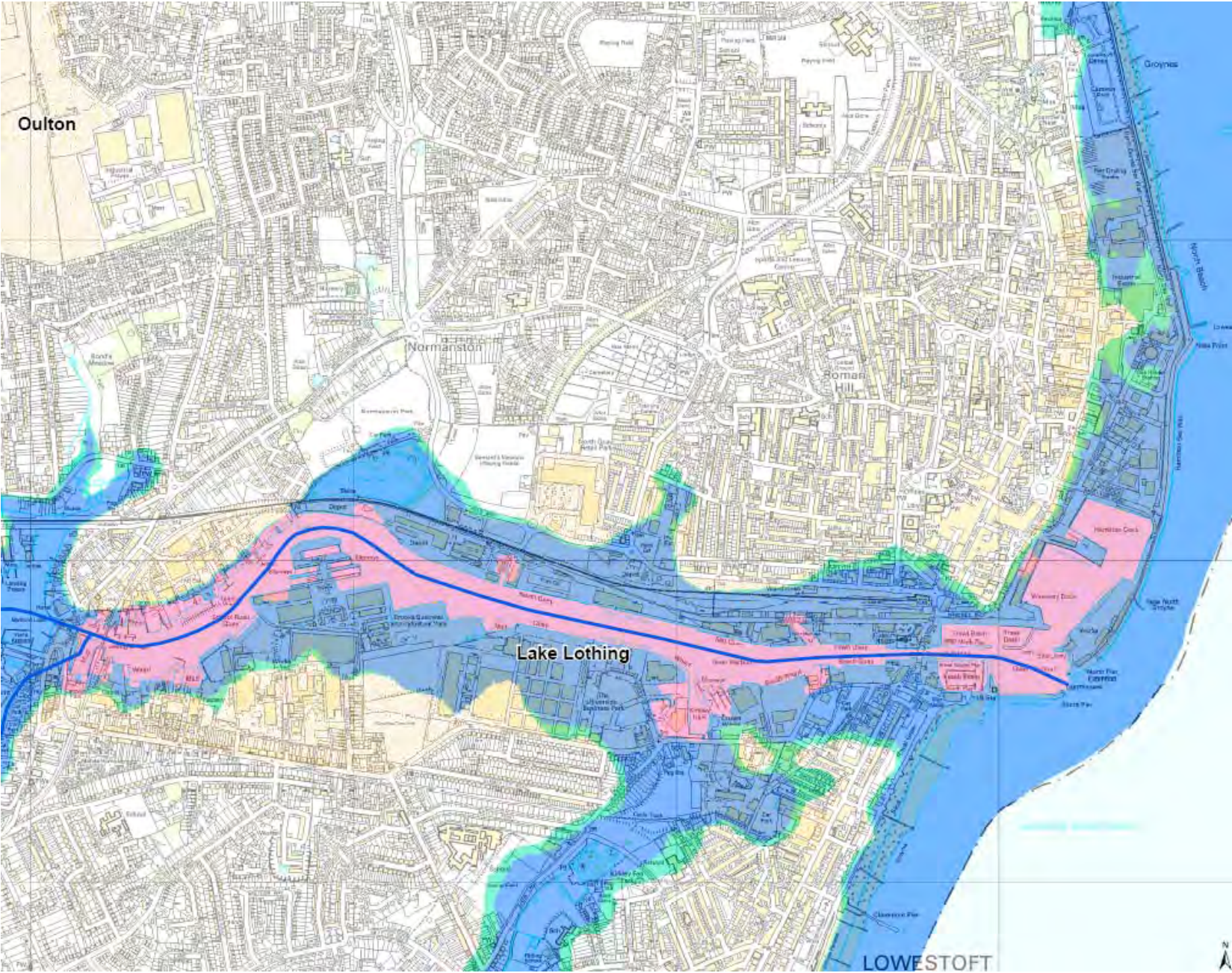
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Lowestoft

PPS25 Flood Zones 2007

Figure A19



Preliminary Core Strategy Assessment

Flood Zone	1, 2, 3a & 3b
Potential Housing Allocation	The Lowestoft URC Area Action Plan preferred option (January 2007) states that there is 'sufficient capacity for 1460 housing units' in the area, 40 units of which should be 'very sheltered housing'. Lowestoft could therefore accommodate a great deal of the proposed 5,800 new homes that are to be built in the District by 2021 according to the 'Waveney Core Strategy Preferred Options' (June 2006). The map highlights growth areas where development could be located. It may be difficult to locate the large number of potential new housing allocations within the LDF Potential Growth Areas in Lowestoft outside Flood Zones 2 and 3. At present, areas outside Flood Zones 2 and 3 are occupied by existing housing and occupied industrial units in the south west, North Quay Retail Park to the north centre, and the historic Scores leading up to the High Street to the north east. New allocations and change of uses are unlikely in these areas.
Potential Employment Allocation	Again, it may be difficult to locate potential new employment allocations within the LDF Potential Growth Areas in Lowestoft outside Flood Zones 2 and 3.
All Potential Development Allocations	The map shows that there are limited regions within the Potential Growth Area that are outside the Environment Agency mapped and PPS25 defined Flood Zones 2 and 3. These areas may not be available or appropriate for development but should be investigated and all options exhausted before sites are allocated in areas at risk of flooding.
Main River	Lake Lothing is situated running through the centre of the development area. To the west of the development area is Oulton Broad.
Problem drainage areas	Area adjacent to Kirkley Stream, including roads to the south-east of Long Road. Surface water drainage is constrained by capacity of Kirkly Stream, subject to tide locking at Lake Lothing, and dependent on pumps.
Flood Record Information data	Flooding around the margins of the lagoon can result when the gravity outfall to Lake Lothing is tidelocked. A pumping station has recently been installed but flooding is still a concern, especially to any new development in the area. Localised flooding occurs in the low-lying areas of the town after heavy rainfall. This is a result of sewer capacity and tidelocking of sewer outfalls to the harbour. A major tunnelling project in progress will reduce the risk of sewer flooding in the area. Tidal flooding in January 1953 in areas east of the Whapload Road resulted in the demolition of the old 'beach village'. As a consequence the sea defences in the area were improved and a return wall at the north end of the existing defence line was constructed.
Origin of Mapping	Environment Agency tidal Flood Zones and modelling (overtopping)
Functional Floodplain	The Functional Floodplain is located in discrete areas surrounding Lake Lothing.

Settlement Level Coarse Assessment

Potential Growth Area
Main River Centreline
Scale @ A3 – 1:11,000
Environment Agency Flood Zone 2
Environment Agency Flood Zone 3a
Functional Floodplain Flood Zone 3b

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	Size of Potential Growth Area	Area in Zone 3	Area in Zone 2 (inclusive of Zone 3 where present)
Area (ha)	247.08	175.81	190.11
% of Area		71.16	76.94