BFI's Toolkit of Actions to Reduce Flood Risk

Purpose of the Broadland Futures Initiative (BFI) and this Consultation

The Broadland Futures Initiative (BFI) is a partnership for future flood risk management in the Broadland area. Our goal is to agree a plan for future flood risk management that adapts to our changing climate and rising sea level.

Through our work so far we have developed an understanding of likely future flood risk, how this could be impacted by climate change, and how managing flooding should help support the characteristics of this unique area[1]. Incorporating your feedback from our previous consultation, we have confirmed the objectives that we want our plan to achieve, including how actions will be developed and evaluated.

Our next step is to identify the different possible ways by which we could manage flood risk from various sources in the future. The image on the next page illustrates the 'toolkit' of possible actions which we propose to explore when developing the plan. We would value your input at this early stage to help complete the toolkit long list of possible actions and ensure we have not missed anything.

Background to Flood and Coastal Erosion Risk Management

The BFI Plan is building on significant investments made in the past 20 years such as:

- The Broadland Flood Alleviation Project[2] which upgraded and realigned flood banks, and delivered environmental improvements
- Implementing the Kelling to Lowestoft Ness Shoreline Management Plan[3] which has led to the installation and maintenance of various coastal structures and the addition of sand to the beaches
- Sheet piling and concrete wall refurbishments to upgrade protection in Great Yarmouth, as recommended in the Flood Defences Strategy Review

The management of flood risk can also be achieved through actions that do not necessarily involve large scale construction, such as the use of land in ways that are less vulnerable to the effects of flooding, and warning systems that reduce the potential disruption to our lives.

Whilst some fundamental requirements to manage flood risk in this area of national and international significance have not changed from what has been done in the past, the context for delivering sustainable flood and coastal erosion risk management is changing. For example, we have a greater appreciation of climate change and the value of the environment and our community wellbeing. In some cases, actions to manage flood risk can have wider benefits such as creating new opportunities for recreation, wildlife, and the management of water resources that at other times may be scarce.

[1] https://www.broads-authority.gov.uk/looking-after/climate-change/broadland-futures-initiative
[2] https://www.gov.uk/government/news/broadland-flood-alleviation-project-reaches-20-year-landmark
[3] http://www2.north-norfolk.gov.uk/smp6/index.html

How the Action Toolkit has been Developed

The action toolkit has been developed from a review of what has been done or considered previously for the BFI area, as well as similar studies being undertaken nationally and internationally. At this stage, actions are not being considered for particular locations and are not being assessed for their suitability. Instead, we are simply creating a long list of all the actions that could potentially be taken, either alone or more likely in combination with other actions, to manage flood risk in the area. These actions are not all new, with some being a continuation of existing practices and infrastructure.

The following pages group together actions that would have similar impacts on the processes which lead to flooding. Following your feedback, we will develop the details of these actions, after which we can assess those that best achieve our objectives and so should be included in the final plan.

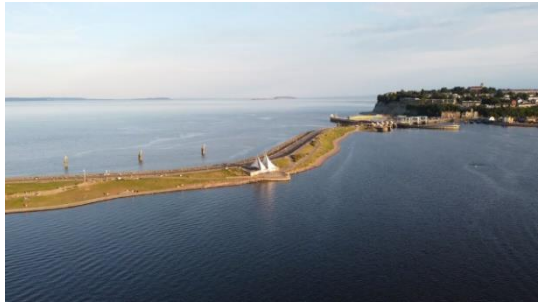
We would Love to Hear from You

- Do you agree that these possible actions should be in the toolkit?
- Are there any actions missing from the toolkit?

Please click *here* to give us your views.

Action Group	Example Image	Short Description
Flood transfer and storage for watercourses (including wetlands, washlands and reservoirs for possible later use) Photo by Silvia Garattini		Following periods of high rainfall and risk of flooding, river water is stored in a designated area to reduce the flow downstream. Similarly, if located near the mouth of a river, the flood storage can take tidal floodwater flowing upstream. The storage areas can be in line with the channel or set back away from the channel. Water can then be released back into the river slowly. Such storage areas could operate without the need for intervention as part of 'natural flood management' or may need to incorporate engineered structures such as spillways and pumps to transfer or evacuate water. Stored water could be used for other purposes e.g., food production, mitigating the impact of saline intrusion, or for drinking water supply if it meets quality requirements.
Slowing rainfall-runoff in *urban* areas (including surface water storage, green roofs and rainwater harvesting) Photo by David Lally (credit Geograph)		Rainfall run-off is allowed to infiltrate into the ground or directed to surface water storage. If this approach, termed Sustainable Drainage Systems (SuDS), is not possible rainfall would be discharged to the existing drainage network or sewers with the possibility of flooding if the capacity to take this water is not sufficient.

Action Group	Example Image	Short Description
Slowing rainfall-runoff and water flow in *rural* areas (including planting woodland, changing soil and crop management practices, the creation of woody dams and re-meandering of small watercourses) Photo by Humphrey Bolton (credit Geograph)		Land management practices and the addition of features within small watercourses, particularly upstream in a catchment, can reduce rainfall run-off, promote infiltration and slow flows downstream. These practices can have wider benefits e.g., improving water quality and reducing soil erosion and provide opportunities for wetland farming such as reed and sedge growing.
Hard protection of beach and dunes by reducing erosion (linear structures including walls, groynes and offshore rock revetments) Photo by Mike Page		Engineered structures such as groynes and offshore rocks help keep sand on the beach by reducing the energy of waves and interrupting the natural movement of sand along the shoreline. Walls resist wave energy which would otherwise erode dunes.

Action Group	Example Image	Short Description
Soft protection of beach and dunes by reducing erosion (beach recharge/sandscaping) Photo by Hugh Venables (credit Geograph)		Adding sand to beaches reduces the energy in waves and, therefore, erosion. It increases the supply of sand which is naturally moved along the shoreline to replenish other beaches. This maintains beaches for the benefit of the environment and recreation.
In-channel flood barrier (typically open structure across larger channels with gates that lower vertically, rotate upwards or otherwise to form a barrier to upstream flow) Photo by Malc McDonald (credit Geograph)		Flood barriers in channels, are normally open but close when extreme tidal levels are forecast, preventing this water travelling upstream. By being closed only temporarily this limits the restriction on flows coming down the rivers and on navigation. Barriers may also help reduce saline intrusion upstream during extreme events.
In-channel flood barrage (mostly closed structure across the channel forming a dam) Photo by Ben Meyrick (credit Geograph)		A barrage forms a permanent closure across the full width of a river channel preventing all tides, including during extreme events, moving upstream. Locks can be added to maintain navigation, while, for flows coming down the river, discharge is maintained by sluices or pumps. Hydroelectric power can be generated from the movement of water.

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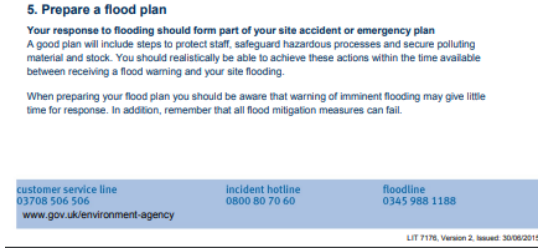
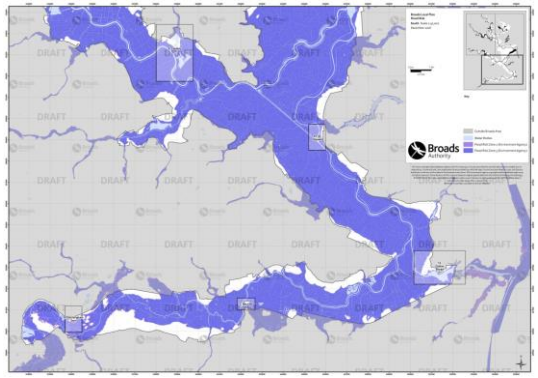
Water level control (pumping stations, sluices and weirs) Photo by Peter Doktor		Much of the BFI area is already below sea level and embanked rivers can be higher than the surrounding land. To drain low lying land, e.g. for agriculture, pumping stations lift water from smaller watercourses on the lower level up into the rivers. Pumps can lower upstream water levels ahead of a flood and return the area to normal levels afterwards. Sluices and weirs are small-scale barriers used to maintain water levels where required, direct water towards pumps, and prevent saline water moving upstream while allowing freshwater to discharge.
Linear flood management structures (including earth embankments, walls, temporary and demountable structures) Photo by Jeremy Halls		Linear structures, such as earth embankments and concrete flood walls, keep water within the watercourses and designated flow routes preventing or controlling the spilling of water onto the adjacent land. In flat areas, water can travel some distance inland if not contained.

Action Group	Example Image	Short Description
Managed aquifer recharge Photo by Water Education (https://www.watereducation.org/western-water/recharging-depleted-aquifers-no-easy-task-its-key-californias-water-supply-future)		In suitable permeable geologies, surface flood water can be collected, cleaned and discharged to ground through gravity or pumped underground to be stored in aquifers. Using natural aquifers avoids the cost and land needed to construct storage above ground. The stored water could potentially be used for e.g., food production and drinking water or alternatively left in the ground to supplement springs and river flows during drought periods.
Property level resilience (including flood gates, air brick covers, raising wiring and building raising) Photo by Broadland Environmental Services Limited		Modifications can be made to individual properties to increase resilience e.g., prevent water from entering and also to reduce the damage if flooding occurs. Both can speed the recovery of properties and people's lives and help reduce the anxiety associated with flood risk to properties.

Action Group	Example Image	Short Description
Conveying water in channels (including widening and deepening of channels, or the creation of new channels) Photo by David Medcalf (credit Geograph)		Constricted channels can be widened or deepened to allow higher flows to pass through. New river channels can provide additional flow capacity, shorten the flow route or divert flood water away from areas at high risk. However, enlarged, or new channels can also allow larger volumes of tidal water to come up rivers.
Flood forecasting and warning (including those issued by the Environment Agency and Met Office)		Forecasts of flood conditions and the issuing of warnings can help people and businesses prepare for, and respond to, flooding by taking the appropriate action to reduce damage and disruption to their lives, properties, land and assets.
Flood action plans (including contingency plans, local equipment pool and community skills) Photo by Environment Agency (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/439863/LIT_7176.pdf)		Flood action plans describe the actions that people, and communities have agreed should be taken to reduce damage and disruption to their lives, properties, land and assets. Actions are typically linked to warnings or river/tide level thresholds.

Action Group	Example Image	Short Description
Controlled spatial and land use planning (including Environment Agency Flood Zones, as used in Local Authority Local Plans) Photo by Broads Authority		Flood Zones[4] categorise areas with similar likelihoods of flooding, from rivers and the sea. Flood Zones steer development away from areas of high flood risk to areas of lower flood risk.
Managed realignment through rollback and relocation of receptors (possibly in combination with coastal or riverine habitat reinstatement) Photo by Environment Agency		In some coastal and inland situations, the vulnerability of existing flood risk management structures may be so severe, and flood risk so great, that people need to relocate to a safer place away from the risk. This can be accompanied with land use changes to improve natural protection for nearby areas.

[4] https://flood-map-for-planning.service.gov.uk/

An idyllic Broads scene © Broads Authority – Tom Mackie