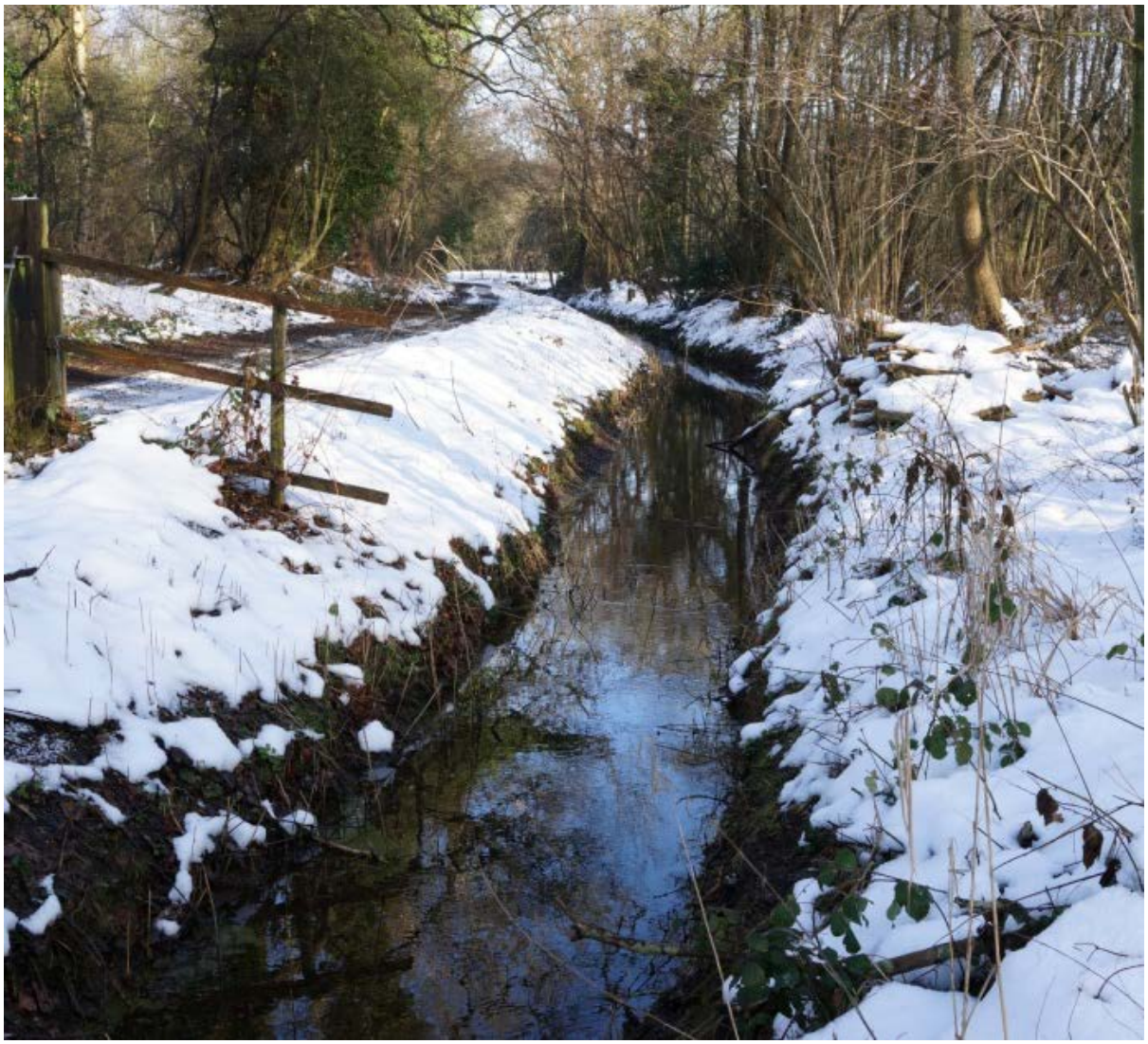
Norfolk County Council

Norfolk Local Flood Risk Management Strategy



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PART ONE – FLOODING AND FLOOD RISK MANAGEMENT

1. Introduction

Background

1.1 In 2006 a torrential thunderstorm in the Great Yarmouth area flooded over 50 properties including 6 schools; more properties and businesses were flooded from Hemsby to Hopton on Sea and serious disruption was caused to a much wider area. The following year saw exceptional flooding across the UK, with 55,000 properties flooded and around 7,000 people rescued from the flood waters by the emergency services.

1.2 In response to these and other flood events the Government commissioned Sir Michael Pitt to undertake a review of the flooding. The resulting 'Pitt Review' recommended that;

"the role of local authorities should be enhanced so that they take on responsibility for leading the co-ordination of flood risk management in their areas".

Legislative context

1.3 In response to the Pitt Review, the Flood and Water Management Act 2010 (FWMA) has introduced a new role of Lead Local Flood Authority (LLFA) which confers new statutory responsibilities on Local Authorities such as Norfolk County Council (NCC).

1.4 One of these new statutory duties is set out in Section 9 (1), FWMA which states that *"a Lead Local Flood Authority for an area in England must develop, maintain, apply and monitor a strategy for local flood risk management in its area"*.

1.5 The status of the Local Flood Risk Management Strategy is also indicated in the Flood and Water Management Act 2010. Section 11 states that an English Risk Management Authority must act in a manner which is *"consistent"* with the national strategy and guidance and (except in the case of a water company) act in a manner which is *"consistent"* with local strategies and guidance. A water company must *"have regard"* to local strategies and guidance.

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What is the strategy seeking to do?

1.6 The Local Flood Risk Management Strategy aims to inform all groups and individuals who may have an interest in, or an ability to influence or manage flood risks, including householders, businesses, landowners, developers and risk authorities.

1.7 The Local Flood Risk Management Strategy seeks to:

- explain what flooding is, its dangers, and how flood risks can be managed;
- inform about the extent and characteristics of flood risk in Norfolk and signpost other sources of information about flood risk in the county;
- clarify which Risk Management Authorities[1] are responsible for which flood risk management activities;
- indicate the objectives of the strategy and make commitments in respect of the actions that will be taken by the Lead Local Flood Authority and other Risk Management Authorities;
- establish a framework of policies that will ensure that riparian owners, businesses, developers and those in authority apply a consistent and strategic approach to flood management;
- outline a series of proactive measures which will increase understanding of local flood risks and identify further measures to manage those risks
- clarify how flood risk management is to be funded in Norfolk
- indicate how flood risk management activities will be monitored and how the strategy will be reviewed

Relationship with other policy documents

1.8 The Local Flood Risk Management Strategy is tasked with addressing matters specifically relating to Local Flood Risks (see para 3.3 and 3.4 for definitions) It is not intended to address in detail other matters such as strategic, coastal and main river flood risks, coastal erosion or water quality management, as these issues lie beyond strategy's remit, as indicated in the Water Management Act 2010.

[1] See section 8 for definition of Risk Management Authority

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1.9 In essence the Local Flood Risk Management Strategy sits within a suite of strategies and plans that relate to flood risk, erosion and environmental matters and does not seek to repeat the work of these other documents. Instead the Local Flood Risk Management Strategy aims to integrate alongside these and, where they interact with local flood risks, this strategy will signpost the relevant document for the benefit of the reader (a list of the evidence base including such strategies is included within the section “Flood Risk in Your Area”, in part 2).

1.10 Local Plans and any other plans or strategies produced by Risk Management Authorities will be expected to be consistent with the policies set out within this strategy, in accordance with the requirements of Section 11 of the Flood and Water Management Act 2010.

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2 What Is Flooding?

Definition

2.1 Section 1 of the Flood and Water Management Act 2010 states that: *"Flood" includes any case where land not normally covered by water becomes covered by water.*

2.2 In addition, this section adds the caveat: *"But "flood" does not include – (a) a flood from any part of the sewerage system, unless wholly or partly caused by an increase in the volume of rainwater (including snow and other precipitation) entering or otherwise affecting the system, or (b) a flood caused by a burst water main (within the meaning given by Section 219 of the Water Industry Act 1991)."*

What are the dangers from flooding?

2.3 The dangers associated with flooding are often greater than people expect. The depth of water is a critical factor, but equally important is velocity. High flows can make it impossible to walk through relatively shallow water and debris picked up by floodwater can cause considerable impact damage. Fast flowing water can erode the landscape undermining building foundations and destroying flood defences. Understanding where water will flow at high velocity is an important factor in understanding flood risk.

2.4 The extent of the flood area is also a material factor in understanding the dangers a flood will present. If a flood extends over many miles, escaping from the flood area will become very hazardous. Furthermore, it is likely that a greater number of people would be affected if a flood covers an extensive area.

Pollution

2.5 Flood water can be contaminated by sewage and other pollutants. Property touched by contaminated flood water may need to be destroyed. Contaminated flood water increases the risk of infection or disease.

Flood hazards

2.6 Even when flood waters are shallow, hazards are likely to be hidden below the water, as flood water is usually cloudy. Manhole covers may be lifted by flood water, exposing holes in footpaths and roadways and debris carried by the flood may present a hazard. Simple changes in level, as slight as a kerb edge, might be hidden and could lead to a fall.

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Small injuries sustained in a flooded environment could expose flood victims to pollution hazards or disease.

Flood damage

2.7 Flood waters can damage essential infrastructure such as power supplies; sewage processing and water supplies. Transport links may be lost and vital bridges or underpasses damaged. Damaged infrastructure could affect populations well beyond the area that is actually flooded.

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3. What is Flood Risk?

3.1 Some floods are more hazardous than others and some will have effects that are more significant. The range of potential impacts can vary from inconvenient small areas of pooling in the street to the devastating effects of a massive inundation from the sea. It is important to understand how flood risk is defined and those factors that affect an assessment of flood risk so that risk management authorities and others with an interest can respond appropriately to the level of risk and the potential impacts when making decisions.

3.2 Section 2 of the Flood and Water Management Act 2010 gives the following definitions of risk:

> *"Risk" means a risk in respect of an occurrence assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences.*
>
> *"Flood risk" means a risk in respect of flood.*
>
> *"Coastal erosion risk" means a risk in respect of coastal erosion.*
>
> *In each case the potential harmful consequences to be considered in assessing risk include, in particular, consequences for—*
> *(a) human health,*
> *(b) the social and economic welfare of individuals and communities,*
> *(c) infrastructure, and*
> *(d) the environment (including cultural heritage).*

3.3 Flood risk has two components: the probability of a particular flood and the impact that the flood would have if it were to happen.

Probability

3.4 The probability of a flood relates to the likelihood of a flood of that magnitude occurring within a 'one year period'. This figure is usually expressed as a percentage. For example, a 1% annual probability flood has a 1% chance (or 0.01 probability) of occurring in any one year.

Impact

3.5 The impact of flooding on human health, social and economic welfare, infrastructure and the environment will depend upon the characteristics of the area flooded (e.g. whether the area is populated, or includes

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economically significant activities, or critical infrastructure), the extent of the area flooded, the depth of the water and the speed of flow.

3.6 Greater impacts may also arise if flood waters become significantly polluted, or if flood damage to infrastructure has secondary effects on the wider locality.

3.7 When assessing risk and allocating resources, an area with a low probability of flooding may be given a higher priority than an area which floods frequently if the consequences of flooding at the former location are more significant than the latter. For example inundation from the sea is unlikely to occur frequently, but if such an event were to occur the impacts could be catastrophic. In contrast rainfall causing pooling on a footpath may be a frequent occurrence, but its impact may be little more than inconvenient. In such a comparison, greater allocation of resources is likely to be allocated to the event with the lower frequency of occurrence.

Cumulative Impact

3.8 Frequently flood events originate from multiple sources. As such, cumulative impacts can arise from both local and strategic sources of risk including:

- Surface Run-off
- Flooding from groundwater
- Sewer Flooding (see paragraph 2.2 for exceptions)
- Flooding from ordinary watercourses
- Flooding from Main rivers
- Inundation from the sea

3.9 Where there are multiple sources of flood risk there is a need for a coordinated approach by all of the responsible Risk Management Authorities, to ensure that all of the risks are addressed. The potential danger in these situations is that major risks may be dealt with, while lesser sources of flood risk are overlooked. This could even result in measures intended to address one form of risk detrimentally affecting the management of another risk (for example if a new defensive wall prevented surface water from draining away). This multiple risk scenario is faced by several settlements in Norfolk including significant urban areas of Great Yarmouth and King's Lynn.

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Factors Increasing Flood Risk

3.10 Flood risk may change over time. Factors that may increase flood risk include;

- Climate Change
- Condition and performance of existing infrastructure (drainage and defence)
- Land use change (including redevelopment and new development).

3.11 In line with climate change there is an increased likelihood of extreme weather. This Strategy is consistent with the Environment Agency's Catchment Flood Management Plans that cover Norfolk in that we expect;

- A 20% increase in peak flow in all watercourses by 2110. This will increase the probability of large-scale flood risk.
- A total sea level rise of 1050 mm by the year 2110. This will increase the probability of tidal flooding and increase the length of time that watercourses will not be able to flow freely to the sea at high tide.

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4. What are the sources of flooding?

4.1 The causes of flooding can be very complex, often flooding can occur as a result of a combination of factors and it can be difficult to identify the sources of a flood at the time an event takes place.

4.2 Flood risk may arise from either local sources or as a consequence of more widespread influences. For the purposes of managing flood risk, sources of risk are identified as either 'strategic' or 'local'.

Sources of Strategic Flood Risk

4.3 Strategic Flood Risk is primarily the responsibility of the Environment Agency and is defined as flooding that occurs from;

- Main rivers
- Large Raised Reservoirs
- The sea

Sources of Local Flood Risk

4.4 Local Flood Risk is defined as flooding that occurs from;

- Surface run-off
- Groundwater
- Sewers (partly or wholly influenced by precipitation)
- Ordinary watercourses

4.5 A more detailed description of the sources of flood risk is provided in the following sections of this document:

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5. Sources of Local Flood Risk

Surface Run-off

5.1 Surface run-off (also known as pluvial flooding), is defined by the Flood and Water Management Act 2010 as *"rainwater (including snow and other precipitation) which: [a.] Is on the surface of the ground (whether or not it is moving), and [b] Has not entered a watercourse, drainage system, or public sewer."*

Why does this occur?

5.2 Flooding from surface run-off occurs as a result of exceptionally intense or prolonged rainfall, which overloads the capacity of existing drainage systems. Flooding from surface run-off can also occur if drainage systems are blocked, broken, or simply undersized.

5.3 Flooding from surface run-off also occurs when the ground is geologically resistant to water penetration so that water is unable to soak away into the subsoil and rock strata. There are also three reasons why ground may subsequently become resistant to water penetration either:

a) due to the deliberate application of paving, tarmac or other water resistant materials;

b) due to natural causes, such as the soil surface being baked hard by the sun, or frozen solid by the cold; or

c) when the soil surface becomes saturated with water to a point where the rate at which soil can absorb further water is impeded and water flows across the surface.

Groundwater Flooding

5.4 Section 6 of the Flood and Water Management Act 2010 states that *""Groundwater" means all water which is below the surface of the ground and in direct contact with the ground or subsoil".*

Why does this occur?

5.5 Water that seeps below ground collects within spaces in the rock and soil strata (often above an impervious layer of geology). The water establishes a level below ground known as the water table. The water table rises when water enters the catchment faster than it can drain away through fissures or to a watercourse.

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5.6 The water that collects in the rock and soil strata below ground flows from areas where the ground level is high to areas where the ground level is low. In low-lying areas the water table is usually nearer to the surface and during very wet periods the water table can rise up to the surface causing groundwater flooding.

5.7 Groundwater flooding takes longer to go away. This is because groundwater moves much slower than surface water and will take time to flow away underground.

5.8 Groundwater flooding is more difficult to prevent than other forms of surface water flooding. There are some areas where groundwater flooding has been dealt with by installing pumps to remove groundwater and so lower the water table. However these only have a localised effect and still require somewhere to discharge the water.

Sewer Flooding

5.9 Sewers can be publicly owned (by a Water Utilities Company) or privately owned. In addition, they can receive foul water, combined foul and surface water or just surface water flows. The different types of sewer flooding are set out below;

5.10 **'Precipitation influenced sewer flooding'** occurs when the sewer network cannot cope with the volume of water that is entering it. This is often experienced during times of heavy rainfall when large amounts of surface water overwhelm the sewer network exceeding its design capacity, causing flooding.

5.11 **'System influenced sewer flooding'** happens when pipes within the network become blocked or the assets managing flows within the network fail. This falls outside the Flood and Water Management Act 2010 definition of 'Flood' and is not a source of Local Flood Risk. Instead it is the responsibility of the Water and Sewerage Companies and is regulated by the Water Industry Act 1991.

5.12 **'Outfall influenced Sewer Flooding'** is a form of restriction where the outfall of a sewer is unable to discharge water at its normal design rate because the water level in the receiving watercourse is partially or fully obstructing the discharge aperture.

Watercourses or fluvial flooding

5.13 Flooding from watercourses (also known as 'fluvial flooding') occurs when a watercourse cannot accommodate the volume of water that is flowing into it.

5.14 For the purposes of flood risk management fluvial flooding is separated into 2 categories, these are flooding from;

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- **Ordinary Watercourses** – a source of local flood risk
- **Main River** – a source of strategic flood risk

5.15 In general terms this distinction refers to the relative size of the watercourses involved, with Ordinary Watercourses (usually but not always) being smaller than Main Rivers.

Why does this occur?

5.16 The ability of a watercourse to accommodate flood water depends upon the capacity of the watercourse's channel, it's floodplain[2] and the amount of water that enters its catchment during a flood event. When a watercourse becomes overloaded, flooding beyond the area of the flood plain can occur. Where rivers are separated from their flood plain by embankments or flood defences this may lead to flooding from overtopping or due to a breach of those banks and defences.

5.17 While the storage capacity of the river and the functional flood plain can be determined by assessment of the watercourse, it is important to recognise that the rate of inundation can be affected by factors that are remote from the river itself. The flow of water in a watercourse is dependent upon the rate of run-off from the entire river catchment. Measures that might increase the rate of water flowing into a watercourse can be remote from the flooding that occurs as a result of any works. Significant reductions in flooding can be achieved if the rate of water flowing into river systems can be effectively managed at source (see paragraph 7.8, Sustainable Flood Risk Management).

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[2] the area where water is allowed to overflow from a watercourse in a controlled manner, to temporarily increase storage capacity

6. Sources of Strategic Flood Risk

Flooding from Main Rivers

6.1 Flooding from Main Rivers forms one of the categories of fluvial flooding, (see 5.13 above). The “Main River” designation delineates those watercourses where the Environment Agency is the responsible regulatory body. Section 113 of the Water Resources Act 1991 defines “main river” as; *“A watercourse shown as such on a main river map…”*

Reservoir Flooding

6.2 Reservoir flooding normally arises from the complete or partial failure of a reservoir structure caused by;

- erosion due to seepage,
- overtopping of the dam beyond its design level or
- damage to the structure.

6.3 The legislation that covers this area of flood risk is the Reservoirs Act 1975. It places a number of requirements on owners and managers of large raised reservoirs of a volume of 25,000 cubic meters and over (there are proposals to reduce this volume to10,000 cubic metres and over in 2014). The enforcement authority for reservoirs in England is the Environment Agency (EA). The EA ensure that reservoirs are inspected regularly and that essential safety work is carried out. In addition, these reservoirs are registered by the EA who may also require a flood plan to be developed if the reservoir is considered ‘high risk’.

6.4 When assessing the risk posed by large raised reservoirs consideration is given to the impact on people downstream. Flood risk mapping was undertaken in 2009 to identify the largest areas that might be flooded if a reservoir were to fail and release the water it holds. It is worth noting that reservoir flooding is extremely unlikely to happen. There has been no loss of life in the United Kingdom from reservoir flooding since 1925.

Coastal Flooding

6.5 Much of Norfolk is very low lying, with many areas at, or below sea level at high tide. In areas where land is below sea level, inundation from the sea would be considerable.

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Why does this occur?

6.6 Coastal flooding is linked to changes in sea level. Short term changes in sea level can result from;

- tidal changes
- changes in barometric pressure and,
- strong winds.

6.7 In the long term, higher sea levels are expected as a result of climate change.

6.8 On Norfolk's coast the greatest coastal flood risk is likely to occur when a combination of tidal and barometric pressure effects operate together to create a "storm surge", (as was experienced in the flooding of 1953 and more recently in December 2013).

6.9 High sea levels also cause rivers flowing into the sea to be held back, leading to higher water levels within the rivers and a greater risk of fluvial flooding. This will be exacerbated if heavy rainfall accompanies a storm surge, adding extra volume to river flows and drainage systems.

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7. Flood Risk Management

7.1 Flood Risk Management requires an understanding of the characteristics of the flood risk, an understanding of how to influence and reduce that risk and a means by which such knowledge can be communicated and applied.

7.2 Section 3 of the Flood and Water Management Act 2010 gives the following definition of risk management;

> *"Risk management" means anything done for the purpose of—*
>
> *a) analysing a risk,*
>
> *b) assessing a risk,*
>
> *c) reducing a risk,*
>
> *d) reducing a component in the assessment of a risk,*
>
> *e) altering the balance of factors combined in assessing a risk, or*
>
> *f) otherwise taking action in respect of a risk or a factor relevant to the assessment of a risk (including action for the purpose of flood defence).*
>
> *In particular, risk management includes things done—*
>
> *a) that increase the probability of an event but reduce or alter its potential consequences, or*
>
> *b) that increase the probability of an event occurring at one time or in one place but reduce the probability of it occurring at another time or in another place.*

7.3 Flood risk management is the means by which the adverse effects of flooding can be;

- Understood
- Communicated
- Reduced

7.4 There are essentially 3 techniques for managing flood risk:

- Avoidance
- Flood Prevention
- Resilience

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Avoidance

7.5 The first principle of avoidance is – wherever possible avoid developing in areas that are at risk of flooding.

7.6 The second principle is to avoid doing anything that will increase the risk of flooding. This includes ensuring that any development constructed within a flood plain, or in area susceptible to surface water flooding does not displace water and cause the size of the flood risk area to increase.

Flood Prevention

7.7 The main objective of flood prevention is to prevent water reaching areas where it might endanger life or damage critical infrastructure and other property that is of value. Flood prevention techniques include:

- Flood Defence
- Sustainable Flood Risk Management

7.8 Flood Defence is the process by which engineered solutions are relied upon to prevent flooding. Examples of Flood Defence projects include the construction of flood walls, bunds and embankments, the construction of new flood relief channels and the construction of flood barriers.

7.9 Sustainable Flood Risk Management (SFRM) is the process by which land use and drainage characteristics are managed with the aim of slowing down the rate at which water flows into watercourses and drainage systems. The purpose of this work is to ensure the water takes longer to run through the system and that the peaks and troughs of water flow are evened out. This reduces the number of occasions where capacity is exceeded and flooding occurs and can also reduce the number of occasions where catchments experiences drought conditions. Examples of SFRM projects include the creation of flood relief areas, reconnection of watercourses with their flood plain, meander restoration, wetland and wet woodland creation,

Flood Resilience

7.10 It is not always possible to avoid building in areas that are at risk of flooding (many existing historic towns are built within flood risk areas). Even where flood defences exist, there is a danger that such defences might be overtopped or breached in extreme weather events. It is important therefore to design built environments in areas at risk of flooding so that, if a flood does occur, the damage to buildings and other infrastructure in the flood area is minimised and they can be brought back into use quickly at minimal cost. This is known as flood

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resilience. Flood resilience also requires measures to protect those who inhabit flood risk areas.

7.11 The following are examples of resilience measures that might be incorporated into new developments or retrofitted into older properties:

- Raising floor levels and land
- Permeable Structures
- Resilient materials
- Protect vulnerable features
- Protect the building
- Amphibious structures
- Safe Escape

Managing Flood Risk

7.12 To manage flood risk, Risk Management Authorities need to:

- Understand the risks
- Investigate flooding
- Resist inappropriate development
- Manage land use
- Maintain and improve flood defence assets
- Manage the development of new sustainable drainage assets and maintain and improve existing drainage systems
- Increase public awareness of flood risk and sustainable drainage issues
- Improve flood risk detection and forecasting
- Improve flood warning and informing
- Reduce the likelihood of flooding
- Minimise the consequences of flooding
- Promote resilience measures

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8. Flood Risk Management Authorities

8.1 Under the Flood and Water Management Act 2010 a number of organisations are classed as Risk Management Authorities (RMAs). This status acknowledges the roles these organisations have in managing flooding and provides them with new statutory powers and duties. Table 1 on page 27 summarises the key new and existing responsibilities that organisations operating in Norfolk have.

8.2 Section 6 of the Flood and Water Management Act 2010 defines Risk Management Authorities to be;

- The Environment Agency (EA)
- A Lead Local Flood Authority (LLFA)
- A District Council for an area for which there is no unitary authority
- An Internal Drainage Board (IDB)
- A Water Company
- A Highway Authority

8.3 In Norfolk there are 34 organisations that meet the definition of Risk Management Authority. In addition to the Environment Agency and Norfolk County Council in its role as Lead Local Flood Authority, this number is made up of 7 District Councils, 22 Internal Drainage Boards, 2 Water Companies and 2 Highway Authorities.

8.4 The following Risk Management Authorities exercise 'Flood Risk Management Functions' in Norfolk

- Environment Agency, (Essex, Norfolk and Suffolk Area, Cambridgeshire and Bedfordshire Area and Lincolnshire and Northamptonshire Area).
- Norfolk County Council
- North Norfolk District Council
- Borough Council of King's Lynn and West Norfolk
- Breckland District Council
- Norwich City Council
- Broadland District Council
- Great Yarmouth Borough Council
- South Norfolk District Council
- Anglian Water Services Ltd
- Essex and Suffolk Water Ltd
- Highways Agency

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- Broads (2006) IDB
- King's Lynn IDB
- Norfolk Rivers IDB
- Downham & Stow Bardolph IDB
- East of the Ouse, Polver and Nar IDB
- Northwold IDB
- Southery & District IDB
- Stoke Ferry IDB
- Stringside IDB
- Churchfield & Plawfield IDB
- Euximoor IDB
- Hundred Foot Washes IDB
- Hundred of Wisbech IDB
- Needham & Ladus IDB
- Manea and Welney DDC
- Nordelph IDB
- Upwell IDB
- East Harling IDB
- Waveney, Lower Yare & Lothingland IDB
- Burnt Fen IDB
- Littleport and Downham IDB
- Middle Level Commissioners

8.5 The existing and new responsibilities of these organisations are described in more detail in the information documents referenced in Table 1. As part of the changes brought about by new legislation all organisations classed as Risk Management Authorities (RMAs) have a duty to cooperate with other Risk Management Authorities in connection with their 'flood risk management functions'.

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Flood Risk Management Functions

8.6 A *"Flood Risk Management Function*[3]*"* as defined by Section 4 of the Flood and Water Management Act 2010 means a function which may be exercised by a risk management authority for a purpose connected with managing flood risk. In practical terms this could be;

- The issuing of ordinary watercourse consents or enforcement notices by Internal Drainage Boards or the Lead Local Flood Authorities.
- The investigation of significant flooding by the Lead Local Flood Authority
- The management of water on trunk roads by the Highways Agency.

8.7 'Flood Risk Management Functions' can be both duties and powers. These are defined as;

- Duty - a legal obligation that entails mandatory conduct or performance
- Power – the right, ability, or authority to perform an act.

8.8 In addition all Risk Management Authorities operate under and are subject to many additional legislative provisions. These can take the form of statutory frameworks and regulations relating to the discharge of wider responsibilities. This is apparent in legislation such as the Local Government Act 2003. Risk Management Authority flood risk management functions are also subject to European Directives such as the Water Framework Directive, Habitats Directive, Birds Directive etc.

Table 1: Risk Management Authorities and their functions

Risk Management Authority	**Risk Management Functions**
Environment Agency (EA) Further detail on the roles and responsibilities of the Environment Agency can be accessed on the County Councils Web Site.	• Required to have a strategic overview of all forms of flooding. • Duty to develop, maintain, apply and monitor a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England. • A duty to act in a manner consistent with the national and local strategies and guidance

[3] "flood risk management function" means a function under; Part 1 of the Flood and Water Management Act 2010, Section 159 or 160 (and a flood defence function within the meaning of section 221) of the Water Resources Act 1991, The Land Drainage Act 1991, Sections 100, 101, 110 or 339 of the Highways Act 1980, The Flood Risk Management Functions Order 2010.

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	when exercising FCERM functions. • Regulatory powers including consenting and enforcement functions on watercourses designated as main rivers. • Powers to undertake flood risk management works • Enforcement powers for reservoirs greater than 25,000m3 and a duty to maintain a register of these reservoirs. • Statutory consultee to planning process • Powers as a Coastal Erosion Risk Management Authority to undertake Coastal Erosion Risk Management functions including works and regulatory powers • Duties as a Category 1 Responder for Emergency Planning (including issuing flood warnings). • Lead authority with responsibility for coordinating and implementing the European Water Framework Directive.
Lead Local Flood Authority (LLFA) (County or Unitary Council) Further detail on the roles and responsibilities of the Lead Local Flood Authority can be accessed on the County Councils Web Site.	• A duty to act in a manner consistent with the national and local strategies and guidance when exercising FCERM functions. • Duty to act in a manner consistent with Local Flood Risk Management Strategies when exercising other functions that may affect flood risk. • Duty to produce a Preliminary Flood Risk Assessment • Develop, maintain, apply and monitor a Local Flood Risk Management Strategy (LFRMS) for their area. • Duty to investigate significant flooding from any source. • Duty to maintain a register of structures or features which affect flood risk from all sources. • Power to undertake works to manage flood risk from surface run-off and groundwater. • County or Unitary Councils could in theory also become SuDS Approving Bodies (SABs) if Schedule 3 of the FWM Act 2010 is commenced (at the time of writing it seems doubtful that schedule 3 will be commenced in its original form).

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	• Powers to regulate activities on ordinary watercourses outside of IDB areas.
Internal Drainage Board (IDB) Further detail on the roles and responsibilities of Internal Drainage Boards can be accessed on the County Councils Web Site. (Map 3 indicates the operational areas of IDBs in Norfolk)	• A duty to act in a manner consistent with the national and local strategies and guidance when exercising FCERM functions. • Duty to act in a manner consistent with Local Flood Risk Management Strategies when exercising other functions that may affect flood risk. • Powers to regulate activities on ordinary watercourses within IDB areas. • Exercise a general power of supervision over all matters relating to the drainage of land within their district. • Powers to undertake works on ordinary watercourses within IDB areas.
District Councils Further detail on the roles and responsibilities of District Councils can be accessed on the County Councils Web Site.	• A duty to act in a manner consistent with the national and local strategies and guidance when exercising FCERM functions. • Duty to act in a manner consistent with Local Flood Risk Management Strategies when exercising other functions that may affect flood risk. • Powers to undertake works on ordinary watercourses outside of IDB areas. • Are the Local Planning Authority for their District area and determine the appropriateness of developments and their exposure and affect on flood risk. • May be a Coast Protection Authority and a Coastal Erosion Risk Management Authority with powers to carry out coast protection work. • Duties as a Category 1 Responder for Emergency Planning.
Water Companies Further detail on the roles and responsibilities of Water Companies can be accessed on the County Councils Web Site..	• Duty to act consistently with the National FCERM Strategy when exercising FCERM functions. • A duty to have regard to the local strategies and guidance when exercising FCERM functions. • Duty to have regard to Local Flood Risk Management Strategies when exercising other functions that may affect flood risk. • Duty to co-operate with other Risk

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	Management Authorities in connection with flood risk management functions • Undertake capital schemes to alleviate or eliminate flooding where the flood event is associated with a failure of their assets • Duty to provide, improve, maintain and operate systems of public sewers and works for the purpose of effectually draining an area • Are responsible for flooding from their foul, combined and surface water sewers, and from burst water mains. • Maintain 'At Risk Registers' for Ofwat that record properties that have flooded from public foul, combined and surface water sewers and that are at risk of flooding again. • Water companies respond to reports from the public of flooding associated with their assets and determine an appropriate response inline with their standards or customer service. • Duties as a Category 2 Responder for Emergency Planning
Highway Authorities Further detail on the roles and responsibilities of Highway Authorities can be accessed on the County Councils Web Site..	• A duty to act in a manner consistent with the national and local strategies and guidance when exercising FCERM functions. • Duty to act in a manner consistent with Local Flood Risk Management Strategies when exercising other functions that may affect flood risk. • Powers to undertake works to manage water on the highway and to move water off the highway. • Enforcement powers to unauthorised alterations, obstructions and interferences with highway drainage. • Have responsibilities for culverts vested in the highway.

Other Bodies And Persons With A Role In Managing Flood Risk

8.9 In addition to the above Risk Management Authorities, there are other parties and individuals who have duties in relation to the maintenance and management of watercourses and drainage systems and thus may be held responsible for flood risks:

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Riparian Owners

8.10 A 'riparian owner' is a person who owns land or property adjacent to a watercourse. The definition of watercourse includes streams, ditches (whether dry or not), ponds, culverts, drains, pipes or any other passage through which water may flow.

8.11 Purchasers of property are often unaware of their inherited riparian duties. These are outlined in the Land and Property Act 1925 (Section 62), which states that "a conveyance of land shall be deemed to include and shall by virtue of this Act operate to convey with the land all buildings, hedges, ditches, fences, ways, waters, watercourses, liberties, easements, rights and advantages whatsoever appertaining or reputed to appertain to the land or any part thereof".

Table 2: Responsibilities of Riparian Owners

Riparian Owners Further detail on the roles and responsibilities of Riparian Owners can be accessed on the County Councils Web Site.	• Duty of care towards neighbours upstream and downstream, avoiding any action likely to cause flooding. • Entitled to protect their properties from flooding and their land from erosion (once the correct permissions have been obtained). • May be required to maintain the condition of their watercourse to ensure that the proper flow of water is unimpeded.

Navigation Authorities

8.12 Each Navigation Authority is given powers and responsibilities to maintain navigable waterways by individual Navigation Acts but they are <u>not</u> Risk Management Authorities. Generally therefore, when a flood management structure lies within a navigable waterway, responsibility for its management and maintenance will lie with a Risk Management Authority rather than the Navigation Authority.

8.13 Notwithstanding the above, as Navigation Authorities are responsible for a wide variety of works within the navigation, including dredging and other activities that could affect flood risk, they will usually work closely with Risk Management Authorities to ensure that any flood risks connected with such works are properly managed.

8.14 Where Navigation Authorities are the owners of land, they will have the same flood risk responsibilities as other riparian Landowners (see Table 2).

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Partnership Working

8.15 In response to the range and number of organisations classed as Risk Management Authorities, in 2009, Norfolk County Council established a Norfolk Water Management Partnership (NWMP) to bring together all the organisations in Norfolk with local flood risk functions and/or identified as Risk Management Authorities (RMA's). Partner organisations include 7 District Council's, 2 water utilities companies, 22 Internal Drainage Boards and 4 other organisations such as the Broads Authority and the Environment Agency (EA).

8.16 The Norfolk Water Management Partnership has a significant role to play in promoting, supporting and delivering partnership working. This includes cooperating to secure funding and using wider permissive powers to mitigate flood risk. It is worth noting that many of these bodies have retained their existing water management / drainage powers, with some enhancements, as part of the legislative changes.

8.17 In 2012 a Strategic Forum of the Norfolk Water Management Partnership was created. This forum involves political members from Risk Management Authorities and the chairs of the Regional Flood and Coastal Committees. This forum represents Norfolk's local flood risk priorities through three elected Norfolk County Councillors who attend the Environment Agency Anglian Region Central Area Regional Flood and Coastal Committee and Eastern Area Regional Flood and Coastal Committee.

8.18 Although the Lead Local Flood Authority does not have direct overall responsibility for matters such as implementing the Water Framework Directive, strategic flood risks or coastal erosion, Norfolk County Council will continue to work in partnership with the relevant lead authorities on these matters, drawing resources from the Lead Local Flood Authority staff when appropriate.

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PART TWO – FLOOD RISK IN NORFOLK

9. Flood Risk in Norfolk

Overview of Norfolk's River Catchments

9.1 It is important to understand the extent and boundaries of river catchments and the connectivity of rivers, as any precipitation that does not either evaporate or discharge to ground aquifers will ultimately flow into these rivers, either directly or via drainage systems.

9.2 Norfolk's river catchments can be split into a number of primary catchments (those rivers that flow to the sea – see Map 1)[4]. These primary catchments fall broadly within 6 Environment Agency Water Framework Directive (WFD) Management Catchment areas[5]:

- Broadland Rivers (River Yare)
- Cam and Ely Ouse
- Nene
- North Norfolk
- North West Norfolk
- Old Bedford and Middle Level

(Map 2 indicates the Environment Agency WFD Management Catchment areas)

9.3 These areas are used by the Environment Agency Anglian River Basin District Flood Risk Management Plan (FRMP) and River Basin Management Plan. In addition to the FRMP the Environment Agency has also published 3 Catchment Flood Management Plans (CFMPs) that cover Norfolk; the Great Ouse CFMP, North Norfolk CFMP and the Broadland Rivers CFMP. These plans give an overview of the characteristics of the area they cover as well as the proposed policies for the management of main rivers.

9.4 Each WFD Management Catchment area and Catchment Flood Management Plan area contains a number of individual river catchments.

9.5 The majority of Norfolk's catchments feed rivers that ultimately connect with either the River Yare (which exits to the sea at Great Yarmouth) or the River Great Ouse, (which exits to the sea at King's Lynn). However, there are also several smaller rivers that exit directly to the sea (the majority of these being in North Norfolk).

[4] Individual catchment boundaries are usually formed by ridges of surrounding higher ground, which separate the lower lying areas (a line known as a watershed). At its greatest extent a primary catchment can describe the whole area that contributes surface water flow to all of the tributaries and outfalls that feed into a river and its ultimate outfall to the sea, but a catchment can be also be subdivided into sub-catchments, which in turn may by subdivided into sub-sub-catchments and so on, until only the area contributing to surface water flow in one watercourse and its outfall is described.

[5] An amalgamation of a number of Water Framework Directive river water body catchments that provide a management unit at which level actions are applied.

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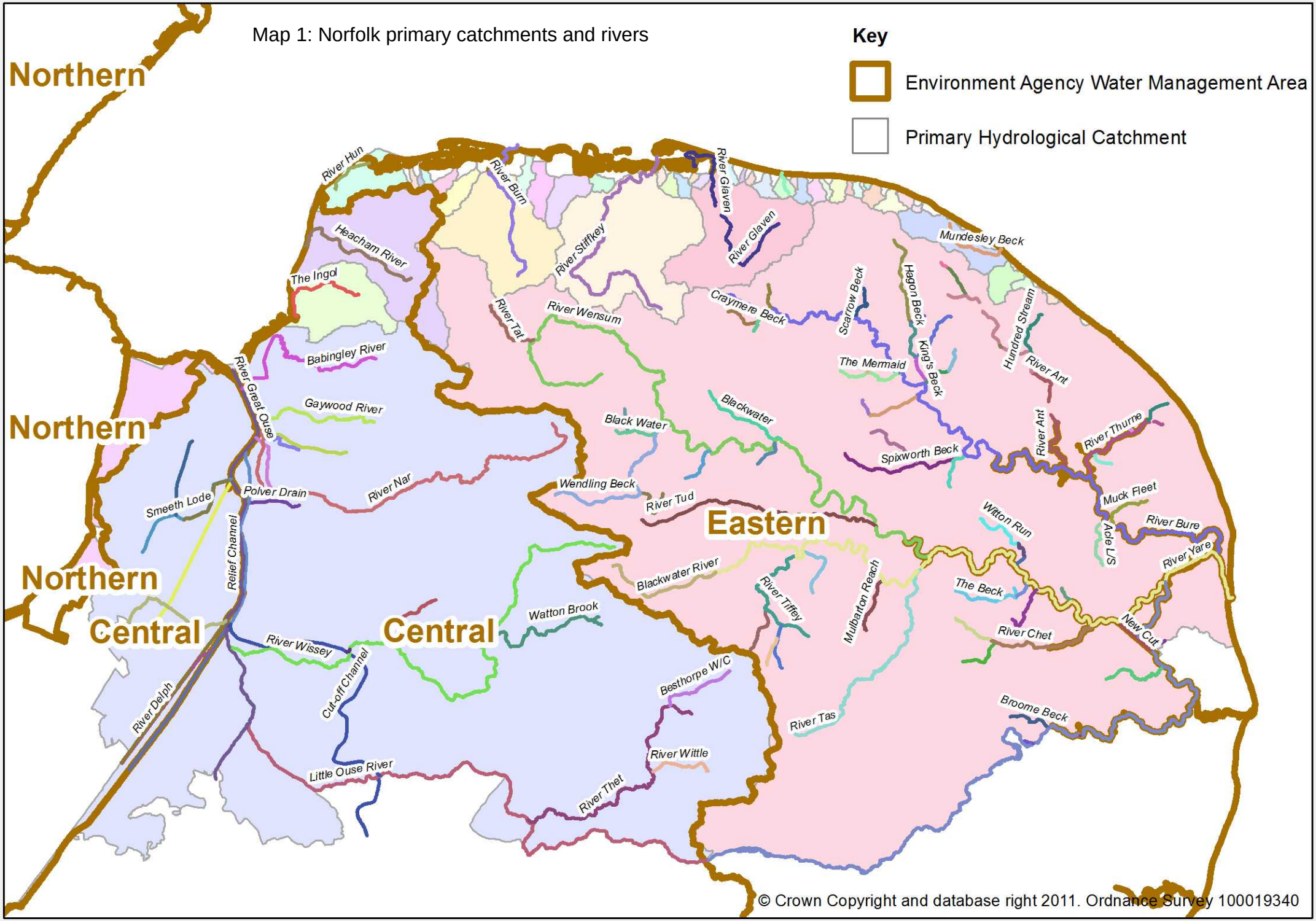
Map 1: Norfolk primary catchments and rivers
Key
Environment Agency Water Management Area
Primary Hydrological Catchment
Northern
Northern
Northern
Central
Central
Eastern
River Hun
River Burn
River Glaven
River Glaven
Mundesley Beck
Heacham River
River Stiffkey
The Ingol
River Tat
River Wensum
Cranmere Beck
Scarrow Beck
Hagon Beck
Hundred Stream
River Ant
Babingley River
River Great Ouse
The Mermaid
King's Beck
Gaywood River
Black Water
Blackwater
Spixworth Beck
River Ant
River Thurne
Smeeth Lode
Polver Drain
River Nar
Wendling Beck
River Tud
Muck Fleet
Witton Run
River Bure
Acle L/S
River Yare
Relief Channel
Blackwater River
River Tiffey
Mulbarton Reach
The Beck
New Cut
River Chet
Watton Brook
River Wissey
Cut-off Channel
Besthorpe W/C
River Delph
River Tas
Broome Beck
River Wittle
Little Ouse River
River Thet
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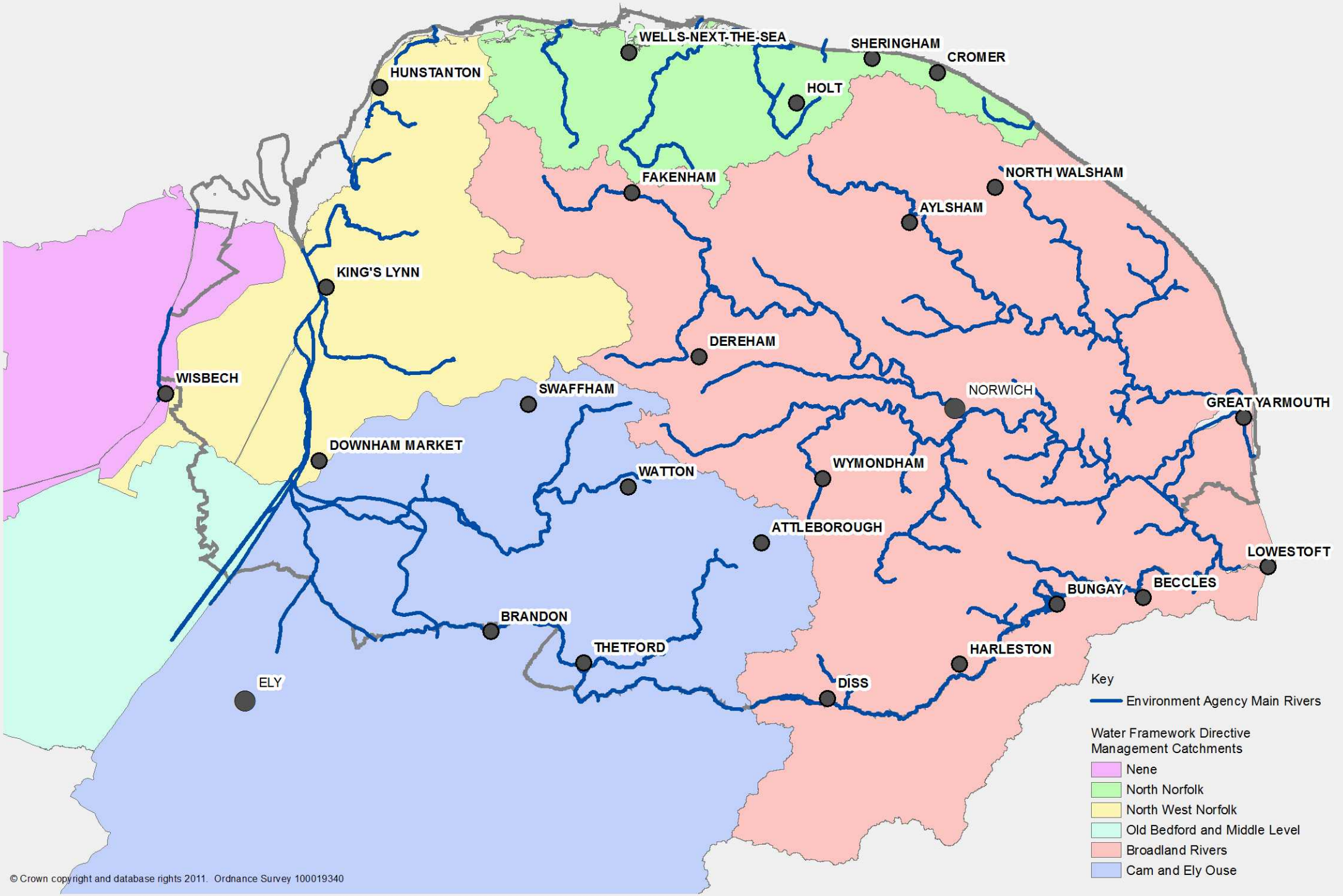
Map 2: Map of Environment Agency Management Catchment Areas



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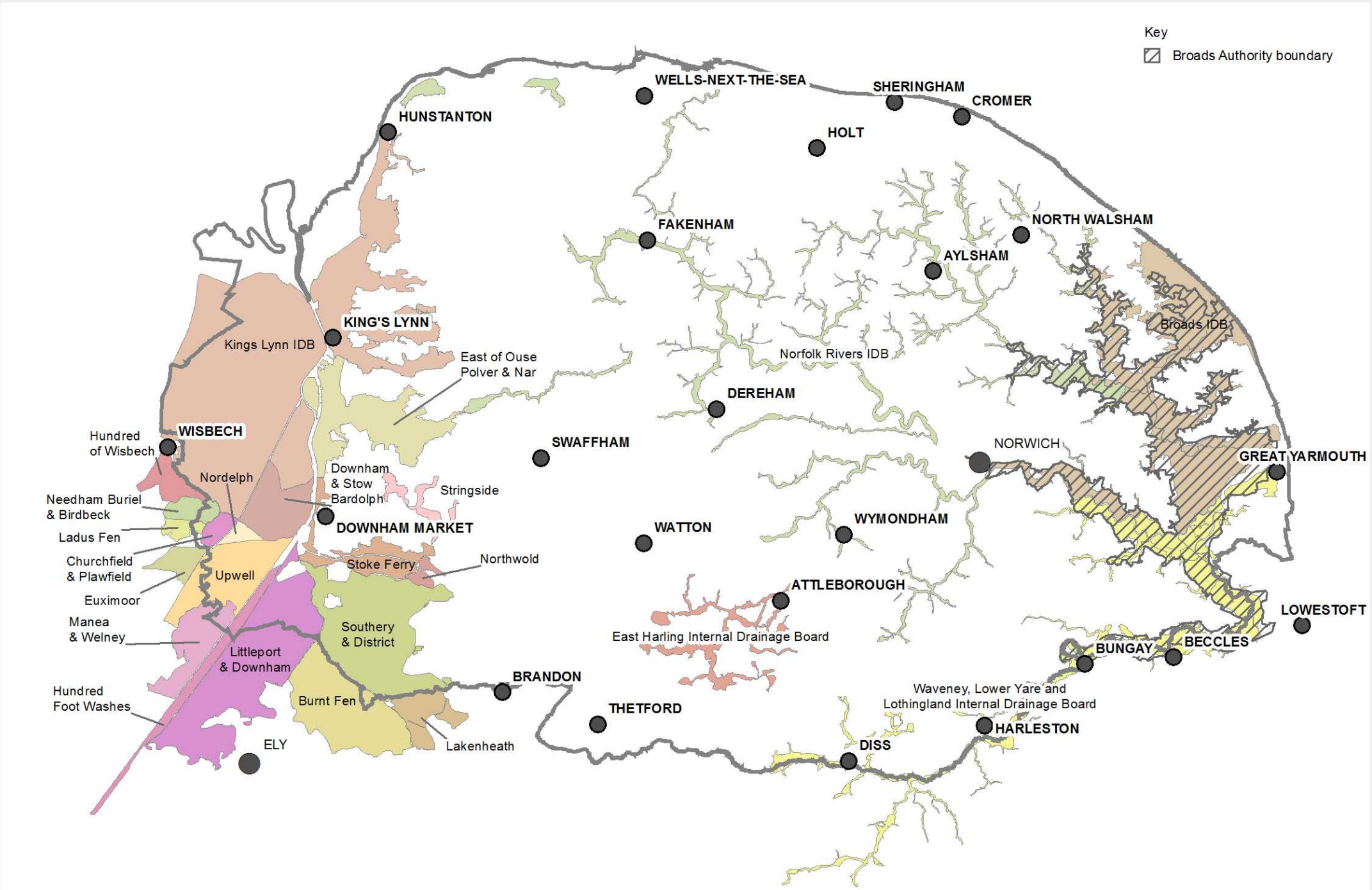

Map 3: Norfolk Internal Drainage Board boundaries

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Overview of flood risk

9.6 National surface water modelling produced by the Environment Agency in 2009 alongside the report "Flooding in England - a national assessment of flood risk" estimated that approximately 37,000 Norfolk properties may be at risk from flooding during a rainfall event with a 1 in 200 annual chance of occurring. This puts Norfolk 10th most 'at risk' area out of the 152 Lead Local Flood Authorities in England.

9.7 The Environment Agency has published maps that indicate the extent of flood risk from main rivers and coastal flooding. In Norfolk 62,086 properties lie within Flood Zones 2 and 3 and are at risk of flooding from main rivers or the sea (Flood Zone 2 identifies areas at risk of having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year; Flood Zone 3 identifies areas where water has to flow or be stored in times of flood). Map 4 indicates the extent of Flood Zones 2 and 3 in Norfolk (these maps assume that flood defences do not exist). Interactive maps showing flood zones 2 and 3 both with and without defences can be viewed on the Environment Agency's section of the Gov.UK website, Link: http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=357683&y=355134&scale=2 .

9.8 In addition to the above, the Lead Local Flood Authority has undertaken a Preliminary Flood Risk Assessment to identify those areas that are most likely to be at risk of 'surface water flooding'. Although this preliminary assessment is only an approximation, it does provide a useful indicator of the populations that are most at risk and this will allow the Lead Local Flood Authority to prioritise more detailed flood investigations in the areas of greatest local flood risk. Map 5 indicates the 1km grid squares that the preliminary assessment indicates as being most at risk of surface water flooding.

9.9 The following table indicates the Norfolk settlements most likely to be affected by surface water flood risk and the potential impact of that risk:

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Table 3: PFRA Priority Settlement Ranking, 2011

Settlement Ranking			
Settlement	**Potential impact within the Places above the Flood Risk Thresholds**		
	Number of people	Critical Infrastructure	Non residential properties
Norwich (inc. Drayton, Taverham and Cringleford	22,273	58	1,909
Gt. Yarmouth (inc. Gorleston and Bradwell)	6,875	31	720
King's Lynn (inc North and South Wootton)	3,707	25	686
Dereham	1,964	12	279
Thetford	1,812	11	286
Cromer	1,690	0	294
North Walsham	1,565	4	157
Sheringham	1,505	2	75
Wymondham	1,381	0	177
Snettisham	1,021	6	66
Attleborough	832	6	183
Caister	747	7	46
Diss	534	2	111
Long Stratton	264	3	79
West Runton	274	0	80
Heacham	208	2	37
Downham Market	204	0	65
Ormesby St. Margaret	281	2	445
Aylsham	339	2	84
Feltwell	393	2	118
Burnham Market	459	0	242
North and South Creake	257	0	132
Fakenham	323	6	75
Stalham	229	0	100
Mundford	211	2	23
Harleston	597	2	23
Wells	283	0	48
Mundesley	234	0	0

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Spixworth	241	2	0
Ludham	218	2	0
Kenninghall	213	0	51
Terrington St. Clement	290	2	81
Weeting	234	0	0
Winterton	321	0	31
Narborough	328	2	0
Watlington	335	0	0
East Harling	276	0	0
Swaffham	206	0	0
Buxton	260	0	0

N.B The fact that a settlement is not listed does not mean that there is no risk of flooding.

9.10 Further to the above information on surface water flood risk, the Environment Agency has provided an interactive map indicating areas at risk of flooding from surface water, which is accessible via the Environment Agency's website.
Link: http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfsw#x=357683&y=355134&scale=2

9.11 The above information does not give a completely comprehensive picture of flood risk in Norfolk. Notably, neither the Preliminary Flood Risk Assessment, nor the Environment Agency's flood maps provide an assessment of flood risk from all 'ordinary watercourses' and although the Environment Agencies modelling is relatively detailed the Preliminary Flood Risk Assessment lacks fine detail.

9.12 Over a smaller area, additional Strategic Flood Risk Assessments have been undertaken by all Norfolk planning authorities, as part of the Local Plan process, and further detailed studies are also being undertaken in some areas by the Lead Local Flood Authority to inform Surface Water Management Plans (see District summaries).

9.13 A combination of the above studies provides a broad overall assessment of flood risk in Norfolk, but further investigations will be required over coming years to increase the detailed understanding of the risk across the county.

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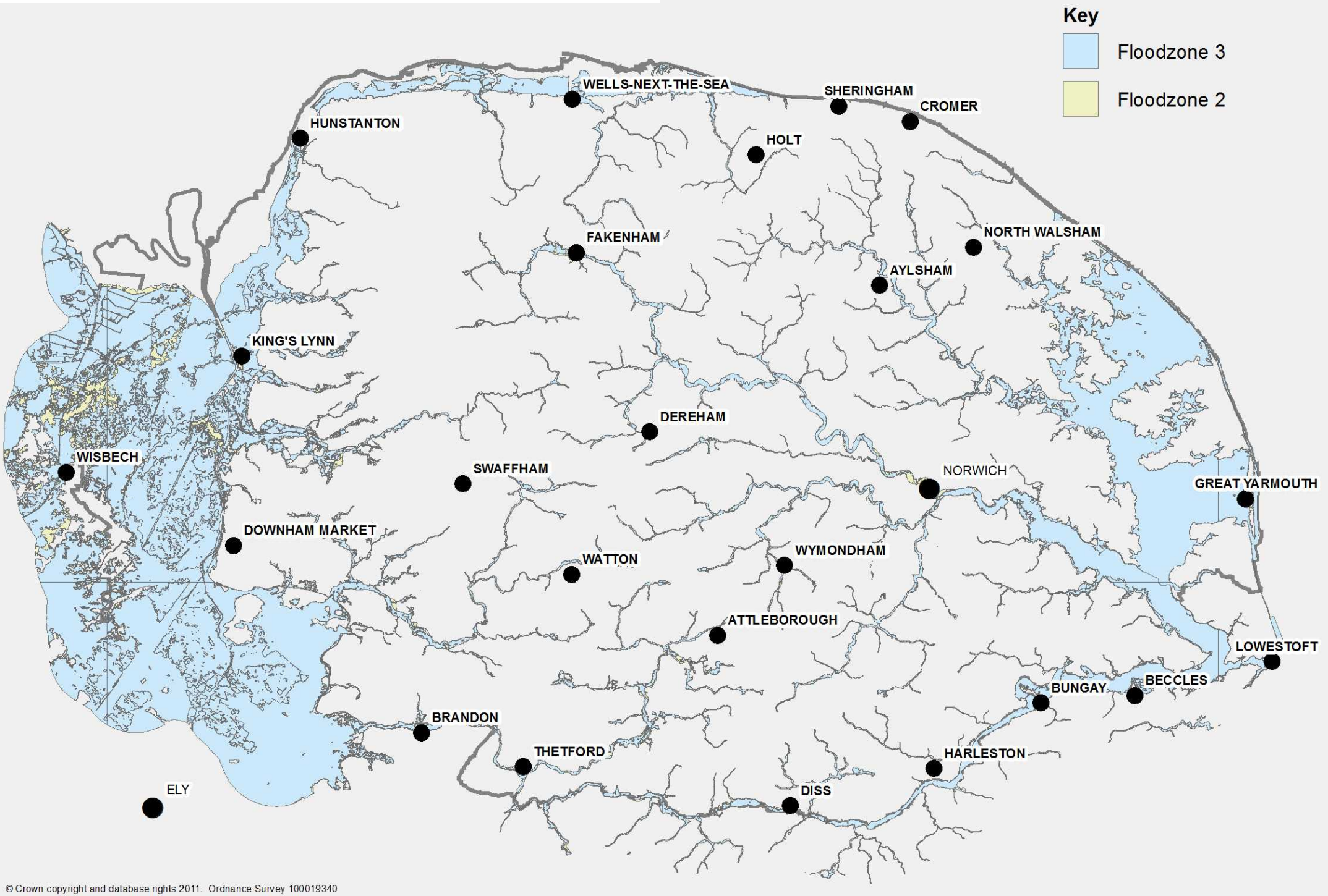
Map 4: Map of Environment Agency Flood Zone 2 & 3 coverage of Norfolk



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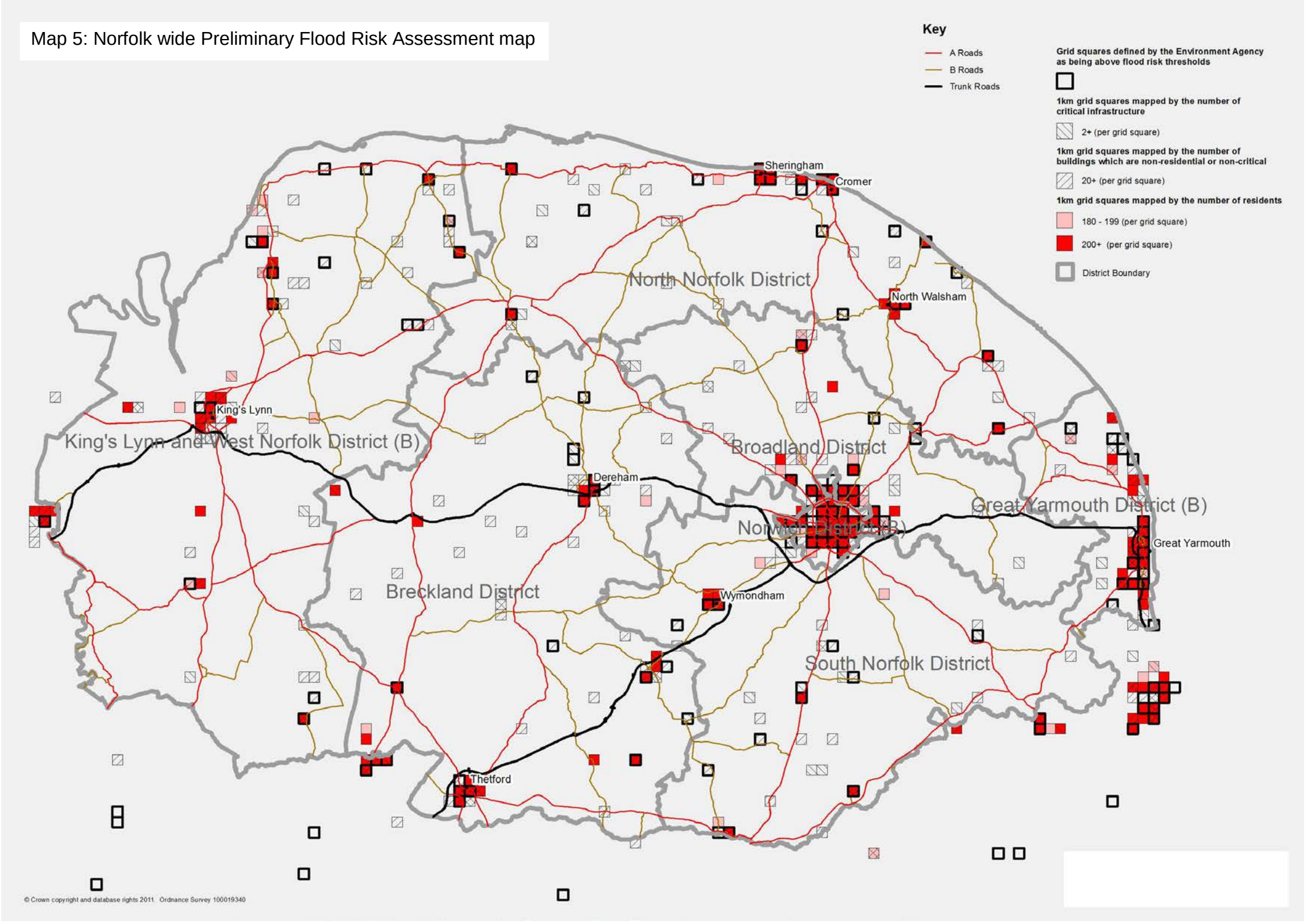
Map 5: Norfolk wide Preliminary Flood Risk Assessment map



Flood Risk in Your Area

10. Broadland District

Key partners

10.1. The following organisations have a role in the management of flood risk in Broadland District:

- Norfolk County Council, Lead Local Flood Authority
- Norfolk County Council, Highways Authority
- Highways Agency
- Anglian Water Services Ltd
- Environment Agency
- Broadland District Council
- Broads Authority
- Norfolk Rivers Internal Drainage Board, Water Management Alliance
- Broads (2006) Internal Drainage Board, Water Management Alliance
- Waveney, Lower Yare & Lothingland Internal Drainage Board

Existing Evidence Base

10.2. The following studies and plans support the understanding of flood risk in Broadland District:

- Broadland Rivers Catchment Flood Management Plan, Dec 2009
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Main Report, Jan 2008
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsiduary Report C, Broadland, Dec 2007
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsiduary Report B, Broads Authority Area, Dec 2007
- Greater Norwich Development Partnership, Water Cycle Study, Jan 2010
- Lead Local Flood Authority Preliminary Flood Risk Assessment, Jul 2011
- Norwich Urban Area Surface Water Management Plan, 2012

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Overview of Broadland District's River Catchments

10.3. Broadland District lies entirely within the River Yare primary catchment and contains reaches of the Rivers Yare, Wensum, Tud, Bure, Spixworth Beck, Stone Beck, Lackford Run and various smaller Becks, Drains and Dykes. The District also has significant areas of marshland and drained floodplains.

10.4. This area of the Broads system includes several large water bodies, including Wroxham Broad, Salhouse Broad, Ranworth Broad and South Walsham Broad.

10.5. A number of the principal watercourses within the District (particularly in the South East) are embanked, with water levels which are above the surrounding topography. In these areas pumping stations are required to raise surface water runoff to discharge into the embanked watercourses (these areas are described as pumped catchments).

10.6. Map 6 indicates the rivers and catchment boundaries within Broadland District.

Overview of flood risk

10.7. The low lying areas of the District are at risk of both fluvial and tidal flooding. There is also a long history of tidal surge flooding affecting the lower reaches of the River Yare catchment (including its tributaries, the rivers Bure and Thurne). The incoming tide holds back the rivers flow and prevents the system draining to the sea. In many of these events there has also been an element of combined flooding affecting the upper catchment reaches, with tidal effects reaching all the way to Norwich.

10.8. Further information on river and tidal flood risk is available in the Partnership of Norfolk District Councils Strategic Flood Risk Assessment.

10.9 Certain Broadland settlements adjacent to the River Bure and River Yare benefit from;

- floodbank defences maintained by the Environment Agency,
- Internal Drainage Board infrastructure.

10.10 Broadland Environmental Services Ltd (BESL) commenced a 20 year programme of improvements and maintenance to flood defences on behalf of the Environment Agency in 2001.

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10.11 The Preliminary Flood Risk Assessment indicates the potential risk from surface water flooding. Map 5 indicates the general areas where surface water flood risk is likely to be most significant.

10.12 The assessment indicates that the following settlements may be at risk of significant surface water flooding in Broadland District. The study estimates the number of properties that might be affected in each of the settlements:

Table 4: Broadland District Settlement Ranking, 2011

Settlement	Properties at risk
Lamas	220
Stalham	120
Spixworth	110
Taverham	90
Aylsham	70
Horsford	70
Hevingham	70
Coltishall	60
Coltishall Airfield*	40
Acle	40
Wroxham/Hoveton[6]*	40
Horsham St Faith	40
Salhouse	30
Freethorpe	30
Lingwood	30
New Rackheath	20
Brundall	20
Foulsham	20
Frettenham	<10
Reedham	<10
Newton St Faith	<10
Reepham	<10
Rackheath/ Salhouse	<10
Cawston	<10
Little Plumstead	<10
Blofield Heath	<10
Lenwade	<10

[6] Part of study area also in North Norfolk

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Felthorpe	<10
Cantley	<10
Thorpe End	<10
Marsham	<10

10.13 If a settlement is not listed, it does not mean that there is no risk of flooding. The preliminary assessment helps to identify settlements which are at the greatest risk of surface water flooding, prioritising them for preliminary investigations by the Lead Local Flood Authority and other Risk Management Authorities across Norfolk.

10.14 The large number of dispersed settlements in the District means that areas at risk of surface water flooding are likely to be widely distributed across the District and that each individual area at risk is likely to be relatively small. At present, detailed investigations by the Lead Local Flood Authority have been focussed only on the more densely populated areas.

10.15 Only the urban fringe of Norwich has been subject to a close examination of surface water flood risks, during the development of the Norwich Urban Area Surface Water Management Plan. The Surface Water Management Plan identified 3 areas in the city that are at the highest risk of surface water flooding. These are designated as Critical Drainage Catchments (CDCs). One of these areas is Drayton, in Broadland District. More detailed studies of the drainage system in these locations are being undertaken. (Map 14 illustrates the Critical Drainage Catchment for Drayton). Part of the Critical Drainage Catchment for Catton Grove and Sewell also extends into Broadland District.

Flood Risk issues in Broadland District

10.16 Any failure of the pumping stations within pumped catchments could increase the risk of surface water flooding during a significant rainfall event.

10.17 Fluvial flood management for Norwich is, in part, dependant on management of the upstream water flow, including the Rivers Wensum and Tud. The flood plains of these rivers provide additional water storage capacity and reduce the river flow volumes passing through the city during significant events.

10.18 Similarly, functional floodplains on the River Bure and on the River Yare (South and East of Norwich) reduce downstream flows to Great Yarmouth and other smaller settlements along the Rivers during significant events.

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10.19 Functional floodplains in the lower reaches of the Rivers Bure and Yare also serve to reduce the impact of tidal flooding in the upstream reaches of the rivers.

10.20 Many of these flood plains are under pressure to accommodate development that may decrease their capacity. Climate change impacts may actually require an increase in flood plain capacity if current levels of flood relief are to be maintained.

10.21 The public sewer network is under pressure to accommodate foul and surface water flows. These pressures result from the water company's duty to provide connections for new developments into the existing infrastructure. In addition there are historical misconnections of surface water runoff to the foul sewer network, which can lead to the design capacity of the system being exceeded.

10.22 There is little available information on recorded incidences of groundwater flooding affecting residential properties in Broadland, presumably as a result of a low water table being maintained through pumping undertaken by the Internal Drainage Boards.

Key Messages

10.23 The South East area of Broadland District is particularly reliant upon extensive networks of drainage channels to facilitate the drainage of agricultural land. These drainage channels, along with the pumping stations discharging water to the rivers will require continual maintenance and investment. Similarly the pumping capacity may need to be increased in the future to adapt to the effects of climate change.

10.24 There is a significant reliance on flood defences. These defences will require continual maintenance and investment to adapt to the effects of climate change.

10.25 Functional flood plains store water that might otherwise flood adjacent areas. It is important that their capacity is not reduced by unsustainable development. Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.

10.26 The use of Sustainable Drainage Systems (SuDS) within the catchments would help to slow the flow of water into the districts sewers and rivers, thereby minimising the impact of extreme weather events.

10.27 There is some risk of foul sewer flooding that results from the misconnection of surface water drainage to the foul sewer network. In order to address this issue opportunities to disconnect surface water from foul sewers need to be explored.

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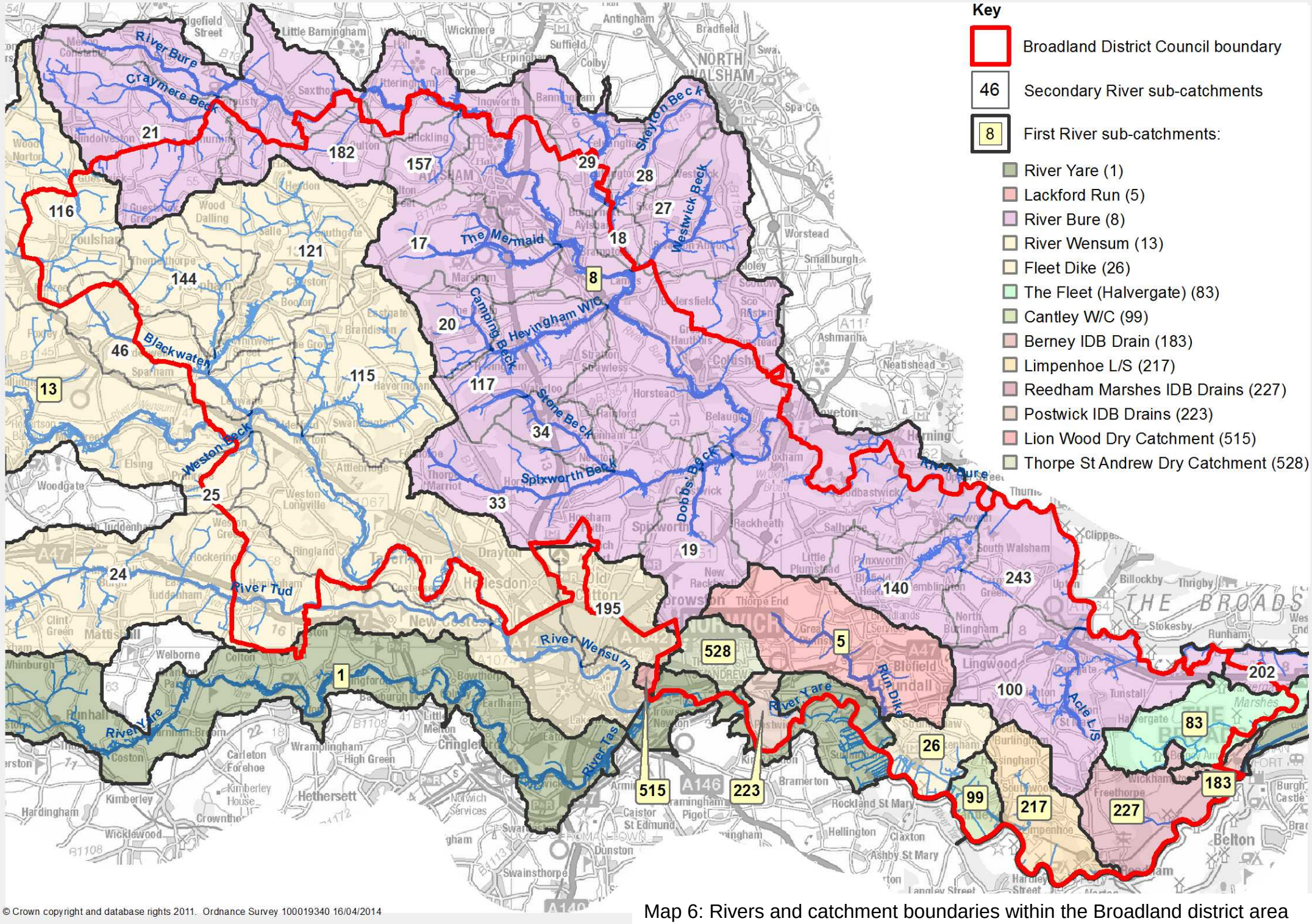

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Map 6: Rivers and catchment boundaries within the Broadland district area

11. Breckland District

Key partners

11.1 The following organisations have a role in the management of flood risk in Breckland District:

- Norfolk County Council Lead Local Flood Authority
- Norfolk County Council Highways Authority
- Highways Agency
- Anglian Water
- Environment Agency
- Breckland District Council
- East of Ouse, Polver & Nar Internal Drainage Board, Downham Market Group of Internal Drainage Boards
- Stringside Internal Drainage Board, Downham Market Group of Internal Drainage Boards
- East Harling Internal Drainage Board
- Waveney Lower Yare & Lothingland Internal Drainage Board
- Norfolk Rivers Internal Drainage Board, Water Management Alliance

Existing Evidence Base

11.2 The following studies and plans support the understanding of flood risk in Breckland District:

- Great Ouse Catchment Flood Management Plan, Jan 2011.
- Broadland Rivers Catchment Flood Management Plan, Dec 2009
- Lead Local Flood Authority Preliminary Flood Risk Assessment, Jul 2011.
- Breckland Water Cycle Study - Stage 1, 2008
- Thetford Water Cycle Study - Stage 1, 2008
- Breckland Water Cycle Study - Stage 2, 2010
- Breckland Strategic Flood Risk Assessment, 2005
- Breckland Strategic Flood Risk Assessment Update, 2007
- Strategic Flood Risk Assessment Level 2 Report - Thetford Town Centre, 2009

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Overview of Breckland District's River Catchments

11.3 Breckland district has an undulating ridge and valley land form with elevated plateaus. The District is the place of origin for many of Norfolk's major rivers.

11.4 The District has a dispersed population, spread across 5 towns (Thetford, Attleborough, Dereham, Swaffham, and Watton); 4 large villages (Necton, Swanton Morley, East Harling, Shipdham) and numerous smaller villages.

11.5 The dispersed population centres, undulating topography and multiple river sub-catchments means that surface water drainage in the district is complex, with most flood risk issues effecting only relatively small areas.

11.6 The following Breckland rivers drain to the west, joining the River Great Ouse system that exits to the sea adjacent to King's Lynn:

- Little Ouse River (including River Thet)
- River Wissey (including Watton Brook & River Gadder)
- River Nar

11.7 The Breckland rivers below drain to the east and eventually join the Yare river system (exiting to the sea at Great Yarmouth):

- River Yare
- River Waveney
- River Wensum (including the River Tud)
- Black Water (including Wendling Beck and Dereham Stream)
- Blackwater River

11.8 Map 7 indicates the rivers and catchment boundaries within Breckland District.

Overview of Flood Risk

11.9 Breckland is not generally at risk from significant and widespread fluvial flooding, but there are several smaller areas where residential and commercial buildings are at risk. In Thetford in particular the predominant flood risk is fluvial, where the Rivers Thet and Little Ouse meet within the town. No formal fluvial flood defences have been constructed in Thetford.

11.10 Breckland's Strategic Flood Risk Assessments of 2005, 2007 and 2009 and the Environment Agency's Flood Maps provide an indication of the

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extent of flood risk associated with the main rivers. Breckland's Strategic Flood Risk Assessments also identified a number of surface water and sewer flooding events across the district.

11.11 Although the risk of fluvial flooding is relatively limited, compared to the level of risk in other Norfolk Districts, some of the major urban areas in Breckland do face significant local flood risk.

11.12 The Preliminary Flood Risk Assessment (Map 5) indicates the general areas where surface water flood risk is likely to be most significant. The assessment estimates that the following number of properties may be at risk of surface run-off flooding in Breckland District.

Table 5: Breckland District Settlement Ranking, 2011

Settlement	Properties at risk
East Dereham	610
Thetford	420
Attleborough	230
Kenninghall	180
Narborough	130
Weeting	100
Saham Toney	100
Swaffham	70
North Elmham/ Swanton Morley Airfield	70
Mundford	60
Mattishall	60
Gressenhall	50
Litcham	50
Sporle	40
Garboldisham	40
Shipdham	30
Necton	30
Lyng	30
Watton	30
Banham	30
Bradenham	20
East Harling	20
Bawdeswell	10
Colkirk	<10
Barford	<10
Ashill	<10
Beetley	<10

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Great Ellingham	<10
Whissonsett	<10
Old Buckenham	<10
North Lopham	<10
Swanton Morley	<10
Griston	<10

11.13 A Surface Water Management Plan has not yet been undertaken for any of Breckland's settlements and reliable information on surface water flooding is diffuse.

11.14 East Dereham has historically suffered from surface run-off and fluvial flooding with areas to the West particularly at risk. The Dereham Stream in particular has had numerous localised flooding events which have affected properties.

Flood Risk Issues in Breckland District

11.15 In Breckland's urban areas there has historically been a reliance on sewers for drainage and many watercourses have been extensively culverted. This has led to a number of instances of flooding due to blockages, or inadequate capacity in the drainage network.

11.16 Development pressures and the effects of climate change are already placing additional stress on the limited capacity of the district's drainage networks. Some of these pressures result from the water company's duty to provide connections for new developments into the existing infrastructure. In addition there are historical misconnection of surface water runoff to the foul sewer network, which can lead to the design capacity of the system being exceeded.

11.17 The possibility of watercourses drying out in drought conditions is a potentially significant issue in Breckland, particularly along reaches that are close to the source of the rivers. This could have detrimental impacts on important habitats, flora and fauna.

11.18 Following significant rainfall in 2012 there have been some instances of flooding associated with high groundwater levels. However at this time there is limited understanding of the risk of groundwater flooding in the district.

Key Messages

11.19 Further work is necessary to understand the full extent of risk from surface water flooding in Breckland, including the preparation of Surface Water Management Plans.

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11.20 Careful assessment of the potential impact of surface water drainage from new developments will be necessary in areas with constrained drainage networks, particularly those networks that are dependent upon sewers and culverted watercourses with limited capacity.

11.21 Reducing the potential impacts of sewer flooding may require the installation of Sustainable Drainage Systems in both new and existing developments. The risk of foul sewer flooding that results from the misconnection of surface water drainage to the foul sewer network could be addressed if opportunities to disconnect surface water from foul sewers are taken.

11.22 Consideration may need to be given to further use of rural Sustainable Drainage Systems to reduce both the risk of flooding and the risk of rivers drying out (smoothing out the peaks and troughs of local rainfall).

11.23 Relative to other Norfolk Districts Breckland has lower levels of fluvial flood risk, affecting fewer properties. Where flooding affects only a limited number of properties, it is unlikely that measures to improve flood defences will attract priority funding. Instead it may be necessary to place greater reliance on making properties that are at risk more resilient to flooding.

11.24 Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.

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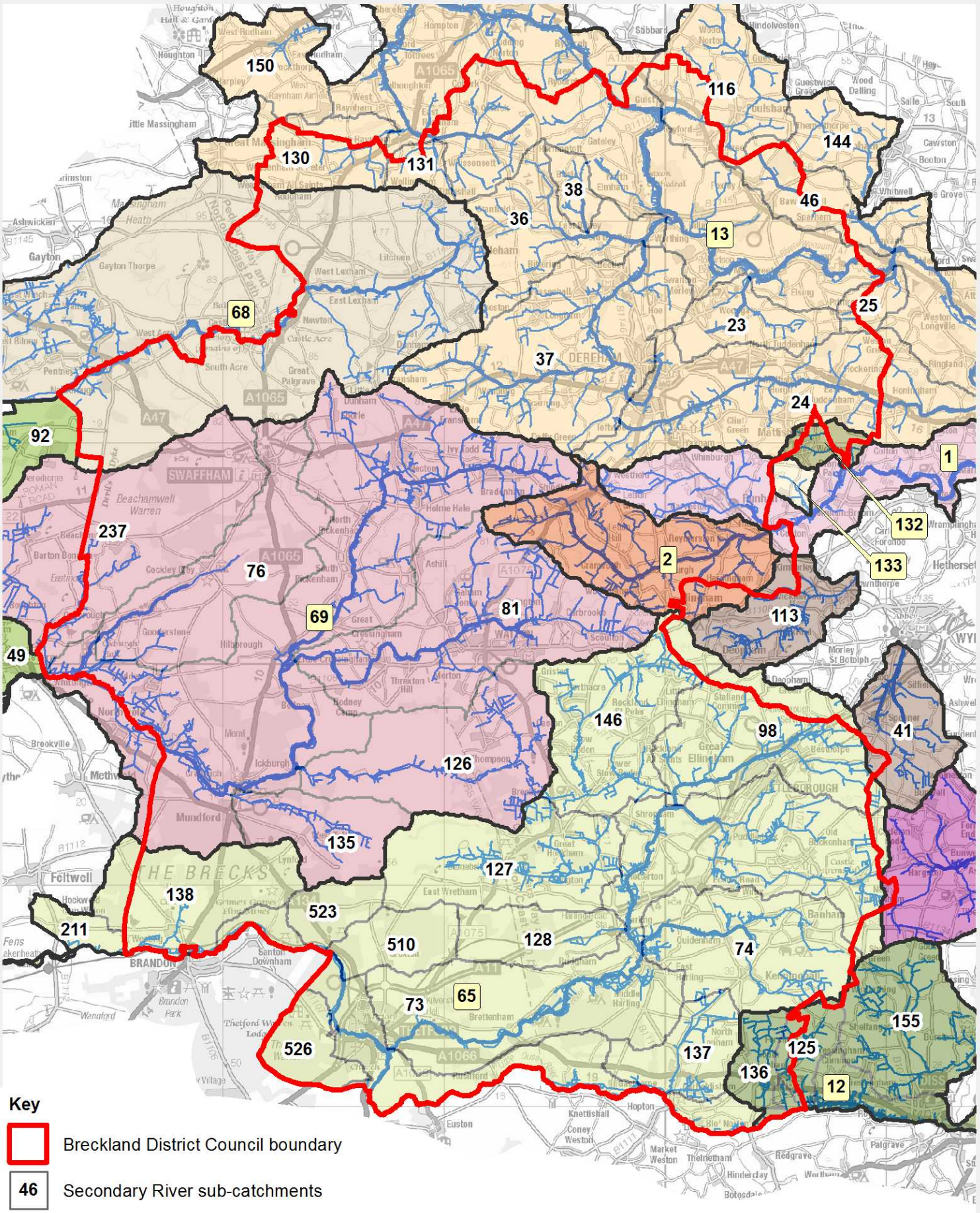

Map 7: Rivers and catchment boundaries within the Breckland district area

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12. Great Yarmouth Borough

Key partners

12.1 The following organisations have a role in the management of flood risk in Great Yarmouth:

- Norfolk County Council Lead Local Flood Authority
- Norfolk County Council Highways Authority
- Highways Agency
- Environment Agency
- Anglian Water
- Great Yarmouth Borough Council
- Broads Authority
- Broads (2006) Internal Drainage Board, Water Management Alliance
- Waveney Lower Yare and Lothingland Internal Drainage Board
- Eastport

Existing Evidence Base

12.2 The following studies and plans support the understanding of flood risk in Great Yarmouth Borough:

- Broadland Rivers Catchment Flood Management Plan, Dec 2009.
- Great Yarmouth and Gorleston Strategic Flood Risk Assessment Sept 2009.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Main Report Jan 2008
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsidiary Report B, Broads Authority Area, Dec 2007.
- Lead Local Flood Authority Preliminary Flood Risk Assessment, Jul 2011.
- Great Yarmouth Surface Water Management Plan, 2013.
- Great Yarmouth and Waveney Water Cycle Scoping Study, Mar 2009.
- Shoreline Management Plan Kelling to Lowestoft Ness, Aug 2012.

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Overview of Great Yarmouth's River Catchments

12.3 Great Yarmouth Borough lies at the downstream end of the River Yare primary catchment. The Borough is crossed by the Rivers Yare, Bure and Waveney, all of which combine and (as the Yare) exit to the sea through Great Yarmouth town.

12.4 The River Thurne, a tributary of the Bure, runs along the borough's northern boundary.

12.5 To the south, the River Waveney runs along the County Boundary. The southern half of the Waveney's catchment lies within Suffolk (an adjacent Lead Local Flood Authority).

12.6 In addition to the main rivers, a substantial tidal basin, Breydon Water, is located directly upstream of the urban area of Great Yarmouth. The River Yare runs through Breydon Water and joins with the River Bure at its eastern end. The River Waveney also connects with the River Yare at Breydon Water, firstly at the New Cut and then at the western end of Breydon Water.

12.7 Another sizable water body, in the borough is the Trinity Broads (which comprises 5 broads in total). The Trinity Broads are located north west of Caister-on-Sea and discharge to the River Bure via Muck Fleet.

12.8 The rivers Yare, Waveney and Bure are at the downstream end of large catchments and move significant volumes of water. In Great Yarmouth Borough these three rivers are also subject to significant tidal influences, which are powerful enough to reverse the flow of the rivers and hold back water within the drainage system.

12.9 Within Great Yarmouth Borough, most of the rivers are embanked and river levels are commonly above the height of the adjacent land. Flood defence structures, which protect against coastal flooding, also form a barrier to natural drainage. As a consequence, most of the area relies upon pumping stations to lift surface water into the rivers (a pumped catchment).

12.10 Map 8 indicates the rivers and catchment boundaries within Great Yarmouth Borough (including the area of the pumped catchment).

Overview of flood risk

12.11 The most significant flood risk in Great Yarmouth Borough is that of coastal inundation and fluvial flooding. Although the frequency of such events is predicted to be comparatively low and in most circumstances flood defences are likely to be effective in preventing such flooding, a

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coastal flood event has the potential to be catastrophic, with deep, fast flowing water and a spread of water that would affect a very large area.

12.12 Further information on river and coastal flood risks can be found in the Great Yarmouth and Gorleston Strategic Flood Risk Assessment Sept 2009.

12.13 The effects of the tide (holding back river flows) and the existence of extensive coastal flood defence structures along the river banks, has a material impact on the management of surface water drainage in the Borough, obstructing natural drainage and increasing dependence on pumping stations.

12.14 Drainage of surface water within much of the urban area of Great Yarmouth is predominantly through a combined sewer system. Recent works by Anglian Water have increased the storage capacity of the surface water drainage network in some locations, but there is still a risk of flooding. The majority of the incidents of sewer flooding have been clustered in the North and Western areas of Great Yarmouth and along the Beccles Road, Northgate Street, Cobden Terrace and Nursery Terrace.

12.15 The North and Western areas of Great Yarmouth town are generally low lying and in close proximity to the River Bure, which may cause the sewer system to back up at high tide, due to the outfalls being tide blocked.

12.16 The Preliminary Flood Risk Assessment (Map 5) indicates the general areas where surface water flood risk is likely to be most significant.

12.17 The assessment estimates that the following number of properties may be at risk of surface water flooding in Great Yarmouth Borough.

Table 6: Great Yarmouth Borough Area Settlement Ranking, 2011

Settlement	Properties at risk
Great Yarmouth (inc. Gorleston and Bradwell)	1300
Hemsby	420
Caister-on-Sea	150
Ormesby St. Margaret	140
Martham	80
Hopton-on-Sea	70
Belton	70
Filby	40
Burgh St Margaret	20

12.18 The most recent, significant surface water flooding event in the borough occurred during several heavy rainfall events in June, July and

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August 2014 which caused multiple properties to flood, particularly around Ormsby St Margaret and Hemsby; flooding also occurred in September 2006, when a torrential thunderstorm flooded over 50 properties (including 6 schools) in Great Yarmouth. The 2006 event also flooded properties and businesses in Hemsby and Hopton-on-Sea and caused serious disruption to a much wider area.

12.19 Having regard to the large number of properties at risk of surface water flooding, the Lead Local Flood Authority has undertaken further investigations into surface water flood risk in Great Yarmouth and a more detailed assessment of surface water flood risk can be found in the Great Yarmouth Surface Water Management Plan.

12.20 The Great Yarmouth Surface Water Management Plan identified 6 areas of significant risk across the urban area of Great Yarmouth and Gorleston and a further two areas in the villages of Caister and Hemsby and these have been designated as Critical Drainage Catchments (CDCs). In combination the 6 CDCs across Great Yarmouth and Gorleston cover much of the urban area. The designation of a CDC does not imply that flooding would occur across the whole area, merely that drainage within the CDC could contribute to flood risk in the low lying parts of the area. Map 9 shows the areas designated as CDCs in Great Yarmouth Borough.

12.21 Broad scale analysis has identified potential areas in Great Yarmouth and Gorleston for groundwater emergence. At present the water table is likely to be held at an artificially low level due to the effects of pumped drainage systems, therefore risk of groundwater flooding in Great Yarmouth is considered to be low (source SFRA). Understanding the potential effect of pump failure on the water table and the residual risk of groundwater flooding will require further investigation.

Flood Risk Issues in Great Yarmouth Borough

12.22 Tidal and fluvial flood risk is the dominant threat due to the low-lying land in the Borough and the vulnerability of coastal settlements to tidal surges from the North Sea.

12.23 The size of the area that could be inundated in a major event represents a significant level of risk due to the number of properties that would be affected and the extreme distances that may have to be traversed for people to reach a safe location above the flood level.

12.24 A severe flood event in the Borough is likely to affect significant areas of critical infrastructure including; power generating sites, pumping stations, trunk roads and communications systems. Damage to such infrastructure could affect areas well beyond the flood zone and is likely to hinder recovery.

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12.25 Over the next hundred years, a much larger area of the Borough may be at risk of flooding and inline with climate change projections it is predicted that there will be a significant increase in the number of properties at risk.

12.26 A network of flood defences has been constructed to reduce flood risk within the Borough, and drainage features are used to manage discharge. These measures are (in normal circumstances), expected to prevent the spread of flood water. However, there remains the potential for the flood defence infrastructure or pumping stations to fail, sustaining a 'residual risk' of flooding in these areas.

12.27 Combined sewer systems in the urban areas are vulnerable to flooding when levels of surface water ingress are high, as most were not generally designed for extreme events and in many instances they are reliant upon pumping systems. In addition there are historical misconnections of surface water runoff to the foul sewer network, which can lead to the design capacity of the system being exceeded.

12.28 There are also a number of flapped outfalls, which discharge water from surface water sewers through flood defence walls into the tidal Yare and other rivers within the borough. The maintenance of these outfalls is important in reducing flood risk in Great Yarmouth, as sewers would be unable to discharge if these features do not function as designed.

12.29 Many Ordinary Watercourses in the Borough have been heavily modified to facilitate drainage of agricultural land and waterway navigation. These modified drainage channels do not enhance biodiversity. To reach the standards required by the Water Framework Directive, further modification of some of these drainage channels may be needed in order to achieve more natural river morphology and improve ecological potential. This could also provide benefits in terms of flood risk management

12.30 The urban areas of Great Yarmouth and Gorleston have the potential for elevated risks of groundwater pollution. The areas industrial heritage has left polluted sites and the potential for new pollution incidents. The need to protect groundwater from pollution may affect surface water drainage mechanisms and place some limitations on possible mitigation actions.

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Key Messages

12.31 Tidal flooding in Great Yarmouth and Gorleston is a medium probability but high consequence event.

12.32 Drainage and surface water issues in Great Yarmouth result in generally less severe but more frequent flooding.

12.33 In Great Yarmouth, there is a significant reliance on flood defences to protect key population areas and areas of valuable and productive agricultural land. These defences will require continued maintenance and investment to adapt to the effects of climate change.

12.34 The area is reliant upon extensive networks of drainage channels and combined sewers to facilitate the drainage of both urban and agricultural land. These drainage channels and sewers, along with the pumping stations and the flapped outfalls, will also require continued maintenance and investment. Pumping capacity may need to be increased to adapt to the effects of climate change.

12.35 There is a risk of foul sewer flooding that results from the misconnection of surface water drainage to the foul sewer network. In order to address this issue opportunities to disconnect surface water from foul sewers need to be explored.

12.36 The high levels of residual flood risk and the predicted additional flood risk from climate change, highlights the importance of locating development away from vulnerable areas and the potential of developments to increase flood risk elsewhere.

12.37 Many of the areas at most significant risk of flooding are developed, including large areas of the historic towns of Great Yarmouth and Gorleston. The areas that are most at risk from surface water flooding are often also the areas that are subject to residual risks from inundation from the sea or fluvial flooding, that could result from a failure of the flood defences. These areas are also subject to residual risks of flooding by surface water due to a potential for pumping stations to fail. In locations where there are cumulative flood risks (and residual flood risks) a greater emphasis on developing resilience to flooding may be advisable.

12.38 A number of sites containing critical infrastructure are vulnerable to flooding in the district. Any flood damage to critical infrastructure could increase the impact of flooding and have detrimental effects on the population as well as the economy well beyond the extent of the flood zones.

12.39 In order to meet the requirements of the Water Framework Directive, some drainage systems may need to be modified to create more

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natural river morphology in the area and better ecological potential. This could also provide benefits in terms of flood risk management.

12.40 There is a need to introduce more sustainable drainage systems in to the area, which can facilitate storage and reuse of water and slow water down.

12.41 Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.

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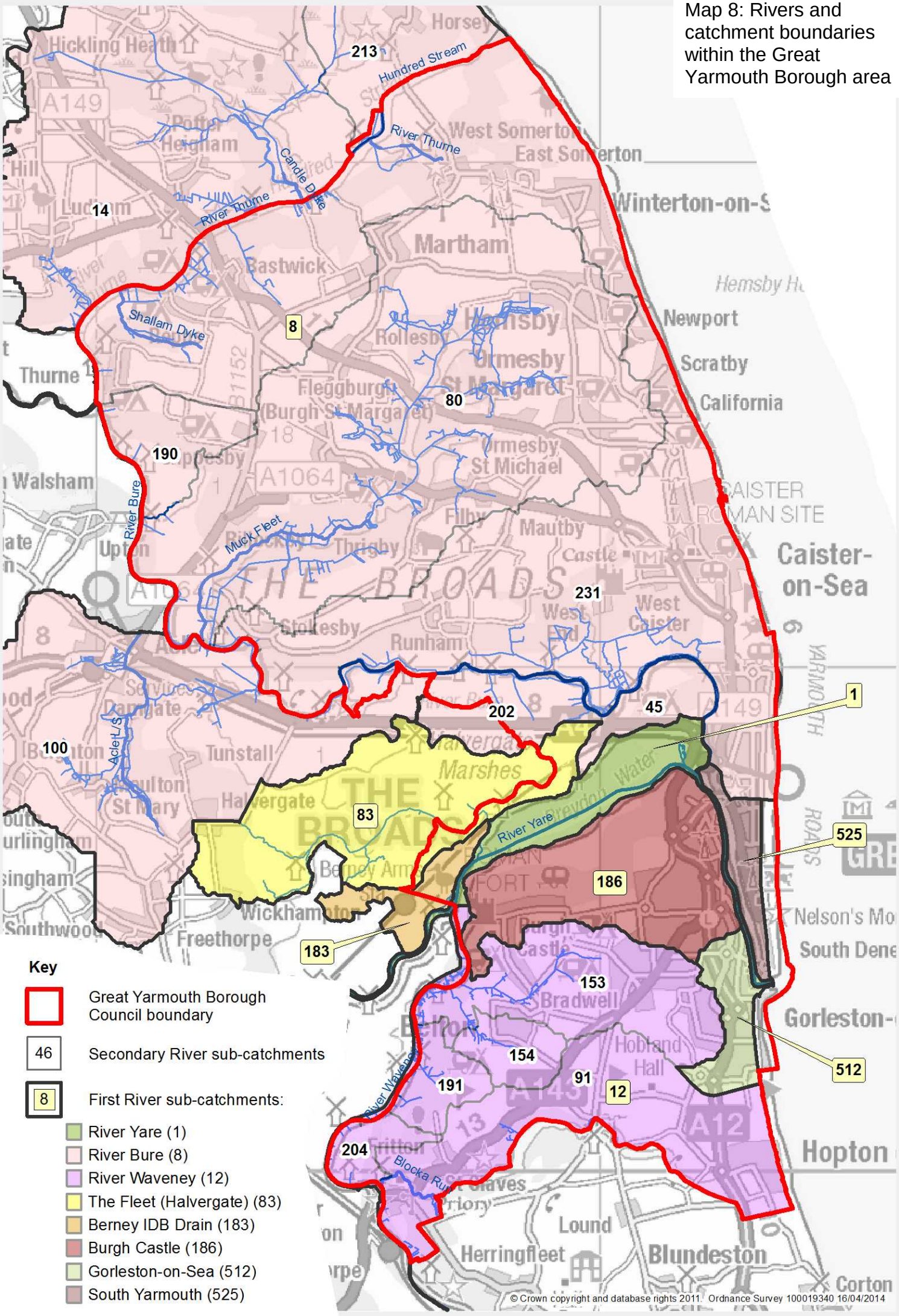
Map 8: Rivers and catchment boundaries within the Great Yarmouth Borough area



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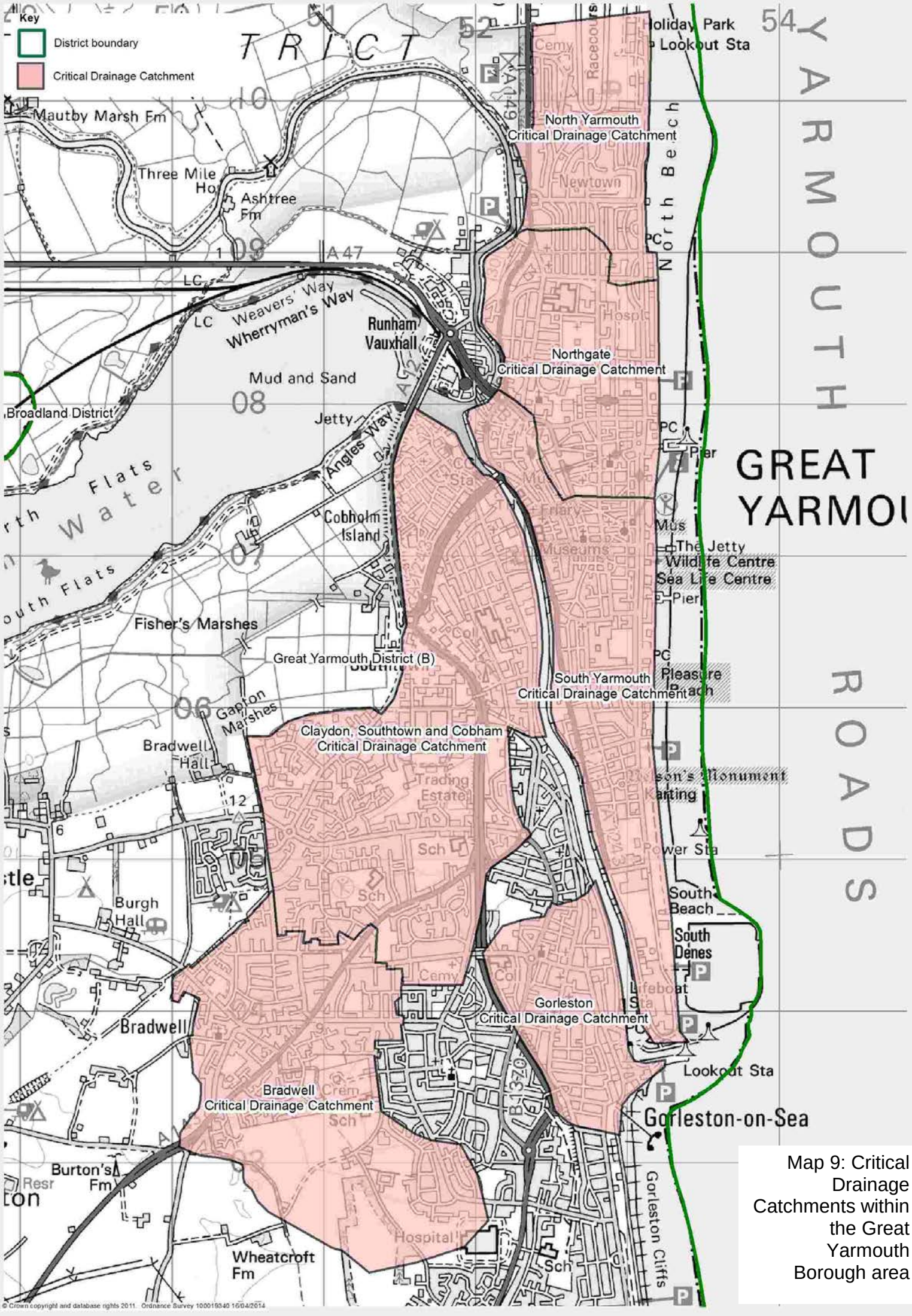

Map 9: Critical Drainage Catchments within the Great Yarmouth Borough area

13. Borough of King's Lynn & West Norfolk

Key partners

13.1 The following organisations have a role in the management of flood risk in Kings Lynn and West Norfolk:

- Norfolk County Council Lead Local Flood Authority
- Norfolk County Council Highways Authority
- Highways Agency
- Environment Agency
- Anglian Water
- Kings Lynn and West Norfolk Borough Council
- Middle Level Commissioners
- Burnt Fen Internal Drainage Board, Ely Group of Internal Drainage Boards
- Churchfield & Plawfield Internal Drainage Board
- Downham & Stow Bardolph Internal Drainage Board, Downham Market Group of Internal Drainage Boards
- East of Ouse, Polver and Nar Internal Drainage Board, Downham Market Group of Internal Drainage Boards
- Euximoor Internal Drainage Board
- Hundred Foot Washes Internal Drainage Board
- Hundred of Wisbech Internal Drainage Board
- King's Lynn Internal Drainage Board, Water Management Alliance
- Littleport & Downham Internal Drainage Board, Ely Group of Internal Drainage Boards
- Manea & Welney District Drainage Commissioners
- Needham & Ladus Internal Drainage Board
- Nordelph Internal Drainage Board
- Norfolk Rivers Internal Drainage Board, Water Management Alliance
- Northwold Internal Drainage Board, Downham Market Group of Internal Drainage Boards
- Southery & District Internal Drainage Board, Downham Market Group of Internal Drainage Boards

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- Stoke Ferry Internal Drainage Boards, Downham Market Group of Internal Drainage Boards
- Stringside Internal Drainage Board, Downham Market Group of Internal Drainage Boards
- Upwell Internal Drainage Board

Existing Evidence Base

13.2 The following studies and plans support the understanding of flood risk in Kings Lynn and West Norfolk:

- Great Ouse Catchment Flood Management Plan Jan 2011.
- North Norfolk Catchment flood Management Plan Dec 2009
- Broadland Rivers Catchment Flood Management Plan Dec 2009
- King's Lynn & West Norfolk Strategic Flood Risk Assessment Dec 2008.
- Lead Local Flood Authority Preliminary Flood Risk Assessment Jul 2011.
- Kings Lynn and West Norfolk Surface Water Management Plan 2012.
- Kings Lynn and West Norfolk Water Cycle Study.
- The Wash Shoreline Management Plan Aug 2010 (Gibraltar Point to Old Hunstanton).
- North Norfolk Shoreline Management Plan (Hunstanton to Kelling Hard) Nov 2010.
- Great Ouse Tidal River Strategy 2010 (GOTRS)
- The Wash East Coastal Management Strategy Dec 2014

Overview of King's Lynn and West Norfolk's River Catchments

The River Great Ouse Catchment

13.3 The most significant river in King's Lynn and West Norfolk is the River Great Ouse, which discharges to The Wash at the town of King's Lynn. The River Great Ouse catchment extends well beyond the boundaries of both the district and the County. The Great Ouse is a heavily modified watercourse, and includes several significant and strategic water management features (for example the Denver sluice and the Great Ouse Washes).

13.4 The rivers flowing into the River Great Ouse from the east are sourced predominantly from conventional gravity catchments, with the rivers Nar, Wissey and Little Ouse River originating in the adjacent district of

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Breckland. Other shorter rivers entering the Ouse from the East, such as the Babingley River and the Gaywood River, start within the borough boundaries. These watercourses are also heavily modified on their approaches to the Great Ouse.

13.5 The remainder of the Great Ouse catchment mostly consists of The Fens, an area of land which is drained and managed as a pumped catchment.

The Fens

13.6 The area known as The Fens covers almost 1,500 square miles, stretching from the Wash out to Lincoln, Peterborough and Cambridge. Five different rivers, the Witham, Welland, Glen, Nene and Ouse, carry water from surrounding uplands through the Fens and into the Wash (see Map 10).

13.7 Localised drainage took place in the fenland landscape from as early as the medieval period. However, large scale drainage of the Fens first began in the 17th Century. Today this artificially drained landscape is home to approximately half a million people.

13.8 Across the Fens, IDBs maintain 3,800 miles of watercourse, 200 miles of watercourse embankment and 286 pumping stations. Coupled with over 60 miles of coastal sea walls and 96 miles of river embankments, the Fens has a high level of protection, and is classified as a defended flood plain.

13.9 Almost half of Kings Lynn and West Norfolk Borough is located within The Fens.

13.10 The Fens area is covered by four different Environment Agency Catchment Flood Management Plans (CFMPs); one for each of the fenland catchments of the Nene, Welland and Glen, Witham and Great Ouse and also by the Wash Shoreline Management Plan (SMP).

13.11 The introduction of the duty for Lead Local Flood Authorities (LLFAs) to produce Local Flood Risk Management Strategies (local strategies) provides an opportunity for integrating and delivering the aims for the Fens. It is considered desirable to ensure that flood risk and drainage management of fenland areas is co-ordinated across the relevant local strategies. This consistency is crucial, for example, to IDBs, who often span more than one local authority and whose practices will be similar throughout their area.

13.12 Management of the Fens is divided between eleven District and five County Councils. The Lead Local Flood Authorities of Lincolnshire, Peterborough, Cambridgeshire, Norfolk and Suffolk have agreed to work together closely to ensure that management of the Fens is

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coordinated. The Environment Agency is preparing an Anglian Flood Risk Management Plan and proposes that the Fens will be treated as a "Strategic Area".

Other Catchments in King's Lynn and West Norfolk

13.13 In addition to the rivers feeding the River Great Ouse the district has some relatively short rivers, the River Burn, River Hun, Heacham River and The Ingol, which drain to the sea through coastal defences along the north coast.

13.14 Map 11 indicates the rivers and catchment boundaries within King's Lynn and West Norfolk (including the area of the pumped catchment).

Overview of flood risk

13.15 The varied topography of the Borough greatly influences the nature of flood risk which is present. Tidal flood risk is a dominant threat due to the low-lying land in the South and West of the Borough and the vulnerability of coastal settlements to tidal surges from the North Sea.

13.16 Fluvial flood risk is of equal importance given that the Borough is located downstream of the River Great Ouse, a major watercourse draining a catchment of approximately 690km^2.

13.17 There is also a risk of fluvial flooding from the tributaries of the River Great Ouse; the rivers Nar, Wissey, Little Ouse River, Gaywood River, Babingley River and the Old Bedford River, along with many other small drainage channels. Understanding of fluvial flood risk from ordinary watercourses in King's Lynn West Norfolk is limited and further investigation of the risk associated with these smaller watercourses is required.

13.18 The Environment Agency predicted flood zones for extreme events extend a significant distance from the coast and the tidal River Great Ouse. Map 4 illustrates the extent of predicted flooding assuming that there are no flood defences.

13.19 The King's Lynn & West Norfolk Strategic Flood Risk Assessment provides further detail on the extent of flood risk associated with main rivers and the sea.

13.20 In addition to the tidal and main river flood risk, which is the responsibility of the Environment Agency, there are also significant surface water flood risks in the Borough.

13.21 The Preliminary Flood Risk Assessment (Map 5) indicates the general areas where surface water flood risk is likely to be most significant.

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13.22 The assessment estimates that the following number of properties may be at risk of surface water flooding in the Borough of King's Lynn and West Norfolk:

Table 7: King's Lynn and West Norfolk Settlement Ranking, 2011

Settlement	Properties at risk
King's Lynn	810
Burnham Market	420
Feltwell	330
Terrington St. Clement	250
Dersingham	190
Snettisham	160
East Rudham	150
Hunstanton	140
North Creake	130
Heacham	120
Great Massingham	60
Stanhoe	60
Watlington	60
Downham Market	50
Clenchwarton	30
Gayton	30
Brancaster Staithe	30
Wereham	30
Grimston	30
Methwold	30
Shouldham	20
Stoke Ferry	20
Thornham	20
Emneth	20
Castle Acre	20
West Walton/Walton Highway	20
Docking	20
Hockwold cum Wilton	20
Holme next the Sea	20
Marham Airfield	10
Brancaster	10
Roydon	10
Outwell	10
Middleton	<10
Southery	<10
Bircham Newton	<10

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Terrington St John	<10
Fincham	<10
St John's Fen End	<10
Denver	<10
Brookville, Norfolk	<10
Hilgay	<10
Northwold	<10
Marham	<10
Burnham Overy Staithe	None Identified
West Winch	None Identified
Old Hunstanton	None Identified
Wimbotsham	None Identified
North Runcton	None Identified
Blackborough End	None Identified

13.23 A significant recent surface water flood event occurred in the Borough in August 2008, where flooding was reported in a number of areas.

13.24 Having regard to the large number of properties at risk of surface water flooding, the Lead Local Flood Authority has undertaken further investigations into surface water flood risk in Kings Lynn and West Norfolk and has published the results in a Surface Water Management Plan for King's Lynn and West Norfolk.

13.25 Analysis undertaken as part of the King's Lynn and West Norfolk Surface Water Management Plan identified further potential risk within the Borough from ground water flooding. The predicted groundwater risks have recently become reality, as sustained rainfall during 2012 has resulted in a number of flooding events that may be attributable to ground water influences.

Flood Risk Issues in King's Lynn and West Norfolk

13.26 The large catchment area that influences water volumes in the Great Ouse extends well beyond the administrative boundaries of the Norfolk Risk Management Authorities. Cooperation with upstream Risk Management Authorities will be crucial to ensure that flood risk can be adequately managed within the borough.

13.27 Tidal and fluvial flood risk is the dominant threat due to the low-lying land in the Borough and the vulnerability of coastal settlements to tidal surges from the North Sea.

13.28 The size of the area that could be inundated in a major event represents a significant level of risk due to the number of properties that would be affected and the extreme distances that may have to be traversed for people to reach a safe location above the flood level.

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13.29 A severe flood event in the Borough is likely to affect significant areas of critical infrastructure, including power generating sites, pumping stations, trunk roads and communications systems. Damage to such infrastructure could affect areas well beyond the flood zone and is likely to hinder recovery.

13.30 A network of flood defences has been constructed to reduce flood risk within the Borough, and drainage features are used to manage discharge. These measures are (in normal circumstances), expected to prevent the spread of flood water, however, there remains the potential for the flood defence infrastructure, or pumping stations to fail and as such there is a significant 'residual risk' of flooding in these areas.

13.31 Over the next hundred years, climate change may mean that a much larger area of the Borough could be at risk of flooding and it is predicted that there will be a significant increase in the number of properties at risk.

13.32 Many ordinary watercourses in the borough are either artificial or have been heavily modified in order to facilitate drainage of agricultural land, or for other purposes. These modified drainage channels do not provide ideal environments to promote biodiversity. To reach the standards required by the Water Framework Directive, enhancement of some of these drainage channels may be needed in order to achieve good ecological potential. This could also provide benefits in terms of flood risk management

13.33 The urban area of King's Lynn town has the potential for elevated risks of groundwater pollution, due to the presence of polluted sites linked to the industrial heritage of the town and the potential for new pollution incidents. The need to protect groundwater from pollution may affect surface water drainage mechanisms and place some limitations on the techniques which can be applied.

13.34 There is potential for groundwater flooding in the Borough due to the characteristics of the Wash and the presence of the underlying Chalk geology. However, normally a low water table is maintained through pumping by the Internal Drainage Boards. There remains a residual risk that groundwater flooding could occur if, for any reason, the pumping stations ceased to operate, or if the pumping capacity is insufficient.

13.35 Tidal locking sometimes occurs on the lower reaches of the river Burn, where the river is prevented from draining to the sea by high tides.

13.36 Fluvial flooding associated with upstream areas of individual catchments can arise rapidly. River flooding has affected several properties along the river Burn.

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13.37 The River Burn also suffers from intermittent flows during dry periods.

13.38 Farming contributes significantly to the success of the local economy. The Fens account for 50% of all Grade 1 agricultural land in England, producing 37% of all vegetables and 24% of all potatoes grown in the country, as well as enough wheat to make 250 million loaves of bread every year. The area also supports significant livestock, and supports a large well-established food processing industry. There is an imperative that this productivity is maintained or improved in order to ensure food security for the nation and avoid excessive and unsustainable levels of food imports, however, significant funding will be needed to ensure maintenance of the drainage features and flood defence structures that are necessary to protect agricultural land in the Fens.

13.39 There is a finite capacity to the flood management systems currently in operation in the borough, particularly in the low lying pumped catchments. Exceeding that capacity would increase flood risk. New development has the potential to increase both the rate and volumes of runoff and has the potential to alter the pathways that surface water takes in entering the drainage system. Controlling the location of new development and controlling runoff from that development through the use of sustainable drainage techniques is important to ensure that flood risk is not increased.

13.40 The public sewer network in parts of the Borough is under pressure to accommodate foul and surface water flows. These pressures result from the water company's duty to provide connections for new developments into the existing infrastructure. In addition there are historical misconnections of surface water runoff to the foul sewer network, which can lead to the design capacity of the system being exceeded.

13.41 Sustainable Drainage Systems normally seek to mimic natural drainage, however, within the Fens any sustainable drainage system will ultimately feed into a managed drainage system. The interface between SuDS drainage systems and the managed Fens drainage system will require careful design to accommodate any limitations within the managed system (e.g. tidal effects which may limit the times when sluices can be opened or pumps operated).

13.42 Land levels in the Fens are falling due to settlement, soil shrinkage and erosion (by an estimated 1.5cm a year), this means that field levels are usually significantly below river heights. Ongoing settlement and erosion of soils can also reduce the height of flood defences. This can lead to a requirement to re-raise flood defences, re-profile drainage channels and lower pumping parameters (this may mean lowering of intake sumps or even the construction of new pumping stations).

13.43 Land shrinkage could be viewed as having a long term impact on residual flood risk. Lowering of land levels will increase potential flood

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depths and therefore increase the consequences of any breach or overtopping of defences.

13.44 The waterways of the Fens offer a potentially desirable recreational environment. Several of the existing waterways are navigable and there are plans to increase the length of navigation (the Fens Waterway Link). While an increase in the recreational potential of the Fens can be regarded as a positive, when waterways become navigable this places further constraints on the management of water levels within the system. (When waterways are navigable, it would not normally be considered acceptable to leave boats grounded in shallow water, or allow water levels to increase such that boats cannot pass under bridges).

13.45 The Fens retain wetland environments that are important for birds and there are numerous local sites, ranging from SSSIs to Local Nature Reserves which need to be protected.

13.46 Effective water level management is critical to maintain these areas in good condition, and can make a fundamental contribution to the opportunities that exist in the Fens for landscape-scale opportunities for fenland and washland restoration.

Key Messages

13.47 Innovative partnership based solutions which consider the Fens holistically will be needed and this approach may take time to develop.

13.48 The five Lead Local Flood Authorities responsible for the Fens have agreed the following aspirations for the Fen environment:

Aspirations

13.49 To reflect the importance of the Fens as a highly productive and precious resource, the following aspirations have been identified for the wider area in respect of flood risk and drainage management:

- Continue to ensure that appropriate flood risk and drainage management measures are taken to protect the nationally important food production areas in the Fens
- Ensure that where appropriate, current levels of protection are maintained in the Fens taking into account climate change
- Manage flood risk and drainage in accordance with principles of sustainable development
- Ensure that development is undertaken appropriately, so that adverse consequences of flood risk are not increased

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- Contribute towards the protection and enhancement of the environmental heritage and the unique landscape character of the Fens including biodiversity;
- Support promotion and use of the waterways and other areas in the Fens for tourism and recreation
- Develop effective dialogue with local communities to facilitate their involvement in flood risk management in the Fens
- Work with local planning authorities to help them grow the economy in the Fens, through the early consideration of flood and water management needs

13.50 In King's Lynn and West Norfolk, there is a significant reliance on flood defences to protect key population areas and areas of valuable and productive agricultural land. These defences will require continual maintenance and investment to adapt to the effects of climate change.

13.51 The area is reliant upon extensive networks of drainage channels to facilitate the drainage of both urban and agricultural land. These drainage channels and the pumping stations that are needed to raise surface water up to river level will also require continual maintenance and investment. In addition the pumping capacity is likely to need increasing in line with climate change projections.

13.52 There is some risk of foul sewer flooding that results from the misconnection of surface water drainage to the foul sewer network. In order to address this issue opportunities to disconnect surface water from foul sewers need to be explored.

13.53 Climate change, poses a serious threat to the Fens and a continued programme of investment in flood defences and drainage systems will be needed for existing standards of protection, including provision for climate change, to be maintained in the medium and long term.

13.54 The high levels of residual flood risk (and the predicted additional flood risk likely to be brought about by climate change) highlights the importance of locating new development away from the most vulnerable areas and the need to assess the potential of developments to increase flood risk elsewhere.

13.55 Many of the areas at most significant risk of flooding are already largely developed, including large areas of the historic town of King's Lynn. The areas that are most at risk from surface water flooding are often also the areas that are subject to residual risks from inundation from the sea or fluvial flooding that could result from a failure of flood defences. These areas are also subject to residual risks of flooding by surface water due to a potential for pumping stations to fail. In locations where there are cumulative flood risks (and residual flood risks) a greater emphasis on developing resilience to flooding may be advisable.

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13.56 A number of sites containing critical infrastructure are vulnerable to flooding in the district and there are also major transport networks, road and rail that would be affected if fenland areas were to flood. A clear understanding of the risk is required to inform improvements to infrastructure resilience.

13.57 To meet the requirements of the Water Framework Directive, some drainage systems may need to be modified to create more natural river morphology in the area and better ecological potential. This could also provide benefits in terms of flood risk management

13.58 It is clear that some of the issues highlighted above are potentially conflicting. Compromises may be necessary in order to achieve material environmental benefits and reduce flood risk without excessively undermining agricultural productivity, or irreparably damaging the local economy.

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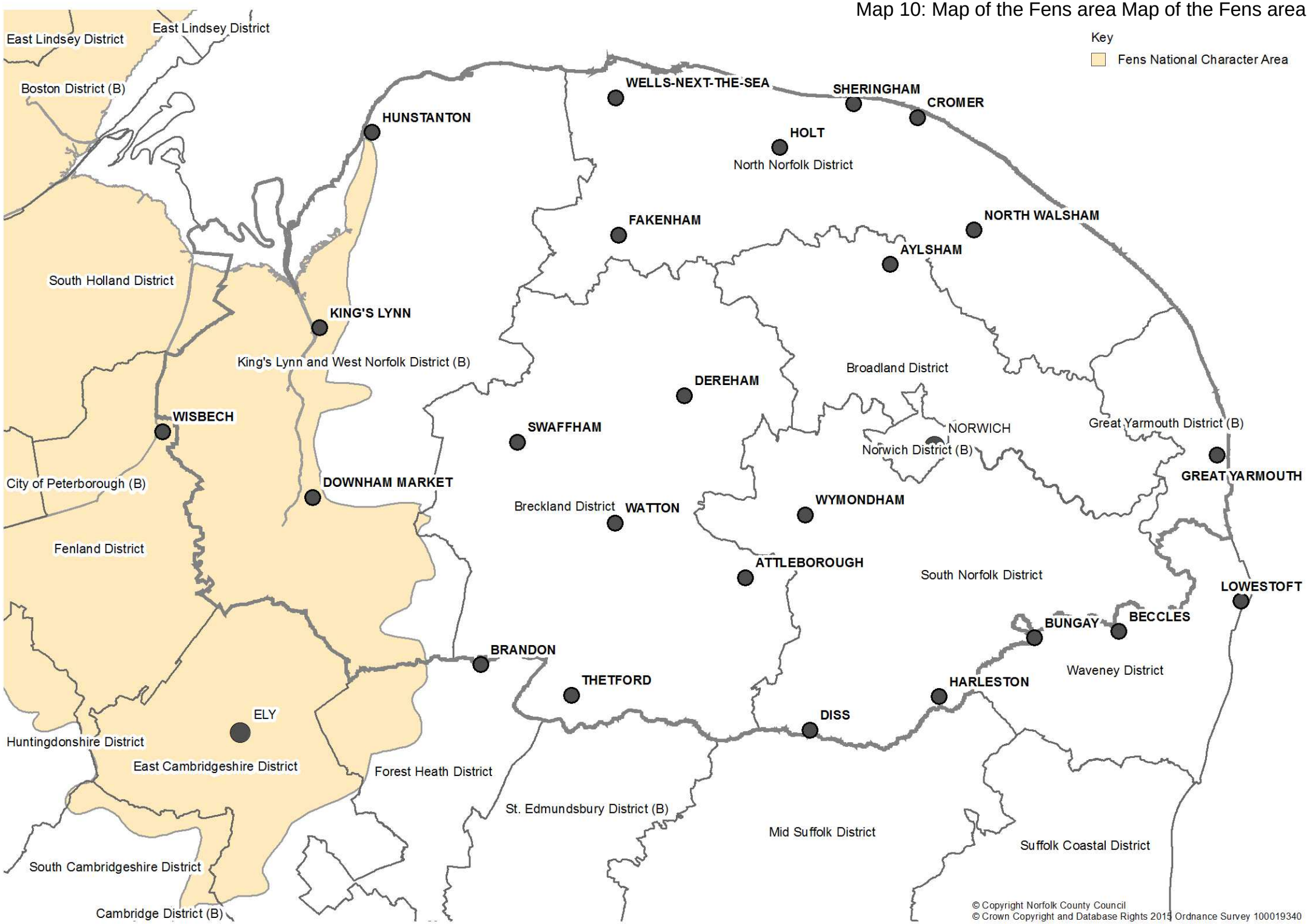
Map 10: Map of the Fens area Map of the Fens area



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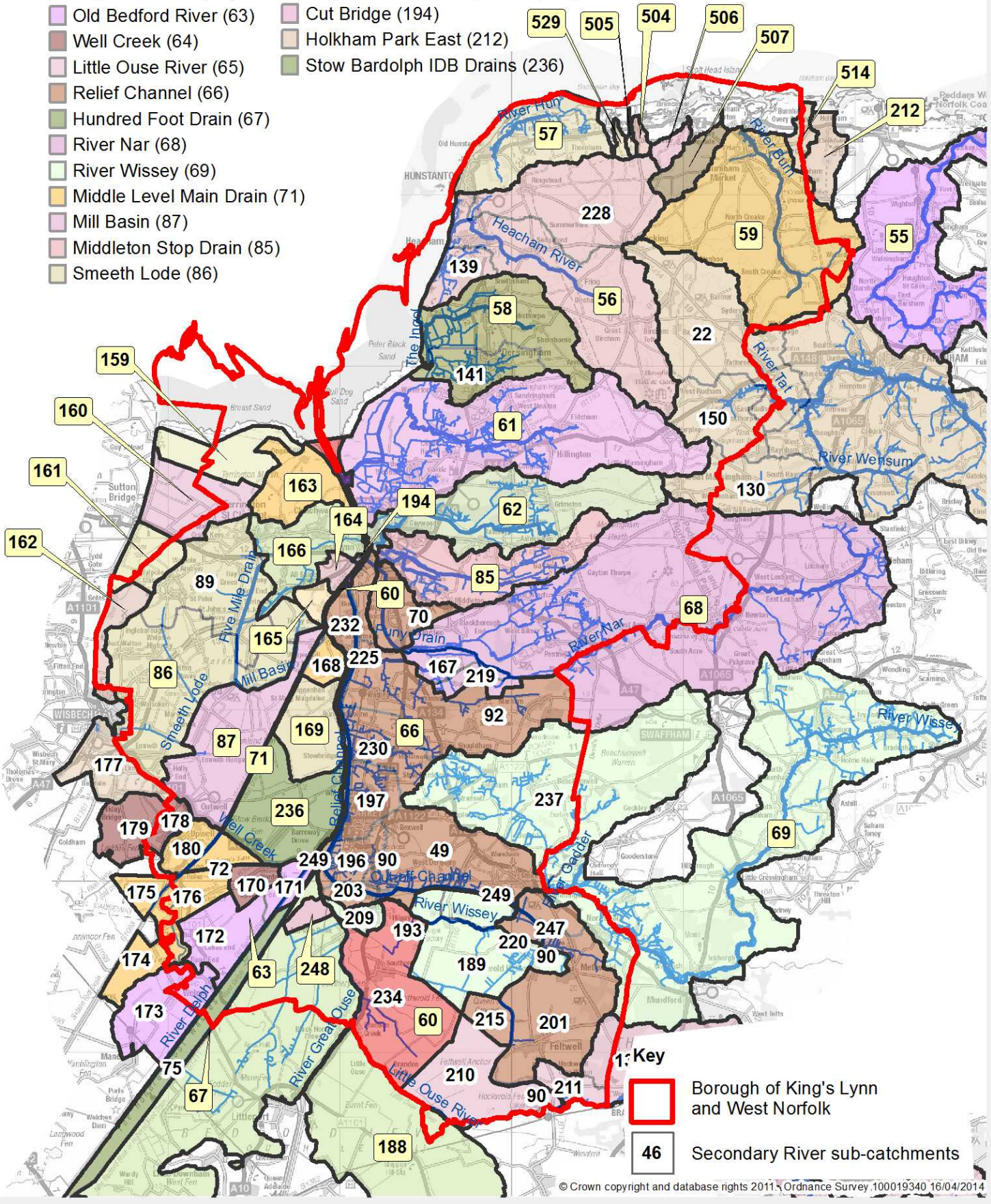
Map 11: Rivers and catchment boundaries within the King's Lynn Borough area

First River sub-catchments:

- River Wensum (13)
- River Stiffkey (55)
- Heacham River (56)
- River Hun (57)
- The Ingol (58)
- River Burn (59)
- River Great Ouse (60)
- Babingley River (61)
- Gaywood River (62)
- Old Bedford River (63)
- Well Creek (64)
- Little Ouse River (65)
- Relief Channel (66)
- Hundred Foot Drain (67)
- River Nar (68)
- River Wissey (69)
- Middle Level Main Drain (71)
- Mill Basin (87)
- Middleton Stop Drain (85)
- Smeeth Lode (86)
- Lighthouse Drain (159)
- Wingland Sluice Drain (160)
- Chalk Lane Sluice Drain (161)
- Ingleborough Drain (162)
- Crooked & Bentineck Drain (163)
- Merries Farm Drain (164)
- North Sea Bank Drain (165)
- West Lynn Drain (166)
- Magdalen Main Pump Drain (169)
- Cut Bridge (194)
- Holkham Park East (212)
- Stow Bardolph IDB Drains (236)
- Ouse Bridge Farm (248)
- Brancaster East (504)
- Brancaster West (505)
- Burnham Deepdale (506)
- Burnham Norton (507)
- Holkham Park West (514)
- Titchwell West (529)
- Hundred of Wisbech



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14. North Norfolk District

Key partners

14.1 The following organisations have a role in the management of flood risk in north Norfolk District:

- Norfolk County Council Lead Local Flood Authority
- Norfolk County Council Highways Authority
- Environment Agency
- Anglian Water
- North Norfolk District Council
- Broads Authority
- Broads (2006) Internal Drainage Board, Water Management Alliance
- Norfolk Rivers Internal Drainage Board, Water Management Alliance

Existing Evidence Base

14.2 The following studies and plans support the understanding of flood risk in North Norfolk:

- North Norfolk Catchment flood Management Plan Dec 2009
- Broadland Rivers Catchment Flood Management Plan Dec 2009
- Lead Local Flood Authority Preliminary Flood Risk Assessment Jul 2011.
- North Norfolk Shoreline Management Plan (Hunstanton to Kelling Hard) Nov 2010.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Main Report Jan 2008
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsidiary Report A, North Norfolk District Council Area, Dec 2007.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsidiary Report B, Broads Authority Area, Dec 2007.
- North Norfolk Surface Water Management Plan (completion date to be confirmed).

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Overview of North Norfolk's River Catchments

14.3 North Norfolk has a dispersed population, spread across the principal towns of Cromer, Fakenham, Holt and North Walsham, the secondary settlements of Hoveton, Sheringham, Stalham, and Wells-Next-The-Sea and numerous smaller villages and hamlets.

14.4 The landscape of North Norfolk has greater relief than other areas of the county; with the Holt-Cromer ridge reaching an elevation of 100m near Sheringham, while land levels in some locations in the south east of the District are at, or below, sea level.

14.5 The District has 82.6 km of coastline which includes large areas of saltmarsh, sand dunes and shingle beaches, with extensive areas of intertidal sand and mudflats.

14.6 There are several short rivers in North Norfolk that drain to the sea through coastal defences along the north coast: The River Glaven, River Stiffkey, Spring Beck, Mundesley Beck and Sheringham Watercourse.

14.7 In addition to the northern rivers, the River Wensum briefly flows into North Norfolk and passes along the southern edge of Fakenham, before turning south and leaving the district.

14.8 The south and east of North Norfolk district includes the River Ant and parts of the Rivers Thurne and Bure. These watercourses drain southwards to join the River Yare near its exit to the sea at Great Yarmouth.

14.9 The Broads system within North Norfolk includes several large water bodies, including Hoveton Great Broad, Hoveton Little Broad, Barton Broad, Hickling Broad, Heigham Sound, Horsey Mere and part of Martham Broad.

14.10 The River Thurne, the lower reaches of the River Ant and the River Bure (where it is joined by these two rivers) are embanked and have water levels which are above the surrounding topography. Pumping stations are required to raise surface water runoff into the embanked watercourses (a pumped catchment).

14.11 Map 12 indicates the rivers and catchment boundaries within North Norfolk (including the area of the pumped catchment).

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Overview of Flood Risk

14.12 Coastal flooding is the most significant hazard in North Norfolk (especially in the south and east of the district where such flooding could extend over a significant area),

14.13 Coastal erosion is also a feature of the North Norfolk coastline which could add to the potential risk of coastal inundation (If coastal defences were to fail, due to erosion, then flood velocities and depths could be extreme in the vicinity of any defence breach).

14.14 A combination of fluvial and tidal flooding, threatens several settlements in the Broads Rivers catchment, where tidal influence dominates.

14.15 Fluvial flooding associated with upstream areas of individual catchments can arise rapidly. North Norfolk's northern rivers are not normally "flashy" but the hazard can be significant during unusual meteorological conditions. River flooding has affected several properties along the river Stiffkey.

14.16 The North Norfolk Strategic Flood Risk Assessment provides further detail on the extent of flood risk associated with main rivers and the sea.

14.17 In addition to the tidal and main river flood risk, which is the responsibility of the Environment Agency, there are also significant surface water flood risks in the borough.

14.18 The Preliminary Flood Risk Assessment (Map 5) indicates the general areas where surface water flood risk is likely to be most significant.

14.19 The assessment estimates that the following number of properties may be at risk of surface water flooding in North Norfolk District:

Table 8: North Norfolk Area Settlement Ranking, 2011

Settlement	Properties at risk
Cromer	360
North Walsham	290
Stalham	120
Ludham	100
Bacton/Walcott	100
Wells-next-the-Sea	90
Mundesley	80
Sheringham	70

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Fakenham	70
Briston	50
Coltishall Airfield*	40
Little Walsingham	40
Hickling/ Hickling Green/ Hickling Heath	40
Weybourne	40
Wroxham/ Hoveton*	40
Roughton	30
Potter Heigham	30
Holt	30
Blakeney	20
Happisburgh	20
Sculthorpe Airfield	20
Southrepps	20
Trunch	10
High Kelling	10
Eccles on Sea	<10
Beeston Regis	<10
Melton Constable	<10
Sea Palling	<10
Catfield	<10
Horning	<10
Overstrand	<10
Cley next the Sea	<10
Hindolveston	<10
Great Ryburgh	<10
Langham	None Identified
Little Snoring	None Identified

14.20 The Preliminary Flood Risk Assessment provides a strategic estimation of the impacts of surface water flooding. The fact that a settlement is not listed does not mean that there is no risk of flooding. However, the preliminary assessment does help to identify the settlements at greatest risk of surface water flooding and therefore establish a level of

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priority for preliminary investigations by the Lead Local Flood Authority and other Risk Management Authorities.

14.21 A Surface Water Management Plan for North Norfolk has been commenced and investigations into surface water flood risk are underway at the time of writing this strategy. When completed the Surface Water Management Plan will provide greater insight into surface water flood risks in the district

14.22 Significant recent surface water flood events included groundwater and surface flooding in both Cromer and Sherringham in August 2006 and surface water flooding with a significant flood impact in North Walsham in 2008.

14.23 There is little available information on recorded incidences of groundwater flooding affecting residential properties in North Norfolk, presumably as a result of a low water table being maintained through pumping undertaken by the Internal Drainage Boards.

Flood Risk Issues in North Norfolk

14.24 Coastal erosion is a significant feature of the North Norfolk coast and, in addition to directly threatening some settlements, erosion has the potential to damage coastal defences and increase the risk of inundation from the sea. The effects of erosion are likely to increase the cost of maintaining coastal defences.

14.25 Groundwater has a role in coastal erosion, as water within the rock strata can create instabilities within coastal cliffs which are then undermined by wave action.

14.26 Tidal locking sometimes occurs on the lower reaches of the rivers Glaven and Stiffkey, where the rivers are prevented from draining to the sea by high tides.

14.27 Controlling flow levels in the short rivers that exit along the north coast of the district is challenging. The steep fall from the rivers headwaters and the relatively short length of the rivers makes it difficult to mitigate against severe meteorological events, which may cause flash flooding, or lead to rivers drying up.

14.28 As a consequence of climate change, peak rainfall intensity and peak river flow are both expected to increase by 20%. There is also an increased likelihood of extreme weather, and the volume of water from peak rainfall events may become more difficult to manage.

14.29 During such events, pumping stations in pumped catchments may need to be operated for a longer time and if sluices become tide-locked localised surface water flooding behind flood defences could occur.

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14.30 An increase in severe events may also make it more difficult to manage flood risk from the rivers with steep headwaters along the North Norfolk coast.

14.31 The public sewer network in some parts of the District is under pressure to accommodate foul and surface water flows. These pressures result from the water company's duty to provide connections for new developments into the existing infrastructure. In addition there are historical misconnections of surface water runoff to the foul sewer network, which can lead to the design capacity of the system being exceeded.

14.32 Within the pumped catchment there are residual flood risks, associated with the potential for a breach of flood defences or pump failures.

14.33 There remains a residual risk that groundwater flooding could occur if for any reason the pumping stations ceased to operate or if the pumping capacity cannot be increased to address the impacts of climate change.

Key Messages

14.34 Severe Coastal flooding has the potential to cause significant environmental and socio-economic impacts in North Norfolk. If coastal flooding is to be avoided, flood defences will require continued maintenance and investment to adapt to the effects of climate change.

14.35 The effects of coastal erosion threaten the effectiveness of coastal flood defences and will add to the maintenance costs.

14.36 In the Broads river system, drainage channels and the pumping stations which discharge water to the rivers will also require continued maintenance and investment. The pumping capacity may (in the future) need to be increased to adapt to the effects of climate change.

14.37 Surface water flooding is evident in several of North Norfolk's urban areas. The use of Sustainable Drainage Systems (SuDS) in new developments may prevent the situation worsening, but there may also be a need to retrofit SuDS within existing settlements if the situation is to be improved.

14.38 There is some risk of foul sewer flooding that results from the misconnection of surface water drainage to the foul sewer network. In order to address this issue opportunities to disconnect surface water from foul sewers need to be explored.

14.39 Where surface water flooding affects only a limited number of properties, it is unlikely that measures to improve flood defences will

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attract priority funding. In such circumstances it may be necessary to place greater reliance on making such properties more resilient to flooding.

14.40 Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.

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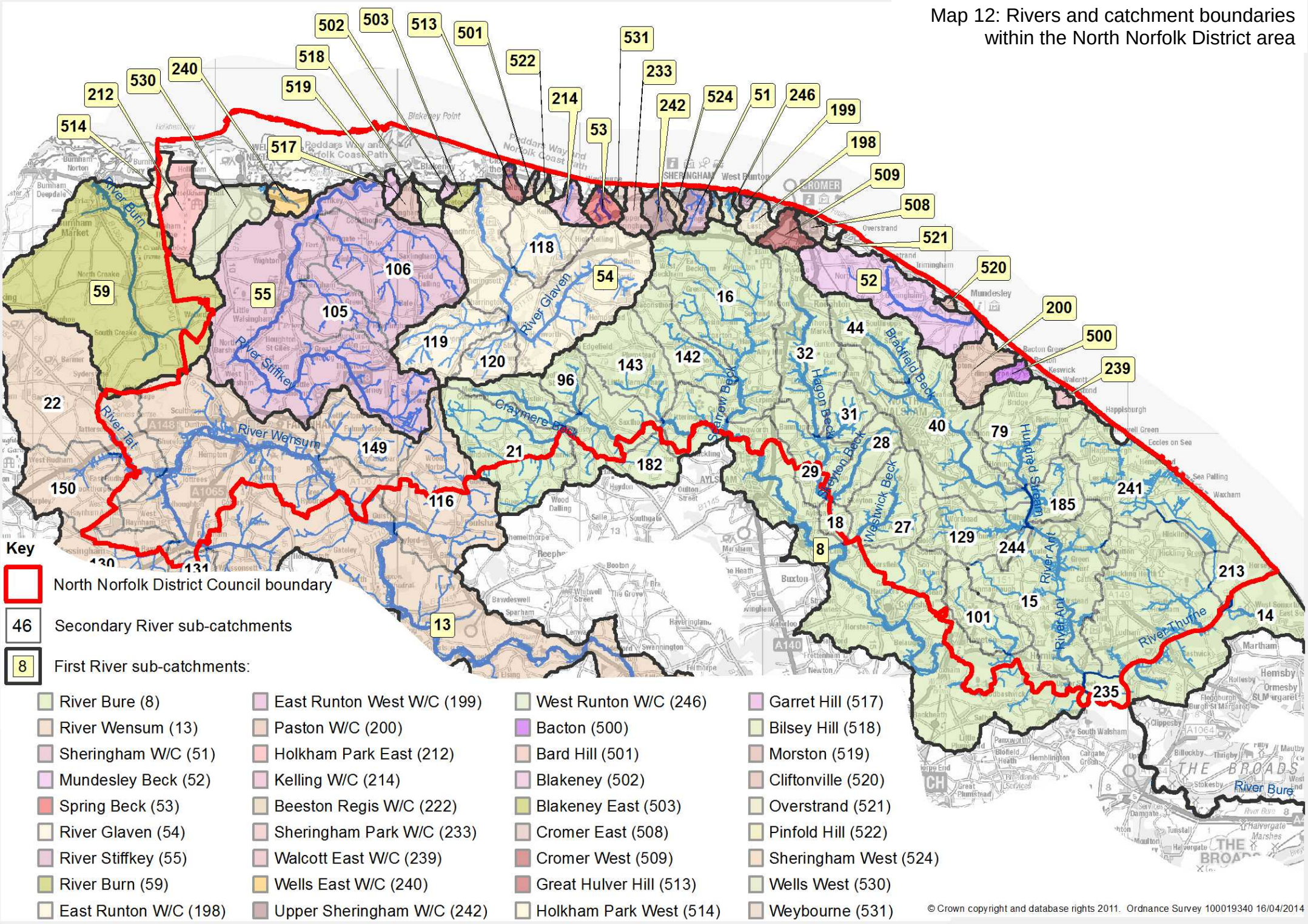
Map 12: Rivers and catchment boundaries within the North Norfolk District area



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15. Norwich City

Key Partners

15.1 The following organisations have a role in the management of flood risk in the city.

- Norfolk County Council Lead Local Flood Authority
- Norfolk County Council Highways Authority (elements of these functions are delivered by Norwich City Council)
- Anglian Water
- Environment Agency
- Norwich City Council
- Broadland District Council
- South Norfolk District Council
- Broads Authority
- Norfolk Rivers Internal Drainage Board, Water Management Alliance
- Broads (2006) Internal Drainage Board, Water Management Alliance

Existing Evidence Base

15.2 The following studies and plans support the understanding of flood risk in Norwich City:

- Norwich Comprehensive Flood Study 2002
- Norwich Flood Protection Strategy Study 2002
- Update of Norwich Hydraulic Model, April 2007
- Broadland Rivers Catchment Flood Management Plan, Dec 2009.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Main Report Jan 2008
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsiduary Report E Norwich City Council Area, Dec 2007.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsiduary Report B, Broads Authority Area, Dec 2007

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- Norwich City Council Level 2 Strategic Flood Risk Assessment, Feb 2010
- Greater Norwich Development Partnership, Water Cycle Study, Jan 2010.
- Lead Local Flood Authority Preliminary Flood Risk Assessment, Jul 2011.
- Norwich Surface Water Management Plan, 2012

Overview of Norwich's River Catchments

15.3 Norwich City is a built up urban area of 4,055 hectares, with a relatively high population density.

15.4 The topography of the city is fairly varied; there are two predominant valleys within the area following the path of two main rivers, the River Wensum and the River Yare. In addition two smaller catchments drain parts of the city and reflect the historic route of old medieval watercourses which have been subsumed within the city's urban structure. One of these is the River Dalimond catchment to the north of the River Wensum. Another, the River Great Cockey, is believed to have flowed from the south to the Wensum. The much altered catchments of these rivers influence surface water flows within the city.

15.5 At the north-west boundary of the city, The River Tud joins the River Wensum and thereafter the Wensum flows south-eastward through the centre of Norwich, until it joins the River Yare at the southern edge of the city. (The River Yare forms the southern boundary of Norwich, with the northern half of its floodplain lying within the City).

15.6 The river Wensum is, in places, confined as it passes through the city centre and in many locations the edges of the river are heavily developed with both residential and commercial properties.

15.7 There are short but important lengths of raised flood defences in the city, located on the River Wensum adjacent to 'Bishopgate' and 'The Close'. These defences protect 408 residential and commercial properties.

15.8 The following man made features (de facto defences) have also been identified as influencing flood risk in Norwich:

- Railway line east of Whitlingham Junction
- Railway line north of Whitlingham Broad
- Railway line east of Kerrison Road Works

15.9 At New Mills Yard, just inside the Norwich Inner Ring Road, the river flows through the New Mills watermill. At the mill, the river level drops

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in height and sluices control the water levels. This feature is the head of navigation on the Wensum.

15.10 Similar sluice controls exist on the boundaries of the city, at Hellesdon Mill on the Wensum and along the Yare at Cringleford Mill, Keswick Mill, Lakenham Mill and Trowse Mill. The Environment Agency is responsible for the management of all of the above sluices.

15.11 There are also a number of bridges over the Wensum as it passes through the city. Some of these, such as Bishops Bridge, have the potential to become blocked and/or to constrict the passage of the river during a flood event.

15.12 Map 13 indicates the rivers and catchment boundaries within Norwich.

Overview of Flood Risk

15.13 Flooding from main rivers (fluvial flooding) is not defined as 'surface water flooding', however a broad understanding of fluvial flood risk is essential, as flooding in the district may arise from a combination of sources that will have a cumulative impact.

15.14 Although tidal influence extends as far as New Mills on the River Wensum, the tidal effects are relatively small in Norwich and the greatest contributor to the risk of fluvial flooding in the City is the volume of water entering the catchment as a result of precipitation.

15.15 The rivers Wensum and Yare have a large catchment and much of this lies upstream of Norwich City, outside of the administrative area of the city authorities.

15.16 The opportunities to manage the upstream catchments of the rivers that flow into Norwich lie within North Norfolk, Breckland, Broadland and South Norfolk Districts.

15.17 Map 4 indicates the area that the Environment Agency predicts to be at risk of flooding from main rivers (the maps assume that there are no flood defences).

15.18 There are very few areas of Norwich within Flood Zone 3. However, an extreme 1000-year event could result in significant flooding along the Wensum, encroaching into the urban area on the right bank upstream of St Miles Bridge (Colsany Street). Between St Crispins Road and Waterside there would be extensive flooding on the left bank of the River Wensum. Downstream of Foundry Bridge (Prince of Wales Road), there would also be a significant increase in flooding across the urban area as far as the railway line.

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15.19 There have been a number of significant historic floods in Norwich of which the 1912 event was the greatest (with a predicted 800-year return period). 15 reported flooding events occurred between 2001 and 2009. The most significant event of those recorded was on 12th August 2008 with 41 recorded incidents spread widely across the area.

15.20 Further information on main river flood risks can be found in the Norwich Strategic Flood Risk Assessments.

15.21 The Preliminary Flood Risk Assessment (Map 5) indicates the general areas where surface water flood risk is likely to be most significant.

15.22 The assessment estimates that 6,500 properties may be at risk of surface water flooding in Norwich city.

15.23 The many buildings and hard surfaces of the built environment limit the scope for infiltration of groundwater and there is a relatively high risk of surface water flooding across the city.

15.24 Within the city, drainage is mainly confined within sewers, some of which are combined foul and surface water sewers. The Greater Norwich Water Cycle Study (Scott Wilson, 2007) highlighted a number of issues with the capacity of the sewer network in Norwich, indicating a significant risk from sewer flooding.

15.25 Anglian Water is currently working towards a long term development strategy in order to provide sufficient capacity to account for new proposed developments across Norwich.

15.26 The Lead Local Flood Authority has investigated local surface water flood risks in Norwich and has produced a Surface Water Management Plan for the city (N.B. the study area also included adjacent urban areas beyond the city boundary).

15.27 The Norwich Surface Water Management Plan identified three areas of significant risk and these have been designated as Critical Drainage Catchments. Two of these Critical Drainage Catchments lie predominantly within the city boundary, at 'Catton Grove and Sewell' and at 'Nelson and Town Close' (see map 14).

Flood Risk Issues in Norwich City

15.28 Fluvial flood management in Norwich is partially dependant on management of the upstream water flow, beyond the city boundaries. The flood plains to the west of the city provide additional water storage capacity and reduce the river flow volumes passing through the city during significant events. There are also a number of sluices that must be managed to ensure that water flows are controlled.

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15.29 Surface water flooding poses a significant risk in the city due to the extent of hard surfacing in the urban environment, which limits natural infiltration drainage and increases the rate of surface runoff.

15.30 Geology beneath the city comprises chalk overlaid with boulder clay. In some areas the underlying chalk strata contains significant cavities. In the recent past, water infiltration has caused the collapse of such features leading to subsidence. The nature of this underlying geology affects the surface water drainage mechanisms and in some areas the geology will place limitations on possible mitigation actions.

15.31 The cities high density urban environment also has the potential for elevated risks of groundwater pollution, due to the presence of polluted sites linked to Norwich's industrial heritage and the potential for new pollution incidents. The need to protect groundwater from pollution may affect surface water drainage mechanisms and place some limitations on possible mitigation actions.

15.32 The public sewer network is under pressure to accommodate foul and surface water flows. This in part relates to historic developments that have added flows to the existing sewer infrastructure and comnnected surface water runoff to the foul sewer network. This has led to of the design capacity of the system being exceeded.

15.33 There is very little data available concerning the risk of groundwater flooding in the city. Anecdotal evidence suggests that Norwich is unlikely to be at significant risk, but, with the presence of a major aquifer under much of the city, a greater understanding of the risk would be desirable.

15.34 As a consequence of climate change, peak rainfall intensity and peak river flow are both expected to increase by 20%. There is also an increased likelihood of extreme weather events. The capacity of the city's drainage network may not be adequate to deal with water from extreme rainfall events.

Key Messages

15.35 Maintenance of existing flood defences and sluices is essential in order to maintain the standard of flood protection within the city.

15.36 Functional flood plains act as vital safety valves, storing water that might otherwise flood other areas and it is therefore important that their capacity is not reduced by inappropriate development.

15.37 The use of rural SuDS in the river catchments, upstream of the city, could help to slow the flow of water into the rivers and thereby minimise the impact of extreme weather events.

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15.38 There are many impermeable surfaces in the city and there is a reliance on piped drainage systems, including combined sewer systems, all of which lead to an increased risk of surface water flooding in extreme rainfall events. There is a need to increase the use of sustainable drainage systems. Where ground conditions allow, an increased use of permeable surfaces and infiltration systems could help to alleviate capacity issues in existing sewer drainage systems.

15.39 There is some risk of foul sewer flooding that results from the misconnection of surface water drainage to the foul sewer network. In order to address this issue opportunities to disconnect surface water from foul sewers need to be explored.

15.40 The geology of the city and the risk of pollution mean that infiltration drainage is not possible across the whole area and in some locations SuDs systems will need to utilise surface water features incorporating multiple water treatment stages and avoid the use of infiltration methods.

15.41 Surface water flood risks are very widely dispersed across the city, due to the extensive use of impermeable surfaces throughout the built environment, however the highest level of risk is concentrated in three main areas: 'Catton Grove and Sewell' (part in Broadland District), 'Drayton'(in Broadland District) and 'Nelson and Town Close'. These three areas have been designated within the Surface Water Management Plan as Critical Drainage Catchments (CDCs) and more detailed studies of the drainage system in these locations are being undertaken.

15.42 The extent of risk from groundwater flooding in Norwich is not fully understood and further investigation is required.

15.43 The expected 20% increase in rainfall intensity and the increase in severe weather events (which is likely to arise due to climate change), combined with the limited capacity of the piped drainage systems in Norwich is likely to lead to an increase in surface water flooding and sewer flooding unless mitigation measures are undertaken to accommodate the predicted increase in rainfall.

15.44 Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.

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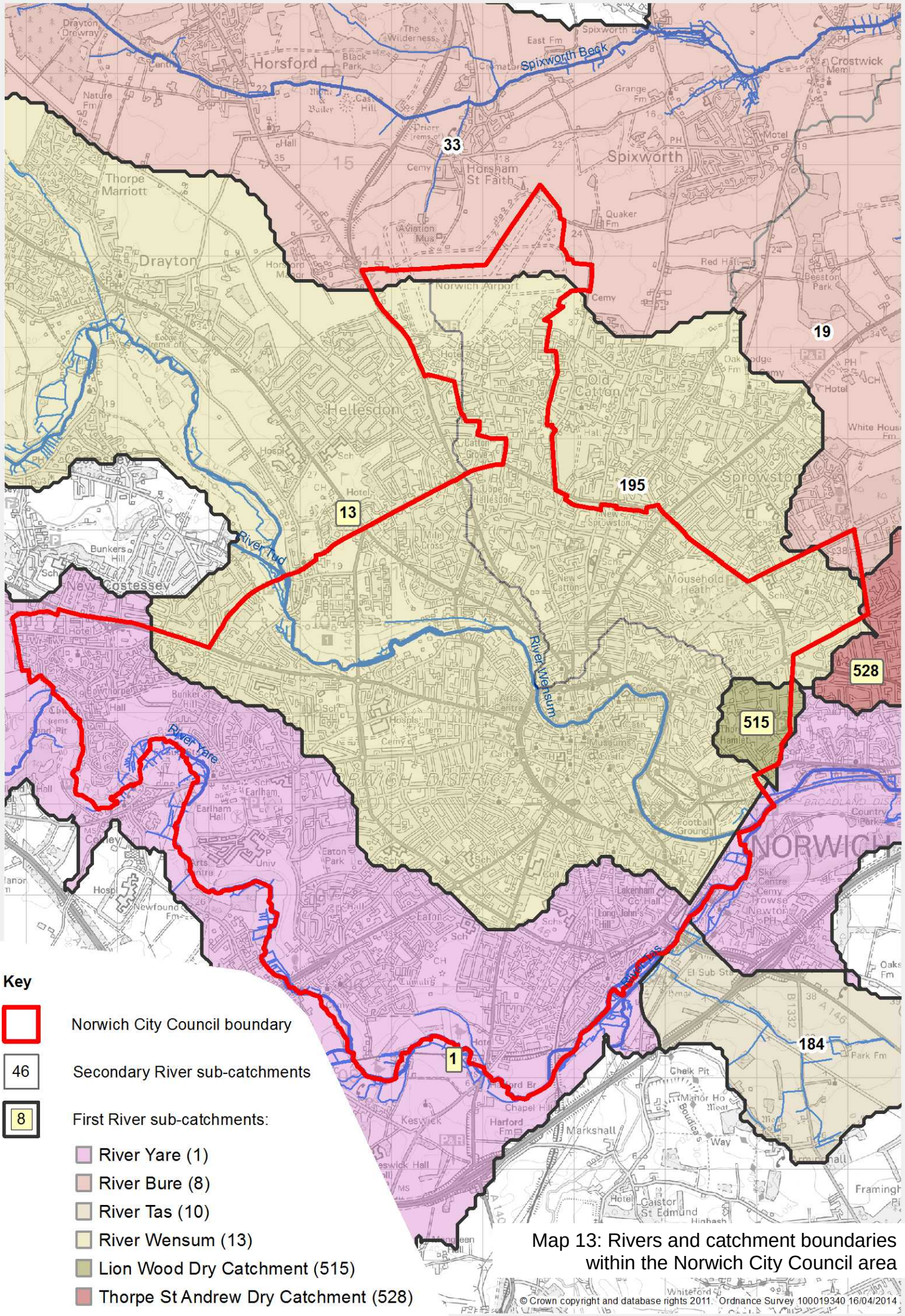

Map 13: Rivers and catchment boundaries within the Norwich City Council area

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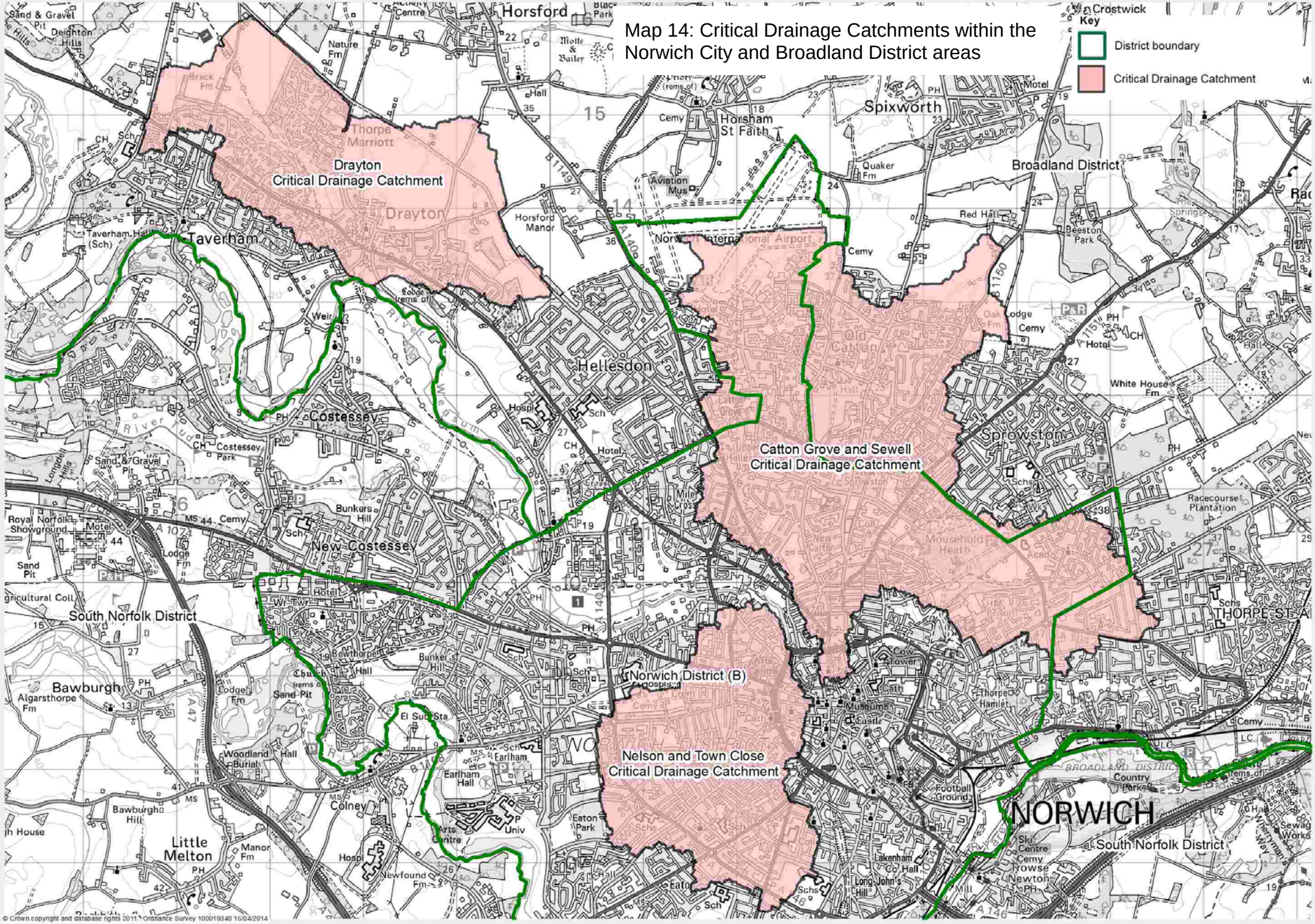
Map 14: Critical Drainage Catchments within the Norwich City and Broadland District areas
Key
District boundary
Critical Drainage Catchment
Drayton Critical Drainage Catchment
Catton Grove and Sewell Critical Drainage Catchment
Nelson and Town Close Critical Drainage Catchment
Broadland District
South Norfolk District
Norwich District (B)
NORWICH
Horsford
Spixworth
Taverham
Drayton
Hellesdon
Costessey
New Costessey
Sprowston
Bawburgh
Little Melton
Horsham St Faith
Thorpe Marriott
Crostwick
THORPE ST A
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16. South Norfolk District

Key partners

16.1 The following organisations have a role in the management of flood risk in South Norfolk District:

- Norfolk County Council Lead Local Flood Authority
- Norfolk County Council Highways Authority
- Highways Agency
- Anglian Water
- Environment Agency
- South Norfolk District Council
- Broads Authority
- Norfolk Rivers Internal Drainage Board, Water Management Alliance
- Broads (2006) Internal Drainage Board, Water Management Alliance
- Waveney Lower Yare and Lothingland Internal Drainage Board

Existing Evidence Base

16.2 The following studies and plans support the understanding of flood risk in South Norfolk District:

- Broadland Rivers Catchment Flood Management Plan, Dec 2009.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Main Report Jan 2008
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsidiary Report B, Broads Authority Area, Dec 2007.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsidiary Report D, South Norfolk Council Area, Dec 2007.
- Greater Norwich Development Partnership Water Cycle Study Jan 2010
- Poringland Integrated Urban Drainage Pilot Study Final Report 2008
- Poringland Integrated Urban Drainage Pilot Strategy Groundwater Drainage Report Jan 2008

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- Lead Local Flood Authority Preliminary Flood Risk Assessment, Jul 2011.
- Norwich Surface Water Management Plan, 2012
- South Norfolk Surface Water Management Plan (completion date to be confirmed).

Overview of South Norfolk's River Catchments

16.3 The northern, eastern and southern edges of South Norfolk District are bounded by main rivers.

16.4 The River Yare runs along the northern edge of the district and the Waveney delineates the southern boundary. The northern tip of the boundary adjoins the Wensum.

16.5 Within South Norfolk the Rivers Tiffey and Tas run north from the middle of the district and join the Yare, east of Barford and at Trowse respectively.

16.6 The River Chet rises in Poringland and runs eastward to join the Yare.

16.7 The River Tud flows east to west through the northern tip of the district, before joining the River Wensum.

16.8 A number of tributaries of the River Waveney (including Broome Beck, Frenze River and several smaller tributaries) run south into the Waveney, which, in turn, joins with the Yare at Breydon Water.

16.9 With the exception of a few small drainage ditches on the south Western boundary of the district (which drain into the River Thet), all surface water in the district eventually converges into the River Yare, which exits to the sea at Great Yarmouth.

16.10 Along the River Yare, in South Norfolk, there are a number of large water bodies including flooded sand pits at Colney, the University of East Anglia Broad, Whitlingham Broad, Surlingham Broad, and Rockland Broads .

16.11 Along the eastern side of the district there are marshland areas adjoining the River Yare around Surlingham and Rockland Broads. Downstream of these broads the river is embanked and the adjacent land has been drained for agricultural use. River water levels there are above the surrounding topography and pumping stations are required to raise surface water runoff into the embanked watercourses (a pumped catchment).

16.12 Map 15 indicates the rivers and catchment boundaries within South Norfolk.

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Overview of flood risk

16.13 Flooding from main rivers (fluvial flooding) and tidal inundation are not defined as 'surface water flooding', however a broad understanding of fluvial and tidal flood risk is essential, as flooding in the district may arise from a combination of sources that will have a cumulative impact.

16.14 The low lying areas of the District adjacent to the Yare, Waveney and Chet are at risk of both fluvial and tidal flooding. There is a long history of tidal surge flooding in the system, where the incoming tide holds back the rivers flow and prevents the river system draining to the sea. In many of these events there has also been an element of combined flooding affecting the upper catchment reaches. Further information on river and tidal flood risk is available in the Partnership of Norfolk District Councils Strategic Flood Risk Assessment.

16.15 The Preliminary Flood Risk Assessment (Map 5) indicates the general areas where surface water flood risk is likely to be most significant.

16.16 The assessment estimates that the following number of properties may be at risk of surface water flooding in South Norfolk District.

Table 9: South Norfolk Area Settlement Ranking, 2011

Settlement	Properties at risk
Wymondham	230
Harleston	200
Long Stratton	100
Diss	90
Kirby Row	70
Hempnall	60
Loddon	60
Newton Flotman	50
Rockland St Mary	30
Dickleburgh	20
Poringland	20
Hethersett	20
Scole	20
Mulbarton	10
Surlingham	10
Thurlton	10
Cringleford	10
Pulham St Mary	10
Little Melton	<10

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Barford	<10
Wicklewood	<10
Ditchingham	<10
Easton	<10
Tacolneston	<10
Earsham	<10
Ashwellthorpe	<10
Pulham Market	<10
Haddiscoe	<10
Wymondham College	<10
Brooke	<10
Stoke Holy Cross	<10
Tasburgh	<10
Bunwell	<10
Costessey	None Identified (See comment at 16.18 and 16.19 below)
Hingham	None Identified (See comment at 16.18 and 16.19)

16.17 The Preliminary Flood Risk Assessment provides a strategic estimation of the impacts of surface water flooding. The fact that a settlement is not listed, or that no properties were identified, does not mean that there is no risk of flooding. However, the preliminary assessment does help to identify the settlements at greatest risk of surface water flooding and therefore establish a level of priority for preliminary investigations by the Lead Local Flood Authority and other Risk Management Authorities.

16.18 At present, detailed investigations by the Lead Local Flood Authority have been focussed only on the more densely populated areas. In South Norfolk only the urban fringe of Norwich has been subject to a close examination of surface water flood risks, during the development of the Norwich Surface Water Management Plan. Evidence gathered during the preparation of the SWMP indicates that some properties in Hingham, New Costessey and Old Costessey have suffered from occasional surface water and sewer flooding.

16.19 A Surface Water Management Plan for the whole of South Norfolk has been commenced and investigations into surface water flood risk are underway at the time of writing this strategy. When completed the Surface Water Management Plan will provide greater insight into surface water flood risks in the district

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16.20 A study carried out in 2008, investigated ground water flooding issues in the area of Poringland and Framingham Earl. This study concluded that groundwater flooding problems in Poringland and Framingham Earl are most likely to be the result of water percolation through the overlying Glacial Sands and Gravels followed by surface run-off across the interface with the underlying Chalky Boulder Clay.

Flood risk Issues in South Norfolk

16.21 As a consequence of climate change, peak rainfall intensity and peak river flow are both expected to increase by 20%. There is also an increased likelihood of extreme weather, and the volume of water from peak rainfall events may become more difficult to manage. During such events, pumping stations in pumped catchments may need to be operated for a longer time and if sluices become tide-locked localised surface water flooding behind flood defences could occur.

16.22 Any failure of the pumping stations within pumped catchments could increase the risk of surface water flooding during a significant rainfall event.

16.23 Certain South Norfolk settlements adjacent to the Waveney and Yare/Chet river systems benefit from floodbank defences maintained by the Environment Agency, together with the IDB infrastructure. The floodbank defences are currently the subject of the 20-year programme of maintenance and upgrading associated with the Broadland Flood Alleviation Project. The standard of defence is generally low, approximately equivalent to the 1 in 7 year return period flood event, with a higher standard local to the settlements. In the South Norfolk area, settlements benefiting from the Broads defence system include Loddon, Haddiscoe and Geldeston.

16.24 Fluvial flood management for Norwich is, in part, dependant on management of the upstream water flow, including the Rivers Yare, Tudd, Tiffy and Tas in South Norfolk. (The flood plains of these rivers provide additional water storage capacity and reduce the river flow volumes passing through the city during significant events).

16.25 On the boundary of South Norfolk and Norwich City there are also a number of disused mills with sluices that control river levels and flows on the Yare. These sluice controls are at Cringleford Mill, Keswick Mill, Lakenham Mill and Trowse Mill. The Environment Agency is responsible for the management of all of the above sluices.

16.26 Similarly, functional floodplains on the Chet, Waveney and Yare reduce downstream flows to Great Yarmouth and other smaller settlements along the Rivers during significant events.

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16.27 Functional floodplains in the lower reaches of the Waveney Chet and Yare also serve to reduce the impact of tidal flooding in the upstream reaches of the rivers.

16.28 Many of these flood plains are under pressure to accommodate development that may decrease their capacity. Climate change impacts may actually require an increase in flood plain capacity if current levels of flood relief are to be maintained.

16.29 There are several areas in South Norfolk that have been affected by the impacts of historic urban development, with several natural watercourses diverted or culverted, leading to greater risk of flooding.

16.30 There are several recorded incidences of groundwater flooding in South Norfolk, affecting residential properties in the area of Poringland and Framingham Earl. Other areas of south Norfolk may be similarly at risk.

16.31 South Norfolk has many sub catchments and short tributaries feeding into the main rivers. These river tributaries have the potential to be vulnerable to flash flooding during severe rainfall events.

16.32 In the Norwich Urban fringe, particularly at Costessey, there is a history of sewer flooding and other surface water drainage issues. The public sewer network is under pressure to accommodate foul and surface water flows. These pressures result from the water company's duty to provide connections for new developments into the existing infrastructure. In addition there are historical misconnections of surface water runoff to the foul sewer network, which can lead to the design capacity of the system being exceeded.

Key Messages

16.33 There is a need to introduce more sustainable drainage systems in to the area, however, while the use of SuDs drainage solutions is generally beneficial from the perspective of ground water recharge, it is likely that, within some areas of South Norfolk (e.g. Poringland area), the use of infiltration methods could create new or aggravate existing local groundwater flooding problems by increasing the rate at which rainwater enters the ground.

16.34 The expected 20% increase in rainfall intensity and the increase in severe weather events (which is likely to arise due to climate change), combined with the limited capacity of the piped drainage systems in Costessey is likely to lead to an increase in surface water flooding and sewer flooding unless mitigation measures are undertaken to accommodate the anticitpated increase in rainfall.

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16.35 There is also some risk of foul sewer flooding that results from the misconnection of surface water drainage to the foul sewer network. In order to address this issue opportunities to disconnect surface water from foul sewers need to be explored.

16.36 Some areas within the District are reliant upon extensive networks of drainage channels and combined sewers to facilitate the drainage of both urban and agricultural land. These drainage channels and sewers, along with the pumping stations and the outfalls, which discharge water to the rivers will also require continued maintenance and investment and the pumping capacity may (in the future) need to be increased to adapt to the effects of climate change.

16.37 Locating new development away from the most vulnerable flood risk areas would minimise the cost of installing and maintaining new flood defences and land drainage measures.

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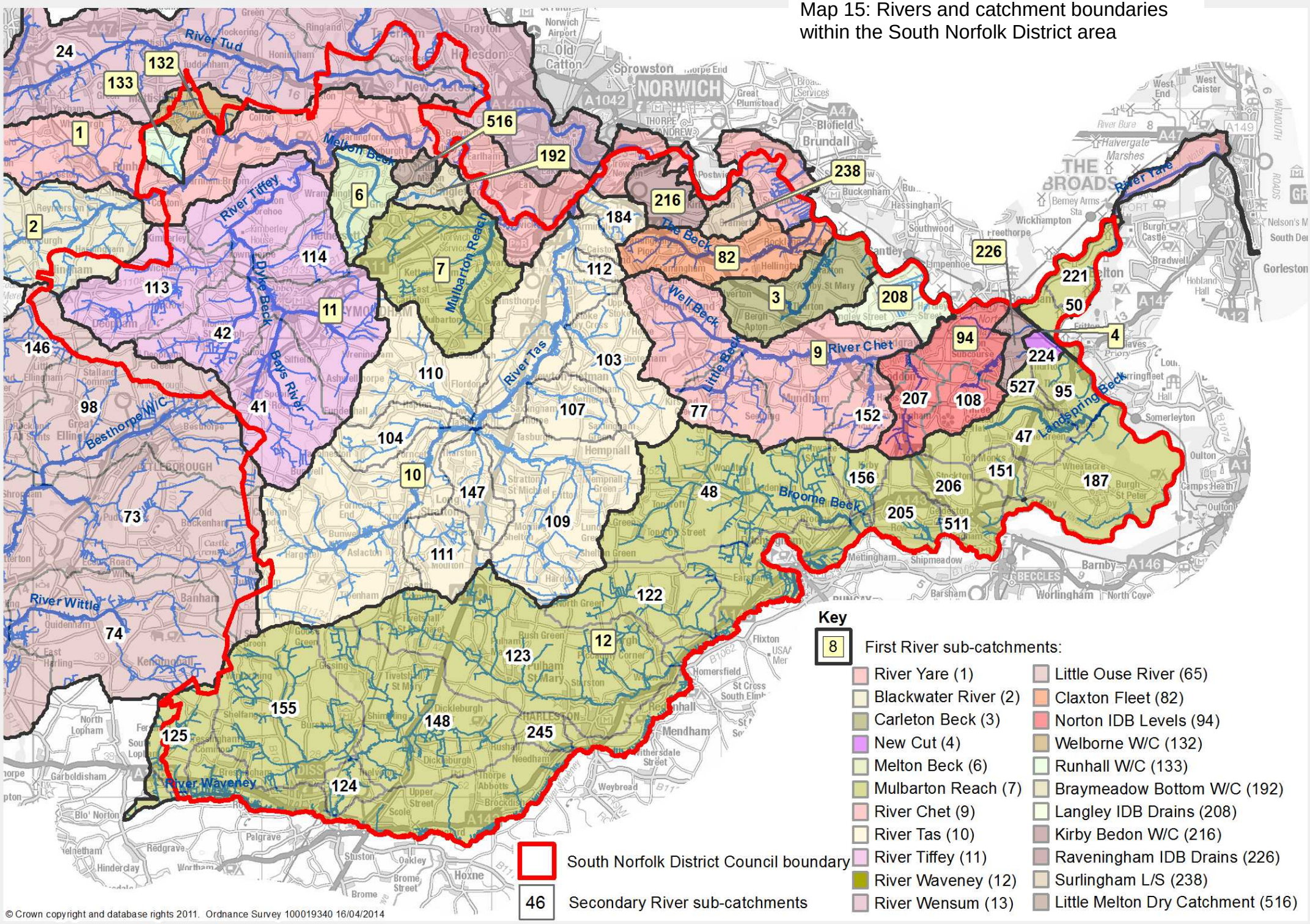
Map 15: Rivers and catchment boundaries within the South Norfolk District area



17. Broads Authority Area

Background

17.1 The Broads Authority area is unique, in that its boundary is very closely related to the network of main rivers and their functional flood plains.

17.2 95% of the Broads Authority area lies in the functional flood-plain and as such is at risk of fluvial and tidal flooding from main rivers.

17.3 The Broads Authority is not itself a Risk Management Authority, but it is a planning authority and a navigation authority and will be a key partner in the implementation of any strategies or projects to improve drainage or address flood risk.

17.4 The Broads Authority area overlaps the jurisdiction of the following Risk Management Authorities North Norfolk District Council, Broadland District Council, Norwich City Council, South Norfolk District Council and Great Yarmouth Borough Council. The Broads Authority's boundary also reaches into parts of Suffolk, beyond the extent of this strategy.

Key partners

17.5 The following organisations have a role in the management of flood risk in the Broads Authority Area:

- Norfolk County Council Lead Local Flood Authority
- Norfolk County Council Highways Authority
- Highways Agency
- Anglian Water
- Environment Agency
- North Norfolk District Council
- South Norfolk District Council
- Broadland District Council
- Norwich City Council
- Great Yarmouth Borough Council
- Broads Authority
- Norfolk Rivers Internal Drainage Board, Water Management Alliance
- Broads (2006) Internal Drainage Board, Water Management Alliance

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- Waveney Lower Yare and Lothingland Internal Drainage Board

Existing Evidence Base

17.6 The following studies and plans support the understanding of flood risk in The Broads Authority Area:

- Broadland Rivers Catchment Flood Management Plan, Dec 2009.
- Great Yarmouth and Gorleston Strategic Flood Risk Assessment Sept 2009.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Main Report Jan 2008
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsidiary Report B, Broads Authority Area, Dec 2007.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsiduary Report C, Broadland, Dec 2007
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsidiary Report D, South Norfolk Council Area, Dec 2007.
- Partnership of Norfolk District Councils Strategic Flood Risk Assessment – Subsiduary Report E Norwich City Council Area, Dec 2007.
- Norwich Surface Water Management Plan, 2012
- Norwich Comprehensive Flood Study 2002
- Norwich Flood Protection Strategy Study 2002
- Update of Norwich Hydraulic Model, April 2007
- Lead Local Flood Authority Preliminary Flood Risk Assessment, Jul 2011.
- Great Yarmouth Surface Water Management Plan, 2012.
- Great Yarmouth and Waveney Water Cycle Scoping Study, Mar 2009.
- Greater Norwich Development Partnership Water Cycle Study Jan 2010
- Broadland Catchment Partnership Plan, June 2014

Overview of The Broads Authority Catchments

17.7 The Broads Authority area in Norfolk takes in the rivers Bure, Ant, Thurne, Yare, Waveney and Chet, along with the tidal Breydon Water estuary. The Broads Authority area also includes many large areas of

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open water (Broads), which are hydrologically connected to the river system and are surrounded by Marshes or Fens (see Map 3).

17.8 The Broads Authority lists 63 Broads within its administrative area, which have a combined water surface of about 836 ha (2066 acres) most of them being 2 metres (6 ft 6 in) or less in depth.

17.9 58 of these broads lie within the County of Norfolk.

Broads in Norfolk	
Alderfen Broad	Little Broad
Bargate Broad	Malthouse Broad
Barnby Broad	Martham North
Barton Broad	Martham South
Belaugh Broad	Martham Pits
Blackfleet Broad	Mautby Decoy
Bridge Broad	Norton's Broad
Brundall Outer Broad	Ormesby Broad
Brundall Gardens Lake	Ormesby Little Broad
Brundall Inner Broad	Pound End
Buckenham Broad	Ranworth Broad
Burntfen Broad	Ranworth Flood
Calthorpe Broad	Reedham Water
Catfield Broad	Rockland Broad
Cockshoot Broad	Rollesby Broad
Crome's Broad	Salhouse Broad
Decoy Broad	Salhouse Little Broad
Devil's Hole	Snape's Water
Filby Broad	Sotshole Broad
Hardley Flood	South Walsham Broad
Hassingham Broad	Strumpshaw Broad
Heigham Sound	Surlingham Broad
Hickling Broad	Upton Great Broad
Horsey Mere	Upton Little Broad
Hoveton Great Broad	Womack Water
Hoveton Little Broad (a.k.a. Blackhorse Broad)	Wheatfen Broad
Hudson's Bay	Whitlingham Great Broad
Irstead Holmes	Whitlingham Little Broad
Lily Broad	Wroxham Broad

17.10 Over 125 miles of the Broads Authority rivers are navigable and many of the broads are at least partially navigable and are connected to the rivers via navigable 'cuts' or 'dykes'.

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17.11 The Broads Authority area has National Park equivalent status and is considered to be a sensitive and valuable landscape, a unique national asset.

17.12 The Broads area contains 28 Sites of Special Scientific Interest, which cover around 24% of the area; there are two Ramsar sites (Globally significant wetlands), covering around 24% of the area; Special Areas of Conservation cover 24% of the area and there are also 8 National Nature reserves:

- Bure Marshes NNR
- Ant Broads & Marshes NNR
- Hickling Broad NNR
- Ludham - Potter Heigham NNR
- Redgrave and Lopham Fen NNR
- Martham Broad NNR
- Calthorpe Broad NNR
- Mid-Yare NNR

17.13 The above designations indicate significant wetland ecological assets.. The protection of these assets is a significant consideration that will need to be taken into account when making decisions in relation to proposals for land drainage and flood defences.

Overview of flood risk

17.14 With so many waterways, marshes and drains, flood risk and drainage issues are a major consideration in the Broads Authority area.

17.15 Flooding from main rivers (fluvial flooding) and tidal inundation are not defined as 'surface water flooding', however a broad understanding of fluvial and tidal flood risk is essential, as flooding in the area may arise from a combination of sources that will have a cumulative impact.

17.16 Most of the Broads Authority area is at risk of both fluvial and tidal flooding. There is a long history of tidal surge flooding in the system, where the incoming tide holds back the rivers flow and prevents the river system draining to the sea. In many of these events there has also been an element of combined flooding affecting the upper catchment reaches. Further information on river and tidal flood risk is available in the Partnership of Norfolk District Councils Strategic Flood Risk Assessment.

17.17 Certain settlements adjacent to the Bure and Yare river systems benefit from the Environment Agency floodbank defences, together with the Internal Drainage Board infrastructure. In 2001 the Broadland

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Environmental Services Ltd (BESL) consortium commenced a 20 year programme of improvements and maintenance to flood defences within the Broads Authority Area. The project is intended to restore the deteriorating existing defences to the 1995 standard and provide additional defence to communities that were undefended (including, Brundall, Wroxham and Reedham). These works are now at an advanced stage and are ongoing.

17.18 The principal watercourses within the Broads Authority area (particularly in their lower reaches) are embanked and thus have water levels which are above the surrounding topography. Pumping stations are required to raise surface water runoff into the embanked watercourses.

17.19 A failure of any of these pumping stations during a significant rainfall event could increase the risk of surface water flooding.

17.20 In low lying areas the action of pumping stations may be artificially lowering the water table. A failure of any of these pumping stations could increase the risk of groundwater flooding.

17.21 Coastal flooding is also a significant hazard in the Broads Authority area, especially if coastal defences were to fail, as flood velocities and depths would be extreme following any defence breach.

Flood risk Issues in the Broads Authority Area

17.22 With 95% of the area lying within flood Zones 2 and 3, flooding from main rivers and the sea will always represent the greatest risk to life and property in the Broads Authority area.

17.23 There is a significant residual risk of groundwater flooding and surface water flooding in the Broads Authority area because the raised waterways and flood defences prevent natural drainage of adjacent land and there is significant reliance on pumps to drain low lying land within the area.

17.24 The highly sensitive environment and landscape of the Broads places constraints on the design of flood management features and may limit the times when works can be carried out.

17.25 The low lying land levels mean that the Broads will become increasingly vulnerable to the effects of climate change (e.g. increased rainfall and rising sea levels) and the ongoing cost of maintaining and improving sea defences and drainage infrastructure might be seen as a potential threat to the long term future of much of the Broads.

Key Messages

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17.26 The expected 20% increase in rainfall intensity and the increase in severe weather events (which is likely to arise due to climate change), is likely to lead to an increase in surface water flooding unless mitigation measures are undertaken to accommodate the anticipated increase in rainfall.

17.27 There is a significant reliance on flood defences to protect key population areas and areas of valuable and productive agricultural land. These defences will require continued maintenance and investment to adapt to the effects of climate change.

17.28 The area is reliant upon extensive networks of drainage channels to facilitate the drainage of both urban and agricultural land. These drainage channels and the pumping stations that are needed to raise surface water up to river level will also require continued maintenance and investment and the pumping capacity may (in the future) need to be increased to adapt to the effects of climate change.

17.29 The high levels of residual flood risk and the predicted additional flood risk likely to be brought about by climate change highlights the importance of locating development away from the most vulnerable areas and the need to assess the potential of developments to increase flood risk elsewhere.

17.30 The risk of coastal flooding is a significant threat to the Broads. There is significant reliance on coastal defences to protect populated areas, areas of productive agricultural land and habitat areas of international importance. If coastal flooding is to be avoided, coastal defences will require continued maintenance and investment to adapt to the effects of climate change.

17.31 The highly sensitive habitat and landscape of the Norfolk Broads places considerable constraints on the timing and characteristics of works that are required to management of flood risk. Potential effects on habitat and landscape will need to be taken into account when any drainage or flood defence works are planned.

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PART THREE – OBJECTIVES AND POLICIES

18. Aim and Objectives

National Context

18.1 Lead Local Flood Authorities (LLFAs) are required to ensure that their Local Flood Risk Management Strategies (LFRMS) are consistent with the National Flood and Coastal Erosion Risk Management (FCERM) Strategy. The National Strategy;

> *"…encourages more effective risk management by enabling people, communities, business, infrastructure operators and the public sector to work together to:*
> - *ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;*
> - *set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risk;*
> - *manage flood and coastal erosion risks in an appropriate way, taking account of the needs of communities and the environment;*
> - *ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond effectively to flood forecasts, warnings and advice;*
> - *help communities to recover more quickly and effectively after incidents."*

18.2 The National Strategy also highlights the role of local strategies. It states that *"These strategies will build on Catchment Flood Management Plans (CFMPs) and Shoreline Management Plans (SMPs) and inform future developments of these plans (or their equivalents) to ensure that flood and coastal erosion risk management activities are co-ordinated, facilitate sustainable risk management and make it easier to deliver multiple benefits."*

Aim

18.3 The Aim of Norfolk's Local Flood Risk Management Strategy (LFRMS) is:

To work with organisations, businesses and communities to manage flood risks and, where it is practicable, affordable and sustainable to do so, to reduce risks to life, property and livelihoods that may arise from local surface runoff, ordinary watercourse and groundwater flooding.

Objectives

18.4 The LFRMS will seek to implement the following strategic objectives:

Objective 1	**Determine and communicate Local Flood Risk –** Undertake projects to determine and understand the risks of flooding from surface run-off, ordinary watercourses and groundwater. Increase public awareness through the publication of clear and consistent information about local flood risk.
Objective 2	**Partnership Working -** Work with all Risk Management Authorities (RMAs) and other stakeholders to coordinate flood risk management roles, responsibilities and activities. Share best practice; raise the profile of Risk Management Authorities working within Norfolk and assist organisations in ensuring their plans and projects take proper account of all flood risk.
Objective 3	**Partnership Programmes and Projects -** Identify, secure and optimise resources to develop and deliver measures to manage flood risk. Assist organisations to establish and update long-term plans to manage flood risk.
Objective 4	**Riparian Responsibilities -** Work with Risk Management Authorities to encourage and where necessary enforce the management and maintenance of privately owned flood management structures and ordinary watercourses and minimise unnecessary constrictions and obstructions within local drainage networks.
Objective 5	**Flood Risk and Development -** Ensure that planning authorities are properly informed about local flood risk, that there is a consistent approach to the consideration of flood risk management in new development and that new developments seek to reduce existing flood risk and

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	contribute to the achievement of sustainable development.
Objective 6	**Water Framework Directive -** Support the implementation of the 'Water Framework Directive' by ensuring that watercourse morphology, water quality and ecological status are not harmed by activities that are controlled by, or undertaken by, owners, occupiers and managers of Flood and Coastal Erosion Risk Management infrastructure. Facilitate measures to improve morphology, water quality and ecological status whenever it is practicable and necessary to do so.
Objective 7	**Support Water and Sewerage Company infrastructure -** Work closely with water and sewerage companies to minimise flood risks associated with their infrastructure and promote the development and management of sustainable water resources.

Rationale

18.5 Further information about the strategy objectives is detailed below.

18.6 Objective 1 acknowledges that there is currently only limited information on the sources and extent of local flood risk within the county. A greater understanding of flooding and drainage issues can enhance the decision-making processes. The severity of the effects of flooding may also be reduced if the character of the risk is communicated to the community affected. The extent to which such risks can be reduced may be dependent upon what communities choose to do in response to information provided. For example if communities and businesses are able to make informed decisions they may invest in resilience measures and prepare emergency plans that will enable them to respond effectively to flooding and recover efficiently after incidents. Risk management authorities may also use the information to devise programs to target maintenance or introduce other measures to help reduce flood risk.

18.7 Objective 2 recognises that the responsibilities for maintaining different elements of the drainage network and for managing different aspects of flood risk lie with a range of organisations and individuals. It is important that there is a clear understanding of which organisations and individuals are responsible for which functions, so that there are no gaps in the management of flood risk, that any synergies are fully utilised and that any duplication of effort is minimised.

18.8 Objective 3 acknowledges the need to make the most efficient use of resources, working in partnership with other organisations to pool knowledge and maximise the benefits of investments. For example,

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when green infrastructure is being planned, or proposals to improve watercourses for nature are being proposed, the potential to include water management measures within those plans should be considered. By amending such plans to take account of water management needs, resources can be combined to provide benefits both for the original objectives and for water management purposes.

18.9 Objective 4 recognises it is necessary to ensure that flood risk is not increased due to lack of investment or negligence in the maintenance of drainage and flood risk structures and features. As the majority of the watercourse network is in riparian ownership the role of regulatory bodies is key in ensuring positive action is undertaken by communities and individuals.

18.10 Objective 5 is required because growth is essential but new developments have the potential to contribute either positively or negatively to flood risk. There is a need to ensure that decision makers are properly informed about local flood risks and that any mitigation proposed by developers would be both proportionate and effective. In addition there is a statutory duty on risk management authorities to contribute to the achievement of sustainable development under the Flood and Water Management Act 2010.

18.11 Objective 6 links the legal requirement to comply with the Water Framework Directive with the Lead Local Flood Authority's statutory requirement to produce a Local Flood Risk Management Strategy. Although the lead authority for the implementation of this response is the Environment Agency, the objectives of the Directive will not be achieved unless all of the authorities, individuals and companies responsible for managing the water environment commit to implementing the many incremental measures that are necessary to ensure compliance.

18.12 Objective 7 is important because Water and Sewerage Companies manage the public sewer networks and in several areas there are pressures on the capacity of those networks. In particular some surface water systems have been connected to the foul sewers and these connections can result in foul sewer flooding. It is important for the Lead Local Flood Authority and Water and Sewerage Companies to work together to explore opportunities to disconnect surface water from the foul sewer network. In addition the supply of water in Norfolk is subject to stresses (there is less water available per person in the eastern region than in many Mediterranean Countries). Norfolk's growth agenda and water dependant agricultural industry makes it seriously vulnerable to water shortages. Norfolk will suffer water shortages if demand increases and droughts occur more frequently without planning for this increased pressure. Given this pressure on water management in general it is appropriate that measures to mitigate flood risk do not prejudice the ability of organisations to manage water in times of stress.

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19. Policies

19.1 All of the policies and supporting text in this section should be read and applied together. Where a proposal is supported by one policy but is in conflict with another policy the proposal should be taken to be unsupported by the strategy. Where a proposal is not supported by the strategy, it should not proceed unless very special circumstances indicate that the benefits of the proposal, to society as a whole, outweigh the policy objection.

20. Undertakings and commitments

20.1 The Lead Local Flood Authority (LLFA) along with other Risk Management Authorities (RMAs) will seek to increase the understanding of flood risks in Norfolk and, where practicable, will seek to manage them. This may involve the delivery of practical flood mitigation measures as well as through influencing land use change including development. In doing so, the Lead Local Flood Authority and other Risk Management Authorities will abide by the following undertakings and commitments:

20.2 Sustainability: Section 27 of the Flood and Water Management Act 2010 requires Lead Local Flood Authorities, district councils, internal drainage boards and highway authorities to "aim to make a contribution towards the achievement of sustainable development".

UC1: Sustainability

The Lead Local Flood Authority, district councils, internal drainage boards and highway authorities will adopt a sustainable approach to Flood Risk Management, maximising environmental and social benefits from policies and programmes, contribute to the achievement of sustainable development, balancing the needs of society, the economy and the urban, rural and natural environment, taking account of the cultural heritage and seeking to secure environmental benefits.

Links to objectives 1 to 7

20.3 Further advice on 'sustainability' in the context of flood and water management can be found in the DEFRA publication "Guidance for risk management authorities on sustainable development in relation to their flood and coastal erosion risk management functions October 2011".

20.4 Lead Local Flood Authority Flood Investigations: Under the Flood and Water Management Act 2010 the Lead Local Flood Authority has a statutory role in investigating flooding in its area. The Lead Local Flood Authority collates information and reports on flood incidents that occur

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within the county. This is used to initiate flood investigations where appropriate as well as to highlight any recurring flooding hotspots. On receipt of a flood report the Lead Local Flood Authority undertakes a determination as to whether any incidents require formal investigation in line with the County Councils Flood Investigation Protocol.

20.5 In order to focus available resources where they can be of most benefit the Lead Local Flood Authority will prioritise investigations. In particular emphasis will be given to investigating events where the cause of the flooding, or the understanding of who may be responsible for managing the flood risk is unclear or where the impact of a flood is particularly significant. The Policy below sets out how the Lead Local Flood Authority will fulfil its flood investigation responsibility.

Policy UC2: Flood Investigation

The Lead Local Flood Authority will undertake a formal flood investigation where it is determined that;

(a) There is ambiguity surrounding the source or responsibility for a flood incident, and/or;

(b) There is cause to investigate the flood incident, due to either its impact, or consequence

When a decision is taken to investigate, the Lead Local Flood Authority will notify the relevant Risk Management Authorities and affected parties and will seek to determine the causal effects of flooding and understand the response of relevant Risk Management Authorities to the incident. After a formal flood investigation has been carried out, the Lead Local Flood Authority will publish the results of its investigation and notify any relevant Risk Management Authorities.

The Lead Local Flood Authority will publish a Flood Investigation Protocol describing how it proposes to carry out flood investigation duties and clarifying the factors that will be taken into account when assessing whether the impact or consequence of an event will trigger a formal investigation.

During widespread flooding the Lead Local Flood Authority will prioritise flood investigations based on the characteristics of the event, with greatest priority given to those events which are judged to have created a risk to life.

Links to objective 1

20.6 The duty to undertake flood investigations is an emergent activity and the Lead Local Flood Authority is developing experience of the process

with each flood event. The Lead Local Flood Authority will monitor the effectiveness and appropriateness of its Flood Investigation Protocol in the context of this evolving knowledge and will amend the protocol if events suggest that a modified approach would be beneficial.

20.7 Lead Local Flood Authority Asset Register: In accordance with Section 21 of the Flood and Water Management Act 2010, the Lead Local Flood Authority is responsible for establishing and maintaining a register and record of structures or features which are likely to have a significant effect on a flood risk in its area. The development of this database includes data sharing between all Risk Management Authorities and updating the information on the register annually. The policy below sets out how the Lead Local Flood Authority will fulfil its responsibilities in the area;

Policy UC 3: Flood Risk Asset Register

The Lead Local Flood Authority will identify those structures or features whose function or attributes have a significant effect on an area of flood risk and will record such assets in an Asset Register.

The Lead Local Flood Authority will also maintain a record of each structure or feature listed in the register, including information about its ownership, state of repair, which person or body is responsible for maintenance and/or operation. The Lead Local Flood Authority will provide a copy of that record to any owner/manager of such structure or feature.

The Lead Local Flood Authority will make the Asset Register available by prior agreement, during office hours at County Hall, Martineau Lane, Norwich and on-line on the Norfolk County Council web site (http://www.norfolk.gov.uk/).

The Lead Local Flood Authority will publish an Asset Register Protocol describing how it proposes to implement this duty.

SuDS delivered as part of new developments will also be included in the Register.

Links to objective 1

20.8 Critical Drainage Catchments: The Lead Local Flood Authority alongside other Risk Management Authorities will undertake works to increase the understanding of local flood risk, (including the preparation of Surface Water Management Plans). The dissemination of this information and the action of identifying the areas at greatest risk should help to ensure that responsible authorities are able to fully take account of the prevailing flood risk. Those catchments of greatest risk may be designated for the purposes of this strategy as Critical

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Drainage Catchments. The Lead Local Flood Authority will publish guidance to indicate the circumstances and thresholds which may trigger the designation of a Critical Drainage Catchment.

20.9 If there is evidence of historic surface water flooding that might be influenced by runoff from a proposed development or where development sites would affect surface water runoff or flood risk within a Critical Drainage Catchment, the Lead Local Flood Authority may seek, through the Local Planning Authority, additional attenuation measures within the proposed design, to achieve a reduction in the existing levels of flood risk.

Policy UC 4: Critical Drainage Catchments

In areas where Surface Water Management Plans or other studies identify a significant risk of surface runoff, groundwater, or ordinary watercourse flooding to homes, commercial properties and/or essential infrastructure, the Lead Local Flood Authority, in partnership with other Risk Management Authorities, may publish maps identifying local catchments as 'Critical Drainage Catchments' (CDCs).

The Lead Local Flood Authority and its partner Risk Management Authorities will proactively develop schemes to reduce flood risks in Critical Drainage Catchments and will seek the cooperation of local landowners to implement such proposals where funding is available.

The Lead Local Flood Authority will also object to any planning application that might, on its own or in combination with other developments, lead to a material increase in flood risks within Critical Drainage Catchments and will encourage measures to reduce flood risks where opportunities arise.

Links to objectives 3 and 5

20.10 Publishing flood risk information: It is important to ensure that flood risk information is accessible to other parties who may be able to make use of the evidence. If information about flood risk is made widely accessible, then Risk Management Authorities, communities, businesses and individuals will have a better appreciation of the risks and a more robust starting point from which to prepare resilience and mitigation measures. The Lead Local Flood Authority will adopt the following approach to publishing flood risk information:

Policy UC 5: Publishing flood risk information

The Lead Local Flood Authority has a significant role in disseminating and publishing flood risk information. It is committed to;

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- Publishing formal flood investigation reports on its website
- Making asset register information available by prior agreement
- Publishing Lead Local Flood Authority led or supported studies on local flood risk once adopted by the Council
- Highlighting the most up-to-date data and mapping on flood risk, integrating this with National datasets where appropriate.

Links to objective 1

20.11 Emergency Planning: The Lead Local Flood Authority is not an emergency response organisation and will not normally be involved in actions to address the immediate effects of flooding. The Lead Local Flood Authority will however often undertake investigations into the cause and effects of significant flood events and will endeavour to predict which areas are likely to be vulnerable to local flooding from surface runoff, ground water or from ordinary watercourses. Dissemination of this information will ensure that emergency response teams are better informed about the spatial distribution of flood risk and can prepare emergency response plans accordingly.[7]

Policy UC 6: Emergency Planning

The Lead Local Flood Authority acknowledges its role in advising emergency planning authorities and will:

- seek to ensure that Emergency Response and Recovery Plans take account of emergencies that might arise as a result of local flood risk.
- contribute to the review of such plans, in consultation with the Environment Agency and other partners within the Norfolk Resilience Forum when required; and
- provide information and guidance on local flood risks to emergency response organisations during flood events if required.

Links to objective 2

20.12 Sustainable Flood Management: For flood management measures to be effective in the long term they must be sustainable. Sustainable

[7] The Civil Contingencies Act (CCA) 2004 sets out which authorities are emergency responders. Norfolk County Council is a category 1 responder and this function is undertaken by the Council's Resilience Team. The Resilience Team works with multi-agency partners (Category 1 emergency services, Maritime and Coastguard Agency) Category 2 (mainly utilities), the military and the Third sector, through the Norfolk Resilience Forum (NRF) to prepare for, respond to and recover from, major emergencies (including lessons identified)

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design will usually require that systems mimic natural processes (where practicable) while being delivered and maintained at a price that society is willing and able to fund. An assessment of sustainability needs to encompass both initial construction costs and the ongoing maintenance costs. Measures that are too expensive to maintain may become ineffective if society subsequently fails to ensure that the maintenance costs are adequately funded. Reliance upon flood mitigation that is not properly maintained would significantly increase levels of residual risk and may lead to a false sense of safety for those who are reliant upon the defences.

20.13 For the above reasons decisions about funding flood management must balance the benefits of such schemes against the costs of construction and maintenance, while the wider interests of society must also be weighed against the benefits that such schemes might bring to individuals.

Policy UC 7: Sustainable Flood Management

In order to support an adequate, economically, technically and environmentally sound approach to providing flood management services, Risk Management Authorities will:

(a) support a strategic approach to provision of flood mitigation measures, particularly by assessing any potentially wider effects of proposed defences. To this effect Risk Management Authorities will continue to play a full role in Local Environment Agency Plans for Norfolk;

(b) support the provision of sustainable flood mitigation measures which provide social and/or economic benefits to people whilst taking full account of natural processes and which avoid committing future generations to inappropriate defence options.

Links to objective 3

20.14 Risk based approach: The primary focus of flood risk management is to reduce risk to people, properties and infrastructure. Although it is recognised that removing the risk of flooding entirely is neither affordable nor practicable, this strategy reaffirms that priority will be given to reducing any risk to human life. Protection of property is desirable, but may not be achievable or affordable in all circumstances. As such, a risk based approach will be adopted which seeks to make the most beneficial and sustainable use of available resources. The policy below sets out this approach;

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Policy UC 8: Risk based approach to prioritisation of resources

All Risk Management Authorities will support the investment of resources in areas of highest risk within their respective jurisdictions through;

- Utilising consistent and up-to-date information on local flood risk in the development of any projects and programmes.
- Detailing the level of flood risk mitigation proposed by projects and programmes in terms of 'return period' for any exceedance events.
- Identifying the possibility of match funding from third parties and beneficiaries of mitigation schemes.
- Assessing the potential wider synergies and effects of proposed mitigation schemes on wider catchments, communities and other Risk Management Authority schemes through consultation with the Norfolk Water Management Partnership.
- Supporting the delivery of sustainable flood mitigation schemes which provide social and/or economic benefits to people whilst taking account of natural processes.

Links to objectives 2 and 3

20.15 Designation of structures or features: The Lead Local Flood Authority, Environment Agency (EA), Internal Drainage Boards (IDBs) and District Councils all have powers to designate any structure or natural/manmade feature of the environment if they think it affects a flood risk or coastal erosion risk. The purpose of designation is to ensure that a structure or feature cannot be altered or removed without the consent of the responsible authority.

20.16 Designating authorities are not permitted to designate a structure or feature that is already designated by, or owned by another designating authority, furthermore, any application for work to a designated structure or feature must be submitted to the authority that issued the designation. Having regard to the above it is considered to be important to clarify which authority would normally be the appropriate body to make a designation in specific circumstances.

20.17 For the sake of clarity, designating authorities will normally designate structures or features on the following basis:

Policy UC 9: Designation of 3rd party structures or features

The Lead Local Flood Authority, the Environment Agency, Internal Drainage Boards or District Councils will 'designate' any structure or natural/manmade feature of the environment, where, in the opinion of

the risk management authority, the protection of such asset would be beneficial in ensuring protection of land and property against flood or coastal erosion risks.

Lead Local Flood Authorities will normally be the relevant authority for designating structures or features that affect surface runoff, groundwater or ordinary watercourses outside of Internal Drainage Board districts. Where it is considered to be necessary for the purpose of ensuring the continuity of effective surface water drainage in the locality, SuDS structures or features (whether on public land or on private property / private) may also be designated by the Lead Local Flood Authority.

The Environment Agency will normally be the relevant authority to designate structures or features that affect strategic sources of risk such as large raised reservoirs, the sea and main rivers.

Internal Drainage Boards will normally be the relevant authority to designate structures or features that affect ordinary watercourses within Internal Drainage Board districts.

District Councils will normally be the relevant authority to designate structures or features that affect surface runoff, groundwater or ordinary watercourses in areas where they have responsibility for managing coastal flood and erosion defences if those structures or features integrate with coastal flood or erosion defence structures or features.

Designating authorities may agree with other authorities to designate on a different basis where material circumstances indicate that is appropriate to do so.

Links to objective 1

20.18 'Material circumstances' that might lead to a designation being undertaken on a different basis from the above policy might include, for example, where a structure or feature serves a dual purpose, or where the management of a structure could be more effectively supervised because a designating authority is already managing a portfolio of similar assets in the locality.

20.19 When assessing whether it is appropriate to designate structures or features which form part of a SuDS scheme the relevant risk management authority will give consideration to the significance of the structure or feature within the wider drainage network and its importance to the overall effectiveness of the system.

20.20 Planning: In determining planning applications and developing planning policy, local planning authorities have to a take account of a range of issues and pressures, some of which may be conflicting. When such

matters are being evaluated, the Lead Local Flood Authority (LLFA) will seek to ensure that an appropriate level of weighting is given to flood risk issues, having regard to National Policies and the available knowledge of local circumstances.

20.21 The siting of developments and flood mitigation schemes within a catchment can influence flood risk. Developments have the potential to further increase flood risk for downstream areas due to factors such as increasing impermeable areas and reducing the capacity of culverts, drains, sewers and watercourses. As such flood risk implications need to be considered at the earliest stages of development planning. Risk Management Authorities are encouraged to offer pre-application advice to prospective developers.

20.22 Individual property owners and users are responsible for managing the drainage of their land in such a way as to prevent, as far as is reasonably practicable, adverse impacts on neighbouring land. Any organisation or person proposing a development should ensure that development will not add to the risk of flooding off site.

20.23 The Lead Local Flood Authority will support LPA's in helping developers to mitigate any negative impact of runoff outside the development boundary. Where development sites form part of a larger development strategy in the locality this should include a consideration of drainage flows from or to adjacent development sites.

20.24 In areas where there is evidence of historic surface water flooding, a reduction in the frequency and impact of future flooding events may only be possible if the properties are either provided with flood defences, or if the local catchment is modified to attenuate water from significant rainfall events. In many cases the construction of defences and the cost of maintaining them can be both impractical and unsustainable in the long term. However, increasing the capacity of the catchment to attenuate water can be achieved through the implementation of numerous relatively small incremental changes to the catchment, which collectively would have a positive and sustainable effect on flood risk.

Policy UC 10: Planning

The Lead Local Flood Authority will take a proactive role in the development of local plans and will expect planning authorities to prepare policies that address local flood risk issues and ensure the provision of effective sustainable drainage in new developments.

The Lead Local Flood Authority will also work with local planning authorities to prepare guidance for applicants and will provide advice in respect of individual planning applications where these effect or are affected by local flood risks.

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The Lead Local Flood Authority will expect planning authorities to take account of flood risks identified by Surface Water Management Plan modelling, Strategic Flood Risk Assessments and other sources of flood risk modelling (such as the flood risk mapping provided by the Environment Agency) and either avoid locating new development within areas that are at risk of flooding, or ensure that designs fully mitigate for the expected flood risk.

The Lead Local Flood Authority will raise objection to any developments or plans that might lead to an increase in flood risks.

Links to objectives 2 and 5

20.25 Securing Sustainable Drainage: Sustainable Drainage Systems (SuDS) manage local flood risks by slowing the flow of water through the drainage network and smoothing out the peaks that arise following heavy rainfall. Sustainable drainage achieved through the implementation of new developments will only represent a small proportion of the overall drainage network, retrospective adaptation of existing systems will also be necessary to achieve significant reductions in flood risks over a wide area.

20.26 The means by which water is discharged from a drainage system is critical to the management of flood risks downstream. Where geology and soil structures are suitable, discharging water to the ground is the most effective method of reducing the burden placed upon piped drainage systems and watercourses during significant rainfall events. It is recognised however that discharge of water directly to the ground will not always be technically feasible.

Policy UC11: Securing Sustainable Drainage

The Lead Local Flood Authority shall, using all available legislative and regulatory measures, seek to secure the implementation of Sustainable Drainage Systems (SuDS). Where practicable, the Lead Local Flood Authority will also, through the voluntary cooperation of landowners, aim to secure adaptation of existing drainage networks to Sustainable Drainage Systems (SuDS).

Links to objectives 3, 4, 5 and 7

20.27 Water Management: Responsibility for supplying potable water to Norfolk's residents and businesses rests with Anglian Water and Essex and Suffolk Water. Anglian Water also manages most of the foul, combined and surface water sewers in Norfolk. Although the Lead Local Flood Authority (LLFA) and other Risk Management Authorities (RMAs) are not directly responsible for water resource management, it is considered to be in the common interest of Norfolk's residents to

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ensure that the objectives of water resource management and flood risk management (from all sources) do not conflict. The policy below sets out how Risk Management Authorities will seek to work with water companies.

Policy UC 12: Water Company liaison

Risk Management Authorities will work closely with water companies to;

- Reduce the occurrence of public sewer flooding caused or exacerbated by sources of local flood risk.
- Influence Water Companies to consider local flood risk in their development of sustainable water resources and infrastructure.
- Promote water efficiency where appropriate

Links to objective 7

20.28 Climate Change: The probable characteristics of the impacts of climate change have been broadly agreed by the majority of climate scientist, however predicting precise outcomes is an inexact science which is constantly being reviewed.

20.29 The United Kingdom's Climate Impacts Programme (UKCIP) was established in 1997 to develop understanding of climate science and possible climate impacts. UKCIP produced the 2009 UK Climate Projections (UKCP09), consolidating scientific reports and some key projections of future climate change for the UK over the 21st century.

20.30 While the UKCP09 projections provide a reliable basis for current planning for climate change, it is likely that understanding, modelling and statistical capabilities will continue to improve and projections may change in the future.

Policy UC 13: Adapting to climate change

When developing policy, determining applications or taking enforcement action, Risk Management Authorities will have regard to the predicted impacts of climate change including the need to account for changes in sea level and more frequent extreme weather events. In doing so Risk Management Authorities will have regard to the most up to date advice available, including UKCIP Climate Change Projections.

Links to objective 1

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21. Ordinary Watercourse Regulation Policies

21.1 Consenting and enforcement activities are together described as regulation. The purpose of watercourse regulation is to control certain activities that might have an adverse flooding impact and to ensure that riparian owners carry out their responsibilities.

21.2 The oversight, management and regulation of watercourses is delivered across a number of regulatory authorities and is provided in the context of specific requirements arising from the Flood and Water Management Act 2010 and the Land Drainage Act 1991. For 80% of Norfolk the Lead Local Flood Authority (Norfolk County Council) regulates approximately 8,900km of ordinary watercourses.

21.3 Within Internal Drainage Board areas, 22 Internal Drainage Boards regulate 20% of Norfolk's ordinary watercourses. (Map 3 indicates the areas of Norfolk covered by internal drainage boards)

21.4 The Environment Agency has permissive powers for managing "Main Rivers" (applications for any works to main rivers should be submitted to the Environment Agency). Map 2 indicates the "Main Rivers" in Norfolk, (all other rivers are considered to be "Ordinary Watercourses").

21.5 Anyone wishing to carry out work in, over, or adjacent to an ordinary watercourse must check with the relevant regulatory authority as to the need to apply for consent. Proposals are assessed for their effect on the drainage network and the wider environment.

21.6 When managing Ordinary Watercourses the Lead Local Flood Authority and other Risk Management Authorities will act in a manner consistent with the following policies:

21.7 Maintenance: There are many reasons why the maintenance of watercourses may be neglected by riparian owners. The Lead Local Flood Authority recognises that such neglect may not be deliberate and therefore will seek to inform educate and persuade riparian owners to secure their cooperation in the first instance. Notwithstanding the desire to work with landowners, neglected or damaged drainage features need to be brought back to a functional state within a reasonable time scale, if flooding is to be avoided. Enforcement powers will therefore be used if any unreasonable delay's in restoring the functionality of the watercourse is likely to result in flooding.

Policy OW1: Maintenance of Ordinary Watercourses

Where responsibility for maintenance of ordinary watercourses rests with a land owner, the Lead Local Flood Authority and other Risk Management Authorities (RMAs) will aim to secure co-operation in

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ensuring appropriate maintenance takes place, but will draw on powers of enforcement when necessary.

The Lead Local Flood Authority and other Risk Management Authorities will inform and advise individuals of their riparian owner responsibilities and of the route for settling disputes with other riparian owners where appropriate.

Links to objectives 2 and 4

21.8 Enforcement: Where enforcement proves to be necessary to secure proper maintenance, or to secure the removal of any unauthorised works or obstruction, the Lead Local Flood Authority and other Risk Management Authorities will take the following approach:

Policy OW2: Enforcement

The Lead Local Flood Authority (LLFA) and other Risk Management Authorities (RMAs) will take a risk-based and proportionate approach to enforcement action under the Land Drainage Act 1991, taking into account the location and nature of any nuisance caused by:

- the failure to repair or maintain watercourses, bridges or drainage works
- un-consented works
- impediments to the proper flow of water

The Lead Local Flood Authority will take enforcement action where there is, or has been, a risk to life or serious injury, internal flooding of residential or commercial properties and flooding impacting on critical services. An initial assessment will be based on the Lead Local Flood Authority's impact criteria.

Where works are un-consented and the relevant landowner, person and/or risk management authority responsible provides no evidence or insufficient evidence to support an assertion that the un-consented works would not cause a nuisance or increase flood risk, there will be a presumption that the un-consented works would cause a nuisance or increase flood risk, unless visible evidence suggests otherwise.

The Lead Local Flood Authority may close an enforcement case file and/or take no action where:

- there is a lack of physical evidence to corroborate the impact of a flood event and/or
- there is no actual or potential risk to properties or infrastructure; and/or
- that the matter complained of is not the cause of the drainage problem; and/or

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- the matter is trivial in nature (de minimis)

Where no enforcement action is taken further correspondence may include:

- referral to the First Tier Tribunal (Property Chamber), Agricultural Land and Drainage (AL&D) where appropriate
- Informing those of their riparian responsibilities

Where the Lead Local Flood Authority or other Risk Management Authorities are made aware of breaches to other legislation they will advise the appropriate authorities.

Links to objective 4

21.9 Ordinary Watercourses - General Requirements: In considering applications for works to an ordinary watercourse the Lead Local Flood Authority must have regard to duties imposed on the authority by several other areas of environmental legislation, as well as addressing concerns about flood risk and water quality. The Lead Local Flood Authority will apply the following policy when determining all applications for ordinary watercourse consent:

Policy OW3: Consenting of works on Ordinary Watercourses

The Lead Local Flood Authority (LLFA) will normally approve alterations to ordinary watercourses where proposed works would not:

(a) lead to an increase in unmanaged flood risks on the site;

(b) increase the risk of flooding in areas beyond the site;

(c) materially increase the risk of a watercourse becoming obstructed;

(d) increase the risk of erosion on the site or in areas beyond the site;

(e) result in water quality that does not meet standards required by the Water Framework Directive or other legislation;

(f) have a detrimental impact on

- protected species of flora and fauna,
- SSSI, Natura 2000, or Ramsar habitats,
- Marine Conservation Zones,
- National Nature Reserves,
- Local Nature Reserves,
- County Wildlife Sites, or
- habitats covered by Biodiversity Action Plans;

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(g) have a materially detrimental impact on the morphology of natural watercourses.
Links to objectives 4, 5 and 6

21.10 Morphology describes the shape of watercourses and how they change over time. The morphology of a watercourse is a function of a number of processes and environmental conditions, including the composition and susceptibility to erosion of the bed and banks; vegetation and the rate of plant growth; the availability of sediment; the size and composition of the sediment moving through the channel; the rate of sediment transport through the channel and the rate of deposition on the floodplain, banks, bars, and bed; and regional aggradation or degradation due to subsidence or uplift.

21.11 The extent to which works may have a "materially detrimental impact" on morphology may be dependent on both the design of the works and their scale. In assessing whether there is a materially detrimental impact on morphology, the cumulative effects that might result from a number of similar alterations to the watercourse may be a consideration.

21.12 Before approving works that might affect areas designated as SSSIs, SPA, SAC, Ramsar, Marine Conservation Zones, or National Nature Reserves the Lead Local Flood Authority will expect applicants to provide evidence that they have submitted their proposal to Natural England and that the proposed works have received an appropriate consent, or that Natural England has confirmed that its consent is not required.

21.13 Culverting: In general, the act of culverting a watercourse tends to have mainly negative effects for flood risk management:

- The performance of a culverted drainage system cannot be easily monitored and culverts are vulnerable to becoming blocked. Such blockages, hidden from sight, may not be detected until a significant event causes flooding.
- If the designed capacity of a culvert is exceeded, or if a culvert is blocked, the backing up of water within a culverted system may result in flooding a significant distance from the actual constraint. This makes identification of the obstruction more difficult.
- Outfalls within culverts are prone to blockage or, in the case of flapped outfalls, the flap can seize. Maintenance of these outfalls is considerably easier in open channels.
- Access to culverts may require the use of special procedures and equipment, making inspection, maintenance and repair both difficult and costly.

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- Drainage connections to culverts are more difficult to make than to open watercourses.
- Culverted watercourses can be dangerous and there have been incidents where children, have entered a culvert and suffered injury.
- Culverting a watercourse makes the early detection and tracing of pollution sources more difficult, resulting in the adverse impacts being more serious.
- Culverting has an impact on water quality, due to the loss of the biological processes which are essential for river purification, and there is normally a reduction in oxygenation of water passing through a culvert. Culverting may also result in stagnant water problems, particularly if culvert levels are badly planned or constructed.
- Culverts offer no significant biodiversity benefits, when compared to an open watercourse, which can have considerable ecological potential if it is well designed and properly maintained.

21.14 Having regard to the above concerns, culverts are generally considered to increase flood risk and have a detrimental effect on the environment; as such they are usually deemed to be undesirable.

21.15 Notwithstanding the above, it is recognised that culverting can offer a low cost solution to some access issues and therefore when assessing applications for culverting the Lead Local Flood Authority will implement the following policy:

Policy OW4: Culverting

The Lead Local Flood Authority (LLFA) will only approve an application to culvert a watercourse if there is no reasonably practicable alternative, or if the detrimental effects of culverting would be so minor that they would not justify a more costly alternative.

In all cases, where it is appropriate to do so, adequate mitigation must be provided for damage caused. Wherever practicable the Lead Local Flood Authority will seek to have culverted watercourses restored to open channels.

The Lead Local Flood Authority will normally reject applications for culverting in areas identified as being;

- in Flood Zones 2 or 3a/3b and/or
- at risk of surface run-off flooding as indicated by the Environment Agency's updated flood map for surface water.

This is due to the potential of proposed works increasing flood risk. Exceptions to this policy will only be considered if the applicant is able to demonstrate that, on the balance of probabilities, the proposed

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development would not increase flood risk.

Where opportunities arise and there is benefit in doing so, the Lead Local Flood Authority may encourage landowners to remove existing culverts and restore surface watercourses.

Links to objective 4

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22. Wider Environmental Considerations

22.1 Although the primary objective of the Local Flood Risk Management Strategy is to manage flood risk, there are several instances where flood risk management activities may influence, effect or complement other environmental objectives. Working with those bodies that have the primary responsibility for such objectives is essential if the management of local flood risk is to support wider environmental objectives.

22.2 This Strategy will contribute to the achievement of wider environmental objectives by:

- Ensuring that, as far as is reasonably practical, actions taken will maximise opportunities to ensure that Norfolk's countryside, coastline and towns become richer in biodiversity and that the county's water-bodies achieve good ecological potential.
- Developing, or maintaining natural watercourse morphologies, wherever it is practicable and affordable to do so.
- Ensuring that measures are implemented that will help to protect ground water and river water from the effects of pollution.

22.3 The County Council are currently reviewing where potential environmental improvements could be made, and are working with the Environment Agency, and other nature partnerships including 'Wild Anglia' Local Nature Partnership, the Norfolk Biodiversity Partnership and Catchment Partnerships to ensure that projects designed to manage flooding also contribute to environmental improvement. A Strategic Environmental Assessment has been carried out to ensure that this Strategy is consistent with the principles of good environmental management.

22.4 Inevitably some short term impacts on habitats and species will arise as a result of watercourse maintenance work, such as vegetation control and de-silting. Such works are necessary to ensure effective drainage, but are also essential for the purposes of maintaining diverse aquatic habitats. In undertaking maintenance work Risk Management Authorities and riparian landowners will be expected to minimise the impact on habitats and species as much as possible.

22.5 All risk management authorities are required to undertake their duties in a way that not only protects the environment, but also seeks to improve it wherever possible.

22.6 Risk Management Authorities have a duty to comply with the Habitats and Birds Directives (European Directives 92/43/EEC, 79/409/EEC and 2009/147/EC) and to ensure that no works or plan approved by the Authorities results in an adverse effect either directly or indirectly on the integrity of identified European sites (Natura 2000 Sites).

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22.7 Risk Management Authorities also have nature conservation duties under The Land Drainage Act 1991, The Wildlife and Countryside Act 1981 and as competent authorities under The Conservation (Natural Habitats, &c.) Regulations 1994.

Water Framework Directive (WFD)

22.8 A further factor that will influence the strategy is the requirements of the Water Framework Directive (European Directive 2000/60/EC). The WFD sets environmental targets (including water quality, morphology and biodiversity standards) for inland surface waters, transitional waters, coastal waters and groundwater. Risk Management Authorities have a responsibility to consider the effects of their decisions, plans and proposals on these targets. In particular the WFD sets requirements to;

- mitigate the effects of floods and droughts on water-bodies;
- achieve 'good status/potential' for all water-bodies ;
- prevent deterioration in the status of water bodies;
- conserve aquatic ecosystems, habitats and species
- promote sustainable use of water, balancing abstraction and recharge.

22.9 The Environment Agency's River Basin Management Plan (RBMP) for the Anglian River Basin District is the lead policy document that covers Water Framework Directive matters for Norfolk. The WFD environmental objectives will only be met if all organisations and stakeholders involved in, or that effect, water management integrate its requirements into their working practices and projects. As such this Local Flood Risk Management Strategy seeks to integrate WFD requirements through the adoption of appropriate policies.

Eel Regulations

22.10 On 15th January 2010, the Eels (England and Wales) Regulations 2009 came into force. These regulations afford new powers to the Environment Agency to implement measures for the recovery of European eel stocks and have important implications for operators of abstractions and discharges. The main people and works they apply to are:

- Licensed abstractors of water: companies or individuals abstracting and/or discharging water for a wide range of industrial, agricultural and other purposes
- Impounding works: any dam, weir, or other works by which water may be impounded

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- Anyone constructing, altering or maintaining a dam, or any other structure in or near water, liable to cause an obstruction to the passage of eels.

22.11 There is a requirement under the regulations to notify the Environment Agency of the construction, alteration or maintenance of any structure likely to affect the passage of eels and to construct and operate an eel pass to allow the free passage of eels. This may include removal of any obstruction, the use of eel screens to exclude eels from water abstraction and discharge points and if necessary, the use of a by-wash to return excluded eels to the waters they came from.

Green Infrastructure and Recreation

22.12 There is a significant correlation between activities necessary for surface water management and the creation of environments that provide landscape benefits and recreational opportunities for communities. Providing recreation facilities and landscaping are not primary functions of the Local Flood Risk Management Strategy, however, Risk Management Authorities need to be aware of the potential synergies between these objectives and where practicable they should make allowance for the development of recreational and landscaping benefits within sustainable drainage and flood risk management schemes. Similarly Risk Management Authorities should look for opportunities to maximise the potential for landscape and recreation proposals to include measures that will enhance sustainable drainage and reduce flood risk.

Water Resource Management

22.13 The management and delivery of water resources is primarily the responsibility of water companies and is regulated by the Environment Agency. However, actions taken in the interests of managing flood risk and sustainable drainage can make contributions to the sustainable delivery of water supplies and similarly management of water resources can affect flood risk. Risk Management Authorities will work alongside the water companies to support the provision of sustainable water resources and ensure that the provision of water resources is undertaken in a manner that does not introduce additional local flood risks.

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23. Environmental Policies

23.1 The Flood and Water Management Act 2010 when defining "Risk" states that:

"potential harmful consequences to be considered in assessing risk include, in particular, consequences for—

(a) human health,

(b) the social and economic welfare of individuals and communities,

(c) infrastructure, and

(d) the environment (including cultural heritage)."

23.2 Risk Management Authorities have a duty to comply with the Habitats and Birds Directives (European Directives 92/43/EEC, 79/409/EEC and 2009/147/EC) and ensure that no works or plan approved by the Authorities results in an adverse effect either directly or indirectly on the integrity of identified European sites (Natura 2000 Sites).

23.3 Risk Management Authorities also have nature conservation duties under The Land Drainage Act 1991, The Wildlife and Countryside Act 1981 and as competent authorities under the Conservation (Natural Habitats C) Regulation 1994.

23.4 The Water Framework Directive (European Directive 2000/60/EC) sets environmental targets (including water quality, morphology and biodiversity standards) for inland surface waters, transitional waters, coastal waters and groundwater and Risk Management Authorities have a responsibility to consider the effects of their decisions, plans and proposals on these targets.

23.5 To ensure compliance with these duties and responsibilities, the Lead Local Flood Authority and other Risk Management Authorities will act in a manner consistent with the following policies:

23.6 Nature Conservation: When developing plans and projects to further the objectives of flood risk management; maintaining existing infrastructure; or considering applications for new works by third parties; Risk Management Authorities will inevitably have to assess the likely impacts of such projects on sensitive habitats and on protected species and consider whether there is potential for enhancement of habitats. In doing so they will act in accordance with the following policy:

Policy E1: Nature Conservation

Risk Management Authorities will:

- play a positive role in fulfilling their statutory and other

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responsibilities for furthering nature conservation, including achievements of the Government's environmental obligations and targets;

- fulfil their responsibilities in relation to nationally and internationally important conservation areas, under the Wildlife and Countryside Act 1981 and as a competent authority under the terms of the Conservation of Habitats and Species Regulations 2010 by applying strategies and policies laid down in policy documents;
- fulfil their responsibilities in relation to the Habitats and Birds Directives (European Directives 92/43/EEC, 79/409/EEC and 2009/147/EC) and ensure that no works or plan approved by the Authorities results in adverse effects either directly or indirectly on the integrity of identified European sites (Natura 2000 Sites) or designated Ramsar sites.
- when carrying out works, seek opportunities for environmental enhancement, aim to avoid net damage to environmental interest and ensure no net loss to habitats covered by Biodiversity Action Plans;
- where an environmental impact assessment or scheme is required, monitor all losses and gains of such habitats as a result of these operations and report on them to Natural England and/or the Environment Agency; and
- ensure that they work in partnership with Natural England to complete, implement and review plans, policies and measures.

Links to objective 6

23.7 Habitats: Open drainage features often incorporate valuable water habitats. In order to ensure that drainage functions are maintained, essential works occasionally need to be carried out within such sensitive environments. Although maintenance or construction works inevitably tend to have some short term effects, the long term impacts can be minimised through careful management of both the timing and the characteristics of the work undertaken. To ensure that habitats are protected, Risk Management Authorities and riparian owners should follow the approach outlined in the policy below:

Policy E2: Protecting habitats

When carrying out works consistent with the need to maintain satisfactory drainage and flood protection standards, Risk Management Authorities and riparian owners (or their contractors) shall:

- avoid any unnecessary damage to natural habitats

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- avoid any long term damage to natural habitats
- ensure no net loss of habitats covered by Biodiversity Action Plans,
- take appropriate opportunities to enhance habitats.

Links to objective 6

23.8 Water levels: Some species of flora and fauna are dependent upon water levels being maintained between a maximum and minimum level, in order that the species can thrive. Pumped Catchments manage water levels artificially and it is sometimes possible to control water levels in these environments specifically so that they benefit particular species of flora and fauna. In some localities, where there is a particularly valuable habitat (Sites of Special Scientific Interest), Natural England seeks to develop Water Level Management Plans to optimise the value of wetland habitats. To ensure that such plans can be implemented risk management authorities must cooperate with Natural England, to develop the plans and modify the management of drainage in the catchments.

Policy E3: Water levels (habitats)

Within pumped catchments, Risk Management Authorities shall sustain water levels in accordance with Water Level Management Plans prepared for Sites of Special Scientific Interest and (in conjunction with Natural England and other interested parties) shall participate in the review of such plans.

Links to objective 6

23.9 Ecological Potential: Water environments offer significant possibilities for creating habitats with great ecological potential. Historically, some drainage schemes or works to ordinary watercourses have failed to maximise their ecological potential, particularly where piped systems or straight channels with hard edges were significant features of the design. More naturalistic water channels and associated planting can offer many benefits, including better water quality, slower water flows and greater opportunities for biodiversity. A Risk Management Authority's primary responsibility is to manage flood risk, however this need not be incompatible with the objective of enhancing habitats and when considering drainage proposals or works to ordinary watercourses the following policy should be applied:

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Policy E4: Ecological Potential

The Lead Local Flood Authority, and , where relevant, Internal Drainage Boards will require applications for Ordinary Watercourse Consents to include measures within their design to preserve or (where practicable) enhance ecological potential, including, where appropriate, providing landscaping using native species that are compatible with the local water environment.

Where there are technical or operational reasons why drainage or flood defence features cannot be designed to preserve or enhance ecological potential, the Lead Local Flood Authority, and, where relevant, Internal Drainage Boards will expect applicants to provide compensatory enhancement measures in the locality of the proposed works.

Applications for the modification of watercourses or the creation of new watercourses may be refused if insufficient information on landscaping and ecological potential is provided, or if landscape proposals are of poor quality.

23.10 River Morphology: Morphology describes the shape and form of watercourses and how they change over time. Historically, many man made drainage dykes were constructed as straight channels, with limited vegetation. Such channels increase the rate of flow, which in turn can increase erosion. This means that the water carries more sediment and allows peaks of rainfall to enter main rivers more quickly, leading to a greater risk of flooding downstream. Such dykes also tend to have poor water quality and offer limited ecological potential. In contrast, natural rivers include meanders, a range of aquatic and marginal vegetation, and variable coarseness in their bank and bed materials. The shape and coarseness of the watercourse and the presence of vegetation helps to slow the flow of water and reduce erosion, while vegetation also helps to capture sediment and oxygenate the water. As a result natural watercourses tend to have better water quality and greater ecological potential, while slowing the flow of water and reducing the risk of downstream flooding.

23.11 Watercourses containing features that mimic natural river morphology are considered to offer significant advantages over more heavily 'engineered', straight line drainage systems. Accordingly, when it is practicable to do so, natural river morphologies are preferred.

Policy E5: River Morphology

Developments which alter the bank of an ordinary watercourse or which create a new watercourse as part of a sustainable drainage

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scheme shall mimic features of natural river morphology and hydrology wherever it is practicable to do so. Where it is not practicable to do so compensatory measures may be required.

Links to objective 6

23.12 Landscape and planting are key components in works to ordinary watercouses. Appropriate planting can add ecological and visual benefits, as well as slowing water flows, improving water quality and helping to resist erosion. Inappropriate planting can lead to the erosion of banks and beds, increase maintenance costs, reduce ecological potential and may even lead to the spread of invasive alien species which are detrimental to the wider ecology of the area. An appropriate level of care is therefore required to ensure that landscaping and planting proposals add to the effectiveness of the design and do not introduce problems for the future.

Policy E6: Landscaping

Landscape proposals accompanying applications for works to an ordinary watercourse shall be designed to:

- enhance the drainage characteristics of the scheme;
- stabilise areas that may be vulnerable to erosion;
- enhance the visual appearance of the development; and
- enhance the ecological potential of the local environment.

The use of plants that are likely to be invasive and/or detrimental to the wider natural environment will not be permitted.

Links to objective 6

23.13 Heritage: Assets such as listed buildings, scheduled ancient monuments and archaeological sites are usually protected by specific heritage legislation and by dedicated heritage bodies, such as English Heritage or the local planning authority.

23.14 In order to ensure that heritage assets and their settings are not unnecessarily harmed by drainage or flood management works, when considering applications for ordinary watercourse consent in the vicinity of heritage assets, the Lead Local Flood Authority, and Internal Drainage Boards will normally seek confirmation from applicants that they have sought the relevant consent from the appropriate heritage body (usually either English Heritage or the local planning authority), or that the relevant heritage body has confirmed that their consent is not required. In particular it will be important to have special regard to any proposed works to a watercourse that has been modified as part of the design of a historic park or garden or as a feature that affects the

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setting of a heritage asset. If there are any instances of doubt, the Lead Local Flood Authority, and Internal Drainage Boards will inform the appropriate heritage body of the proposal, to allow the relevant authority to take whatever action it deems necessary.

Policy E7: Heritage Assets

When considering applications for ordinary watercourse consent in the vicinity of protected heritage assets, the Lead Local Flood Authority, or relevant Internal Drainage Board will make enquiries to confirm that applicants have given due regard to the impact of the development on such assets and, where relevant, that they have sought the appropriate consent.

When Risk Management Authorities are carrying out works in the vicinity of heritage assets, they will seek advice from the appropriate heritage body and, wherever it is practicable to do so, will aim to avoid any detrimental effect on heritage assets.

Links to objective 2

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24. SuDS Approving Body (SAB)

24.1 Under the Flood and Water Management Act 2010 a new role for the County Council in approving and adopting Sustainable Drainage Systems (SuDS) on new developments was envisaged. This role, known as the SuDS Approving Body or SAB, is set out in Schedule 3 of the Act.

24.2 Notwithstanding the above, on the 18 December 2014 the Secretary of State for the Environment issued a statement confirming that the role of managing surface water drainage in new developments would in future be administered by local planning authorities. The statement indicated that the government *"……expect local planning policies and decisions on planning applications relating to major development - developments of 10 dwellings or more; or equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010) - to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate. Under these arrangements, in considering planning applications, local planning authorities should consult the relevant lead local flood authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development. The sustainable drainage system should be designed to ensure that the maintenance and operation requirements are economically proportionate……."*.

24.3 Although the above statement did not expressly indicate that schedule 3 will not be implemented, the implication of the statement is that schedule 3 will not be implemented in its current form and the proposed role of the SuDS Approving Body has, in practice, been abandoned. If this role is subsequently reprised the Lead Local Flood Authority will review this chapter of the strategy and introduce appropriate policies to manage any duty that may be imposed.

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PART FOUR – MEASURES AND FUNDING

25. Measures

25.1 The Norfolk Local Flood Risk Management Strategy is required to propose measures to achieve the objectives set out in Part 3 of this document. The strategy must also detail how and when the measures are expected to be implemented including their costs, benefits and sources of funding. This part of the document has been compiled to answer this requirement.

25.2 The measures and actions that are proposed reflect the characteristics of local flood risk identified in Part 2 of the strategy. This in turn draws information derived from multi agency evidence (including Surface Water Management Plans and other flood risk investigations).

25.3 In addition to managing flood risk through regulation, the Lead Local Flood Authority and other Risk Management Authorities will aim to undertake proactive measures to better understand and communicate local flood risks as well as to minimise such risks where it is practicable to do so. In particular, in this first iteration of the strategy, there is an emphasis on developing a better understanding of flood risk in Norfolk and disseminating this information to those who are either affected by flood risk, or have it within their power to influence flood risk.

25.4 Developing a better understanding of flood risk is particularly important, as it is necessary to identify the causes and characteristics of any flood in order to devise appropriate actions to mitigate that risk. Furthermore, in order to ensure that funding can be secured, evidence must be produced to satisfy funding bodies that any proposed mitigation is likely to have a worthwhile impact.

25.5 The table at **Appendix 1** describes the measures that are proposed by the Local Flood Risk Management Strategy, including the planned actions that will be undertaken to implement the measures. The table also indicates the identity of the authority that is leading on each measure, an approximation of the funding requirements and an indication of the proposed timescales.

25.6 The strategy does not indicate priorities for the measures at **Appendix 1**. The Preliminary Flood Risk Assessment indicated the localities with the most concentrated surface run-off risk and further analysis will be undertaken to refine the understanding of the distribution of all sources of local flood risk. Although some of the areas with the most concentrated risk are likely to attract funding, this factor alone is unlikely to be the sole rational for applying resources (see section on Funding below).

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25.7 Alongside the Measures to manage local flood risk that are being proposed by the Local Flood Risk Management Strategy, there are also several other activities being undertaken, that are likely to have secondary benefits in terms of managing flood risk within catchments. In particular there are several river restoration projects that are aiming to improve watercourses with the objective of meeting the standards set by the Water Framework Directive.

25.8 These river restoration projects are primarily intended to improve water quality and river and floodplain habitat, but the schemes may also include restoring natural river channels, connecting rivers to floodplains and reducing silt input into watercourses. Works of this nature are likely to have benefits in terms of reducing flood risk and as such the Lead Local Flood Authority and other Risk Management Authorities will endeavour to work with the organisations leading these projects to secure maximum benefits in relation to reducing flood risks. Table 10 indicates a range of Norfolk environmental projects that have the potential to influence local flood risk and drainage.

Table 10: Norfolk environmental projects that have the potential to influence local flood risk and drainage

Project	**Lead Organisation(s)**
9 Chalk Rivers (Babingley, Bayfield, Burn, Gaywood, Heacham, Hun, Ingol, Mun and Stiffkey chalk rivers)	Norfolk Rivers Trust Norfolk County Council (Norfolk Coast Partnership Team)
Wensum Demonstration Test Catchment project	Wensum Alliance
Broadland Rivers Catchment Plan	The Broadland Catchment Partnership
The Wissey WFD Pilot Catchment Project	The River Wissey Partnership
Little Ouse River Restoration Project	Forestry Commission, Environment Agency, Suffolk County Council
Great Ouse Sediment Strategy	Environment Agency
Upper Wensum Restoration	Norfolk Rivers IDB
Broadland Flood Alleviation Project	Environment Agency
Felbrigg / Upper Scarrow Beck river improvements	National Trust
Blickling - River Bure improvements	National Trust
Ingworth - River Bure mill	National Trust

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bypass channel	
Waveney Valley - diffuse pollution farmer advice	River Waveney Trust
River Waveney improvements at Billingford	River Waveney Trust
Wissey Living Landscape Partnership	Norfolk Wildlife Trust
Ouse Washes Landscape Partnership Scheme	Cambridgeshire ACRE
Lifecycle LIFE+ Green infrastructure and ecosystem	Norfolk County Council
Wensum Restoration Strategy	Environment Agency
River Babingley floodplain restoration	Norfolk Rivers Trust
River Nar restoration – approx. £600k	Norfolk Rivers IDB
Upper Bure catchment improvements and river rehabilitation	Environment Agency
Wilding the Wissey	Environment Agency
Two new country parks to north east of Norwich	Broadland District Council
Silvergate River restoration - Bure	Norfolk Rivers IDB

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26. Funding

FUNDING MECHANISMS

26.1 There are various streams of funding that are, or may be, accessible to Risk Management Authorities. It should be noted that the availability of finance will depend upon the nature of the risk and a variety of other circumstances that might arise at the time funding is sought.

26.2 The following potential sources of funding have been identified in the table below;

Table 11: Sources of funding

Source of Funding	Description	Administered by:	Appropriate for:
Flood and Coastal Risk Management Grant-in-Aid (FCRMGiA)	Central government funding for flood (and coastal) defence projects – recently revised to encourage a partnership approach to maximise match-funding, work towards achieving specified outcomes with a requirement to evidence a reduction in flood risk to properties	Environment Agency	Small, medium and large capital Flood Risk Management (FRM) projects
Local Levy	Annual contributions from Councils to a regional "pot", smaller than the FCRM GiA budget but offers more flexibility on the type and size of project it can fund. Funds can be allocated by RFCCs and can be used for capital investments (as Partnership Funding contributions) by all RMAs and/or revenue investments by the EA.	Environment Agency (as agreed by RFCC, LLFA members)	All FRM projects or as a contribution to FCRMGiA projects
Private Contributions	Voluntary, but funding from beneficiaries of projects could make contributions from national funding viable. Contributions could be financial or "in kind" e.g. land, volunteer labour	Lead RMA for each FRM scheme, (includes all RMAs). Can also include 3rd parties such as community interest companies (CICs)	All projects
Water Company Investment	Investment heavily regulated by Ofwat but opportunities for contributions to area-wide projects which help to address sewer under-capacity problems	Water Company	Projects which reduce flooding from water company assets
Section 106 contributions (Town & Country	Contributions from developers, linked to specific development sites where off-site improvements to drainage infrastructure are required to make the	LLFA and Districts	Larger development sites

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Source of Funding	Description	Administered by:	Appropriate for:
Planning Act)	developers proposals acceptable		
Community Infrastructure Levy (CIL)	A local levy applied by the Planning Authority on developers to contribute to a general infrastructure fund. A bid for CIL would have to be made for flood management/drainage improvements against other competing council priorities. A proportion of CIL is provided to and administered by Parish Councils. As such these may be opportunities for Parish Councils to support FRM schemes through partnership contributions utilising this fund.	Districts and Parish Councils	All measures outlined in the Strategy
Local Enterprise Partnership (LEP)	The LEP is an organisation that aims to create jobs and remove the barriers to growth that exist in Suffolk and Norfolk. One of the barriers that affect a number of growth locations is flood risk. As such it is recognised there may be synergies between investment in flood risk mitigation and increases in economic output and resilience.	New Anglia LEP	Medium to large capital Flood Risk Management (FRM) projects
Ordinary Watercourse Consent Income	Application and inspection fees from developers in support of the approval and inspection of new development affecting ordinary watercourses	LLFA & IDBs	Development drainage approval and FRM issues
Council Tax	A provision within the annual council tax for the specific purpose of addressing FRM.	Districts	Key measures in the Strategy
Business Rates Supplements	Agreement from local businesses to raise rates for specified purposes.	Districts	Measures which address flood risk to businesses
Council Capital Funding	The Council's infrastructure programme prioritising capital improvement projects. The County Council programme has included funding for drainage capacity improvements for a number of years which is targeted at the highway drainage systems	County and Districts	Measures which are small to medium capital projects
Council Revenue Funding	The County Council has a number of revenue streams to support technical and admin processes and to maintain council infrastructure. Existing revenue budgets include Highway Drainage Maintenance, Highway Gully Maintenance, Watercourse Maintenance and funding for the Flood Management Team discharging the LLFA duty for the Council.	County and Districts	Measures requiring officer time and/or maintenance activity

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Source of Funding	Description	Administered by:	Appropriate for:
IDB Income	• Drainage Rates – annually from agricultural landowners • Special Levies – annually from District Authorities • Highland Water Contributions • Development contributions and commuted sums	IDBs/EA	Measures in IDB Areas
IDB Precept	The Environment Agency issues precepts to IDBs requiring payment of any amount required to be contributed by those Boards towards the expenses of the Environment Agency. The Precept allows local funds raised by an IDB to finance works essential to Main River within, adjacent or flowing from or into an IDB's Drainage District.	Environment Agency	Works on Main River within, adjacent or flowing from or into an IDB's Drainage District
General Drainage Charge	A statutory levy introduced in 1963 payable by the occupiers of agricultural land that is not within an Internal Drainage Board district. It is currently applied within the Anglian Northern, Central and Eastern RFCCs areas. The charge forms a financial contribution towards maintenance carried out by the Environment Agency.	Environment Agency	Environment Agency maintenance of FCRM assets
Lead Local Flood Authority funding	Risk based award by Government of revenue funds to upper tier local authorities for delivery of statutory Lead Local Flood Authority functions. It should be noted these funds are not "ring fenced" by central Government.	Defra	Delivery of statutory LLFA functions
European Regional Development Fund & European Agriculture Fund for Rural Development	These funds are primarily focused on job retention and creation across all EU partners. One key priority for these funds is to promote corporate, agricultural and community resilience to flooding and climate change.	EU	Medium resilience revenue schemes
Natural England	Capital Grant Scheme	Natural England	Catchment sensitive farming methods
Trusts, Foundations, Landfill Community Funds, Big Lottery,	Charity sources of funding	Various	Various type of projects, usually small to medium scale capital schemes

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26.3 These funding streams, when successfully secured have the capacity to significantly progress the aims and objectives of the strategy. Risk Management Authorities will endeavour to assess opportunities to develop plans and draw on funds, where possible, from all of the above sources and any other sources that can be identified. However, in Norfolk, the primary funding source (on an annual basis) is likely to be from Flood and Coastal Risk Management Grant-in-Aid (FCRM GiA).

FLOOD AND COASTAL RISK MANAGEMENT GRANT-IN-AID

26.4 The FCRM GiA programme allocates funding based upon the public benefits of a scheme weighed against its cost. Benefits may include reducing flood risk to households, businesses and infrastructure as well as creating habitat for wildlife. Under the programme some schemes will receive full funding, while others will only be allocated partial funding. The Government's intention is that this approach will encourage local beneficiaries to invest in flood risk schemes, enabling more to be achieved from the allocated level of government funding.

26.5 To facilitate access to FCRM GiA funding, it will be important to find alternative sources of match funding. In general the lower the public benefit the greater the match funding that is likely to be required. It is the Government's view that contributions should come from those who gain the most from a scheme and that contributions should be proportionate to the benefits that they will receive.

PRIORITISATION AND DISTRIBUTION OF FUNDING

26.6 It is highly unlikely that sufficient funding will be available to finance all of the mitigation measures that might be desirable in the areas of Norfolk that are at risk of flooding. It follows therefore that some decisions will need to be made about how available funding will be distributed.

26.7 As set out in Part 3 of this strategy Norfolk County Council encourages a risk based approach to the prioritisation of resources. For example Policy UC 8 requires all Risk Management Authorities to support the investment of resources in the areas of highest risk within their respective jurisdictions.

26.8 Decisions on how funding is to be distributed will require the agreement of multiple agencies, but inevitably such decision making will be determined by the assessment and ranking methodologies of the individual funding bodies, each of which is likely to have its own values and priorities.

26.9 In many instances, the cost effectiveness of measures will be a significant factor. If a lot of properties and people can be protected for

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a relatively low cost then that would normally be considered to be an effective way of spending limited financial resources, rather than protecting a small number of properties through the implementation of a resource intensive project.

26.10 Where there are simple and less expensive measures that can be easily undertaken, these may come forward at an earlier stage simply because they are possible and affordable within the timescale of currently available and/or emerging funding streams.

26.11 It may be possible to attract 3rd party funding to projects where the wider benefits are also beneficial to that 3rd party. This can be possible even where the focus of the funding is for non-flood risk benefits e.g. the funding of open space on a new development that can also be used as a flood storage area. In such circumstances mitigation measures may need to be spatially linked to the funders' development, in order that they would benefit from the expenditure.

26.12 In some circumstances, it may simply be impractical to protect properties that are at severe risk of flooding, because of the high cost of doing so, relative to the benefits that might result. In areas where flood mitigation measures are unlikely to be affordable or practical, the Lead Local Flood Authority will endeavour to advise landowners and businesses how they might adapt their property to become more resilient.

26.13 All of the above factors mean that developing a rigid strategy for prioritising expenditure, based purely upon risk may not be possible. Instead, the Lead Local Flood Authority will seek, wherever practicable, to maximise the beneficial use of any available funding, having regard to the limitations and constraints imposed by the relevant funding body.

PARTNERSHIP WORKING AND 3RD PARTY FUNDING

26.14 In order to maximise the potential benefits that might be derived from FCRM GiA, it is proposed that the Norfolk Water Management Partnership (NWMP), with support from the Regional Flood and Coastal Committees (RFCCs) and any other key funding partners, will review this part of the strategy on an annual basis. This will support the identification of appropriate schemes that can be submitted to the capital programme.

26.15 In developing partnership projects RMAs will seek to avoid duplication of activity. Where RMAs identify duplication, schemes should be reviewed to establish if there are mechanisms to combine schemes or realign timescales to maximise the opportunities to communities.

26.16 It is important for RMAs to fully explore opportunities to draw upon sources of funding that are not reliant upon central government. This

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reflects government's 'beneficiaries' pay' principle and would increase the deliverability of any partnership project as many funding programmes prioritise those schemes which attract the greatest amount of 3rd party funding.

26.17 This position is supported by the approximate £4.2 million of 3rd party funding that would be required for Norfolk County Council surface water mitigation schemes to draw in an approximate £6.4 million of government grant in aid funding, as indicated by current treasury guidelines. This level of investment would protect around 3,700 properties across the county and would represent a total investment of £10.6 million from all sources. Considering there are 37,000 properties across the county at risk of surface water flooding the level of investment required by 3rd parties, government and risk management authorities to mitigate this risk is significant.

MONITORING OF MAINTENANCE BUDGETS

26.18 The final measure listed in **Appendix 1** is the monitoring of expenditure on maintenance. The aggregated figure given in the appendix will, over time, give an indication of any variance in maintenance expenditure over the years ahead.

26.19 In the interests of transparency an additional table at **Appendix 2** indicates the breakdown of annual maintenance expenditure by Risk Management Authority. It should be noted that as each authority is responsible for differing levels of risk and different sizes of geographical area, no direct inference can be made about the levels of expenditure without first undertaking a more detailed analysis of wider data.

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27. Monitoring and Review

27.1 The Norfolk Local Flood Risk Management Strategy requires monitoring and review to ensure that its objectives, policies and measures reflect the most up to date evidence base as well as progress in the delivery of flood risk mitigation projects. This on-going monitoring will be undertaken in conjunction with the Norfolk Water Management Partnership and the relevant Committee of Norfolk County Council.

FREQUENCY OF REVIEW

27.2 It is proposed that parts 1 and 2 of this Strategy will be reviewed (and if necessary updated) at five years from the date of the Strategy's final approval and adoption by Norfolk County Council (unless there are revisions to Government legislation or guidance that may require modifications in order to conform).

27.3 It is likely that Part 3 of the strategy (aim, objectives and policies) may be subject to an early review, if it is necessary to take account of any future amendment and/or commencement of schedule 3 of the Flood and Water Management Act 2010, or any other means of approving SuDS that may be proposed by Government. The timing of such a review will be dependent upon the date of legislative change and/or the nature of guidance that accompanies any new process.

27.4 Part 4 of the strategy will be subject to an annual review, to ensure that all stakeholders are kept up to date in respect of planned measures and funding and to introduce any new measures that may have been identified as necessary following investigations that have been undertaken during the year.

27.5 Changes in partner responsibilities, updates to legislation, new information on flood risk and/or significant flooding may require an update to specific sections of the strategy. In these cases this information will be appraised by the Norfolk Water Management Partnership to determine the need for, and level of, review required.

REQUIREMENT FOR MONITORING

27.6 Monitoring is required to measure the effects of implementing the policies and measures of the strategy, as well as any potential effects identified by the Strategic Environmental Assessment. This monitoring should be undertaken in a manner which affords determination of the relative influence of individual policies and measures over the achievement of the Strategies objectives. In addition it should allow the identification of any unanticipated adverse effects of policies and measures and the need to undertake appropriate action.

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FOCUS OF MONITORING

27.7 It is not practicable to monitor every aspect of policies and measures as this would divert a disproportionate amount of resources away from the principal activity of managing flood risk. Monitoring will therefore be targeted to help measure the effectiveness of key objectives and policies within the strategy through the identification of significant effects or trends.

27.8 Table 13 describes the monitoring and implementation regime. It sets out the indicators that will be reviewed and when this information will be collected. This monitoring process will compare the current year conditions against previous data collected by financial year from and including the statistical baseline.

27.9 One of the significant outcomes of flood risk management should be the delivery of activities that contain or reduce both the levels of flood risk and/or the severity of the impact of flooding. This is articulated in this strategy through Objective 3 and in policies UC 7, 8, and 11. This key area of work is already monitored by individual organisations through their programme of works and through the Regional Flood and Coastal Committees in their approved medium term plans (which use government grant in aid amongst other funding sources). For information on RFCC programmes please use the following link; (Eastern RFCC) https://www.gov.uk/government/groups/anglian-eastern-regional-flood-and-coastal-committee (Central RFCC) https://www.gov.uk/government/groups/anglian-central-regional-flood-and-coastal-committee

27.10 This strategy draws on a number of already existing governmental measures used by these committees. These detail the movement of properties in and out of different bandings of flood risk or those removed from flood risk. These bandings are defined by the Environment Agency and are highlighted in the table below. It should be noted that these indicators have not previously been utilised to specify Norfolk-wide trends.

Table 12: EA significance banding

EA Significance Banding	Annual Event Probability	Return periods
Very significant	≥ 5%	Up to and including 1:20
Significant	<5% but >1.33%	Between 1:20 and 1:75
Moderate	≤1.33% but >0.5%	Between 1:75 and 1:200
Low	≤0.5%	Above 1:200

27.11 A number of other indicators have been included in Table 13 to report against Objective 3 and its associated policies. These include metrics

to measure the impact of flood management activities on the number of non-residential buildings and critical infrastructure at risk and to determine the impact of maintenance programmes on levels of risk.

27.12 Objective 4 and policies OW1, 2, 3 and 4 of this strategy set out the role the Lead Local Flood Authority has in minimising flood risk through the regulation of ordinary watercourses for 80% of Norfolk. Monitoring the number of regulatory decisions awarded against the Lead Local Flood Authority at appeal will highlight the level to which this outcome has been achieved.

27.13 It is important to ensure that land use change within existing high risk areas appropriately reflects the influence of development on flooding. This is reflected in this strategy through Objective 5 and policies UC 4 and UC 10. As such decisions in high risk areas that do not provide appropriate measures to mitigate flood risk will be monitored.

27.14 A number of strategy objectives will not be monitored specifically by this document as they do not lend themselves to quantitate measurement. This includes a number of policies under Objective 1 which relate to projects and processes that provide information and mapping to the public. The outputs and outcomes of these policies will be reported to the relevant Council Committee to ensure appropriate scrutiny and progress against this objective. They will also be highlighted in the annual review of this part of the strategy.

27.15 Objective 6 and the policies E1, 2, 3, 4, 5 and 6 of this strategy highlight the interaction that flood risk management activities have with the ecology, biodiversity and morphology within Norfolk's sensitive catchments. The implications that risk management authority decisions and activities have on the achievement of Water Framework Directive outcomes are primarily reported by RMAs to the Environment Agency. However, whilst this is not an area of work that the Lead Local Flood Authority leads on, it remains important to report on the level of overall compliance achieved in support of WFD objectives through decisions and projects.

27.16 The Environment Agency's River Basin Management Plan (RBMP) for the Anglian River Basin District is the lead policy document that sets out and monitors the delivery of activities under the Water Framework Directive. This document can be found using the following link https://www.gov.uk/government/collections/river-basin-management-plans

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Table 13: Monitoring and implementation regime

Link to LFRMS Objective	Link to LFRMS Policy	Indicator(s)	Metric	Agencies responsible	Implementation mechanism	Timescale
Objective 1 - Determine and communicate Local Flood Risk	UC 5 - Publishing flood risk information	Flood risk information published via a range of communication platforms	(Number of publications approved or adopted by the authority)	Lead Local Flood Authority	LLFA Flood investigations, flood risk studies and updates to the asset register published.	On–going throughout time period of Strategy
	UC 9 - Designation of 3rd party structures or features	3rd party structures or features designated	(Number of designations)	All designating authorities	Designation process	On–going throughout time period of Strategy
Objective 2 – Partnership Working	UC 6 - Emergency Planning	Emergency response and recovery plans that reflect local flood risk	(Number of plans reviewed and adopted)	Category 1 and 2 responders	Surface Water Management Plans, Emergency Response and Recovery Plans, Norfolk Resilience Forum, Support to emergency response	On adoption of relevant plans
Objective 3 - Partnership Programmes and Projects	UC7 – Sustainable Flood Management UC 8 - Risk based approach to prioritisation of resources UC 11 - Securing Sustainable	Actual values of investment and levels of protection resulting from Local Flood Risk Management (LFRM) schemes.	(Value in £ of all LFRM schemes) (Number of residential and non-residential properties and critical infrastructure moved out of any flood probability category to a lower probability category)	All Risk Management Authorities	Regional Flood and Coastal Committee (RFCC) capital programmes Risk Management Authority capital programmes	Annual approval of RFCC 6 year programme

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Link to LFRMS Objective	Link to LFRMS Policy	Indicator(s)	Metric	Agencies responsible	Implementation mechanism	Timescale
	Drainage UC3 - Flood Risk Asset Register	Values of investment and levels of protection resulting from LFRM schemes programmed to be delivered in the next 6 years.	(Value in £ of all LFRM schemes) (Number of residential and non-residential properties and critical infrastructure moved out of any flood probability category to a lower probability category)	All Risk Management Authorities	Regional Flood and Coastal Committee capital programmes Risk Management Authority capital programmes	Annual approval of RFCC 6 year programme and RMA budgets
		Total capital spend on local flood risk mitigation delivered through RFCC programme	(Value in £ spent on local flood risk vs value in £ spent on all sources as a %)	All Risk Management Authorities	Regional Flood and Coastal Committee capital programmes	Annual approval of RFCC 6 year programme
		Total 3rd party (non-RMA) capital investment in local flood risk mitigation through RFCC programme.	(Value in £)	All Risk Management Authorities	Regional Flood and Coastal Committee capital programmes	Annual approval of RFCC 6 year programme
		Structures or features included in the LLFA section 21 register that are known not to be operating efficiently due to condition.	(Number of structures on asset register not operating efficiently vs total number of structures on register as a % of total)	LLFA, RMAs and 3rd parties	LLFA Section 21 asset register	On–going throughout time period of Strategy
		Levels of risk resulting from structures on the LLFA section 21 register that are not operating efficiently due to condition.	(Number of properties and critical infrastructure at significant or very significant risk of flooding as a result of structures on the register not operating efficiently)	LLFA	LLFA Section 21 asset register	On–going throughout time period of Strategy

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Link to LFRMS Objective	Link to LFRMS Policy	Indicator(s)	Metric	Agencies responsible	Implementation mechanism	Timescale
		Actual values of revenue investment and levels of protection resulting from maintenance activities undertaken by all RMAs	(Value in £ of total revenue) (Number of residential and non-residential properties and critical infrastructure moved out of any flood probability category to a lower probability category)	All RMAs	Regional Flood and Coastal Committee revenue programmes Risk Management Authority revenue programmes	Annual approval of RFCC 6 year programme and RMA budgets
Objective 4 - Riparian Responsibilities	OW1 - Maintenance of Ordinary Watercourses	Ordinary watercourse regulatory cases where maintenance of watercourses is undertaken without the need for criminal sanctions	(Number of cases as a % of total enforcement cases)	LLFA and Internal Drainage Boards	Ordinary watercourse regulatory process	On–going throughout time period of Strategy
	OW2 – Enforcement	Ordinary watercourse regulatory decisions awarded against the LLFA or IDBs at appeal.	(Number of decisions awarded at appeal vs total number of enforcement cases)	LLFA and Internal Drainage Boards	Ordinary watercourse regulatory process	On–going throughout time period of Strategy
	OW3 - Consenting of works on Ordinary Watercourses OW4 – Culverting	Ordinary watercourse consenting decisions awarded against the LLFA or IDBs at appeal.	(Number of decisions awarded at appeal vs total number of consent cases)	Lead Local Flood Authority	Ordinary watercourse regulatory process	On–going throughout time period of Strategy
Objective 5 - Flood Risk and Development	UC 4 – Critical Drainage Catchments UC 10 - Planning	Local plans containing an appropriate flood risk policy in accordance with this strategy.	(Number of local plans with appropriate policy vs total number of plans)	Local Planning Authorities	LDF process	On adoption of relevant plans and documents

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Link to LFRMS Objective	Link to LFRMS Policy	Indicator(s)	Metric	Agencies responsible	Implementation mechanism	Timescale
		Planning decisions awarded where the LLFA or IDB had recommended refusal.	(Number of decisions vs total number of LLFA or IDB consultations as a %)	Local Planning Authorities	Development management decisions	On-going throughout time period of Strategy
		Strategic Flood Risk Assessments (SFRAs) updated within the review period.	(Number of documents updated vs total number of documents as %)	Local Planning Authorities	LDF process, Surface Water Management Plans	On adoption of relevant plans and documents
		Planning decisions within critical drainage catchment that are awarded without appropriate measures to take into account local flood risk.	(Number of decisions)	Local Planning Authorities, Lead Local Flood Authority	Development management decisions, Surface Water Management Plans	On-going throughout time period of Strategy
Objective 6 - Water Framework Directive	E 1 - Nature Conservation E 2 - Protecting habitats E 3 - Water levels (habitats) E 4 - Ecological Potential E 5 - River Morphology E 6 – Landscaping	Decisions and projects that have led to confirmation of environmental harm or a change in status of a water body classified under the WFD.	(Number of decisions and projects)	Environment Agency Lead Local Flood Authority Risk Management Authorities	Anglian District River Basin Management Plan	Annual review
Objective 7 - Support Water and Sewerage Company infrastructure	UC 12 - Water Company liaison	Properties included on and taken off the DG5 register.	(Number of properties included vs total number of properties listed)	Water Companies	Water Company AMP and investment plan	Annual review

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Appendix 1: Measures

Measure	Action	Aim	Benefit	Lead RMA	Estimated cost	Potential Funding Source	Timescale
Understanding catchments and flood risk (links to Objective 1 - Determine and communicate Local Flood Risk)	Breckland Surface Water Management Plan	• identify areas of significant local flood risk; • communicate that risk to the public, local businesses and Risk Management Authorities; • designate Critical Drainage Catchments where the risk is most significant; • identify actions to mitigate flood risk affecting the Critical Drainage Catchments; and • develop programmes to implement the identified actions	The areas that are at greatest local flood risk will be identified. Accurate information can then be shared between RMAs and the local community. Flood resilience and response measures are updated to reflect risk. Mitigation measures are directed towards areas where the most benefit might be achieved and are implemented or planned through projects and programmes.	Norfolk County Council	£50k	RFCC local levy, RMAs	TBA
	Broadland Surface Water Management Plan				£50k	RFCC local levy, RMAs	TBA
	Great Yarmouth Surface Water Management Plan				£60k	NCC, AW & GYBC	2012-15
	King's Lynn and West Norfolk settlements Surface Water Management Plan				£60k	BCKL&WN	2012-15
	North Norfolk Surface Water Management Plan				£50k	RFCC local levy	2012-16
	Norwich Surface Water Management Plan				£70k	Defra	2011-15
	South Norfolk Surface Water Management Plan				£50k	RFCC local levy, RMAs	TBA
	Assessment of Ordinary Watercourses	Assess Ordinary Watercourses, to better understand their condition and develop appropriate on-going maintenance and funding strategies;			£30k	Defra LLFA funding & RMA funding	2015 onwards

Measure	Action	Aim	Benefit	Lead RMA	Estimated cost	Potential Funding Source	Timescale
	Deliver LLFA asset records and register	Develop a record of all assets, structures and features that affect flood risk and develop a register of those assets, structures and features critical to managing flood risk.	By recording all significant assets structures and features that affect flood risk, the Lead Local Flood Authority can highlight to RMAs, riparian owners and the public the importance of those assets in managing flood risk.	Norfolk County Council	£30k p.a.	Defra LLFA funding	2012 onwards
	Catchment Mapping	Review catchment mapping in light of any new evidence.	Understanding and defining the boundaries and extent of catchments provides the ability to strategically manage local flood risk on a catchment wide basis.	Norfolk County Council	£10k	Defra LLFA funding	2013 onwards
	Groundwater flood risk study	Determine an effective means of investigating groundwater flood risks across Norfolk.	The extent of groundwater flood risk is not currently understood. Further research in this field will enhance knowledge of the risk and enable appropriate mitigation to be planned and implemented.	Norfolk County Council	£20k	Defra LLFA funding and RMA funding	TBA
	Installation of Rain Gauges	The provision of additional rain gauges in Norfolk.	Rain gauges enable the accurate assessment of individual rainfall events that cause flooding. This analysis provides a greater understanding of the ability of existing and planned water management systems to mitigate flooding. This action directly supports LLFA flood investigations.	Norfolk County Council, Environment Agency, Anglian Water	£15k	Defra LLFA funding, RMA funding and RFCC local levy	2015-16
Disseminating Knowledge (links to Objective 1 - Determine and	Education Programme (e.g. seminars and lectures).	• Increasing awareness of flood risks and flood risk management;	Engaging directly with development professionals, land and property owners and staff in local authorities increases the	Norfolk County Council	As required	Defra LLFA funding	On-going

Measure	Action	Aim	Benefit	Lead RMA	Estimated cost	Potential Funding Source	Timescale
communicate Local Flood Risk)		• Providing access to information about the techniques and products that can enable mitigation, defence or resilience measures; • Providing design guidance; and • Providing advice about seeking the appropriate consents.	understanding of flood risk management. This increases the potential influence of outcomes and levels of cooperation in other sectors.				
	Published Guidance (e.g. publishing research findings, guidance leaflets, undertake marketing programme and dissemination via media).		Publishing evidence and guidance will enhance the knowledge of RMA's, 3rd parties and the public and enable those who are in a position to influence and mitigate Local Flood Risk to formulate plans and implement works.	Norfolk County Council	As required	Defra LLFA funding	On-going
	Web based resources (e.g. displaying LLFA information online and signposting of other web resources).			Norfolk County Council	As required	Defra LLFA funding	On-going
Partnership coordination and working (links to Objective 2 – Partnership working)	Promote partnership working	Lead and support the Norfolk Water Management Partnership officer and member groups to communicate and share best practice between Norfolk RMAs.	All Norfolk RMAs are aware of their role and responsibilities and that of the LLFA. Partnership opportunities are identified and actioned.	Norfolk County Council	£5k	Defra LLFA funding	On-going
	Review of Water Level Management Plans and System Asset Management Plans	Work with the Environment Agency and IDBs to ensure that local flood risk is taken into account within Water Level Management Plans and System Asset Management Plans.	These documents establish the relative importance of, or environmental restrictions on, the operation of water management systems that also mitigate flood risk. Engaging in this process will enable the LLFA to better understand the resilience and mitigation provided by assets and to affect long term planning.	Environment Agency, Internal Drainage Boards, Norfolk County Council	£10k	Defra LLFA funding and RMA funding	2015-17

Measure	Action	Aim	Benefit	Lead RMA	Estimated cost	Potential Funding Source	Timescale
	Critical infrastructure flood risk assessment	Identify key infrastructure and services that are vulnerable to flood risk and investigate the potential need for mitigation measures	Flood risks to critical infrastructure are identified and appropriate mitigation is planned and programmed for.	Norfolk County Council, all RMAs and NRF	£30k	Defra LLFA funding and RMA funding	2016-17
	Disseminate outputs of local flood risk studies and investigations to the Local Resilience Forum (LRF) and multi-agency flood plans.	To ensure that Local Flood Risk is reflected and integrated into the activities of the Local Resilience Forum and multi-agency flood plans.	The LRF and its emergency response and recovery plans direct emergency activities to the areas where the greatest benefit can be realised whilst not impacting others.	Norfolk County Council, Environment Agency, LRF	£5k	Defra LLFA funding and RMA funding	2011 onwards
	Highway flood risk investigation	To identify and prioritise risk of flooding on priority highway routes and develop mitigation measures to manage the identified risk.	Flood risk on roads is better communicated to the public through warning signage and highway drainage investment reflects risks to the network.	Norfolk County Council and Highways Agency	£30k	Defra LLFA funding and RMA funding	2016-17
Flood mitigation funding (links to Objective 3 - Partnership Programmes and Projects)	Identify funding opportunities including 3rd party funding for areas of local flood risk	To have a complete portfolio of "shovel ready" local flood risk partnership projects that reflects the need across Norfolk.	Partnership projects can take advantage of all upcoming funding opportunities.	Norfolk County Council and RMAs	£25k p.a.	Defra LLFA funding and RMA funding	2012 onwards
Monitoring Maintenance Spend (links to Objective 3 - Partnership Programmes and Projects)	Norfolk Risk Management Authorities	Review previous year's revenue spending on maintenance in Norfolk.	Annual monitoring of maintenance spending can, over time, indicate a potential increase or decrease in residual flood risks. Knowledge of any such changes could alert RMAs of the need to reassess their understanding of the known risks and adapt to any change.	Norfolk County Council	£5k	Defra LLFA funding	2014 onwards

Measure	Action	Aim	Benefit	Lead RMA	Estimated cost	Potential Funding Source	Timescale
Implementation of identified mitigation measures (links to Objective 3 - Partnership Programmes and Projects)	Caister on Sea Flood Risk Mitigation Project	Protection to businesses, critical services and transport infrastructure at risk from surface water flooding through retrofitting SuDS, flood defences, increased capacity and conveyance of drainage systems and improved land management practices. Improvement to water quality discharging to the main river or the sea, positive contribution to WFD objectives.	Protection of 175 properties to a 1 in 100 standard	Norfolk County Council	£800k	Defra GiA, RFCC local levy, NCC, RMAs 3rd party funding	2021-22 onwards
	Cromer Sustainable Urban Drainage Retrofit Scheme		Protection of 348 properties to a 1 in 100 standard	Norfolk County Council	£825k		2014-15 to 2020-21
	Diss Flood Risk Mitigation scheme		Protection of 205 properties to a 1 in 100 standard	Norfolk County Council	£550k		2021-22 onwards
	Downham Market Flood Risk Mitigation Scheme		Protection of 187 properties to a 1 in 100 standard	Norfolk County Council	£550k		2021-22 onwards
	Great Yarmouth Surface Water Mitigation Scheme		Protection of 146 properties to a 1 in 100 standard	Norfolk County Council	£1,150k		2014-15 to 2024-25
	Harleston Flood Risk Mitigation Scheme		Protection of 140 properties to a 1 in 100 standard	Norfolk County Council	£550k		2021-22 onwards
	Heacham Flood Risk Mitigation Scheme		Protection of 29 properties to a 1 in 100 standard	Norfolk County Council	£275k		2021-22 onwards
	Hemsby Flood Risk Mitigation Project		Protection of 89 properties to a 1 in 100 standard	Norfolk County Council	£275k		2015-16 to 2016-17
	King's Lynn Flood Risk Mitigation Scheme		Protection of 299 properties to a 1 in 100 standard	Norfolk County Council	£1,100k		2015-16 to 2018-19
	North Walsham Sustainable Urban Drainage Retrofit Scheme		Protection of 220 properties to a 1 in 100 standard	Norfolk County Council	£525k		2014-15 to 2019-20
	Norwich: Catton Grove and Sewell Sustainable Urban drainage Retrofit Scheme		Protection of 847 properties to a 1 in 100 standard	Norfolk County Council	£500k		2016-17 to 2018-19
	Norwich: Drayton Sustainable Urban drainage Retrofit Scheme		Protection of 86 properties to a 1 in 100 standard	Norfolk County Council	£500k		2021-22 onwards

Measure	Action	Aim	Benefit	Lead RMA	Estimated cost	Potential Funding Source	Timescale
	Norwich: Nelson and Town Close Sustainable Urban drainage Retrofit Scheme		Protection of 667 properties to a 1 in 100 standard	Norfolk County Council	£500k		2016-17 to 2018-19
	Sheringham Sustainable Urban Drainage Retrofit Scheme		Protection of 106 properties to a 1 in 100 standard	Norfolk County Council	£575k		2014-15 to 2016-17
	Wymondham Flood Risk Mitigation Scheme		Protection of 217 properties to a 1 in 100 standard	Norfolk County Council	£825k		2021-22 onwards
	A1101 Wash Road Welney Improvement Scheme	Investigate the practicality of reducing the frequency and extent of flooding on the A1101 Wash Road, at Welney	The options for improving the connectivity between local communities would be determined and where appropriate and cost effective mitigated.	Norfolk County Council	£1,100k	NCC, DfT, LEP, RFCC local levy, 3rd parties	2014-15 to 2016-17
	Islington Catchment Flood Risk Management Scheme	Undertake appraisal of options for increasing flood storage, diverting flows and/or the construction of a new pumping station. Deliver most appropriate mitigation options.	Provide protection to 762 residential and 60 commercial properties	Kings Lynn IDB	£12,313k	Defra, IDB, and RFCC local levy funding	2015-16 to 2019-20
Delivery of small scale projects (links to Objective 3 - Partnership Programmes and Projects)	Installation of Property Level Protection	Identify opportunities for initiating property level protection, where flood mitigation or defence measures to protect a general area may be inappropriate or unaffordable	Properties are more resistant to flood risk when it occurs.	All RMAs	£4-25k per property	RFCC local levy and Defra GiA	TBA
	Installation of Highways Warning Signage for subways underpasses and fords.	Identify areas of highways infrastructure that are at risk of severe local flood risk effects and develop warning signage that will better inform the public of the risk.	The public are better informed of flood risks on the highway. This reduces the likelihood of accidents and injury during flood conditions.	Norfolk County Council	£30k	NCC, Highways Agency and RMAs	TBA
Deliver local flood risk regulation (links	Ordinary Watercourse Regulation	Promote riparian responsibilities in high risk areas and where necessary consent and enforce 3rd	Flood risk on ordinary watercourses is not increased or is mitigated by 3rd party	Norfolk County Council, IDBs, District	£30k	RMA funding	2012 onwards

Measure	Action	Aim	Benefit	Lead RMA	Estimated cost	Potential Funding Source	Timescale
to Objective 4 – Riparian responsibilities)		party activities on ordinary watercourses that affect flood risk.	activities.	Councils			
	Designation of 3rd Party Structures	Designate those significant 3rd party assets, structures and features that need protecting.	Designation gives legal protection to assets, structures and features and enables control of any unauthorised alterations, thus preventing any unmanaged changes affecting flood risk.	All designating authorities	TBC	Defra LLFA funding and RMA funding	2015 onwards
Support for local planning authorities (links to Objective 5 – Flood Risk and Development)	Provide targeted and proportionate advice to local planning authorities on local flood risk	To inform local planning authority officers of local flood risk within their district as determined by Surface Water Management Plans and EA mapping.	Development control / management planning decisions will take into account the best available evidence of flood risk when determining planning applications.	Norfolk County Council, Environment Agency, District Councils	£60k	Defra LLFA funding and RMA funding	2012 onwards
	Provide advice to local planning authorities on appropriate development plan policies when they are developed and updated.	To ensure local planning authority development plans include appropriate policies that reflect the local flood risk within their district.	Development control / management planning officers are supported in their decisions by appropriately local plan policies and evidence that guide appropriate development decisions.	Norfolk County Council, Environment Agency, District Councils	£40k	Defra LLFA funding	2012 onwards

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Appendix 2: Breakdown of Maintenance Expenditure by Risk Management Authorities

Risk Management Authority	Annual maintenance spend 2013-14	% of Norfolk covered by RMA	% of RMA area in Norfolk
Environment Agency (Eastern RFCC Area)	£1,935k	60%	35.9%
Environment Agency (Central RFCC Area)	£708k	39.4%	24.7%
Environment Agency (Northern RFCC Area)	£110k	0.6%	0.3%
Breckland District Council	£5k	24%	100%
Broadland District Council	£0**	10%	100%
Great Yarmouth Borough Council	£TBC	3%	100%
Borough Council of King's Lynn and West Norfolk	£11k	28%	100%
North Norfolk District Council	£60k	18%	100%
Norwich City Council	£2.5k	<1%	100%
South Norfolk District Council	£TBC	17%	100%
Anglian Water Services Ltd	£TBC	100%	TBC
Highways Agency	£150k*	n/a	n/a
Norfolk County Council Highways	£2,638k	100%	100%
Broads (2006) IDB	£880k	3%	100%
King's Lynn IDB	£1,426k	6%	92%
Norfolk Rivers IDB	£279k	3%	100%
Downham & Stow Bardolph IDB	£93k	<1%	100%
East of the Ouse, Polver and Nar IDB	£270k	1%	100%
Northwold IDB	£4k	<1%	100%
Southery & District IDB	£330k	2%	100%
Stoke Ferry IDB	£80k	<1%	100%
Stringside IDB	£6k	<1%	100%
Churchfield & Plawfield IDB	£9k	<1%	100%
Euximoor IDB	£41k*	<1%	<1%
Hundred Foot Washes IDB	£7k*	<1%	30%
Hundred of Wisbech IDB	£78k*	<1%	<1%
Needham & Ladus IDB	£14k*	<1%	25%
Manea and Welney DDC	£60k*	<1%	15%
Nordelph IDB	£4k	<1%	100%
Upwell IDB	£104k*	<1%	76%
East Harling IDB	£41k	<1%	100%
Waveney, Lower Yare & Lothingland IDB	£327k*	2%	68%
Burnt Fen IDB	£161k*	<1%	3%
Littleport and Downham IDB	£525k*	<1%	23%
Middle Level Commissioners	£TBC	TBC	TBC
TOTAL:	**£10,359k**		

* = This figure is not a Norfolk specific figure as the RMA could not disaggregate county specific spend from their total spend. ** = Can access limited emergency funding in extremis.

Appendix 3: Glossary

Term	Definition
B	
Breach	Flooding caused by the constructional failure of a flood defence or other structure that is acting as a flood defence.
C	
Catchment	The area contributing surface water runoff flow to a point on a drainage or river system. Can be divided into sub-catchments.
Catchment Flood Management Plans (CFMPs)	A strategic planning document through which the Environment Agency identifies and agrees policies for the sustainable management of fluvial flood risks that affect people and the developed and natural environment.
Climate Change	The change in average conditions of the atmosphere near the Earth's surface over a long period of time.
Combined sewer	A sewer designated to carry foul sewage and surface water sewage in the same pipe.
Competent Authority	An authority or authorities identified under Article 3(2) or 3(3) of the Water Framework Directive. The Competent Authority will be responsible for the application of the rules of the Directive within each river basin district lying within its territory.
Control structure	Structure to control the volume or rate of flow of water through or over it.
Critical Drainage Catchment (CDC)	An area of significant flood risk, characterised by the amount of surface runoff that drains into the area, the topography and hydraulic conditions of the pathway (e.g. sewer, river system), and the receptors (people, properties and infrastructure) that may be affected.
Critical Infrastructure	Assets and critical services that are essential for the functioning of a society and economy, such as power generation sites, pumping stations, trunk roads, communication systems, schools and hospitals
Culvert[8]	A covered channel or pipe which prevents the obstruction of a watercourse or drainage path by an artificial construction.

[8] This definition is provided by Schedule 2 of the Flood and Water Management Act 2010 which amended Section 72 (interpretation) of the Land Drainage Act 1991.

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D	
Designating Authority	‘Designating Authority’ means (a) the Environment Agency (EA), (b) a Lead Local Flood Authority (LLFA), (c) a District Council, (d) an Internal Drainage Board (IDB).
E	
Efficiency	‘Efficiency’ means the designed or rehabilitated standard of flood protection (return period) afforded by a drainage structure or structures that make up a water management system. This would normally be expressed more generally in return periods or specifically in percentile figures.
Extreme Weather Events	Extreme weather describes weather phenomena that are at the extremes of the historical distribution, especially severe or unseasonal weather.
F	
Flood	Section 1 of the Flood and Water Management Act 2010 states that ““Flood” includes any case where land not normally covered by water becomes covered by water.” For the purposes of the Act a flood does not include a flood from any part of a sewerage system, unless wholly or partly caused by an increase in the volume of rainwater (including snow and other precipitation) entering or otherwise affecting the system, or a flood cause by a burst water main (within the meaning given by section 219 of the Water Industry Act 1991).
Flood and Water Management Act 2010 (FWMA)	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Flood frequency	The probability of a flow rate being exceeded in any year.
Flood plain	Land adjacent to a watercourse that would be subject to repeated flooding under natural conditions.
Flood Resilience	The ability to return to pre-flood condition after flooding has occurred.
Flood Risk Management	The activity of understanding the probability and consequences of flooding, and seeking to modify these factors to manage flood risk to people, property and the environment in line with agreed policy objectives.

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Flood risk management function	Means a function listed (below) which may be exercised by a risk management authority for a purpose connected with flood risk management. The functions are; [a] A function defined by the Flood & Water Management Act 2010 [b] A function under section 159 or 160 of the Water Resources Act 1991 and [c] a flood defence function under section 221 of the WRA1991. [d] a function under the Land Drainage Act 1991 [e] a function under section 100, 101, 110 or 339 of the Highways Act 1980
Flood Zones 2 and 3	Flood Zone 2 identifies areas at risk of having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year. Flood Zone 3 identifies areas where water has to flow or be stored in times of flood.
Fluvial	Flooding from rivers, such as the River Wensum is referred to as fluvial flooding. This type of flooding occurs when rivers burst their banks as a result of sustained or intense rainfall.
G	
Greenfield runoff	The surface water runoff regime from a site before development or the existing site conditions for Brownfield redevelopment sites.
Ground Water[9]	The water which is below the surface of the ground and in direct contact with the ground or subsoil.
Groundwater flooding	Occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable strata are particularly susceptible.
H	
Highways Agency	The government agency responsible for strategic highways in England, i.e. motorways and trunk roads.
Highways Authority	A local authority with responsibility for the maintenance and drainage of highways maintainable at public expense. Or Has the meaning given by section 1 of the Highways Act 1980
Highway drain	A conduit draining the highway, maintainable at the public expense and vested in the highway authority.

[9] Defined by the Flood and Water Management Act 2010

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I	
Impermeable	Material that will not allow water to pass through it.
Internal Drainage Board (IDB)	Has the same meaning as in section 1 of the Land Drainage Act 1991
L	
Lead Local Flood Authority (LLFA)	The unitary authority for the area, or if there is no unitary authority, the county council for the area. They are responsible for local flood risk management, (in Norfolk this is Norfolk County Council).
Local Flood Risk	Local Flood Risk is defined by the Flood and Water Management Act 2010 as being flood risk from surface runoff, groundwater and ordinary watercourses.
Local Planning Authority (LPA)	The public authority whose duty it is to carry out specific planning functions for a particular area.
M	
Main River[10]	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers.
O	
Ordinary Watercourse[11]	"Ordinary Watercourse" means a watercourse that does not form part of a main river. Every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a main river.
Outfall	Structure through which water is discharged into a channel or other body of water.
P	
Pitt review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial Flooding	Flooding resulting from rainfall, occurring after short, intense downpours which cannot be quickly enough evacuated by the drainage system or infiltrated to the ground.

[10] For full definition see Section 113 of the Water Resources Act 1991
[11] Definition provided by Section 6 (3) of the Flood and Water Management Act 2010 and Section 72 (1) of the Land Drainage Act 1991

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Preliminary Flood Risk Assessment (PFRA)	The Preliminary Flood Risk Assessment (PFRA) process provides a consistent high level overview of the potential risk of flooding from local sources such as surface water, groundwater and ordinary water courses. Past flood events and mapping of potential future flooding are analysed to highlight the areas of locally significant flood risk.
Public Sewer	A sewer that is vested in and maintained by a sewerage undertaker.
Pumped System	A water management system where water levels are controlled by and, dependent on, the artificial pumping of water.
R	
Rainfall event	A single occurrence of rainfall before and after which there is a dry period that is sufficient to allow its effect on the drainage system to be defined.
Residual Risk	The risk that remains after risk management and mitigation has been undertaken.
Return period	Refers to how often an event occurs. A 100-year storm refers to the storm that occurs on average once every hundred years. In other word, its annual probability of exceedance is 1% (1/100).
Riparian Owner	Legal term for owners of land adjoining, above or with a watercourse running through it, therefore having certain rights and responsibilities. Under common law you are normally a 'riparian owner' if you own land with, or property adjacent to a watercourse (see definition of watercourse below). The duties of a riparian owner are set in the Law of Property Act 1925 (Section 62).
Risk[12]	"Risk" means a risk in respect of an occurrence assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences.
Risk Management	Means anything done for the purpose of; [a] analysing a risk, [b] assessing a risk, [c] reducing a risk, [d] reducing a component in the assessment of a risk, [e] altering the balance of factors combined in assessing a risk, [f] otherwise taking action in respect of a risk or a factor relevant to the assessment of a risk (including action for the purpose of flood defence).

[12] Definition provided by Section 2 of the Flood and Water Management Act 2010

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Risk Management Authorities (RMAs)	Organisations that have a key role in flood and coastal erosion risk management as defined by the Flood and Water Management Act 2010. These are the Environment Agency, Lead Local Flood Authorities (LLFA's), district councils where there is no unitary authority, internal drainage boards, water companies and highways authorities.
River Basin Management Plans (RBMPs)	Describes the main issues to be addressed under the Water Framework Directive for each river basin district and highlights some key actions proposed for dealing with them.
Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or if rainfall is particularly intense.
S	
Sewage Undertaker	The water company appointed by the Secretary of State or Ofwat as the sewerage undertaker for a particular area.
Sewer Flooding	Flooding that occurs as a result of heavy rainfall exceeding the capacity of the underground system.
Special Areas of Conservation (SAC)	Areas given special protection under the European Union's Habitats Directive, which is transposed into UK law by the Habitats and Conservation of Species Regulations 2010.
Strategic Environmental Assessment (SEA)	Identification of the significant environmental effects that is likely to result from the implementation of the plan or alternative approaches to the plan. It intends to increase the consideration of environmental issues during decision making related to strategic documents such as plans, programmes and strategies.
Strategic Flood Risk Assessment (SFRA)	A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future. A SFRA takes into account the impacts of climate change and assesses the impact that land use changes and development in the area will have on flood risk.
Sub-catchment	A division of a catchment, to allow surface water runoff to be managed as near to the source as is reasonable.

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SuDS Approving Body (SAB)	The SAB (SuDS Approving Body), as defined by the Floods and Water Management Act, was to be responsible for approving drainage applications in accordance with the National Standards and then taking ownership of all drainage units serving more than one property. The legislation to enable this duty had not been implemented at the time this strategy was published.
Surface Runoff[13]	Rainwater (including snow and other precipitation) which (a) is on the surface of the ground (whether or not it is moving), and (b) has not entered a watercourse, drainage system or public sewer.
Surface Water	All bodies of water on the surface of the earth.
Surface Water Flooding	Surface water flooding is a general term for local flood risk.
Surface Water Management Plan (SWMP)	A Surface Water Management Plan (SWMP) takes a comprehensive look at the causes of surface water flooding and its consequences, using historical flood records and detailed models of potential future floods.
Surface water sewer	The surface water sewer is designed to carry water such as rainwater from roof, driveway, patios and roads directly to a local river, stream or soakaway
Sustainable Drainage Systems (SuDS)	A sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques. They aim to mimic or improve the natural drainage of a greenfield catchment.
Swale	Swales are shallow, broad and vegetated channels designed to store and/or convey runoff and remove pollutants. They may be used as conveyance structures to pass the runoff to the next stage of the treatment train and can be designed to promote infiltration where soil and groundwater conditions allow.
T	
Tidal Locking	Prevention of water to drain from a watercourse, such as rivers as result of high tides creating a barrier.

[13] Definition provided by Section 6 of the Flood and Water Management Act 2010

W	
Watercourse[14]	The term “watercourse” includes all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows.
Water Control Structures	Means a structure or appliance for introducing water into any watercourse and for controlling or regulating or affecting flow, and includes any sluice, slacker, floodgate, lock, weir, pump or pumping machinery.
Water Cycle Study (WCS)	A method for determining what sustainable water infrastructure is required and where and when it is needed. A Water Cycle Study is undertaken to analyses potential Environmental constraints (water quality, water resource availability and flooding) and Infrastructure constraints (wastewater treatment flow, wastewater treatment quality and water supply) for a particular region, area or territory
Water Framework Directive (WFD)	The European Water Framework Directive came into force in December 2000 and became part of UK law in December 2003. It gives us an opportunity to plan and deliver a better water environment, focusing on ecology.
Water Management Systems	‘Water management systems’ means structures or features aggregated to provide a water management function within a defined area.
Water Table	The point where the surface of groundwater can be detected. The water table may change with the seasons and the annual rainfall.
Weir	A weir is a barrier across a river/watercourse designed to alter its flow characteristics. In most cases, weirs take the form of obstructions smaller than most conventional dams, pooling water behind them while also allowing it to flow steadily over their tops. Weirs are commonly used to alter the flow of rivers to prevent flooding, measure discharge, and help render rivers navigable.

[14] Definition provided by Section 72 (1) of the Land Drainage Act 1991

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Appendix 4: Abbreviations

A	
ABI	Association of British Insurers
ADA	Association of Drainage Authorities
AWS	Anglian Water Services
B	
BCKLWN	Borough Council of King's Lynn and West Norfolk
BDC	Broadland District Council
BGS	British Geological Survey
BKDC	Breckland District Council
C	
CDA	Critical Drainage Area
CDC	Critical Drainage Catchment
CES	Community and Environmental Services department of Norfolk County Council
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
CLG	(The Department for) Communities and Local Government
D	
Defra	(The) Department for the Environment, Food and Rural Affairs
DG5	Water companies register of properties that have flooded from sewers and are at risk of flooding again.
E	
EA	Environment Agency
F	
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act 2010
G	
GIS	Geographical Information System
GYBC	Great Yarmouth Borough Council
I	
IDB	Internal Drainage Board
IDD	Internal Drainage District
L	
LDF	Local Development Framework
LFRMS	Local Flood Risk Management Strategy
LGA	Local Government Association
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum

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N	
NCC	Norfolk County Council
NCityC	Norwich City Council
NFF	National Flood Forum
NNDC	North Norfolk District Council
NPPF	National Planning Policy Framework
NRF	Norfolk Resilience Forum
NWMP	Norfolk Water Management Partnership
P	
PFRA	Preliminary Flood Risk Assessment
R	
RBMP	River Basin Management Plan
RFCC	Regional Flood and Coastal Committee
RMA	Risk Management Authority
S	
SAB	SuDS Approval Body
SAC	Special Areas of Conservation
SAMP	System Asset Management Plan
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SNDC	South Norfolk District Council
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
W	
WCS	Water Cycle Study or Strategy
WFD	Water Framework Directive
WLMP	Water Level Management Plan

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