

Case study 43. Evenlode Catchment Project

Authors: Jo Old and David McKnight

Main drivers: Flood risk (small rural communities), rural diffuse pollution (Water Framework Directive water quality failures) and habitat (Water Framework Directive fish failures)

Project stage: Year 1 of a 5-year (2016 to 2021) Natural Flood Management project; first cycle of consultation and design for tributary interventions completed, with construction planned in 2017



Photo1&2: Natural Flood Management at Honeydale Farm and a woody dam in the Littlestock Brook

Project summary:

The River Evenlode, a headwater tributary in the Thames Basin (Map 1), is a flashy clay catchment with several small rural towns and villages prone to flooding. The Environment Agency is working with the Evenlode Catchment Partnership and local communities to develop and coordinate a 5-year project that integrates Water Framework Directive (WFD) objectives with a Natural Flood Management (NFM) demonstration scheme. The natural solutions to manage floodwaters often require land management changes to slow and store run-off, which can have multiple benefits for water quality and habitat creation, and drive improvements in agricultural land management.

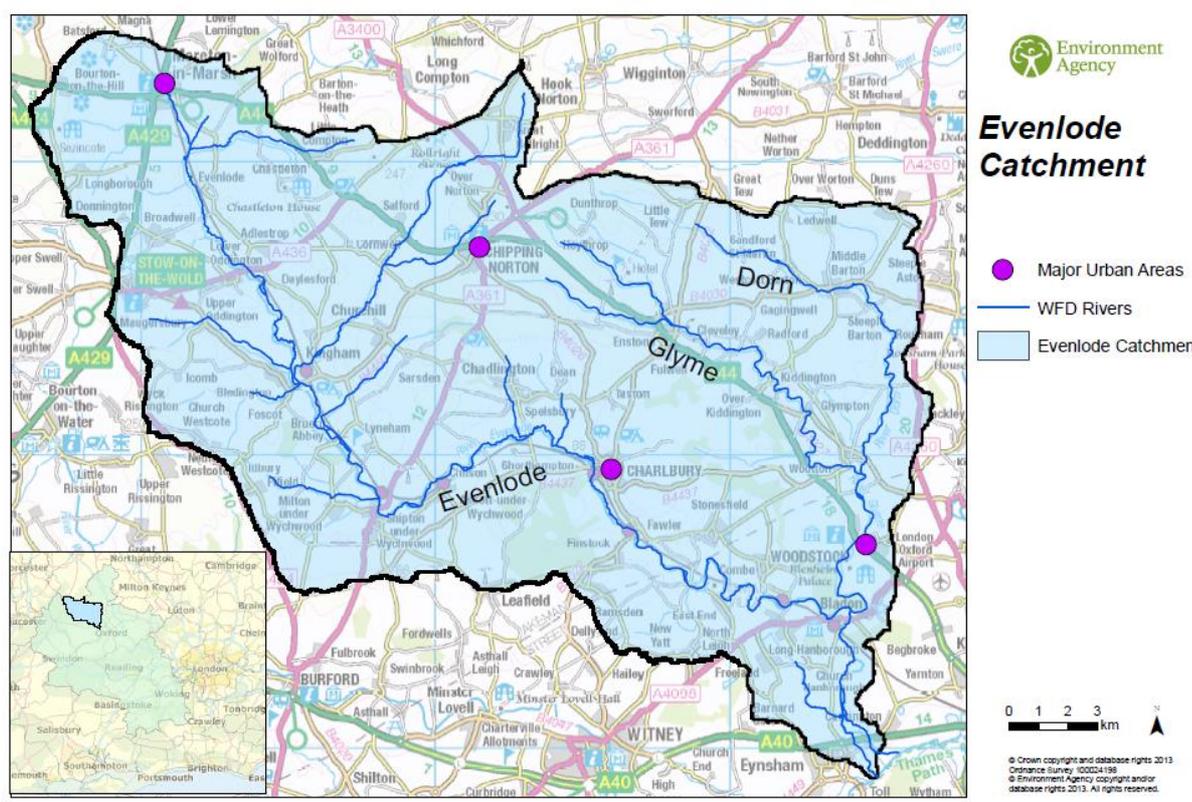
In Year 1 of the project, a tributary catchment (16.3km²) trial in Littlestock Brook was set up with key landowners and the Parish Council. Opportunity mapping, site walkovers and modelling are being used to plan and implement a suite of NFM/WFD measures such as creating temporary water retention ponds in field corners, constructing bunds and scrapes to store more floodwater on grassland areas, installing woody material in-channel to create leaky dams, and land management changes including planting woodland in flood source areas and along flood pathways.

A project officer employed by the Evenlode Catchment Partnership in 2017 will work with partners to implement NFM and WFD opportunities across the 180km² Upper Evenlode catchment. A key objective is to ensure full integration with Thames Water's phosphate reduction project and Natural England's Catchment Sensitive Farming initiative if opportunity mapping directs the project to work in the same tributaries of the Evenlode.

Key facts:

The results from this first NFM trial in the Thames Basin will contribute to the call nationally for evidence on the effectiveness of natural measures for flood risk in lowland catchments. Through an academic partnership a river level and turbidity monitoring network has been installed in Littlestock Brook. The plan is to engage the community to actively support this monitoring network. A key objective of this project is to determine whether multiple small-scale NFM interventions in these catchments can provide a material benefit to flood frequency and extent.

For these natural solutions to be successful, it is crucial to empower the community in decision-making and for them to take ownership of the local solutions employed. Employing an NFM project officer to work with the Evenlode Catchment Partnership is fulfilling Defra's ambition to develop community driven, catchment-based solutions to environmental issues through the forum of catchment partnerships.



Map 1: Location of Evenlode catchment (source: Environment Agency)

1. Contact details

Contact details

Names:	Joanne Old (Environment Agency), David McKnight (Environment Agency), Hilary Phillips (Wild Oxfordshire), Richard Bennett (Wild Oxfordshire)
Lead organisations:	Environment Agency and Wild Oxfordshire
Partners:	Evenlode Catchment Partnership Steering Group – West Oxfordshire District Council; Windrush AEC Ltd; Wychwood Project; an independent hydrologist and Thames Water Utilities Limited. Catchment partnership members – Cotswolds Rivers Trust; Berks, Bucks and Oxon Wildlife Trust; Forestry Commission; Sylva Foundation; Centre for

	Ecology and Hydrology (CEH); Cotswolds Area of Outstanding Natural Beauty (AONB); Natural England; Upper Thames Fisheries Consultative; Combe Mill Education Centre at Blenheim Estate. Landowners Parish councils
e-mail addresses:	joanne.old@environment-agency.gov.uk david.mcknight@environment-agency.gov.uk hilary@wildoxfordshire.org.uk richard@wildoxfordshire.org.uk

2. Location and catchment description

Catchment summary	
National Grid Reference:	SP27201860 (centred on Milton-under-Wychwood)
Town, County, Country:	Milton-under-Wychwood, Oxfordshire, UK
Regional Flood and Coastal Committee (RFCC) region:	Thames
Catchment name(s) and size (km²):	Evenlode (approximately 430km ²)
River name(s) and typology:	Headwater tributaries such as Littlestock Brook (active pool-riffle channel) and main River Evenlode (inactive single thread channel)
Water Framework Directive water body reference:	Year 1 in 29910 and 29960 (Years 2 to 5 extending through Upper Evenlode waterbodies 37410, 37420, 37400, 37390, 30000, 29980, 29950)
Land use, soil type, geology, mean annual rainfall:	Largely agricultural catchment (49% arable, 32% grassland, 14% woodland, 1.4% urban extent) with scattered settlements Headwaters largely impervious (Lias Series), lower Evenlode reaches pervious Oolitic limestone geology Average annual rainfall: ~700mm (source: National River Flow Archive)

3. Background summary of the catchment

Socioeconomic / historic context

Like many agricultural catchments, the Evenlode catchment has a legacy of widespread land drainage operations which has resulted in the river channels being straightened, becoming over wide or over deep, and disconnected from their floodplains. A history of milling has left several barriers to fish passage and perched, uniform mill leat channels. The flashy, clay soils in the headwaters of the Evenlode have been extensively underdrained for agricultural productivity, which may increase the responsiveness of the catchment to rainfall.

Flood risk problem

The Evenlode is a very rural catchment with a responsive flow regime (as indicated by the low Baseflow Index of 0.71 given for Cassington Mill gauging station). It has just two significant riparian settlements – Moreton-in-the-Marsh (population 3,493 in 2011) and Charlbury (population 2,830 in 2011). The rest of the catchment's population is dispersed into many small riparian towns and villages, which are prone to flooding, such as the Wychwoods (Milton, Shipton and Ascott) in the middle Evenlode. Four properties flooded in 1990 and 1998, and 318 properties suffered fluvial flooding in 2007, with additional property flooding attributed to groundwater and surface water sources. Critical infrastructure that may be subject to flood risk includes the Oxford–Worcester railway line which follows the course of the Evenlode for the length of the catchment. Several bridge crossings include Charlbury, which was damaged in the 2007 flood. A residential home situated in the flood zone at Shipton-under-Wychwood was evacuated in 2007.

Property level products and a flood storage area (FSA) were installed after 2007 to reduce the flood risk to seven houses in Milton-under-Wychwood on the Littlestock Brook. Despite these measures the community still feels vulnerable to flooding from the very responsive headwater tributary.

Other environmental problems

In 2016, only one waterbody in the Evenlode catchment was achieving the 'good ecological status' measure required by EU Water Framework Directive. Ten were failing for water quality (phosphate) due to sewage effluent and rural diffuse inputs. Seven waterbodies had failing fish populations due to a combination of poor habitat and barriers to fish passage. Poor habitat is reflective of the uniform and disconnected channel morphology resulting from a history of land drainage. A further issue, evident in the Littlestock Brook, is the excessive production of coarse bed material resulting from channel incision as the river responds to historical realignment away from its natural valley bottom. The downstream transport of this bed material by the flow into the constrained channel of Milton-under-Wychwood further reduces its capacity for peak flows and puts neighbouring properties at risk.

4. Defining the problem(s) and developing the solution(s)

What evidence is there to define the flood risk problem(s) and solution(s)

This NFM/WFD project is community driven and catchment partnership delivered. The small rural communities in the Evenlode catchment are aware of their own flood risk and the inability to attract traditional flood prevention infrastructure and national flood defence grant-in-aid. The Evenlode Catchment Partnership has been working with individual landowners on the main Evenlode to install NFM measures on a field scale such as at Honeydale Farm (Photo 1) and on river restoration to increase floodplain connectivity (Photo 3). Residents in the local villages became interested in these solutions and, through their parish councils, have engaged with the partnership to trial NFM measures.



Photo 3: River restoration on the Evenlode

The flooding/near flooding experiences of the residents of Milton-under-Wychwood generated a wealth of photographic and anecdotal evidence. A study commissioned by the residents suggested flooding had occurred due to a combination of the restrictive size of the road bridge arch, an accumulation of coarse gravel reducing channel capacity (Photo 4) and a very responsive flow regime.



Photo 4: Accumulation of coarse gravel reducing channel capacity

Following the 2007 flood event, an overflow for floodwaters into a bunded field was created 1km upstream (Bruern Grange FSA), property level products measures were installed and works to improve conveyance at the road bridge took place. Most recently, the Parish Council commissioned upstream bank re-profiling work to reduce bank erosion and the suspected source of coarse gravel (Photo 5). Since engaging with the Evenlode Catchment Partnership, the parish is now keen to trial alternative NFM solutions throughout the tributary catchment area (Map 2), with an initial 12 woody dams installed in March 2017 to reduce the transport of coarse bed material (Photo 2).



Photo 5: MP & landowner visit to Littlestock Brook to view excessive coarse gravel deposits

Although the project does not yet have quantitative evidence to show what extent the different NFM measures installed throughout the headwater catchment will have on the flow regime of the catchment, the community is content with a 'no regrets' logic in that measures to slow and store surface run-off should, cumulatively, help to reduce flood risk. The parish is very enthused to be part of a trial to better understand the potential value of NFM, including the additional benefits for water quality and habitat quality through reducing the sediment and nutrient loading to the rivers from agricultural run-off.

What was the design rationale?

A tributary catchment (16.3km²) trial in Littlestock Brook was set up in year 1 of the project with the landowners and the Parish Council. Catchment walkovers are being used, directed by surface water flow maps (Photo 6), to identify significant run-off pathways with the landowners (Photo 7). From these visits, NFM and diffuse pollution measures are discussed and proposed for installation which will work

both hydrologically to slow and store flows and fit with local needs, farming business and practices. Map 2 shows the potential suite of proposed measures which the landowners are considering such as:

- creating temporary water retention ponds in field corners
- constructing bunds and scrapes to store more flood water on grassland areas
- installing woody material in-channel to create leaky dams
- land management changes e.g. woodland creation on valley slopes, riparian and floodplain areas.



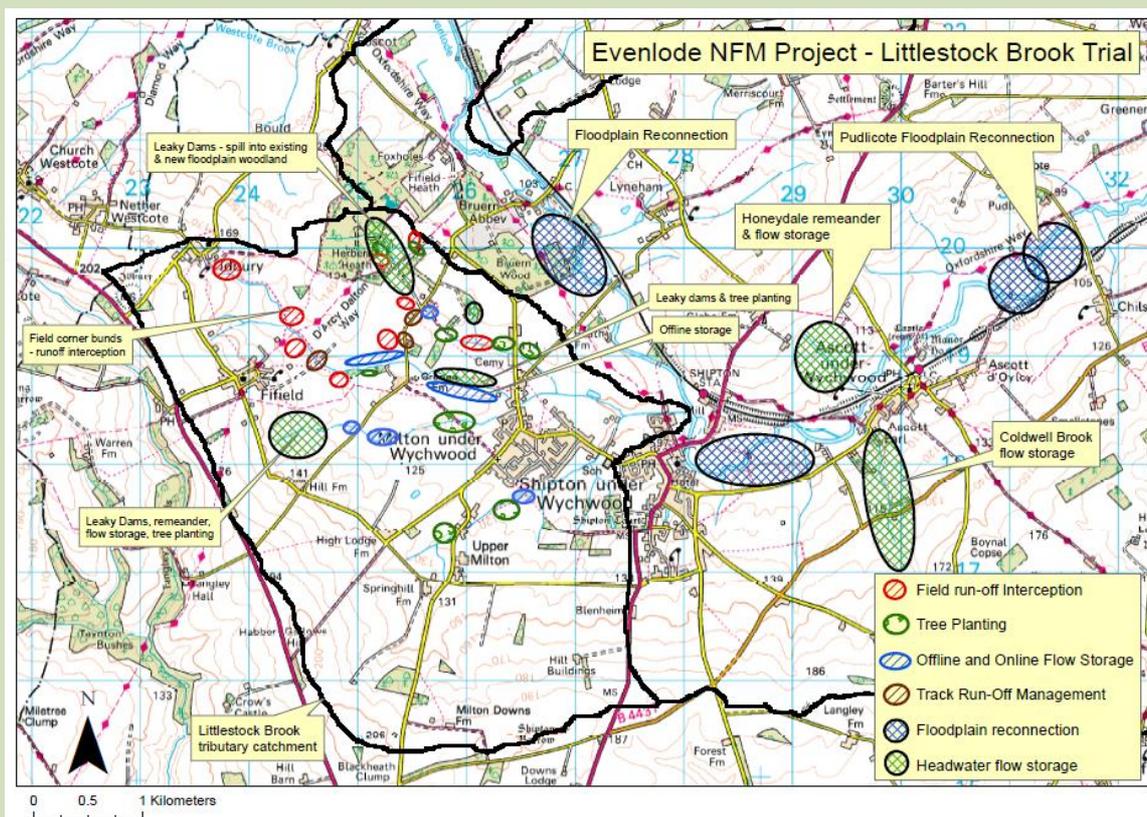
Photo 6: Surface water flow map



Photo 7: Site walkover with landowners

There is a hydraulic model available for this part of the Evenlode catchment which, together with opportunity mapping and hydrological assessments of storage volumes, is being used to test the potential effectiveness of different NFM measure scenarios, including the possible modification and

extension of the existing FSA. The results will enable the project to identify the most suitable locations for NFM measures in the remaining 180km² upper Evenlode catchment for implementation in years 2 to 5 of the project.



Map 2: Potential suite of NFM/WFD interventions in the middle Evenlode catchment

5. Project construction

How were individual measures constructed?

Delivery of interventions is being undertaken by the Evenlode Catchment Partnership (ECP), making best use of local contractors and locally sourced materials. An example is the planned use of felled tree stock provided by local land owners and tree surgeons to construct 'leaky dams'. West Oxfordshire District Council will provide engineering oversight where appropriate. Match funding and in-kind contributions have been secured from a number of sources and partners including landowners, and further funds will be sought through central government land management grants.

How long were measures designed to last?

Information not available at this time as we are still deciding on types of measures to implement.

Were there any landowner or legal requirements which needed consideration?

Public liability concerns for both the catchment partnership in the delivery phase and the riparian owner once the interventions are constructed, require negotiation and agreements. An additional consideration for the Evenlode pilot scheme, particularly in terms of woodland planting, is to maintain the Cotswold landscape character and views as set out in the Cotswold Area of Outstanding Natural Beauty (AONB) management plan.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	2016 to 2021
How was the project funded:	Thames RFCC Local Levy: £230,000 over 5 years Flood and Coastal Risk Management Flood Defence Grant-in-aid (FDGiA): £20,000 in 2017 Water Framework Directive Grant-in-Aid (WFDGiA): £150,000 over 5 years Parish Council: £5,000 Cotswold River Trust: £25,000 Landowners: £50,000
Total cash cost of project (£):	£480,000 (this figure is likely to increase as project evolves)
Overall cost and cost breakdown for WWNP/NFM measures (£):	Funding of project officer post: £200,000 NFM measures and monitoring/modelling: £280,000
WWNP/NFM costs as a % of overall project costs:	Not applicable
Unit breakdown of costs for WWNP/NFM measures:	Not applicable
Cost–benefit ratio (and timescale in years over which it has been estimated):	This project seeks to implement small-scale catchment wide interventions over a period of 5 years. Over this period the number of interventions put in place will build into a quantifiable mosaic of catchment solutions. In isolation these interventions are only likely to have minor effects, making it difficult to measure their benefit.

7. Wider Benefits

Not applicable – this is only year 1 of the project so this information is not yet available.

It is hoped the legacy of this catchment partnership approach, and delivery of NFM as part of an integrated catchment plan addressing multiple local environmental issues, is one that will see local communities empowered to take control and invest in local catchment-based solutions to reduce their own flood risk, and improve the water quality and biodiversity of their surroundings.

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

By working with natural processes, it is expected that the NFM measures planned will be self-sustaining, with any maintenance requirements being delivered through existing agricultural and environmental management. Maintenance and ownership of structures will remain with the riparian landowner. However, the partnership, including the Parish Council and landowners will regularly

monitor the condition of the interventions, most of which will use low-tech, natural materials and methods. An objective of the pilot scheme is to gain an understanding of the ongoing maintenance and adaptive engineering required and the varied lifespans of the range of materials and methods of construction used in the NFM measures. As part of the ongoing legacy of the project, any constructed interventions will be added to a register to allow for inspection and maintenance where required.

Is the project being monitored?

River level and turbidity monitoring (photo 8) has been installed in three locations by the EA and Centre for Ecology and Hydrology (CEH), with additional monitoring and modelling of individual interventions being pursued through student projects as the project progresses. A base-line bed profile survey has been completed prior to the woody dam installation in the Littlestock Brook. Community engagement in the monitoring is being promoted through the ECP by setting up 'monitoring hubs' which will enable the timing of flow peaks to be observed and photographed, and additional parameters such as phosphate levels and invertebrate species richness to be measured through collaborations with Earthwatch and the Riverfly partnership.

Water quality is being monitored in three waterbodies in the Upper Evenlode by Thames Water (TW) through their linked Evenlode rural phosphate reduction trial within their Asset Management Plan 6 (2015-2020). A collaboration of EA, TW and the delivery forum of the ECP, will allow the evaluation of NFM measures in addressing multiple catchment issues and provide the necessary evidence to support future investment in this integrated catchment approach in AMP7 (2020-2025).

The results of this monitoring and modelling programme will hopefully provide quantitative evidence on the effectiveness of NFM measures to provide flood storage and to reduce flood flows and peaks (peak flow, time to peak, desynchronisation), catchment sediment delivery and the number of properties at risk of flooding.

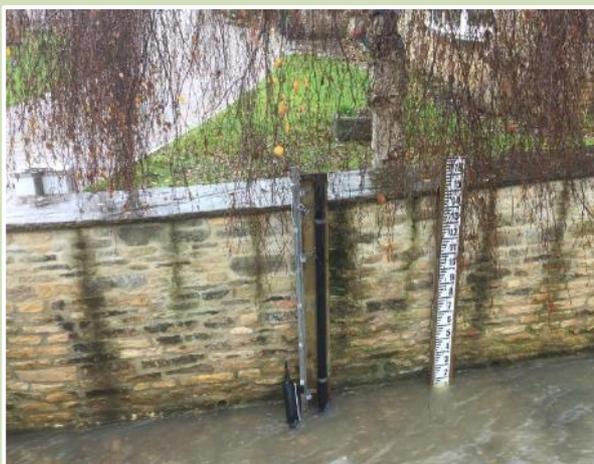


Photo 8: River level monitoring

Has adaptive management been needed?

Not applicable – this is only year 1 of the project.

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

This project is only in the first year of five, but already good progress has been made. As in all multi-partner projects, it takes considerable time to develop relationships with landowners and the community. It also takes time to work through the sometimes conflicting site specific constraints to find the optimum solutions. The success of this project so far has been due to the establishment of an

effective NFM working group drawing together key organisations (EA, Wild Oxfordshire, Local Authority, Thames Water, Wychwood Project, a local river restoration specialist and expert hydrologist) within the wider Evenlode Catchment Partnership, to work with local communities and landowners to develop sustainable NFM solutions. This has allowed a cost effective delivery model to be developed and funded that maximises the potential for local priorities with multiple benefits. As the further lessons are learnt and results shared, they will provide valuable evidence for the potential application of the NFM catchment approach in many other suitable areas of the Thames River Basin. The ambition of the scheme is to provide a positive, sustainable and adaptive model that will create benefits to both the local catchment and at risk communities downstream.

Key challenges which have emerged in year 1 have included:

- Developing appropriate mechanisms to incentivise farmers to implement NFM, including introducing greater flexibility into existing and future agri-environment schemes to allow landowners to make land use changes without incurring penalties.
- Negotiating and agreeing the ownership, liability and maintenance of NFM interventions.
- Evaluating the flood risk and wider benefits of NFM projects and the associated uncertainties with modelling techniques and the appraisal guidance.
- Facilitating the application of the new Environmental Permitting Regulations to catchment partnership NFM projects.
- Resourcing the essential time needed to create, engage and enthuse landowner and community partnerships to deliver catchment-scale NFM projects with integrated outcomes.

10. Bibliography

Not applicable

Project background

This case study relates to project SC150005 'Working with Natural Flood Management: Evidence Directory'. It was commissioned by Defra and the Environment Agency's [Joint Flood and Coastal Erosion Risk Management Research and Development Programme](#).