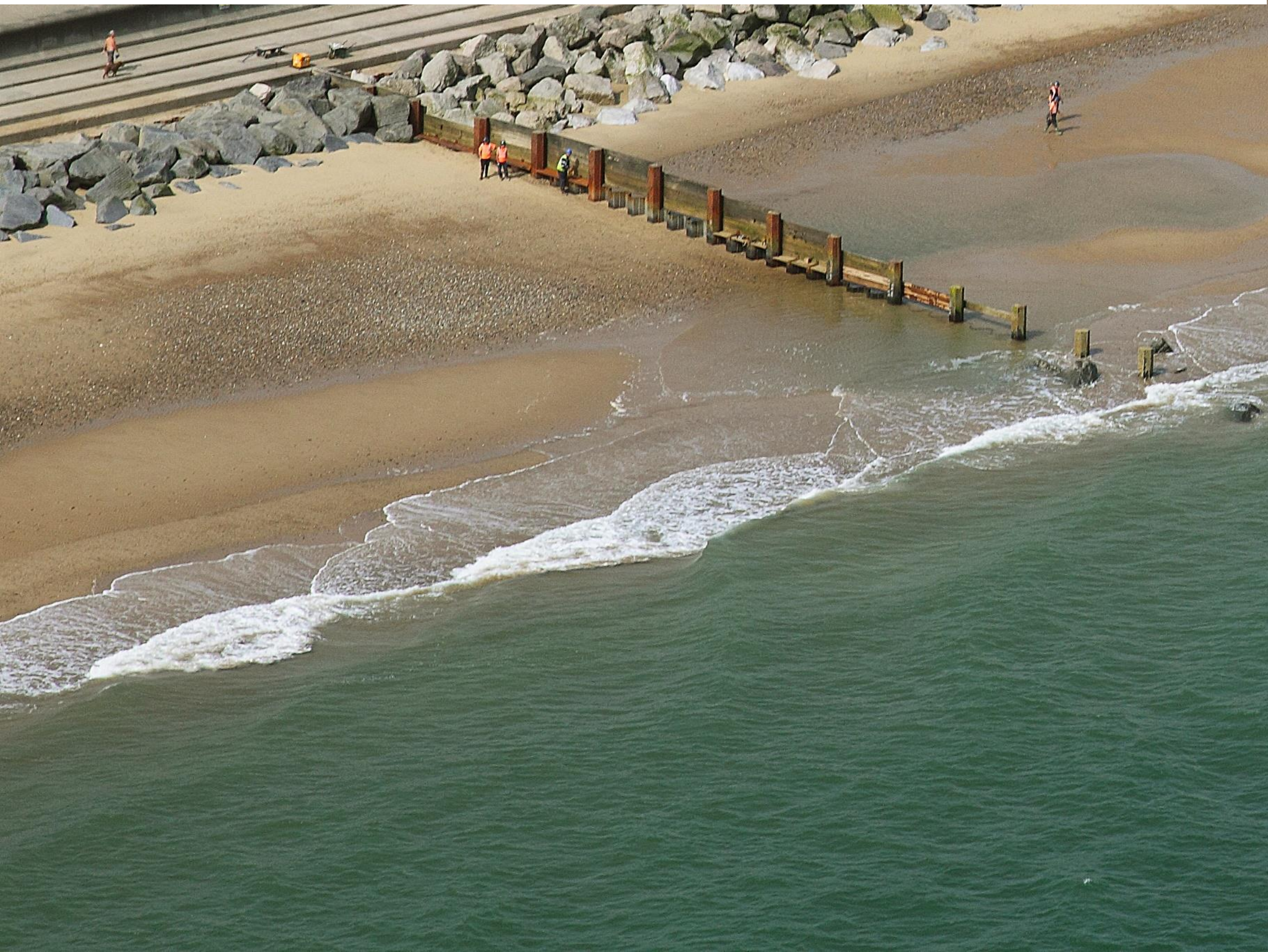
Current Approaches to Flood Risk Management within the Plan Area

Broadland Futures Initiative



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Coversheet image: Aerial photo of works being undertaken on the groynes at the stretch of coast by the Bush Estate (Eccles on Sea) © 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 our 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 aims to inform you about the current approaches to managing flood risk within the BFI plan area. Additionally, it will provide an overview of how flood risk management is funded.

Specific organisations are responsible for managing flood risk depending on the source of flooding. The local community also has the opportunity to manage flood risk to their property and land.

The Plan Area

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

River Yare at Reedham on spring tide © Jeremy Halls

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

2. Flood Risk in the Plan Area

What is Flood Risk?

Flooding is a natural process. Flood risk is the likelihood of flooding occurring together with the consequence of the flood event, such as something valuable being flooded or a potential threat to life. Things of value can include land (that is environmentally or agriculturally valuable), property or infrastructure (such as homes, businesses and road networks).

Sources of Flood Risk

The related BFI document "The Sources and Nature of Flood Risk Within the Plan Area" details the flood sources and past flood events. The sources investigated were:

Flooding along Postwick marshes © Jeremy Halls

- **Coastal** – flooding from breaches, overtopping and erosion along the open coast
- **Tidal** – storm surges and high tide levels flowing up rivers and over river banks/flood management structures
- **Fluvial** – high river levels, following rainfall events, flowing over river banks/flood management structures
- **Surface water** – inability of water to drain away due to saturated ground, exceeding the capacity of drainage infrastructure or due to failure of drainage infrastructure
- **Groundwater** – the rise of water in permeable rocks to exceptionally high levels

Approximately 60% of land in the plan area is below present day sea level. Indeed, analysis of past flood events and predicted flood extents indicates that the greatest risk from flooding in the plan area is flooding from the sea (coastal along the Walcott and the Eccles to Winterton frontage and tidal along the rivers and at Great Yarmouth). Tide locking, where the incoming tide prevents river water together with the previous tide draining out to sea, has also been identified as a particular risk along the River Bure and to a lesser extent on the Yare and Waveney. This phenomenon can last several days under certain weather conditions.

Given the largely rural nature of the BFI plan area, property flooding from surface water is generally limited, with the exception of Great Yarmouth. Several areas of Great Yarmouth have been flooded four times in the last 13 years from surface water. Groundwater flooding currently poses a lower risk across most of the plan area.

It is also important to note that because most of the agricultural land within the plan area is below sea level it requires water levels to be managed to prevent it being permanently flooded.

3. Managing Flood Risk

Risk Management Authorities (RMAs)

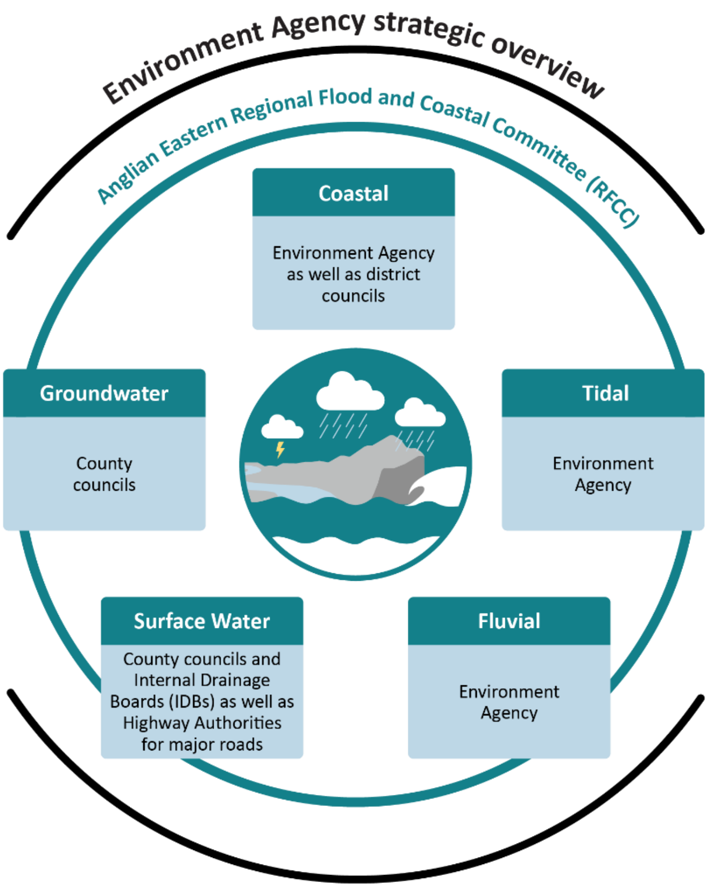
Flood risk can never be removed completely but can be reduced through proactive planning and management. This is one reason why we talk less about flood *defence*, and more about flood *management*. Because of historic roles and responsibilities of different organisations, all sources of flood risk are investigated and managed by one or more **Risk Management Authorities** (RMAs) as listed below. RMAs operate under different legislation with different powers or duties and are resourced accordingly. The RMAs ensure that people, the environment and infrastructure receive a certain standard of protection against flooding.

All the different RMAs work together and cooperate with each other. Clear communication and exchange of information is vital to ensure that responses for every kind of flood event are suitably provided. This is important because the combined effect of different flood sources can lead to a larger risk.

Who is Responsible for which Flood Source?

The following list, as summarised in the figure, shows the authorities responsible for managing the different sources of flood risk in the plan area:

- **Coastal** – the Environment Agency as well as local councils on some stretches of coast
- **Tidal** – the Environment Agency
- **Fluvial (river)** – the Environment Agency as well as the Lead Local Flood Authorities (usually County Councils) for smaller watercourses
- **Surface Water** –Lead Local Flood Authorities, Internal Drainage Boards and Highways Authorities for major roads such as the A47
- **Groundwater** – Lead Local Flood Authorities



Risk Management Authorities and their primary responsibilities for flood risk. Adapted from diagram in the Draft National Flood and Coastal Erosion Risk Management Strategy for England, Environment Agency

The **Environment Agency** has an overarching role and overview of all sources of flooding and is responsible for national flood strategy. The Environment Agency works alongside the different RMAs and ensures that stakeholders and communities have platforms to influence strategic decisions taken to manage flood risk. It also has primary powers to manage risk from designated Main Rivers and the sea. A map showing Main Rivers, managed by the Environment Agency, can be found at: https://environment.maps.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386.

There is also a **Regional Flood and Coastal Committee** (RFCC) that covers the plan area, called the Anglian Eastern RFCC. This is established by the Environment Agency and brings together elected local councillors who are appointed by Lead Local Flood Authorities (LLFA) together with other nominated experts. The RFCC approves the annual programme of flood risk management work in the region and sets the local levy that funds activities that are a local priority (for more on local levy and funding see section 5).

A **Lead Local Flood Authority** (LLFA) is the body with the authority to undertake flood risk management of surface water, groundwater and smaller watercourses that are not designated Main River. Lead Local Flood Authorities are often county councils, and this is the case in both Norfolk and Suffolk. An LLFA is responsible for developing and maintaining strategies for flood risk management, preparing flood risk assessments and taking the lead on preparing surface water management plans.

Approximately 80% of the plan area is subject to drainage management. In rural areas the **Internal Drainage Boards** (IDB) have powers to manage land drainage of surface water and use control structures such as sluices to manage water levels. They are able to move excess water from low-lying land into the river network via pumping stations. The BFI plan area is covered by three IDBs: the Norfolk Rivers IDB, Broads IDB and Lower Yare, Waveney and Lothingland IDB.

Although the RMAs have organisational responsibility and powers for managing flood risk, homeowners are also able to prepare for, and manage flood risk, and to protect their property. If you own land or property adjacent to a watercourse (termed as a riparian landowner) then you have a responsibility to ensure that any action you undertake does not increase the risk of flooding up or downstream. You are also required to maintain the condition of the watercourse to ensure that the flow of water is not obstructed.

4. Current Approaches to Flood Risk Management in the Plan Area

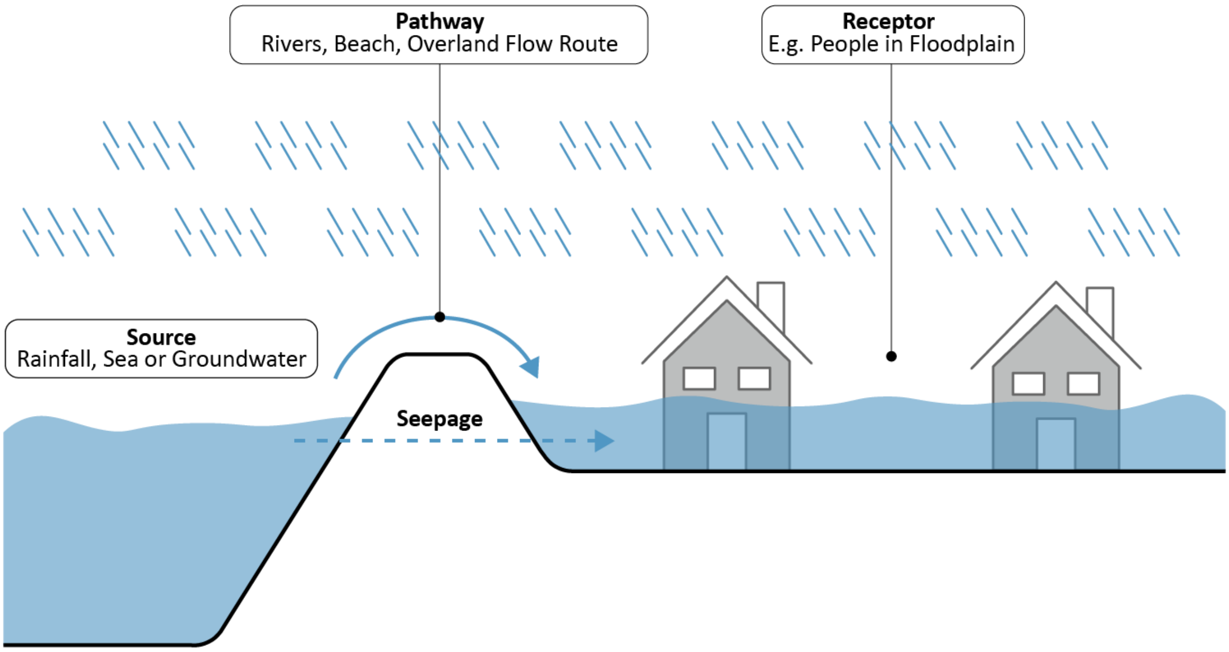
Managing the Sources, Pathways and Receptors of Flood Risk

The approaches to flood and coastal risk management which are currently used in the plan area are introduced below under the headings of **Source, Pathway and Receptor.** For instance, a watertight wall may be built to manage or intercept the pathway of flood water which would otherwise flow from the source (e.g. the sea) to the receptors (e.g. properties).

Receptors, in flooding terms, are things of value that could be damaged by flooding

As a general rule, management of flood risk is most effectively addressed as near to the **source** of the hazard as possible. For example, storing rainfall naturally in the upstream areas of the catchment so reducing the volume or rate at which water drains into a river. Although flood management structures in the plan area may be designed to reduce flooding from one source, they typically act to reduce risk from multiple sources.

Pathways recognise that water flows downstream through drainage ditches and rivers (and in the lower tidal river reaches will flow upstream on the incoming tides), and groundwater can rise through permeable rocks and soil in a number of different ways to cause flooding. Therefore, a second approach to flood management aims to intercept the water as it travels along these pathways**.** These could include further natural flood management actions to 'slow the flow' e.g. tree planting upstream, embankments along rivers or pumps to drain land. Another example is maintaining high beach levels so wave height and energy is reduced by the time they reach the flood management structure at the rear of the beach and so are less able to breach or spill over the structure and flood behind the beach.



Finally, the consequences of flooding are the impacts seen on houses, roads, environmental sites and many other **receptors**. It will not always be possible for actions on the flood source and pathway to prevent all water reaching these receptors, and this could result in damage. Therefore, additional measures may be needed at the receptors themselves. These include works to make individual properties more resilient to flooding and the use of emergency planning and early warning procedures.

Considering different approaches in this way ensures that all possible actions to manage flood risk are evaluated, that actions across the whole plan area are considered, and that the most effective actions are prioritised.

Regardless of whether the source, pathway or receptor is being targeted there are different flood risk management approaches that can be taken. For example: an engineered hard structure, such as a concrete wall; softer techniques that use the natural environment, such as re-meandering a river that had previously been artificially straightened; or temporary flood risk management structures, such as temporary pumps and barriers. These different responses may be preferential in different situations as they have different pros and cons. Some of these are summarised in the table below.

Different Flood Risk Management Structures Positives and Negatives

	Hard	vs	Soft	vs	Temporary
Positives	• Can be built to provide a set standard of protection • Relatively strong		• More sustainable as working with natural processes • Lower cost • Less visual impact		• Can be deployed quickly • Can be used when needed and then removed, so no visual change for most of the time
Negatives	• Can be expensive • Require maintenance • Deteriorate over time and require rebuilding • Set to a standard of protection which might decrease over time		• Cannot provide a guaranteed standard of protection • Less likely to be effective against larger events • Can require maintenance to a lesser extent		• Require pre-warning/ forecast to deploy and implement ahead of an event • Can require specialists to deploy and implement • Not long-term solution • Can be limited supplies and required elsewhere at the same time • May be deployed when not needed

Source Approaches

Natural Flood Management

Natural Flood Management (NFM) is an approach to reduce flood risk by working with natural processes. NFM techniques are often more environmentally sensitive than traditional flood management structures and help provide habitats for wildlife to thrive. Different areas are suited for different NFM approaches. Generally, an NFM approach will achieve one or more of the following:

- Increase infiltration of rainfall (for example by reducing compaction of soils in the catchment)
- Slow the flow by reducing delivery of water from one part of the catchment to another (for example woody debris dams in the upstream reaches of a watercourse can help in time of high river flows as it causes water to be held upstream by the natural dam; slowing the flows which can reduce water levels downstream)
- Store water (for example wetland creation)
- Dissipate wave energy and height (for example saltmarsh or sand dune restoration)

NFM is being used in the upstream reaches of rivers that flow into the BFI plan area, for example on the River Bure at Buxton, which may reduce flood risk downstream within the plan area.

Pathway Approaches

Temporary Barriers

Example of what temporary flood barriers look like
© Environment Agency

Temporary flood barriers are portable structures that are brought to site for a limited period when flooding has been forecast. They are then removed when the risk of flooding has passed. They have no foundation other than the ground on which they are based. There are a number of different types, with the most common consisting of a metal A-frame joined by panels and covered with a waterproof membrane. If barriers are deployed they are often used along with pumps to deal with seepage through the barrier. However, high volume pumps can also be deployed on their own to pump water over an obstruction. There is a central stock of barriers that can be deployed anywhere in the country. Temporary flood barriers often require specialists to assemble them together. In the BFI plan area temporary barriers have been used within Great Yarmouth during times of high flood risk.

Permanent Structures

Coastal

Aerial photo of Winterton North Wall with groynes © Mike Page

Along the Eccles to Winterton coastal frontage a 14 km stretch of concrete wall is present having been built in stages and completed in 1987. This is to prevent flooding from the sea. The height of the wall varies in different sections and only the upper section of the wall is visible as the beach sand shifts exposing and burying the base of the wall – there is also steel sheet piling at the base of the wall for stability. At Walcott there is a sea wall between the beach and the Coast Road which is 3.2 km in total length.

The present Shoreline Management Plan policy for the coastal stretches in the plan area is "**hold the line**", meaning that structures and management techniques are currently maintained. These policies are set for different time periods and so the policy for the future may be different to the current approach. It is important to note that SMP policies are aspirational and not funded.

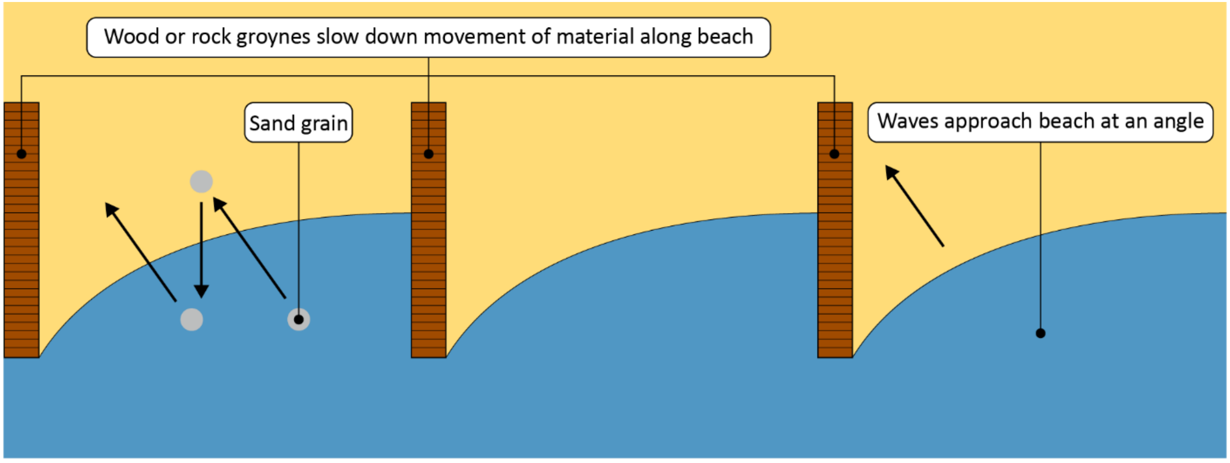
The beach, as well as sand dunes, are an important natural buffer to the sea. Maintaining beach levels is critical to maintain the sea walls structurally and reduce the risk of breaches and flooding. There are therefore structures present to protect the beach and dune system.

Flood gates and **demountable barriers** are used at points along the coastal stretch to prevent tidal surges breaching low points amongst the dune system (e.g. access points onto the beach). These gates vary in size. An example of a typical flood gate is at Walcott in the sea wall. When open it provides access onto the beach via ramps to enable access to the beach.

Flood gate at Walcott © Hugh Venables - www.geograph.org.uk

Breakwater structures are parallel to the coast and made of boulders of rock. They help to remove energy from incoming waves and therefore aim to encourage deposition and maintain the sediment levels on the beach. There are nine breakwater structures between Eccles and Waxham that were built between 1993 and 1997.

Groynes are barriers built at right angles to the beach- they are often wooden but can also be made of boulders or rocks and are a common sight on many beaches. Groynes aim to trap sediment moving along the coast, preventing sediment transportation and reducing erosion from waves. There are sixty groynes along the Eccles to Winterton stretch.



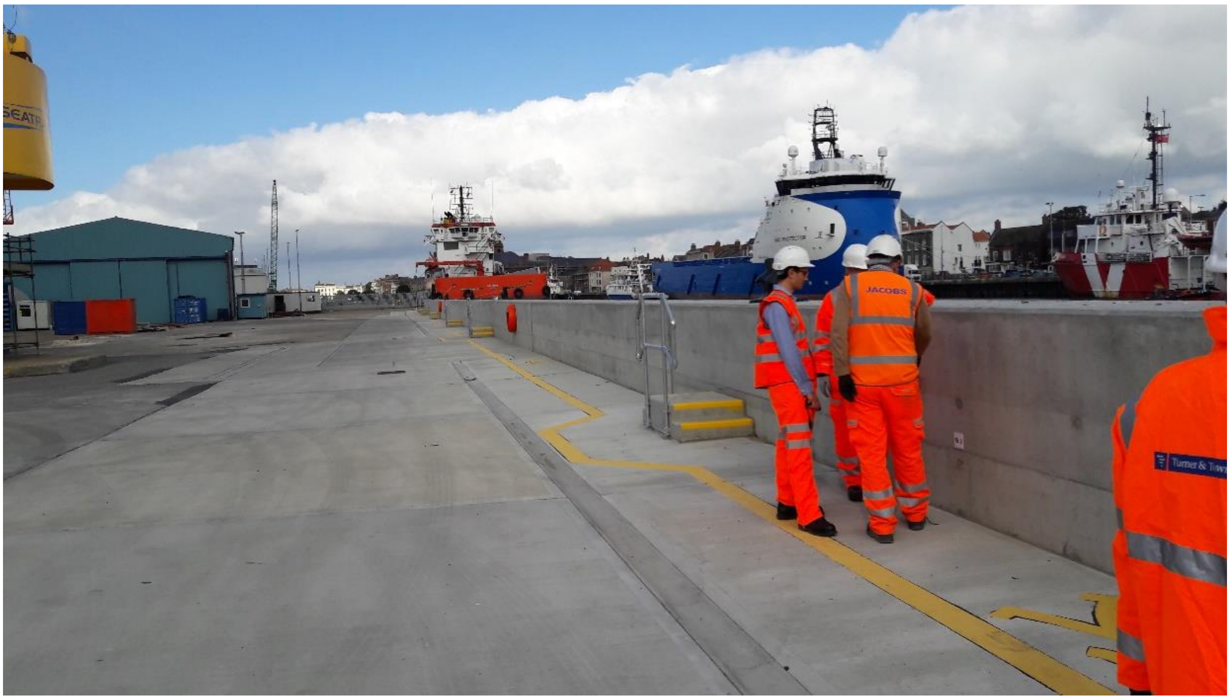
Birds eye view of beach showing how groynes trap sediment moving along beach during longshore drift

There are also timber groynes between Bacton and Walcott to reduce erosion of the cliffs by maintaining a beach along this frontage. Additionally, in 2019, the Bacton to Walcott stretch had 1.8 million cubic metres of sand added to the frontage to increase the width and height of the beach as part of a "**sandscaping**" project. For reference, this is equivalent to approximately 720 Olympic sized swimming pools. Some of the sand added to the beach will be eroded naturally and some will be transported to become an additional source of sand for beaches to the south.

The addition of smaller volumes of sand (to maintain the sediment on the beach) and re-profiling of the beach (moving and re-distributing sediment on the beach to reduce the volume eroded), has occurred on the Eccles to Winterton frontage historically. The last recharge occurred in 2009 where 525,000 cubic metres of sand was added between Sea Palling and Poplar Farm.

Tidal/Fluvial

In Great Yarmouth, flood risk management structures are formed of **concrete walls founded on steel sheet piles**, extending below the water level into the river bed. These are robust and have been built to withstand a certain level of impact from boats. There are also flood gates (permanent and demountable) in places. Above Breydon Bridge and upstream of Runham on the River Bure the flood risk management structures change to earth embankments.



Concrete flood wall in Great Yarmouth © Environment Agency

There are over 240 km of embankments along most of the main Broadland river banks in the plan area. As the area is low lying and flat, these grass covered embankments constructed of locally excavated clay prevent river and tidal water from flowing out of the river onto the adjacent land on a daily basis, and also during low magnitude flood events.

Embankment at Breydon Water. Raising has recently taken place and so grass coverage is patchy © Jeremy Halls

BESL (Broadland Environmental Services Limited) was appointed by the Environment Agency in 2001 to improve existing flood risk management structures and also to monitor and maintain the embankments in the Broadlands under the Broadland Flood Alleviation Project. Embankments settle and compact over time and therefore require topping up periodically to ensure they provide the same level of flood protection.

Along many stretches of the Broadland rivers metal **sheet piles** were originally installed as a lower cost form of erosion protection for the embankments but are no longer the favoured option because of the higher cost of steel and maintenance issues.

The alternative solution has been to remove the piles and **construct new lengths of embankment further back from the river** making them less vulnerable to erosion**.** The space created is used to establish reedbeds and lagoons. This solution presents multiple benefits:

- **Reedbeds** provide a buffer to erosion from waves (created by wind or boats) and from high river flows.
- The extra space created between the river channel and the embankment increases flood storage space at times of high flood risk.
- It provides considerable landscape and biodiversity benefits through the expansion of natural habitats.

Pile removal as part of Broadlands Flood Alleviation Project on the River Waveney in 2008. Reedbeds can be seen in the background © Broadland Environmental Services Limited

Dredging in the Broads

Dredging is used at key locations to maintain navigation in the Broads. It can also have an effect on small magnitude flooding from some rivers. However, dredging will not reduce the risk of tidal flooding (the predominant risk in the Broadland area) as peak flood levels are dictated by the tide height of the sea and not by how much capacity is in the Broads river system. Whilst dredging can sometimes evacuate flood water in a fluvial river faster than in a more naturally draining system, in a tidal river, dredging can increase flood risk by increasing the amount of sea water able to enter the system, contributing to increased flow speeds, scour and erosion. Even in a fluvial river dredging can have negative impacts downstream, and on the environment, so it must be carefully planned and targeted. Fluvial and tidal processes will move and re-distribute sediments as the river naturally adjusts itself to the overall sediment load in the system. Therefore, the system quickly replaces the lost sediment so that dredging typically has only short-term benefit.

Dredging works on Hickling Broad © Broads Authority

Surface Water

Rainwater that falls over urban areas may land on impermeable surfaces such as tarmac. Roads and pavements are designed to direct water to drains. For example, the drain will be lower than the road or path, so water naturally flows to it. Pipes then transport this water to water bodies, such as rivers, through outfalls.

Norfolk County Council maintain approximately 4200 gullies and drains in the plan area and approximately 80 culverts. **Culverts** are tunnel-like structures that allow water to flow under infrastructure such as roads or railway lines.

Sustainable Urban Drainage Systems (SUDS) try to store and re-use water to decrease the flow rates and transport of water from urban areas to rivers and surrounding developments. An example of SUDS are ditches of gravel that are designed to allow water to drain and soak into the rocks (infiltration) and store some water. Additionally, landscaping can be used so water naturally drains through vegetated areas, where plants may uptake some of the water. All new, large housing developments should not increase surface water runoff by including SUDS.

The most common structures used to ensure low lying land is drained are **pumping stations**. There are approximately 60 maintained pumping stations in the plan area. As the land is flat, low-lying and often below sea level, water does not drain away effectively by gravity. Therefore, water that has collected in drainage ditches, for example surrounding agricultural fields, is pumped into the adjacent river. Some drains may be lower than the river network and, therefore, a pumping station will pump this water up from a lower level into the river.

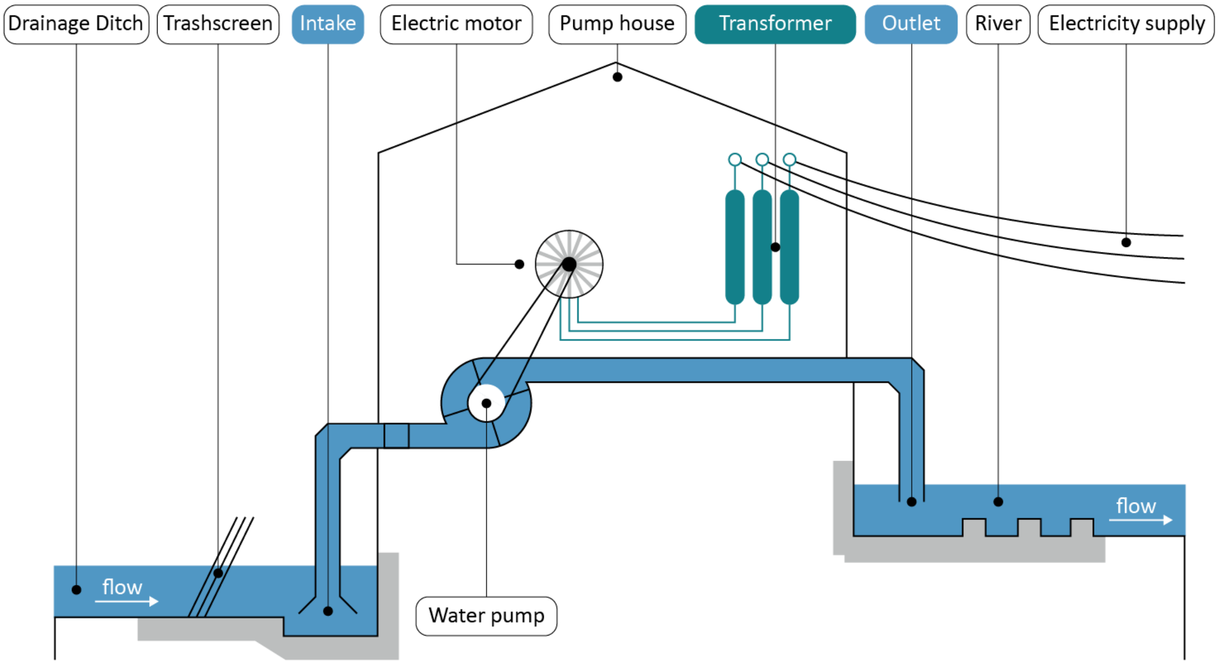


Diagram of a pumping station illustrating how water is pumped from a lower elevation to a higher one

Water levels are also controlled by sluice gates. Watercourses are maintained to ensure that they are not obstructed, and that water can flow through them. **Sluices gates** and **flaps** allow movement of water from one part of a drainage system or river to another and are used to control water levels within the marshes. For example, a sluice gate might be open if water levels are significantly high in one watercourse to distribute the water to another part which has lower water levels. These water control structures can have sensors for when to open and close in relation to water levels or can be manually opened and closed.

Receptor Approaches

Rollback and Relocation

The coast has always been eroding and changing and will continue to do so into the future. An example of adaptive management is rolling back communities at risk.

At **Trimingham** in North Norfolk (a location outside of the plan area) the Parish Council and community, working with North Norfolk District Council, built and opened a new village hall as the current one was at increasing risk of collapse due to coastal erosion in the next 20 years. Four dwellings were also demolished, and new replacement properties were built in the nearby settlement of Mundesley. The dwellings being demolished mean that there is no longer a threat of collapse and therefore no risk of future debris and environmental hazards on the beach below from those properties.

Relocation and rollback of properties does depend on funding and innovative planning policies, however, adaption to changing and increasing risk can be accomplished with community engagement and assistance and guidance from local authorities.

Adapting to changes in the landscape is not a new concept. Norfolk villages have been eroded completely or relocated elsewhere (for example Clare, Foulness, Keswick, Ness, Newton, Waxham Parva and Whimpwell). Shipden was one such village and was at risk during the 14th century and the population relocated to Cromer. Although Shipden was outside of our plan area this is a common tale across Norfolk's coastal frontage.

Property Level Resilience

Property Level Resilience (PLR) adapts aspects of buildings or small groups of buildings to reduce the chances of water entering buildings or reduce any subsequent impact of flood water. Homeowners can buy and have PLR alterations installed to better safeguard their property from flooding. For example, higher risk houses may be kept safe using small scale structures such as dam boards. Slots or frames for the boards are fitted in front of doors and when flooding is expected the boards are inserted to provide a barrier to the water. Other examples include covers to airbricks, flood doors with seals that limit water entering through the door frame, and non-return valves to make sure flood water does not enter the house through existing pipes/plumbing.

The lowest point of entry into a building for flood water is termed the **property's threshold.** PLR seeks to prevent water entering through these thresholds. It also aims to reduce the impact of flood water if it were to enter a property, for example by raising electric circuits or the use of hard flooring rather than carpets. PLR is typically designed to reduce impacts in smaller, more frequent, flood events. Some riverside properties along the Broads have also been raised to reduce flood risk and can be put on stilts. Additionally, properties can be designed with higher floor levels, living quarters upstairs or designed to float. Not all PLR methods are suitable for every building type. It is important to have these measures assessed and installed correctly to prevent structural damage during flooding, for example holding back deep water on the outside of the property that may damage the walls through loading.

Demountable flood boards in a boatyard at Chedgrave © Broadland Environmental Services Limited

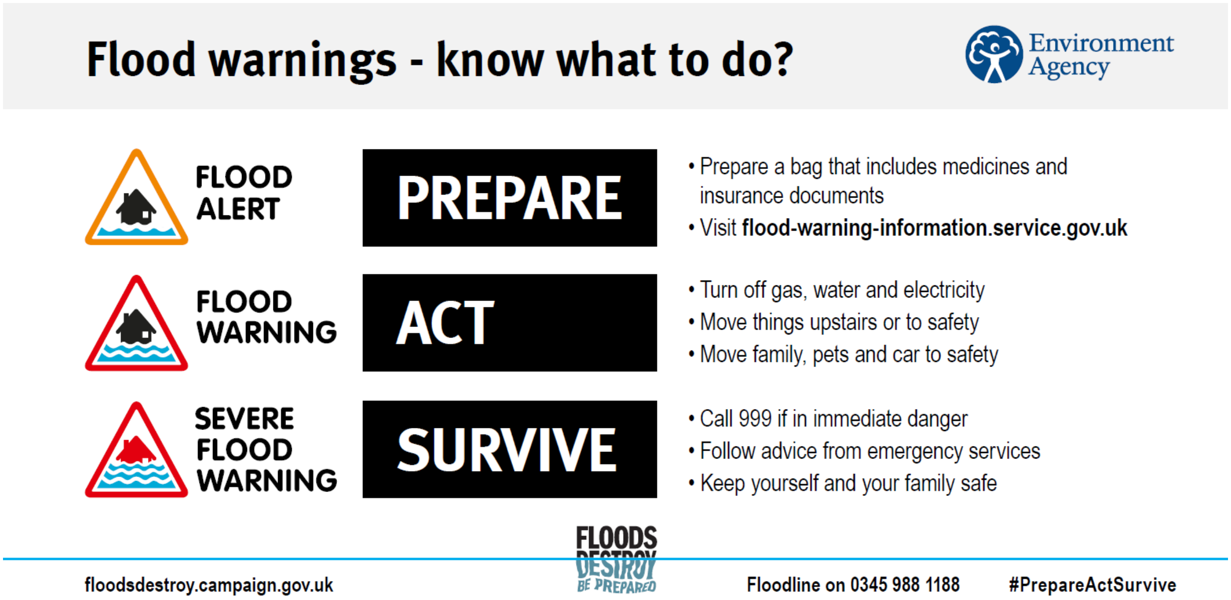
Development Planning to Reduce the Number of Receptors at Risk

For Local Planning Authorities, a **Strategic Flood Risk Assessment** (SFRA) assesses flood risk and any impacts that development or changing land use would have on flood risk over a wide area. There are four SFRAs that cover the plan area, produced by the four planning authorities. The SFRAs provide useful data to inform flood risk considerations at a site-specific level (termed a Flood Risk Assessment). The underlying principle of development and flood risk is summarised in the 2019 National Planning Policy Framework as 'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere'.

The majority of development proposals have to carry out a **Flood Risk Assessment** (FRA). This FRA must demonstrate that the development is not increasing flood risk elsewhere and that the development is sufficiently safe over its lifetime, for example raised above a certain flood level.

Flood Warning and Emergency Response

Properties in areas at risk of fluvial or tidal flooding can be sent alerts and warnings if flooding is possible, based on weather forecasting and flood modelling. These alerts are available online and are also sent via text messages, email and mobile phone and land line phone calls if the homeowner has signed up to receive them. The flood alerts are the lowest level of warning and mean there could be flooding on low lying land and roads. Flood warnings are issued if flooding is expected to affect properties such as homes or businesses. Severe flood warnings are the highest level of warning and are sent if there is danger to life. Active flood warnings can be found at https://flood-warning-information.service.gov.uk/warnings. Sign up for Floodline Warnings Service online at this https://www.gov.uk/sign-up-for-flood-warnings or call Floodline on 0345 988 1188.



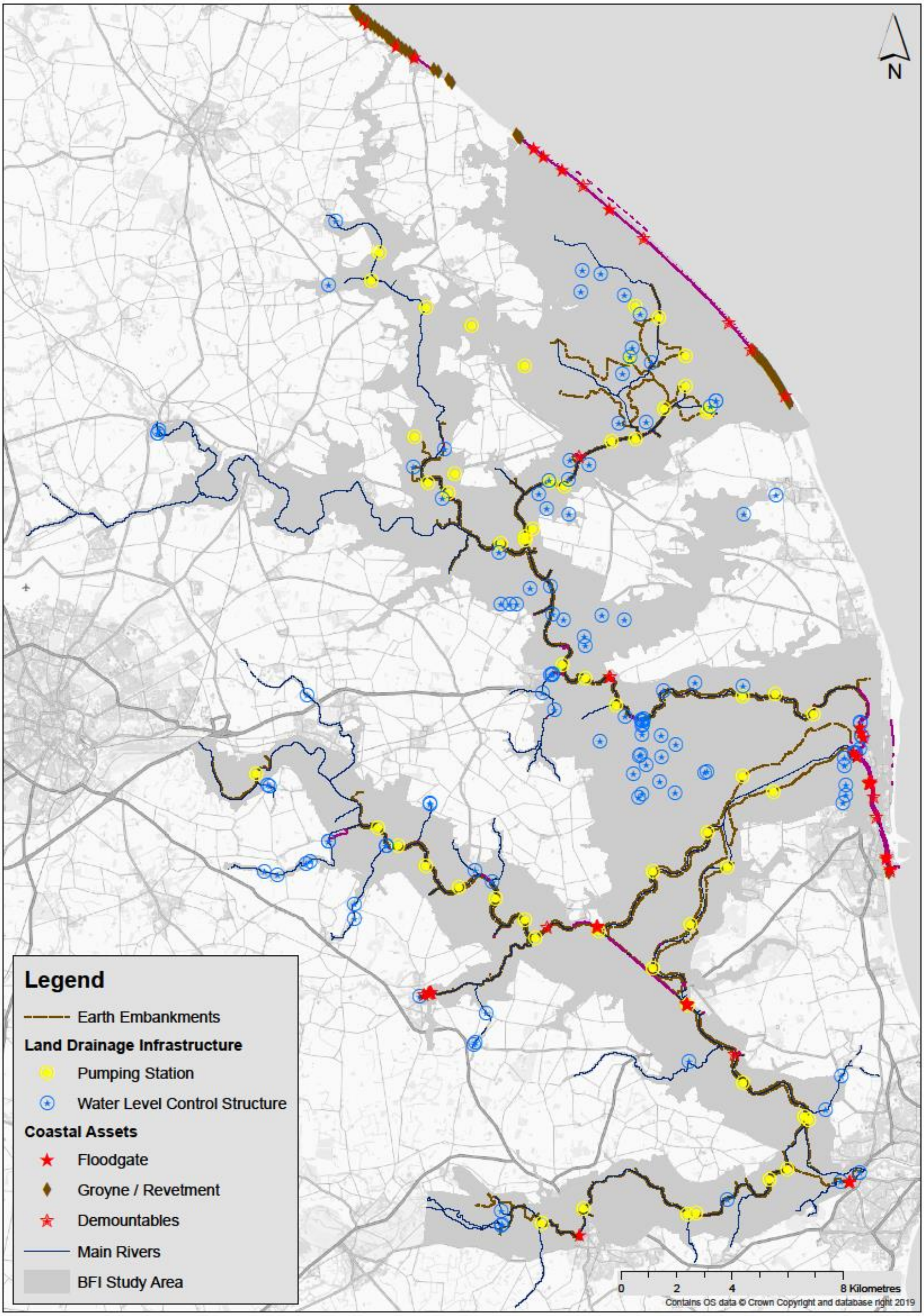
In the plan area, the flood warning service is based on the tidal forecast, a forecast for the Broads and levels recorded in real time at a series of gauges throughout the Broadland rivers. If there is a flood alert, some home or business owners may need to close flood gates or take other action to keep their property safe. Local councils may distribute sand bags from a local site such as community hall, which can be used to prevent water entering buildings. However, councils may not always have the required resources, and so homeowners should be prepared to take their own action to protect their property from flooding. Guidance on sand bags can be found online at https://www.gov.uk/government/publications/sandbags-how-to-use-them-to-prepare-for-a-flood, or refer to the other products available at e.g. http://bluepages.org.uk/. After use sand bags are classified as contaminated waste because flood water may be contaminated and, therefore, they need to be disposed of properly.

Flooding adjacent to the River Yare, 1993 © Mike Page

Summary of Permanent Flood Management Structures

Due to Broadland being mostly below sea level permanent flood management structures constrain tidal flood water daily, preventing frequent flooding. Also, on a day to day basis, pumps are running to enable low-lying land to drain. During a flood event, the flood walls, barriers and embankments aim to prevent the surrounding area from flooding. After a flood event, the pumps help to ensure waterlogged areas drain and return to normal conditions. Groynes and breakwaters safeguard the sea wall (and the area behind it) by trapping sediment in order to maintain high beach levels and minimising beach erosion on a day to day basis and during storm surges.

The permanent structures in the plan area have been grouped together into general types to visually show the layout and scale of the flood risk management structures within the plan area (see following page). The majority of the plan area is rural with embankments and pumping stations sitting along the rivers. Groynes, breakwaters and flood walls are mainly located along the coast. The map shows the key assets managed by each RMA. Culverts, gullies and other similar infrastructure for surface water, which are concentrated in urbanised areas, cannot be seen on the map due to the scale.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Legend
Earth Embankments
Land Drainage Infrastructure
Pumping Station
Water Level Control Structure
Coastal Assets
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Demountables
Main Rivers
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Map showing key permanent flood risk management structures currently in the plan area

5. Funding for Flood Risk Management

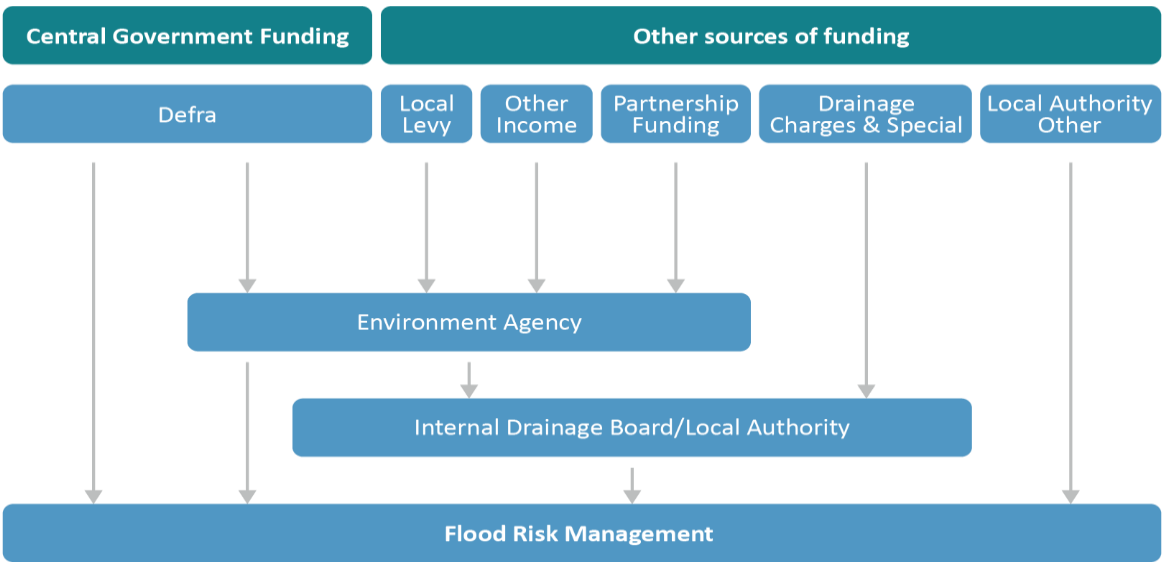
Currently, £2 million a year is budgeted for both capital (new construction, major repairs, replacements and upgrades) and maintenance works on the Broadland flood embankments (and structures relating to the embankments) through the Broadland Flood Alleviation Project. In total, approximately £143 million has been spent by the project between 2001 and 2020, mainly during the first half of this time period, on raising and strengthening the embankments.

From 2009 to 2020 the Environment Agency have spent £43 million on piling and refurbishments in Great Yarmouth with a further £28 million approved for on-going construction works. The most recent large scale repairs of groynes on the Eccles to Winterton coast in 2015-2016 cost £3.6 million and this frontage has had over £68 million spent on works since 1991. Building and repairing these structures is inherently expensive, especially in a coastal setting where specialist techniques and machinery are required and in the Broads area where the ground is soft and access to remote locations is difficult.

The three Internal Drainage Boards each spend over £1.5 million a year to maintain drains and pumping stations. One of these IDB's; Broads IDB, spent just under £2 million in 2018/2019 on capital works. Norfolk and Suffolk County Councils allocate highways funding to clean gullies, culverts and associated surface water drainage infrastructure.

Based on these examples over £260 million has been spent on flood risk management in the plan area over the last few decades. However, the actual sum is far greater due to additional smaller schemes and activities, and if works undertaken by other organisations and groups is included, which also contribute to improved flood risk management.

Different RMAs will have different internal processes for obtaining funding for flood risk schemes. This has been simplified below in an example of how funding would be obtained for a flood risk management scheme. A common feature between the RMAs is that the major funding stream is through **central government grants**, via the Department for Environment Food and Rural Affairs (Defra), but this money generally needs to be supplemented from other sources, for example from local businesses (called **partnership funding**). There are tests to obtain funding and these can be simplified into a strategic case (is it needed?), technical (is it achievable?), economic (is it value for money?), financial (is it affordable?) as well as checking environmental impact, and if private contributions are obtainable. These assessments need to consider not just the immediate investment for construction, but the costs and impacts over the whole life of the scheme.



Capital/Replacement Work

Proving a Need and Viability of a Flood Risk Management Scheme

We will illustrate the process of capital works through the example of a pumping station in the BFI area which needs building or replacing. Such a business case is an essential requirement in order to obtain funding from central government, to ensure best use of public money.

The strategic part of the business case will provide evidence for why continued or improved flood risk management is required at the location. Because the primary purpose is to manage flooding, the business case will look at the benefits associated with the pumping station, for example how many homes could be better protected, what area of environmental habitat would benefit, what critical services could continue to operate etc.

The BFI plan area is comparatively rural and so will require larger proportions of partnership funding (private sources)

Once the need for an approach to flood management has been established, the **technical justification** for a pumping station (in this example) is made. Other approaches must be considered to ensure it is the best option, but if a pumping station provides the most viable solution then this is promoted as the preferred option. It is important that any negative impacts (e.g. noise, pollution, visual impact etc) of the pumping station are considered so that these can be avoided or mitigated.

Economically, the benefits of the pumping station should outweigh the cost, i.e. the predicted monetary damages from flooding which are avoided because of the pumping station should be greater than the full cost of constructing, maintaining and operating the pump. Since much of the BFI area is rural, the number of homes which the pumping station would better protect will typically be smaller than in more urbanised areas. However, the importance of protecting commercial activities such as farming, tourism etc. as well as environmentally important habitat is recognised in the appraisal process. These benefits cannot be counted twice for different projects. Homes better protected attract the largest proportion of funding and in the calculation, homes have to be shown to have their risk reduced by the proposed works. However, we are not allowed to include in the calculation any homes built after 2012 as these properties should already be protected from flooding through the development planning process.

Even though the benefits of the pumping station could be shown to outweigh the costs, it must still be established that the pumping station can be afforded. This **financial check** will consider funding likely to be available both initially to build the pumping station, as well as over the whole lifetime of the pumping station, as it will require maintenance and operation.

The business case and evidence of the viability of the scheme will go through multiple reviews to ensure that it is accurate, there is indeed a need for the proposed scheme, and that it represents best use of public money.

Obtaining Funding

Although the various RMAs can access different funding streams, a common route is to seek **funding from central government under** Flood and Coastal Erosion Risk Management **Grant in Aid** (GiA). As discussed previously funding is preferentially given to projects based on set criteria. Since central government funding must be spread across the whole of England, there are always more schemes proposed than can be funded in any one year. Additionally, funds are based primarily on the number of homes better protected from flooding. Therefore schemes, especially those in more rural areas or with low numbers of homes benefitting, often require additional local funding, termed **partnership funding**. This is where local businesses and homeowners can contribute to the cost of the flood risk scheme. It also considers local priorities, as the scheme is developed with input from the local community. For example, the **Bacton to Walcott** sandscaping project, where sand was added to the beach**, had approximately two thirds of the construction cost** funded privately from the gas terminal at Bacton.

Another funding source is **local levy** which comes from the local councils, and is raised through council tax, for example. These levies are subject to the approval of the RFCC (Regional Flood and Coastal Committee) and the RFCC and local councils come to an agreement as to which flood risk schemes receive this funding. This is a more flexible funding source but will consider the business case for the scheme.

There are systems in place so that RMAs may lend each other money if one has a surplus in a given year. This surplus may be required in case of emergency works following storms or flood events.

Maintenance Work

Planned and Unplanned Maintenance

Maintenance works occur throughout the lifetime of a flood risk management structure but are usually planned ahead over a rolling programme of every 5 years. We will illustrate how **maintenance works** are funded using the example of embankments.

A programme of works will consider the condition the embankments are in and the condition they should be in, to ensure they provide the service for which they were designed. **Condition surveys** often use a grading system to prioritise which structures require maintenance. They are undertaken by an engineer and ecologist working together to decide the best approach.

If, for example, the programme suggested the embankment was due for maintenance but was in good condition, then this would be noted, no works would be undertaken, and the embankment would be inspected again at a later date. However, if works were required, then the engineer and ecologist would plan how to carry out the engineering works in a manner that also considers any impacts on the environment.

Unplanned maintenance activities are also undertaken as required. For example, if a flood event removed soil from the top of an embankment, or had otherwise weakened it, emergency works may be undertaken to top up the embankment with soil and ensure it is structurally sound.

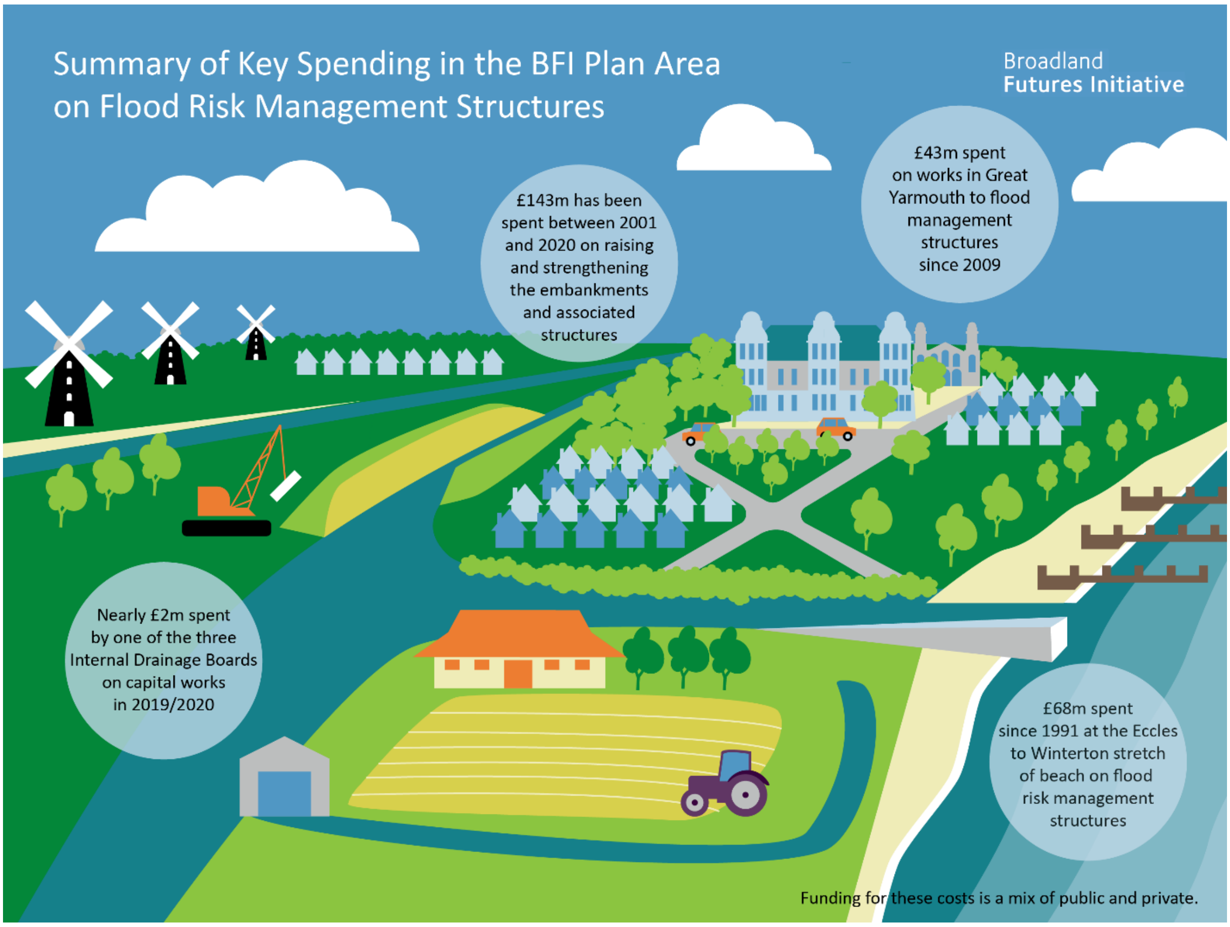
Obtaining Funding

RMAs fund maintenance activities through different means:

The Environment Agency annually requests money from central government for proposed maintenance works. Government then allocates money on the basis of which structures are higher risk (number of people and homes being protected).

Some RMAs charge other RMAs a rate for maintenance activities. For example, councils pay fees for the drainage service provided by the IDB, calculated on the number of hectares of land that lie within the IDB area. Another maintenance funding source for IDBs is through land owners in the drainage area. Land owners get charged a rate per acreage of land that falls within the IDB boundary.

Local Authorities may use council tax to support local schemes.



6. Summary

This document aims to inform you about the current approaches to flood risk management within the BFI plan area. This is to enable local communities to understand the issues and to contribute to decision making about managing future flood risk.

Flood risk cannot be removed completely but can be reduced through active planning and management. RMAs are responsible for flood management depending on the source of flood risk, as listed below:

- **Coastal** – the Environment Agency as well as local councils on some stretches of coast
- **Tidal** – the Environment Agency
- **Fluvial (river)** – the Environment Agency as well as the Lead Local Flood Authorities (usually County Councils) for smaller watercourses

> Flood management structures in the plan area require continuous maintenance and capital works; the funding of these works can be both private and public.

- **Surface Water** – Lead Local Flood Authorities, Internal Drainage Boards and Highways Authorities for major roads such as the A47
- **Groundwater** – Lead Local Flood Authorities

These RMAs ensure that people, the environment and infrastructure receive a certain standard of protection against flooding. They work together to ensure that flood risk is actively managed. Although the RMAs are responsible for managing flood risk, homeowners also have the ability to prepare for, and in some situations have responsibility to manage, flood risk.

There are many different approaches and techniques being used to manage flood risk in the plan area. These include; temporary structures, permanent structures, natural flood management, development planning, flood warnings and property level resilience. As a general rule, management of flood risk is most effectively addressed as near to the **source** of the hazard as possible. A second set of approaches to flood management aim to intercept the water as it travels along the various **pathways.** Finally, the consequences of flooding occurs at houses, roads, environmental sites and many other **receptors**. It will not be possible for source and pathway actions to prevent all water reaching these receptors and cause damage, and therefore additional measures may be needed at the receptors themselves.

Different RMAs will have different internal processes for securing funding for flood risk schemes. In general, a common source of funding is through government grants under Flood and Coastal Erosion Risk Management **Grant in Aid** (GiA). Money may need to be supplemented from private investment (for example from local businesses and communities), known as **partnership funding**. Funding for new schemes, referred to as capital works, requires a rigorous evidence base that demonstrates both that the scheme benefits will outweigh the costs, that sufficient funding is available, and also that the scheme will not have undue negative impacts. GiA is a limited fund that is allocated based primarily on the number of homes benefitting. The BFI plan area is largely rural and so will likely require large partnership funding contributions for new flood risk schemes.

7. What is 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

Aerial image of Hickling Broad © Mike Page

- Origins of the plan area
- Sources and nature of flood risk
- Coastal processes review
- The influence 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

8. Glossary

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.

Breakwater: A barrier that aims to take the energy of waves and therefore protect a coast or harbour and reduce erosion.

Broadland Futures Initiative (BFI): A partnership formed to agree a framework for future flood risk management in the Broadland area. The strategy aims to better cope with our changing climate and rising sea level. Planning has started now with the strategy to be implemented from the mid-2020s onward.

Capital works: Work involving new construction, major repairs, replacements and upgrades.

Catchment: Area where water is collected by the natural landscape. Each river has a catchment area that drains to it.

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.

Culvert: A culvert is a structure that allows water to flow under a road, railroad, trail, or similar obstruction from one side to the other. Typically embedded and surrounded by soil, a culvert may be made from a pipe, reinforced concrete or other material.

Deposition: When sediment, being carried in water, wind or ice, is dropped and settles on the ground surface.

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.

Erosion: Process by which particles are removed by the action of wind, flowing water or waves (opposite is accretion).

Flood Risk Management: Flood risk management aims to reduce the likelihood and/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.

Groyne: A structure used to interrupt longshore drift and therefore trap sediment and maintain beach levels**.**

Gullies: In the context of surface water gullies can be chambers and gutters used to collect surface water runoff from roads and pavements.

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

IDB: Internal Drainage Boards are independent locally funded and operated public bodies. There are currently around 100 IDBs in England which consist of elected members. They are responsible for reducing flood risk for both rural and urban communities (including protection of businesses and infrastructure) and they also have duties in protecting and enhancing valuable wildlife habitats.

Longshore drift: The movement of material along a coast by waves which approach the shore at an angle (the direction driven by the prevailing wind) and recedes directly away from the shore at a right angle.

Maintenance works: Works undertaken to ensure a structure does not deteriorate over time to the point that it cannot provide its original purpose/function.

Overtopping: When water exceeds the height of a flood risk management structure or ground and so spills over the top of it.

Pipes: Cylindrical water tight tubes.

Receptor (with relation to flooding): Refers to anything or anyone which can be affected by a flooding event e.g. properties, people, environment.

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

Seepage: The process of a liquid or gas moving through a permeable/porous substance over time e.g. water moving through soil.

SFRA: Strategic Flood Risk Assessments inform planning development and policy. It is carried out by the local council and should assess flood risk from all sources of flooding.

Sluice: A sliding gate or other device used for controlling the flow of water.

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.

Tide Locking: The phenomena which occurs when the high level of the incoming tide restricts the normal drainage of river water out to sea.

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

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