

Creating a flood plain to prevent flooding, river Harbourne, UK

1. Policy Objective & Theme

- SUSTAINABLE USE OF RESOURCES: Preserving coastal environment (its functioning and integrity) to share space

2. Key Approaches

- Ecosystems based approach
- Technical

3. Experiences that can be exchanged

Using innovative measures, which harness natural processes, a river, notorious for its flooding, has been made safe, removing fear from the local communities living along its banks.

4. Overview of the case

This is a flood prevention scheme on a river incorporating an award-winning combination of ecological (wetland creation) and conventional (damming) measures.

5. Context and Objectives

a) Context

The village of Harbertonford, in the south-west of England, has been flooded 21 times in the past 60 years - including six times since 1998. The high frequency of flooding and serious damage caused to properties resulted in a flood defence scheme for the village being made a priority by the government. The village is located at the confluence of three rivers, the main one being the River Harbourne, which eventually reaching the English Channel. One of the smaller waterways has a catchment of less than 1 km² but it is very steep and water levels rise rapidly when it rains. A scheme was needed to reduce the frequency of property flooding from once in three years to a minimum of once in 25 years, and if possible to a higher standard of protection. The development of the village around the river has resulted in there being no significant floodplain that can be reconnected, and also restricts any potential channel enlargement. Started in 1999, a key objective was to ensure the scheme was completed before winter 2002.

b) Objectives

The aim was to provide a sustainable flood defence system, both in terms of the use of natural resources and with minimal maintenance requirements, such as dredging. It was also the intention to enhance the socio-economic, historic and natural values of the area. The scheme was also planned so that the local communities could enjoy their river once again, rather than be fearful of flooding.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

Creation of this flood defence scheme was initiated and approved by the Environment Agency for England and Wales and the Department for Environment, Food and Rural Affairs (Defra) with considerable input provided by the regional government, Devon County Council. Design of the scheme was by Halcrow Group Ltd of Exeter and construction by E. Thomas Civil Engineering of Truro, part of Mowlem Civil Engineering.

b) ICZM tools

A large number of options were investigated, including various combinations of channel improvements, together with flood storage areas at different sites upstream of the village. The scheme chosen had two main features, an upstream flood storage reservoir and flood defence works through the village. This option has reduced the risk of flooding to a minimum of once in 40 years.

The flood storage area is 4.1 ha., which can hold 150,000 m³ of water. It was created one kilometre upstream of the village, using a claycore earth dam to retain the water in times of flood. The dam enables the Agency to monitor and control the amount of water flowing down the River Harbourne into the village. This is done automatically with river levels downstream of the dam measured with a pair of hydrostatic level recorders. When the downstream flow rate approaches the maximum limit, the lead flood gate progressively closes down: when this gate is fully closed and flows continue to remain high, a second gate starts to close progressively. This gate does not fully close, only to a preset limit, allowing an opening (approx. 80 cm high) through which the impounded water can pass safely downstream through the village. Flows through the village can be considerable but stay within the design tolerances. After the flood event and when the impounded water has passed downstream, the gates are manually reset to the initial fully open position. This manual resetting only takes place when water levels in the dam are at a safe level to avoid causing flooding downstream.

5000 tonnes of clay were excavated from the storage area and used to construct the earth dam across the valley. The downstream face of the dam is unusual because it slopes gently, and the whole structure has been carefully orientated and contoured to fit in with the surrounding landscape. The dam is located at the narrowest point in the steep river valley and designed to link existing woodlands. It has been designed to allow a once in 10 year flood event to flow through the opening in the dam whilst retaining larger floods up to a once in 40 year event. It is also designed to overtop, in a safe and controlled manner, greater than the once in 40 year flood event. The downstream slope is grassed in order that overtopping floodwater is not impeded. Trees help both to screen the dam, but also form extra habitat and a corridor for the dormice and other wildlife which inhabit the area. The opening through the dam has been engineered to allow the movement of migrating salmon and trout.

This area has become a wildlife area replacing the plain grass field that was there previously. The hollows where the clay was removed are suitable for a variety of wetland species of plants and animals. The bed of the channel was lowered by 60 cm to increase flow capacity. The river channel had been widened for milling in the past but this had caused the river to silt up and requiring frequent maintenance. Three large stone riffles were also installed to maintain a self-cleansing flow of water and help return the river to its natural pre-mill state. A wet, natural lower part of the bank, colonised with wetland plants, was created as part of a two stage channel; the central part to maintain flowing water during low flows when the lower bank is inundated during floods.

The river has been brought back into village life by replacing large stone blocks, which prevented pedestrian access to the river from the village green, with a gently shelving beach. An all weather flat area, opposite the village store, has been created with access for disabled people, or those with prams. Several other local modifications were made including an overflow pipe between the river and one of the other waterways, doubling the width of the river channel and providing vastly improved highway drainage. Local, natural materials have been used where possible.

7. Cost and resources

This flood defence scheme cost £2.6 million funded by the Environment Agency, the Department for Environment, Food and Rural Affairs (DEFRA), South Hams District Council and Harbertonford parish council. Considerable help in kind was provided by Devon County Council. .

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

The flood defence has kept the village dry since it was constructed including several severe weather events, e.g. in 2003, which would otherwise have inundated the village. The hollows, from which clay was removed, have already been colonised by a variety of wetland plant and animal species.

9. Success and Fail factors

The fields purchased to create the flood storage area were used for the temporary site compound and subsequently restored to form part of the nature reserve. Material for the construction of the dam was dug from the area. This helped to reduce costs and keep transport movement to a minimum. The children from the local primary school have been involved from the outset in order to help give them a sense of ownership of the project. They have monitored the colonisation of wildlife in the new flood plain area as part of their nature studies, planted wildflowers within the green, prepared posters to reinforce the safety message whilst works were in progress etc.

10. Unforeseen outcomes

The Flood Defence Scheme has won a Green Apple Environmental Award and been described by the Chairman of the Environmental Agency as 'the future of flood defence schemes'.

11. Prepared by

A. H. Pickaver, Coastal & Marine Union (EUCC), The Netherlands

12. Verified by

It has not been possible to verify this case.

13. Sources

- Effective flood alleviation design and construction. (2005) Bradley, W. Proceedings of the Institution of Civil Engineers: Municipal Engineer 158 107-113 (available through purchase only).
- Harnessing the Harbourne. A flood defence scheme for Harbertonford (undated) Environmental Agency.
- How To Use Floodplains For Flood Risk Reduction (2006) M.S.A. Blackwell & E. Maltby (Eds.) European Commission
- <http://www.environment-agency.gov.uk>
- Integrating design with the environment to maximise benefits from a flood storage dam: successful implementation at Harbertonford (2004) W. T. Bradley, M. E. Jones & A. C. Morison in Long term benefits and performances of dams. Publ. Thomas Telford (available through purchase only).



Harnessing the Harbourne (1.22 MB) 



How to use floodplains for flood risk reduction (3.32 MB) 