

Lowestoft

FLOOD RISK MANAGEMENT STRATEGY

Summary 2016



©Mike Page



Introduction

This Strategy Summary Document is a brief overview of the Strategy for managing the risk of flooding to Lowestoft from the sea, rivers and extreme rainfall. More information can be found by visiting our website www.lowestoffrmp.org.uk

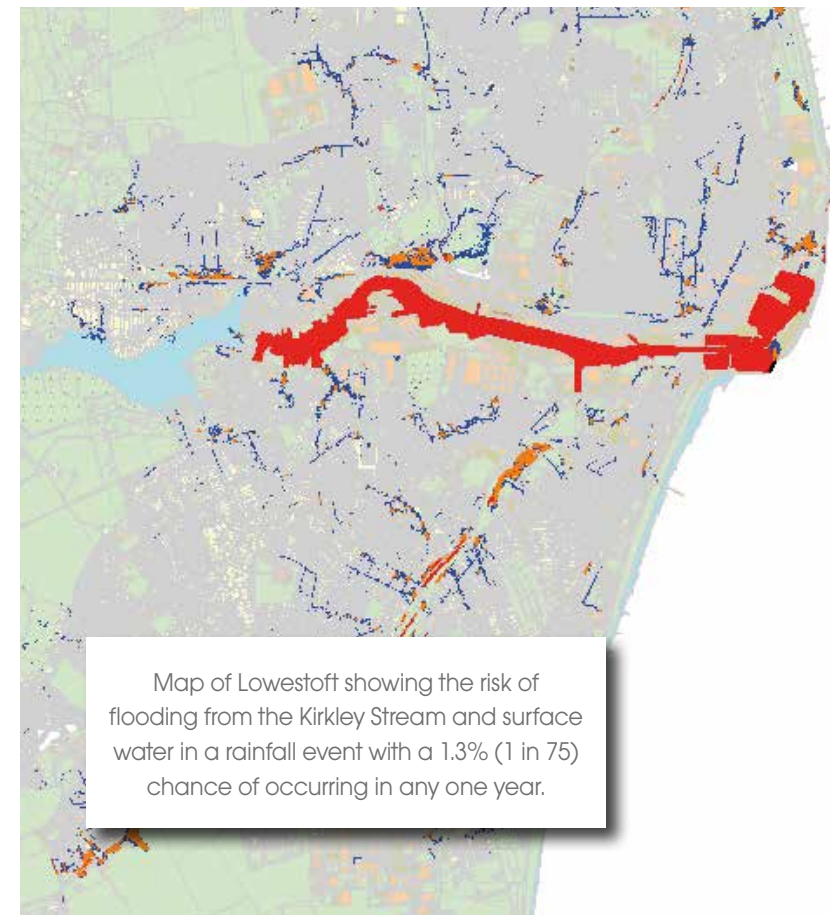
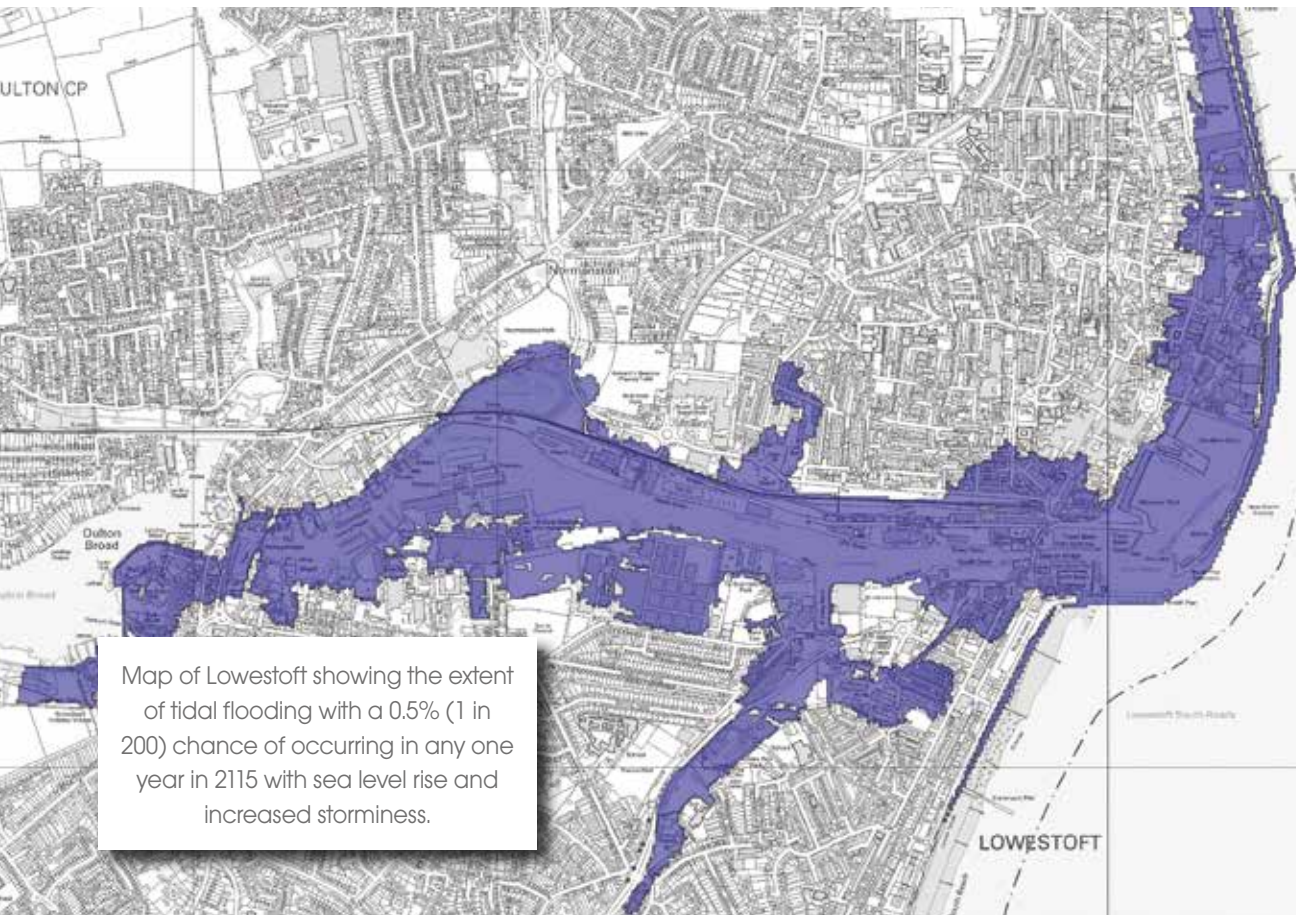


What area does the Strategy cover?

This Strategy covers the areas of Lowestoft deemed to be at significant risk from tidal flooding between the Outer Harbour and the western end of Lake Lothing at Mutford Lock; from river flooding along Kirkley Stream, and from surface water flooding both adjacent to Kirkley Stream and other key areas identified to the north and south of Lake Lothing.

The main risk from tidal flooding is from the sea caused by a tidal surge that develops in the North Sea along the eastern coastline of the United Kingdom as was demonstrated by the events in 1953 and most recently in December 2013. Lowestoft has very limited existing tidal flood defences and without further investment, the town will remain at significant risk.

The risk from river flooding was demonstrated by the event last July 2015 along Kirkley Stream. The risk of surface water flooding from extreme rainfall events has been considered within a number of local flood risk zones. In both cases it is important to consider the zone or area that contributes to the flood risk rather than a specific location where the flooding occurs.



Why do we need a Strategy?

The December 2013 tidal surge flood event which resulted in over 160 properties being affected and business brought to a standstill, highlighted the inadequacy of Lowestoft's flood defences and the impact it has on existing and potential growth for the town.

This was further reinforced by the flooding in the Kirkley area of Lowestoft in July 2015 following an extreme

rainfall event. This demonstrated Lowestoft's vulnerability to all forms of flooding from the sea, rivers and extreme rainfall.

Solutions are needed to address all these forms of flooding to offer the best possible flood risk management for Lowestoft.

Lowestoft has very limited existing flood defences and, without further investment, there is a risk that the instances of flooding will increase as the impacts of climate change increase. Unless we act there is a risk that in the future losses to property and businesses from flooding within Lowestoft will become unsustainable and will prevent any future growth.

We need a Strategy so that we can gain approval from the government for the schemes and help secure public grant aid monies to contribute to the cost of the flood risk management solutions. The Strategy will also feed into our local plans.

This Strategy forms the first step in setting out our future approach to managing this flood risk. In making decisions about this, we need to consider how our actions in one area could affect another and also make sure that choices we make now will not have a negative impact on our long term plans.

Following on from this Strategy there will be a number of activities before any schemes can take place. These will include detailed appraisal of the options, confirming funding sources and planning.



How has the strategy been developed?

In deciding the best ways in which we should manage flood risk in Lowestoft now and in the future, we have carried out a number of studies looking at:

- the current extent and risk of flooding
- how flood risk could increase in the future through the impacts of climate change
- the costs and benefits of providing different flood risk management solutions

To ensure that impacts to people, the local economy and the environment have been fully understood and taken into consideration, everyone living, visiting or working on or around Lowestoft has been invited to take part in determining how flood risk within Lowestoft should be managed.



To date this has been through:

- engagement with key stakeholders
- one-to one discussions
- the formation of a Project Advisory Group, consisting of members of the community and local businesses.

We have used the feedback from this consultation to make decisions on the best approach and the options that are proposed to be taken forward in the strategy.

How will we pay for future defences?

To undertake any works identified within the Strategy it will rely on the availability of funds. Some funding is available from central government - this is known as 'Flood Defence Grant in Aid' or 'FDGiA'.

The amount of money the government contributes depends upon the number of households and other assets, such as businesses, being protected.

For Lowestoft it is unlikely that we will be given full funding from Flood Defence Grant in Aid. But it is possible that projects may qualify for partial funding and still go ahead in time if other funding can be found to meet the remainder of the cost.

So we have been looking at ways that we can find funding from others in order to pay for works now and in the future.

How does this strategy tie-in with the the Gorleston to Lowestoft coastal strategy?

This strategy abuts and overlaps in some areas with the Gorleston to Lowestoft Coastal Strategy which is considering the shoreline and coastal defences.

Due to these overlaps both strategies are being consulted on together and will seek approval with the Environment Agency and Defra at the same time.



What strategic flood risk management solutions have been considered for tidal flooding?

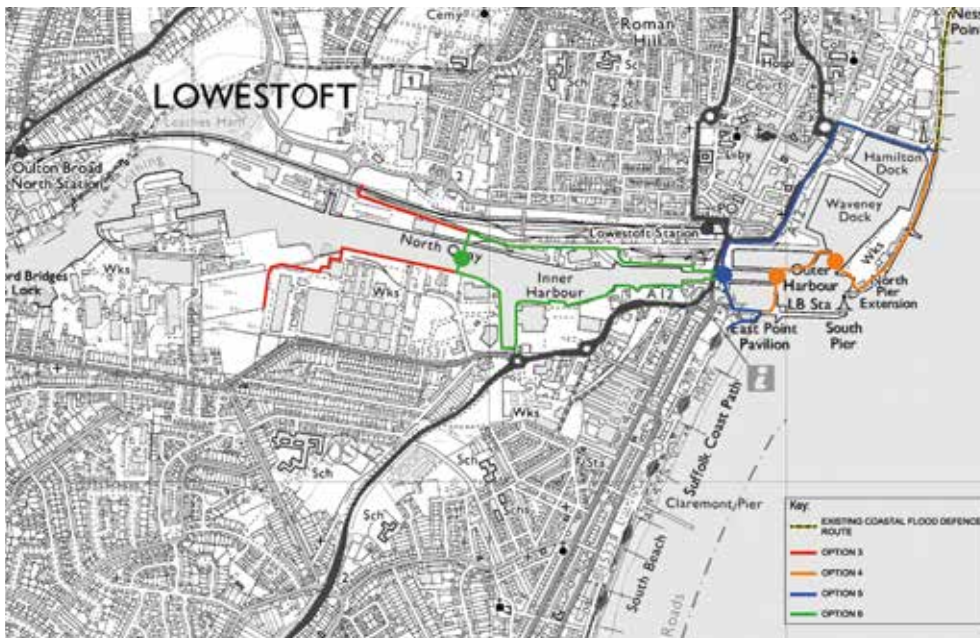
In deciding the best ways in which we should manage tidal flood risk in Lowestoft now and in the future, we have assessed a long list of options as follows:

- Do nothing (Option 1)
- Maintain existing defences (Option 2)
- Improve - defence raising – walls only (Option 3)
- Improve - defence raising – walls combined with a barrier – 3 barrier locations considered
- Outer Harbour (Option 4)
- seaward of Bascule Bridge (Options 5)
- within Lake Lothing combined with 3rd crossing (Option 6)

What criteria have been used to assess the strategic flood risk management solutions considered?

In assessing the possible options the following criteria have been used to decide which of those solutions offer the best with ways to manage tidal flood risk in Lowestoft now and in the future:

- Level of flood risk reduction
- Impact on navigation
- Impact on residents and businesses
- Environmental and landscape impact
- Impact on highways and bridges
- Buildability
- Delivery timescale
- Cost – capital and whole life
- Potential regeneration benefits
- Potential benefits linked with 3rd Crossing project



Tidal flood risk management options

Option 1 Do nothing

This option is a **baseline only** against which to evaluate the economic benefits of the other options. It allows the existing tidal flood risk management assets to degrade and ultimately fail.

This option is not considered any further based on social, economic and sustainability grounds.

Option 2 Do minimum - maintain

This option involves the continued maintenance of the existing wall along the east side of the A12 Waveney Road, which forms the foundation for ABP's security fence and provides an informal tidal flood defence. This wall only prevents tidal flood waters up to a level



of 2.90m AOD from flowing into the town centre directly from the Outer Harbour. It does not prevent tidal flooding from other routes from inside Lake Lothing.

This wall, in combination with the restrict of flood water flows through the Bascule Bridge opening, only provides a very low standard of flood protection (7) and was overtopped during the flood event in December 2013.

Option 3 Improve – Flood walls only

This option involves the construction of 5km of flood walls to the north and south of Lake Lothing, as well as in front of the Royal Norfolk & Suffolk Yacht Club to the south and along the perimeter of the Outer Harbour to

the north where it ties in with the existing coastal flood defences at the north-east corner of Hamilton Dock.

The flood defence wall on the north side of Lake Lothing would need to tie into high ground at its western end. This can only be achieved by either a flood gate across the dual Norwich to Lowestoft railway line near the Peto Way/Barnards Way roundabout or by a further 750m of wall construction to the west. On the south side the wall would need to tie into high ground at its western end close to Waveney Drive.

There would be numerous floodgates, especially on the north side, to allow access to the port quayside area in front of it. The walls between 0.4m and 1.7m in height would also be crossed by a significant number of drainage outfalls.



Option 4

Improve – Outer Harbour barriers & walls

This option involves the construction of the barrier across the channel entrance to Lake Lothing on the seaward side of the Bascule Bridge as well as another barrier at the entrance to the Outer Harbour.

It involves the construction of 0.7km of floodwall which ties into the same point of high ground to the south as per the other improve options as well as to the harbor sea wall to the north.

The number of floodgates required and the number of drainage outfall crossings would be minimal in comparison to all the other improve options considered. This option was considered to understand if there would be any benefit to the Outer Harbour area and the key businesses that operate in that area.

Option 5

Improve – Bascule Bridge barrier & walls

This option involves the construction of the barrier across the channel entrance to Lake Lothing on the seaward side of the Bascule Bridge.

It involves the construction of 1.5km of floodwall along the same alignment as Option 3 but the floodwalls would tie into the barrier structure rather than continue further west within Lake Lothing to tie into high ground.

The height of the floodwalls would vary between 0.4m and 1.7m. The number of floodgates required and the number of drainage outfall crossings would be significantly less than those for Options 3 and 6.



Option 6 Improve – 3rd Crossing barrier & walls

This option involves the construction of the barrier across Lake Lothing adjacent to the Riverside Business Park at the proposed location for the 3rd Bridge Crossing to consider whether there were any benefits from that joint construction.

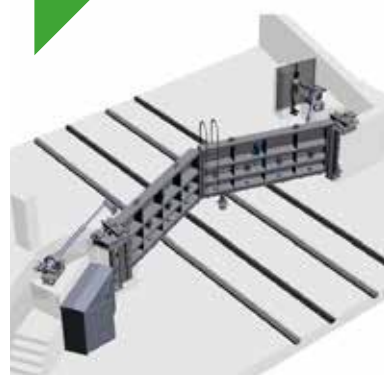
It involves the construction of 3.7km of floodwall along the same alignment as Option 3 but the floodwalls would tie into the barrier structure rather than continue further west and tie into high ground at the north-west and south-west ends.

As for Option 3 there would be numerous floodgates, especially on the north side, to allow access to the port quayside area in front of it. The walls would also be crossed by a significant number of drainage outfalls.

What could the barrier structure look like?



What could the flood walls and gates look like?



Assessment of the tidal flood risk options considered

Option 1 **Do nothing**

This option is a baseline against which to evaluate the economic benefits of the other options. It allows the existing tidal flood risk management assets to degrade and ultimately fail.
This option is not considered any further based on social, economic and sustainability grounds.

Option 2 **Maintain**

Does not offer credible standard of flood protection
Not sustainable as it relies on third party structures which are not formal flood defence assets

Option 3 **Improve – Flood walls only**

Estimated cost = £28million
Significant impact and constraints imposed on land based port operations especially within Lake Lothing
Does not reduce flood risk to properties at western end of Lake Lothing
Buildability and operational issues with flood gate across railway line
Resiliency of defences compromised by large number of flood gates and drainage outfalls

Option 4 **Improve – Outer Harbour barriers**

Estimated cost = £55million
Significant impact on port operations
Buildability issues with construction of two barriers affecting entrances to both Lake Lothing and Outer Harbour at the same time
Compromises Outer Harbour designation as “safe haven”

Option 5 **Improve – Bascule Bridge barrier**

Estimated cost = £17million
Least impact on port operations
Disruption to navigation during construction of barrier across Lake Lothing entrance
Benefits from integrating with Bascule Bridge control facility and mechanical stand-by plant

Option 6 **Improve – 3rd Crossing barrier**

Estimated cost = £52million
Significant impact on port operations and navigation within Lake Lothing
Resiliency of defences compromised by large number of flood gates and drainage outfalls
Potential cost benefit from joint construction offset by traffic and other impacts

What strategic flood risk management solutions have been considered for river and surface water flooding?

In deciding the best ways in which we should manage river (fluvial) and surface water (pluvial) flood risk in Lowestoft now and in the future, we have assessed a long list of options. To date we have only looked at one rainfall scenario – that with a 1.3% or 1 in 75 chance of occurring in any one year. This gives us a guide as to which options might be worth considering further.

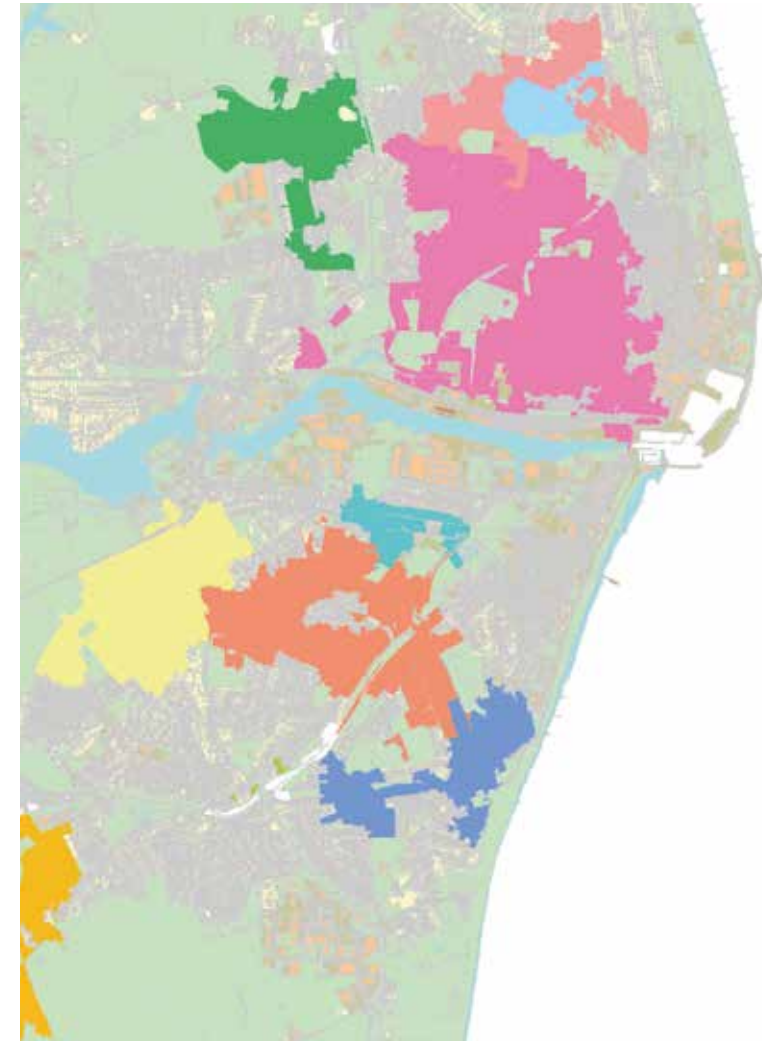
What criteria have been used to assess the strategic flood risk management solutions considered?

In assessing the possible options the following criteria have been used to decide which of those solutions offer the best ways in which we should manage flood risk in Lowestoft now and in the future:

- Level of flood risk reduction
- Impact on residents and businesses
- Local acceptability and availability of land
- Environmental and landscape benefits and impact
- Impact on highways and bridges
- Buildability
- Delivery timescale
- Cost – capital and whole life
- Potential regeneration benefits

Surface water management using sustainable drainage systems

The risk of surface water flooding depends on a complex interaction between the quantity of rain, where it falls, the topography, the amount of permeable land and the drainage systems. One of the key ways to manage surface water flooding is to work with nature, increasing the area of permeable land and places where water can naturally be held or stored. This is known as Sustainable Drainage and is the strategic option being considered in all areas. The location of sustainable drainage options will be targeted within the zones that contribute to the flood risk and can include a wide range of different measures.

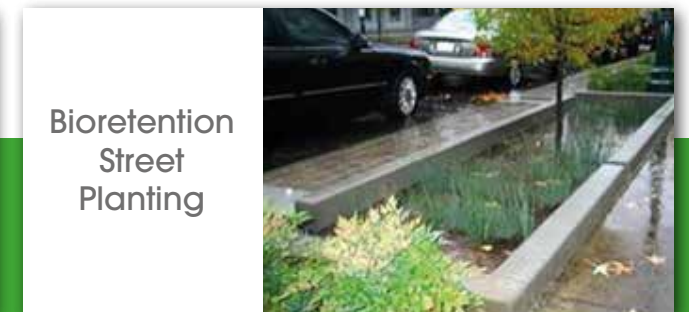
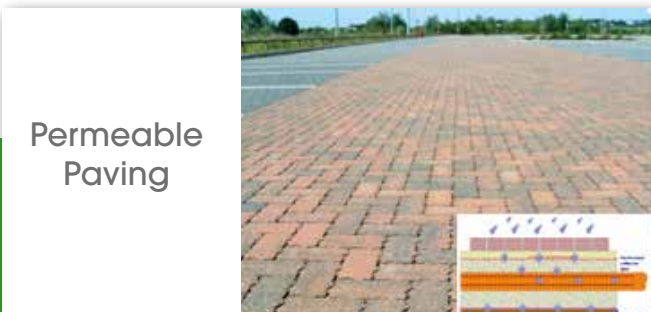
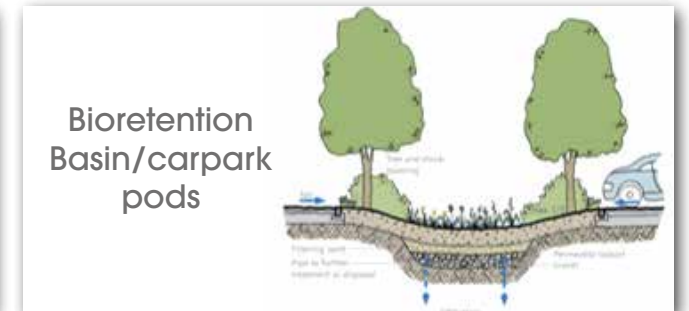
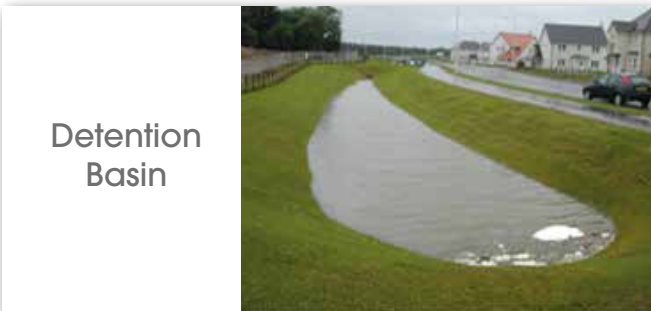
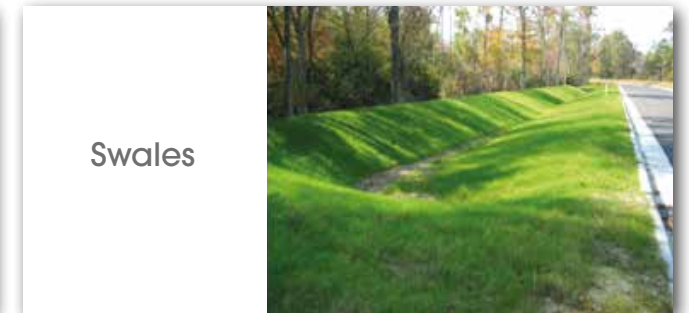


Map of target area reduction zones

At this stage we are starting to consider which combination of sustainable drainage features are likely to be the most technically effective in reducing flood risk in each target zone. The range of such features is illustrated below. Whether these are taken

forward will depend on the willingness of individuals and communities to accept them and whether these options can be delivered at a cost that reflects a benefits provided and also the availability of land to install such features.

Source control



Options for the Kirkley Stream

Due to the recent flooding, which led us to undertake a detailed investigation into the way the stream and local drainage systems operate, we have more data about the area. This enabled us to consider a wider range of options to manage the flood risk along the Kirkley Stream. These are all based on the assumption that the stream is maintained in its current (May 2016) state. We know that keeping the stream clear of vegetation is important as one of the key factors that led to the flooding in July 2015 was blockages by vegetation and debris.

Pictures of Kirkley Stream at the time of flooding and after vegetation clearance - This is the baseline from which we will judge whether any other interventions will further reduce local flood risk.



Fluvial Options Overview – Location & Description

Options Considered

- 01 Create new storage and restrict flows
- 02 Additional storage in existing green spaces
- 03 Re-routing of the watercourse
- 04 Reducing flows from upstream watercourses
- 05 Restrict flows to use capacity in existing drainage systems
- 06 Create embankments
- 07 Installing a two stage channel in Kirkley Stream
- 08 Earlier operation of surface water pumps
- 09 Increasing capacity of existing storage areas
- 10 Removal of silt and re-grading of the watercourse
- 11 Adding non return valves on the network
- 13 Installing local mitigation measures
- 14 Optimising throttles in the river
- 15 Strategic non-return valve and underground storage



Assessment of the flood risk options considered for Kirkley Stream

Option	Description of Option	Assessment of option
01 - New storage and restrict flows	Using upstream greenspace to store flood water.	Reduces flood risk to The Street, Carlton Colville. We suggest this option is considered further.
02 - Additional storage in existing green spaces	Using greenspace in Meadow Park to store flood water.	Not effective alone as doesn't reduce flood risk in Carlton Colville, Aldwyck Way/Velda Close or Tom Crisp Way, in a 1 in 75 storm,. May work during more extreme storms so we suggest it is considered as part of wider package of storage measures
03 - Re-routing of watercourse	Diverting and re-routing part of Kirkley Stream which currently enters a culvert under properties in Carlton Colville.	This has been demonstrated to reduce flood risk and we suggest this should be considered further
04 - Reducing flows from upstream watercourses	Implementing measures upstream (such as basins and swales) that reduce the flow of water.	This reduces flood risk to The Street, Carlton Colville and should be considered further as part of a wider package of SuDS and storage measures.
05 - Restrict flows in existing surface water system	Using drains with spare capacity during storm events to maximise the current drainage system.	This will be technically challenging and risks transferring flood risk to other areas. We do not propose to take this option further.
06 - Creating embankments	Raising the banks of Kirkley Stream around Aldwyck Way & Velda Close.	This does not appear to reduce flood risk in the Aldwyck Way/Velda Close area in a 1 in 75 storm, but may work in more extreme rainfall events. We suggest this is considered further
07 - Implementation of two stage channel	Increasing the capacity of Kirkley Stream by re-profiling the river banks.	On its own, this is shown to have limited benefit in reducing flood risk to Tom Crisp Way. However, we believe this is worth being considered as part of a wider package of measures.

Option	Description of Option	Assessment of option
08 - Earlier operation of surface water pumps	Switching on the water pumping stations earlier during a flood event.	This does not have any impact on flood risk and we will not be taking this forward in the short-list of options to be considered.
09 - Increased capacity of existing storage areas	Clearing silt from the existing flood storage area (off Tom Crisp Way) to increase storage capacity for flood water. Doesn't reduce flood risk to the area in a 1 in 75 year flood.	This was not shown to be effective in reducing flood risk to the area in a 1 in 75 year flood but may work in more extreme rainfall events. We believe this is worthy of further consideration as part of a wider package of storage measures.
10 - Removal of silt and re-grading of the watercourse	Clearing silt from 1.5km stretch of Kirkley Stream. Doesn't reduce flood risk in 1 in 75 year flood.	Modelling demonstrated no reduction in flood risk in 1 in 75 year flood. On its own this option does not appear to be effective but may be worthy of consideration as part of a wider package of measures to improve the flow along the stream.
11 - Installation of non-return valves	Installing non-return valves to stop water from Kirkley Stream going back up into the drainage network.	Whilst the initial results do not appear to reduce flood risk we believe it is worthy of further consideration, looking at different valve locations along the stream.
13 - Local mitigation measures	Installing raised doorways, blocked airbricks and other Property Level Protection measures.	Demonstrated to reduce flood risk for a 1 in 20 year flood. We suggest this is considered as part of a Property Level Protection measures appraisal across the whole project area.
14 - Removing restrictions in the river	Removing restrictions in Kirkley Stream including increasing the size of culverts.	No demonstrable benefit in a 1 in 75 rainfall event, but we suggest this may be worthy of being considered as part of a wider package of measures to improve flows in the stream. This might be technically challenging and expensive to achieve.
15 - Strategic non-return valve and underground storage	Installing a storage tank alongside the Aldwyck Way area of Kirkley Stream with non-return valves and a water pump.	This demonstrated some flood risk benefit and we suggest it is considered further.

Proposed short list of pluvial/fluvial options

Having explored individual options as described in the table above, few appear to merit progressing alone so we suggest exploring further a range of measures in combination including:-

- Upstream Storage
- Sustainable Drainage Systems
- Improving conveyance of water through the stream
- Installing non return valves
- Local mitigation measures such as property level protection measures

As well as further studying the technical aspects of these options, we will be looking at whether they provide benefits during more frequent and/or more extreme storms and whether the benefits they provide outweigh the costs of implementation. Our ability to deliver many of these options will depend on the availability of suitable land and landowners' co-operation.

Have your say...



If you would like to comment on the Strategy presented in this document, please complete the following questions and return to Sharon Bleese (Waveney District Council Project Manager), or alternatively you can provide specific comments by letter, phone or email:

post to Riverside, 4 Canning Road Lowestoft, Suffolk NR33 0EQ **phone** 01502 523 346 **email** Sharon.bleese@eastssuffolk.gov.uk

We would appreciate your response by the 29th July.

About you Name (optional): **Organisation / business** (if relevant):

I am particularly interested in knowing more about:

Do you... live in Lowestoft or the surrounding area? (please circle) YES NO Work or run a business in Lowestoft or the surrounding area YES NO
 Visit Lowestoft for leisure? YES NO

How do you feel about the overall draft options we have presented here (please circle)?

I generally agree I partly agree I don't agree I don't know I don't understand the information

Please give any reasons:

How do you feel about particular options we have presented here (please tick)?

	I generally agree	I partly agree	I don't agree	I don't know	I don't understand the option
Tidal barrier option 1					
Tidal barrier option 2					
Tidal barrier option 3					
Tidal barrier option 4					
Tidal barrier option 5					
Tidal barrier option 6					
Surface water flooding (rivers and extreme rainfall)					
Option 1					
Option 2					
Option 3					

	I generally agree	I partly agree	I don't agree	I don't know	I don't understand the option
Option 4					
Option 5					
Option 6					
Option 7					
Option 8					
Option 9					
Option 11					
Option 13					
Option 14					
Option 15					

Your thoughts about flooding from rivers and extreme rainfall (known as surface water flooding)

.....

.....

.....

.....

.....

.....

.....

.....

In this document you will see that we have identified areas potentially at risk of flooding. Do you agree with this information? (please circle)

Yes No

Tell us about your local experience of where flooding occurs.

.....

.....

.....

.....

In this document we have shown different options that can be used for sustainable drainage (see page 10). We would be grateful for your thoughts about which options would be acceptable to you and why.

.....

.....

.....

.....

.....

.....

.....

.....





.....
.....
.....
.....
Do you have any other suggestions? (please continue on the next page)

.....
.....
.....
.....
Do you have any outstanding concerns or issues with the information presented here? (please continue on the next page)

.....
.....
.....
.....
Thank you for your time in completing these questions, we value your feedback.
If you would like to be kept informed about the project's progress please tell us how best to contact you.

By post - Your address:

.....
.....
.....
.....
By email - Your email address:



A series of horizontal dotted lines spanning the width of the page, providing a guide for handwriting practice. The lines are evenly spaced and extend from the left margin to the right edge of the page.



Lowestoft
& Waveney
Chamber of
Commerce

NEWANGLIA
Local Enterprise Partnership
for Norfolk and Suffolk

anglianwater



Suffolk
County Council



Waveney
District Council



**Environment
Agency**



**ASSOCIATED
BRITISH PORTS**