Broadland
Futures Initiative

Origins of the Plan Area

Contents

Photo on cover sheet is aerial shot of the Upper Thurne and Hickling Broad © Mike Page

1. Introduction

The Broadland Futures Initiative

The **Broadland Futures Initiative** (BFI) is a partnership for future flood risk management in the Broadland area. Our main goal is to agree a plan for future flood risk management that better copes with changing climate and rising sea level. The focus will be on what will happen from the mid-2020s onwards, however we need to start planning now to secure support and make well-informed decisions.

This document is an introduction to the plan area of the BFI. It highlights the characteristics of the area today and provides a chronology of key events in the past that have shaped its landscape and culture.

The Plan Area

The BFI plan area includes the full extent of the Broads Authority executive area and key stretches of the coastline which could influence flooding in the Broads. Refer to the map on page 3. The plan area is predominantly in east Norfolk but also crosses into north east Suffolk.

Description of Plan Area Today

The Broadland landscape is a rich mosaic of wetland habitats, farmland and winding waterways. At its heart is the Broads Authority executive area which operates as one of the 15 National Parks in the UK, with the added responsibility for navigation.

The Broads are a network of navigable rivers and lakes; there are six rivers in the plan area. The upper valleys are underlain by thick deposits of peat whereas the vegetation of the lower valleys is predominantly underlain by clay (with some smaller peat layers below the surface). Areas near to the river network are usually a gravel and sand mix.

The broads themselves are the flooded remnants of old peat works and are man-made. Large areas of the Broads are not accessible by foot due to the mixture of open water, reed swamp and wet woodland. These areas feel unspoilt and untouched.

The Broads are home to one of the rarest breeding birds in the UK- the Bittern

A Bittern © Broads Authority – Brian Macfarlane

The Broads are Britain's largest protected wetland, attracting many wildlife watchers. 25% of the National Park area is internationally designated and recognised for its biodiversity[1]. It is home to over a quarter of the rarest species in the country.

The plan area is low lying; **60% of the Broadland area is at or below mean sea level**[2]. It contains large, open areas of grazing marsh along the lower reaches of the rivers, such as at Halvergate Marshes near Great Yarmouth. There are also large stretches of reed beds (reed cutting still occurs and is sold for thatching), wet woodland and fen.

Thatching is still used in Norfolk - see video link for more information: https://www.youtube.com/watch?v=RZ_Fq7ab3EE&feature=emb_title

Saltmarsh and intertidal mudflats are restricted to Breydon Water. This area used to be the location of a much more extensive estuary in Roman times.

The Eccles to Winterton stretch of coast is dominated by sandy beaches and dunes. The dunes are vegetated with hardy shrubs and grasses such as marram grass. Horsey Gap is a popular site for seal watching. The Walcott frontage also has sandy beaches but with the area behind the sea wall occupied by houses.

25% of the Broads National Park is internationally designated and is home to over a quarter of the rarest wetland species in the country

Within Broadland there are many historic towns and villages as well as characteristic drainage mills. The mills are in varying condition with some undergoing restoration to ensure that these iconic structures survive for future generations.

Wherries and motor boats on the Broads © Broads Authority - James Bass

Wherries (trading and passenger boats originating from the 17th century) can still be seen on the Broads and have a distinctive large sail. A more common sight is modern motor and sailing boats, both private and for hire. Sailing clubs organise regattas (boat races) on the larger broads and along the rivers.

There are 8 million visitors every year with an economic impact of £632m, supporting 7,355 jobs[3]

50% of the land use in Broadland is for agriculture[4], with the area particularly important for traditional cattle grazing. Tourism also contributes significantly to the economy; not only for boating/sailing, but also fishing. The Broads are an ideal location and of national importance for fishing with a diverse range of species including bream, perch, roach, rudd and pike.

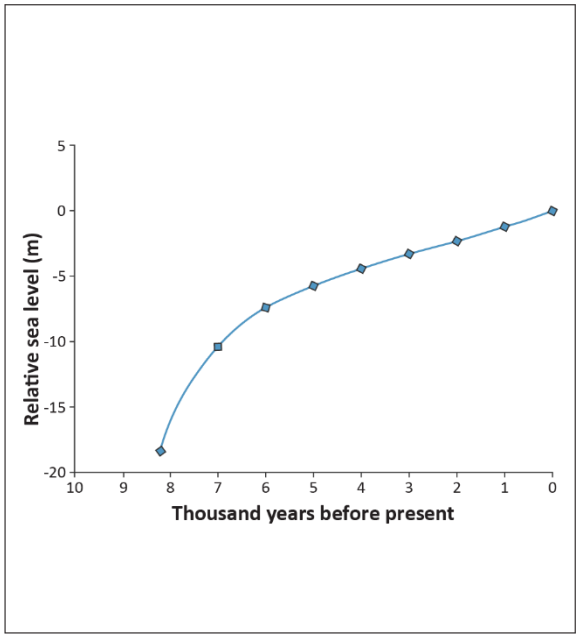
There are over 8 million[3] visitors to the Broads National Park annually. This produces an income of £632m, supporting 7,355 jobs - testament to the unique landscapes of the area. Great Yarmouth is one of the UK's top ten seaside resorts and 35% of jobs in Great Yarmouth are tourism related[5]. Great Yarmouth is also an important port and provides support to the oil and gas rigs as well as offshore wind farms.

BFI plan area extent. The figure contains OS data © Crown copyright [and database right] 2020.

2. History of the Plan Area

Since the last Ice Age the positioning of the coast of Norfolk has changed dramatically. This is predominantly due to a continual rise in sea levels. At the last glacial maximum, approximately 20,000 years ago, sea level was over 100m below current. After the last Ice Age sea levels rose due to the melting of ice. Additionally, the majority of the ice sheet lay over the north of the UK. The melting of the sheet caused a see-saw effect, with the land to the north rising whilst land in the south east subsided. There is evidence that this is still occurring today.

The physical development and present-day habitat and land use of the Broadland area has been shaped by a rise in sea levels, as well as the erosion and deposition of material around the coast and historical changes in climate.



Sea level rise over the last 9,000 years for North Norfolk (replicated from Shennan et al, 2000)

Last Glaciation, Mesolithic and Neolithic Periods (10,000-2,500 BC)

At the end of the last glaciation, owing to lower sea levels, England and continental Europe were connected by a strip of land called Doggerland. This land bridge is the area where the North Sea is today.

Emerged land in Europe at the end of last glaciation including Doggerland

By the Mesolithic Period, the sea level had risen significantly due to melting of major ice sheets. This rise changed the shape of the coast and submerged Doggerland. It also reduced river drainage owing to the higher sea level. For Broadland this resulted in wetter swampier freshwater conditions. Large areas of vegetation became submerged and died leading to deposition of organic material forming a 'lower peat' layer. This lasted from around 7,000 to 5,500 BC.

From around 5,500 to 2,500 BC, which is up to the end of the Neolithic Period, the continued rise in sea level meant Broadland

comprised a large estuary, with the sea extending up the river valleys resulting in the deposition of a thick layer of clay, up to 11m deep in Halvergate, called the 'lower clay'.

Bronze Age and Iron Age (2,500 BC-50 AD)

Around 2,500 BC sand and shingle carried by longshore drift on the coast began to block the mouth of the estuary. Due to the accumulation of sediment more sheltered conditions prevailed.

Freshwater vegetation was able to expand down the river valleys, replacing former areas of saltmarsh and mudflat. The resulting swampy habitats and wet woodland existed for around 2,000 years and led to the laying down of the 'middle peat'. Farming at this time occurred on the higher ground away from the wetter river valleys. The start of the Iron Age was marked by a colder and wetter climate giving rise to larger and more erosive river flows. This could have contributed to the breakdown of the sand and shingle spit at the coast. A large storm surge could also have eroded the spit. The spit breakdown resulted in the return to a large, open saltwater estuary called the Great Estuary that reached further up the river valleys than it had previously and causing an 'upper clay' layer to be deposited. Due to the formation of the Great Estuary, relative water levels in Broadland are likely to have been higher than some of the managed levels we see today.

Roman Period (50-400 AD)

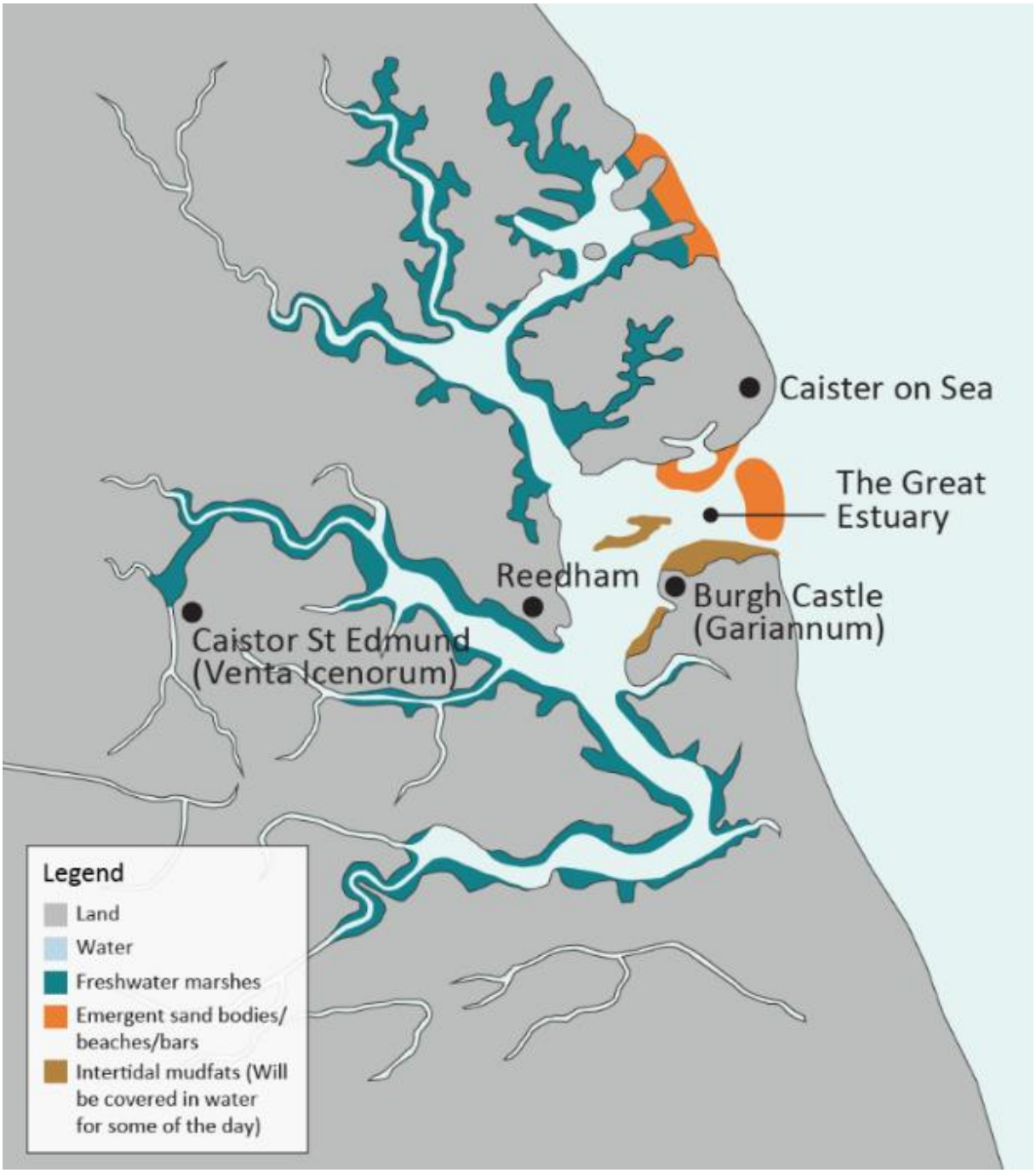
The Great Estuary allowed for navigation inland by larger ships. There is evidence of sea trading and **two coastal forts were built by the Romans - Burgh Castle and Caister-on-Sea.**

In the Iron Age and Roman Period, all Broadland rivers flowed into the 'Great Estuary' to the west of where Great Yarmouth now stands – see video link for more information:

https://www.youtube.com/watch?v=kce_Uu5Rb-8&feature=emb_title

Towards the end of the Roman Period, another coastal spit of sand and shingle began to re-form at the estuary mouth.

Remains of a roman house at Caister on Sea © Ashley Dace www.geograph.org.uk



The Broads area during the Roman Period. Map not to scale.

Anglo Saxon Period (400-1000 AD)

With the creation of the new sand and shingle spit, on which Great Yarmouth now stands, the entrance to the estuary again became constricted and the influence of the sea reduced. In the lower river reaches, around Halvergate, mudflat and saltmarsh remained but further up the river valleys freshwater conditions expanded. This was helped by another period of wetter climate with more rainfall. Following the closing off of the Great Estuary a third phase of peat formation began, creating the 'upper peat' layer which is up to 2m thick.

The Great Estuary closed off in the Anglo Saxon Period (over 1,500 years ago) leading to a larger influence of freshwater from rivers opposed to the sea

In late Saxon times the River Thurne flowed in the opposite direction to the path it currently takes and discharged into the sea to the north east. The River Ant and upper reaches of the River Bure may also have reached the sea along the same route. As a possible result of the Thurne outfall becoming choked by sand and shingle, together with man-made changes to the other river alignments, their present-day courses were established. Other significant early changes to the Broadland rivers include the blocking of the River Waveney from entering the sea at present day Lowestoft and the deliberate diversion in the 14th century of the River Bure into the Yare at Great Yarmouth, away from its original outfall at Caister.

Middle Age and Early Modern Britain (1000-1800 AD)

In the **11th century**, there was a **large wool industry**. The Domesday Book (1086) records a huge number of sheep being grazed on marshland.

St Benet's Abbey
© Ashley Dace
www.geograph.org.uk

The Domesday Book records 1,500 sheep grazing at St. Benet's Abbey

In the 12th century, peat digging occurred with large pits excavated. Many woodlands had been cut down and therefore an alternative fuel source was needed. Peat was the alternative fuel source that filled this demand. The excavations were later abandoned and naturally flooded due to rising sea levels and a wetter climate during the 14th century. This led to the formation of the broads and their colonisation by water plants and reeds around the margins.

There is debate around how the peat diggings were initially cut as, due to shallow groundwater, it is difficult to understand how they did not flood while being dug. Some suggestions are that small pits were dug first so that the diggers could manually remove water. The smaller individual peat pits could then have been joined together. Other theories suggest that the groundwater levels were lower. It was not until the 1950s that Dr Joyce Lambert and

others discovered that the broads were not natural and were in fact formed by man-made excavation.

In the 14th century, the broads were created by the flooding of abandoned peat excavations

Embanking of the Broads, grazing marshes and surrounding watercourses began in the 13th century. This was mainly done in order to bring the land into more permanent agricultural use. Ditch maintenance took place to ensure no obstruction to flow, allowing the marshland to drain better and reduce flooding of the land.

By the **15th and 16th century** grazing had begun to shift from predominantly sheep to **cattle grazing**, some cattle coming from as far away as Scotland.

By the **16th and 17th century** the broads were commonly referred to as **fisheries** highlighting the importance of fish as a food source in the area. Additionally, in the 17th and 18th century large populations of wildfowl attracted shooters who used decoys to lure the birds in. The land surrounding the broads was used for animal grazing and reed and rushes were cut as they were a useful material and used for roofs.

By the 18th century drainage mills were a common sight along the Broads. Mills were concentrated mainly on the lower reaches and around the Halvergate triangle.

Herringfleet Smock drainage mill © Evelyn Simak www.geograph.org.uk

Before mills, drainage had predominantly relied upon embankments and sluices- allowing gravity discharge from the grazing marshes into the rivers. The switch to using mills was probably because gravity drainage became less efficient due to the rising sea level.

The Eccles to Winterton frontage was vulnerable to breaching which led to widespread flooding, for example in 1250 and 1287. In response to a major breach in 1608, which led to flooding that affected the upper reaches of the Bure and Yare, the first **Sea Breach Commission was set up in 1609.** The Commission was responsible for repairing the breaches and was made permanent in the 1800s.

The First Sea Breach Commission was set up in 1609 and was chaired by the Bishop of Norwich

The Commission was responsible for repairing breaches on the Eccles to Winterton frontage

Coastal erosion has led to many Norfolk villages being lost to the sea over time (for example Clare, Foulness, Keswick, Ness,

Newton and Waxham Parva). Shipden was one such village and was at threat during the 14th century. There was a petition to the King to have a new church built as the one Shipden already had was being washed away. The petition was successful, and a new church was built. Ultimately both churches were washed away by the sea and the population relocated to Cromer. Although Shipden was outside of our plan area this is a common tale across Norfolk's coastal frontage.

Early drainage and embanking works were largely undertaken and maintained by individuals or groups of landowners in a relatively uncoordinated manner.

Drainage mills pumped water from dykes into rivers. Pumping allowed for more productive marshland, increasing profits for owners and farmers

The parliamentary enclosure of land within Broadland took place mainly in the early 19th century and focussed largely around the northern river valleys. This process saw the establishment of Drainage Commissions who were responsible for maintaining the new drainage ditches and mills. A proposal was put forward to drain Hickling Broad. The proposal was later found to be unfeasible due to the high volume of water and the fact that there were many channels flowing into the Broad (which would have required diversion). Four small broads were drained permanently.

Drainage Mills

Herringfleet Smock drainage mill © Evelyn Simak www.geograph.org.uk

A typical 18th century brick drainage mill would have had four sails. Sails consisted of a wooden framework over which a narrow sheet of canvas was stretched.

Based on the different wind conditions sails had to be adjusted much like the sails of a ship. Whenever the wind direction changed, the cap of the mill had to be manually winched into the wind direction.

The four sails turned a pole which was mounted to a wheel. Wheels resembled and acted like the wheel of a watermill but in reverse, lifting water up from the marshes over the low wall into a higher-level dyke or river.

Two different views of Halvergate Marshes © Jeremy Halls

Victorian Period to Present Day (1800 AD onwards)

The 19th and 20th century saw enhancements to the drainage infrastructure to make agriculture and grazing more profitable. Steam powered pumps began to replace wind pumps from the 1840s. This in turn led to the **first diesel pump** being installed in the area in 1913.

In the 1930s **Internal Drainage Boards** were set up in the Broads who were responsible for drainage of specific areas. During the late 1930s and 1940s highly efficient **electrical pumps** became widespread.

Doles pumping station at Upton Marshes © Jeremy Halls

The iconic and long-standing scene of cattle grazing and mixed agricultural land use faced potential change to arable land use in the 1980s. This led to major disputes at the time between farmers and conservationists and was later named the **Halvergate Controversy**. As a result, Broadland became the first **Environmentally Sensitive Area** (ESA) in England, to support the protection of landscape and wildlife features. The ESA provided a funding scheme that incentivised a range of more traditional land use and land management practices to maintain the rich landscape and wildlife heritage of the area. The Norfolk and Suffolk Broads Act (referred to as the Broads Act) was passed in 1988 which created the Broads Authority. The Act gave the Broads the equivalent status to that of a national park. The Broads Authority has the responsibility to conserve and enhance the distinct natural beauty and ecology of the Broads whilst having regard to navigation, agriculture, forestry and social/economic interests of those who live or work in the Broads.

From the 1600s to the 1800s there were various acts of parliament with the purpose of extending Broadland's navigable rivers. In 1730 the River Ant was diverted to flow through Barton Broad.

Haddiscoe Cut, also called the New Cut, was constructed in 1833. This is a straight channel linking the Yare and the Waveney rivers between Reedham and St Olaves respectively. It was built with the purpose of providing an alternative route from the North Sea and enabling faster travel between Norwich and Lowestoft. The main motivation for building the Cut was for commercial reasons to compete with the cargo vessels going through Great Yarmouth. Larger vessels had to unload onto smaller ones to be able to navigate Breydon Water and the rivers to Norwich (as they were shallower). There was a charge for this transfer process. To avoid this charge and make Lowestoft more accessible the Haddiscoe/New Cut was proposed along with dredging of the Yare.

Transport and trade via these water networks reduced over time with faster means such as rail and road being preferentially used.

Following the arrival of the railway line in the 19th century, the Broads became a popular holiday destination and tourism flourished

Britannia Pier at Great Yarmouth © Chris Downer www.geograph.org.uk

Other transport improvements during the 19th century included the establishment of the current **Acle Straight road**, part of the Norwich-Acle Turnpike. Shortly after this the main **railway line** between Norwich and Great Yarmouth was constructed in **1844**. This increased tourism in Great Yarmouth, with Wellington Pier and Britannia Pier opening in the 1850s. It also provided access to the Broadland area, which became a holiday destination- especially with the rail line between Norwich and London opening in 1849. This led, along with popularisation in Victorian writing about the Broads, to an increase in growth of visitors. Faircraft Loynes was established in 1878 by John Loynes and was one of the first companies to target tourism with boat hire. Motor cruisers appeared from the 1920s onwards and by the 1970s the number of hire boats exceeded 2000. Holiday chalets were constructed along the waterside as get away retreats during the 1880s to 1960s.

During the 20th century the Broads faced increased threat owing to the larger number of people using the area. Water quality started to decline owing to discharge from sewage treatment works and fertiliser inputs carried in water running off fields.

The **storm surges of 1938 and 1953** had far reaching impacts with loss of life and property. Saltwater intrusion also affected freshwater habitats and agricultural land. More recently, there have been storm surges in 2013 and 2017; however, the consequences were much less severe than previously. In part this was due to the investment in more robust flood defences following the 1953 event.

Further details on the flood history of the area is explored in a separate document focused on sources of flood risk.

The Haddiscoe Cut was constructed in 1833 to reduce the sailing time between Norwich and Lowestoft

3. Summary

The current landscape of Broadland has been shaped by numerous changes since the last glaciation, notably sea level rise, water level management and farming practices. There is evidence of a long history of adaptation in Broadland to changing physical conditions and the past populations have demonstrated an ability to make changes to cope with this.

Human activities such as peat digging, land drainage and the construction of flood embankments have created the Broadland landscape and will continue to do so.

Looking ahead, sea level will continue to rise but at a faster rate than historically. This has consequences for the way that flood risk is managed and will require a range of adaptation measures to be adopted.

Boathouses on Hickling Broad @ Adrian S Pye www.geograph.org.uk

4. What is The Broadland Futures Initiative?

The Broadland Futures Initiative (BFI) is a partnership for future flood risk management in the Broadland area. Our main goal is to agree a framework for future flood risk management that better copes with our changing climate and rising sea level. The focus is to define a flood risk management plan for Broadland over approximately the next 100 years putting people at the heart of decision making.

BFI has been set up by organisations responsible for managing flood risk, working together with partners. The Environment Agency, Natural England, County and District Councils, Internal Drainage Boards, Broads Authority, National Farmers Union, Water Resources East, the Royal Society for the Protection of Birds (RSPB) and the Wildlife Trusts will work together in developing the plan.

Elected members representing local communities will be the decision makers. This will be a democratic process, with local politicians making the core decisions in order to agree the future flood risk management plan, having considered the latest projections on our changing climate.

The plan will be developed over a number of stages. This document is part of establishing the background to the plan. For more information about the BFI and how it's organised see our Frequently asked questions document.

Other documents to be produced during this initial stage are shown below. Some of these are aimed at the general public while others are more technical in nature. They will be available through the BFI website: https://www.broads-authority.gov.uk/looking-after/climate-change/broadland-futures-initiative

- Sources and nature of flood risk
- Coastal processes review
- Current approaches to flood risk management
- The impacts of flood risk management
- Strategic plans and documents review
- Existing key data sources and indicators
- The future impacts of climate change
- The result of initial stakeholder survey
- Objectives for the plan
- The methodology for options appraisal and preferred options selection
- Strategic environmental assessment scoping
- Frequently asked questions

An idyllic Broads scene © Broads Authority – Tom Mackie

5. Glossary

Broads/broads: When capitalised, Broads refer to the Broads Authority executive area. When reported in lower case, the word refers to the broads/expanses of water themselves.

Biodiversity: Variety of plant and animal life in the world or in a particular habitat. A high level of plant and animals is usually considered to be important and desirable and is referred to as being biodiverse.

Broadland Futures Initiative (BFI): The BFI is a partnership for future flood risk management in the Broadland area. Our main goal is to agree a framework for future flood risk management that better copes with our changing climate and rising sea level. The focus of the BFI is to define a flood risk management plan over the next 100 years and putting people at the heart of decision making. The Plan will be implemented from the mid-2020s onward.

Climate Change: Any significant long-term change in the expected patterns of average weather of a region (or the whole Earth) over a significant period of time.

Decoy: An object or person used to attract the attention of something/someone for another purpose. For example, a model bird is used as a decoy to attract wild birds towards it so that people can study or shoot them.

Deposition: The laying down/accumulation of sediment carried by wind, water or ice.

Discharge: The volume of water that passes through a channel cross section in unit time, normally expressed at cubic metres per second (m^3/s) in fluvial design (often more simply referred to as 'flow').

Doggerland: Doggerland was an area of land, now submerged beneath the southern North Sea, which connected Britain to continental Europe. It was flooded by rising sea levels over 10,000 years ago. Geological surveys suggest that it stretched from Britain's east coast to the Netherlands and the western coasts of Germany.

Dyke: Water-filled ditches that provide wet fences and a source of drinking water for livestock in grazing marshes.

Embankment: An artificial, usually earthen structure, constructed to prevent or control flooding, or for various other purposes including carrying roads and railways.

Environmentally Sensitive Area (ESA): A type of designation (description, name or title given to something) for an agricultural area which needs special protection because of its landscape, wildlife or historical value. Defra introduced a new Environmental Stewardship Scheme in 2005 which supersedes the Environmentally Sensitive Areas schemes.

Erosion: Process by which particles are removed by the action of wind, flowing water or waves.

Estuary: The wide mouth of the river where it joins the sea. Seawater and fresh water mixes, providing high levels of nutrients and making estuaries among the most productive natural habitats in the world.

Excavation: Excavation can refer to the action or process of digging up land and the hole in the ground which is left after the digging.

Fen: One of the main types of wetland, the others being grassy marshes, forested swamps and peaty bogs. Fens are characterised by their distinct water chemistry, which is pH neutral, and are usually dominated by grasses and brown mosses.

Flood bank: Embankment used for flood risk management.

Flood risk management: Flood risk management aims to reduce the likelihood or the impact of floods. Experience has shown that the most effective approach is through the development of flood risk management programmes incorporating the following elements:

- **Prevention**: preventing damage caused by floods by avoiding construction of houses and industries in present and future flood-prone areas by adapting future developments to the risk of flooding, and by promoting appropriate land-use, agricultural and forestry practices;
- **Protection**: taking measures, both structural and non-structural, to reduce the likelihood of floods and/or the impact of floods in a specific location;
- **Preparedness**: informing the population about flood risks and what to do in the event of a flood;
- **Emergency response**: developing emergency response plans in the case of a flood;
- **Recovery and lessons learned**: returning to normal conditions as soon as possible and mitigating both the social and economic impacts on the affected population.

Habitat: Natural home or environment of an animal, plant, or other organism.

Internationally designated: Areas which have been protected because of their exceptional value for nature conservation.

Intertidal: The area of land that is above water level at low tide and underwater at high tide.

Longshore drift: The movement of material along a coast by waves which approach at an angle but recede/move away directly from it.

Maintain: Active intervention to keep defences at their current level of protection.

Marshland: Type of wetland characterized by being intermittently or continuously flooded with water that is not deep and with predominately soft-stemmed vegetation, such as grasses and sedges.

Peat: Accumulation of partially decayed vegetation or organic matter. It is unique to natural areas called peatlands, bogs, mires, moors, or muskegs.

Risk: Combination of the probability that an event will occur and the consequence to receptors associated with that event.

Sediment: Material ranging from clay to gravel (or even larger) that is transported in flowing water and that settles or tends to settle in areas where the flow slows down.

Sluice: Rectangular gate that moves vertically between guides and is used to manage water levels.

Spit: Made from deposited beach material it is a landform off coasts or lake shores, protruding from the main land.

Stakeholder: An individual or group with an interest in, or having an influence over, the success of a proposed project or other course of action.

Storm surge: Rising of the sea as a result of wind and atmospheric pressure changes associated with a storm.

Wake: Wake from a boat is the waves and current created behind a boat using a motor.

Wetland: Transitional habitat between dry land and deep water. Wetlands include marshes, swamps, peatlands (including bogs and fens), flood meadows, river and stream margins.

Wet woodland: Type of plant community occurring on poorly drained or seasonally wet soils. They may occur in river valleys, the surroundings of mires and raised bog, the transition zones between open water and drier ground, and beside small winding streams.

Wherry: A type of rowing or sailing boat traditionally used for carrying cargo or passengers.

St Benets drainage mill © Jeremy Halls

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