Case study 32. Roe and Ive

Author: Roe Catchment Community Water Management Group and Eden Rivers Trust

Main driver: Flood risk with additional multiple benefits

Project stage: In progress

Photo 1: Apprentices from the Roe Catchment Community Water Management Group and Eden Rivers Trust installing leaky dams, August 2016

Project summary:

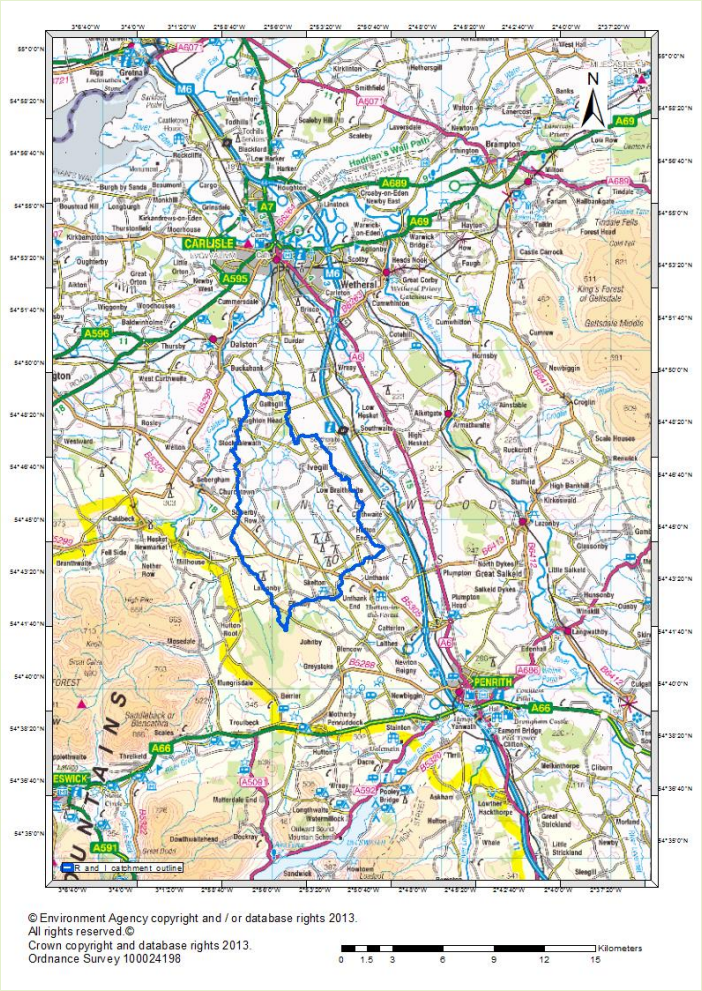
This is a community-led project in the catchments of the Roe and Ive Becks in Cumbria (Map 1) where the Roe Catchment Community Water Management Group, the Eden Rivers Trust, the Environment Agency, Durham University, Catchment Sensitive Farming, Cumbria County Council, the Forestry Commission and the Woodland Trust are working in partnership. A Masters by Research (MRes) project at Durham University commissioned by the project has identified the most important locations and techniques for reducing peak flow, and is now carrying out subsoiling, implementing targeted tree planting and creating leaky dams. The project is also one of the Cumbria Flood Partnership pilot catchments. There has been a positive approach to self-help with individual property resilience measures installed and a community flood warden scheme now in place.

Key facts:

The local community has been flooded 3 times. In 2005 and 2013 many houses were catastrophically flooded, with the property repairs taking over a year in several cases and some residents forced out of their homes. Working with Durham University this project has implemented various Natural Flood Management (NFM) measures to help reduce flood risk. To date this includes:

- soil aeration/subsoiling across 156 acres (63.1ha)
- installation of 25 leaky dams

Local residents have installed property level resilience measures, which alongside these NFM measures, helps to make their properties more resilient to flooding.



Map 1: Location of the Roe and Ive catchments (source: © Environment Agency copyright and/or database rights 2015. All rights reserved (covers Environment Agency). Contains public sector information licensed under the Open Government Licence v1.0 (covers Natural England). © Crown copyright and database rights 2013. Ordnance Survey 100024198)

1. Contact details

Contact details	
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Partners:	Eden Rivers Trust, Environment Agency, Durham University, Catchment Sensitive Farming, Cumbria County Council, Forestry Commission and The Woodland Trust
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2. Location and catchment description

Catchment summary	
National Grid Reference:	NY 38741 45001
Town, County, Country:	Stockdalewath, Cumbria, UK
Regional Flood and Coastal Committee (RFCC) region:	North West
Catchment name(s) and size (km^2):	Roe and Ive: combined area 69.4km^2
River name(s) and typology:	Roe Beck (Upper): mixture of mainly step pool channels and bedrock channels Roe Beck (Lower): mixture of mainly step pool channels and bedrock channels Ive: mixture of mainly step pool channels and bedrock channels
Water Framework Directive water body reference:	Roe Beck (Upper): GB102076073750 Roe Beck (Lower): GB102076073770 Ive: GB102076073760
Land use, soil type, geology, mean annual rainfall:	Land use: Dominant land use is improved grassland, arable; rough grassland also common. Woodland present in small blocks. Soil type: Dominated by Soilscape 18: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. Also present Soilscape 6: Freely draining slightly acid loamy soils (Soil information taken from Cranfield Soilscapes) Superficial geology: Till Bedrock geology: Yoredale Group (limestone, sandstone, siltstone and mudstone), Pennine Lower Coal Measures Formation and South Wales Lower Coal Measures Formation (undifferentiated) (mudstone, siltstone, sandstone, coal, ironstone and ferricrete), Permian Rocks (undifferentiated) (sandstone and conglomerate, interbedded), Yoredale Group (limestone with subordinate sandstone and argillaceous rocks) Annual average rainfall in the River Roe catchment is 984mm (NERC 2015)

3. Background summary of the catchment

Socioeconomic/historic context

The Roe Catchment Community Water Management Group is a community group in Cumbria south of Carlisle based in the catchments of the Roe and Ive Becks, which feed into the River Caldew and ultimately the River Eden. The community was flooded in 2005 and were told this was a '1 in 200 year event'. After flooding again in 2013, they realised that the return on investment for the agencies to assist a small community was prohibitively low and so decided to take a lead to find solutions, not only for themselves but for other dispersed communities. The Roe Catchment Community Water

Management Group's vision is to develop a collaborative relationship with the Environment Agency and other stakeholders to produce transformational change in the management of rural river catchments. The Roe Catchment Community Water Management Group's role as the Community Keystone Organisation within a community-driven ecosystem (Figure 1) allows it to:

- co-ordinate all stakeholders
- develop a systemic approach
- be community driven
- be individually accountable

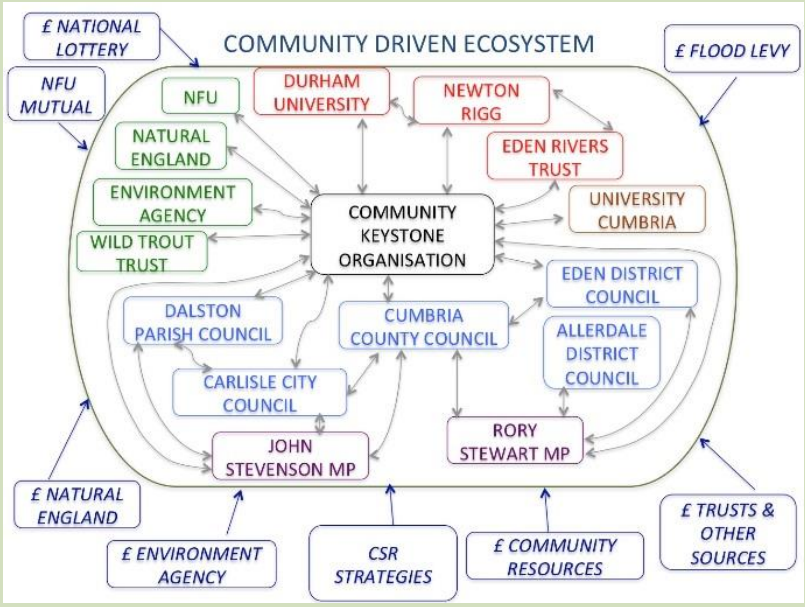

Figure 1: The project framework

In his thesis, MRes student Callum Pearson wrote the following about the historic land cover:

'Throughout the medieval period the River Roe catchment formed part of the Forest of Inglewood which stretched from Carlisle to Penrith and would have been predominantly forested (Cumbria County Council 2009). Gradual deforestation to increase agricultural output and the shift from common moorland grazing and arable fields to planned enclosures in the 18th and 19th century has left the catchment with its current land coverage of small blocks of woodland plantations and ancient gill woodland surrounded by agricultural land' (Pearson 2016, p. 29).

Flood risk problem(s)

Flash river flooding and surface water run-off are the 2 most damaging types of flooding faced by the community. The community has been flooded 3 times since 2005. In 2005 and 2013 many houses were catastrophically flooded, with the property repairs taking over a year in several cases and some residents being forced out of their homes. This being particularly stressful for the elderly residents. Some young residents in rented houses never returned to the village after the flood, pushing the average age up further. With fewer young people to help during a flood, the elderly are even more vulnerable. Although property sales are low in the catchment, one house lost half its value when sold and several have been on the market now for much longer than usual. This has been attributed to people not wanting to move in to a house with a known flood record.

Individual houses have taken personal flood mitigation measures such as bund walls, sump pumps, flood gates and tanking of buildings. These measures are costly and have had to be initiated by the owners, but are only realistic up to previous flood peaks. Any global warming impacts causing flood levels to rise further would not be protected by these local measures and so a catchment-wide solution is necessary.

Other environmental problems

Water quality on all 3 water bodies is below their target of 'good' ecology status by 2027: Roe Beck (Upper) is currently classified as 'moderate', Roe Beck (Lower) as 'poor' and Ive as 'poor'. There have been several pollution incidents in the catchment in the past, including a large fish kill as a result of a slurry spillage.

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

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

This project is driven by the Roe Catchment Community Water Management Group. Targeting work on the ground was informed by the Durham University MRes modelling project. The project is also using a combination of Durham University's open source SCIMAP software and the Environment Agency's surface water flooding maps to identify possible areas for offline storage features. This information will then be groundtruthed during walkover surveys.

What was the design rationale?

The Durham University modelling produced information on the type and scale of the NFM features required (Pearson 2016). The recommendations are summarised below.

- The implementation of soil aeration on higher risk fields within the catchment is encouraged, but work is needed to determine the current levels of soil compaction (Mean MaxQ% change: -16.11)
- Woody debris dams should be constructed within the channels with a Strahler order of >3 (Mean MaxQ% change: -2.37 to -4.33).
- Land within the catchment that can be assigned to land cover change to reduce flood risk should, for the greatest flood risk reduction, be converted to deciduous woodland. Natural grassland is also predicted to reduce the maximum river flow.
- The most effective land cover change location with regards to agricultural area affected and the corresponding percentage reduction in maximum river flow occurred were the riparian buffer zone scenarios (Mean MaxQ% change: -5.23)..

Project summary	
Area of catchment (km^2) or length of river benefitting from the project:	7 km^2
Types of measures/interventions used (Working with Natural Processes and traditional):	Leaky dams, grassland soil aeration and subsoiling Opportunities for offline storage, tree planting and hedge planting to be investigated in 2017 to 2018
Numbers of measures/interventions used (Working with Natural Processes and traditional):	Interventions to date: • 156 acres (63.1ha) of soil aeration/subsoiling • ~25 leaky dams
Standard of protection for project as a whole:	Not known at present
Estimated number of properties protected:	Not known at present

How effective has the project been?

The project is in the early stages of delivery and so it is currently difficult to assess the effectiveness of the scheme. There is a gauging station at Stockdalewath which has the potential to be used for comparative purposes and a local resident also maintains a long-term rain gauge dataset.

The modelling has indicated that NFM features would have to be installed in very large numbers to make an impact on downstream flows. The partnership would appreciate additional advice or help on evaluating the effectiveness of the scheme.

Crucial to the project's success to date has been the fact that the Roe Catchment Community Water Management Group has been driving progress forward. It has been closely involved in the modelling project, hosted site visits for MPs and key civil servants, promoted the project widely at meetings and conferences, made landowner introductions and become involved in the creation of the leaky dams.

5. Project construction

How were individual measures constructed?

Eden Rivers Trust apprentices and a local contractor constructed the leaky dams. An agricultural contractor who lives within the Roe catchment carried out the soil aeration and subsoiling.

How long were measures designed to last?

Leaky dams are expected to last in the region of a few years to 10 years (Quinn et al. 2013). However, this project is aiming to carry out riparian tree planting, which should provide a sustainable input of natural leaky dams in the years to come.

The longevity of the positive impacts of soil aeration and subsoiling depends on the management of the land. If the management practice on the land continues to compact the soil, then this is not considered to be a sustainable solution. By working closely with Catchment Sensitive Farming, however, landowner awareness and knowledge about the importance of soil health will increase throughout the catchment.

Were there any landowner or legal requirements which needed consideration?

Ordinary Watercourse consent for the leaky dams was obtained from Cumbria County Council (the Lead Local Flood Authority).

Landowner negotiations involved some introductions made by the Roe Catchment Community Water Management Group and agreements obtained through the Eden Rivers Trust.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	NFM measures: 2015 Property level resilience: 2013
How was the project funded:	NFM measures were funded through the Environment Agency, in kind time from the Roe Catchment Community Water Management Group and Heritage Lottery Fund

	Eden Rivers Trust apprentice time through the Cherish Eden project Property level resilience was funded by individual home owners.
Total cash cost of project (£):	The costs of the NFM element are unknown at present as the project is in its early stages. To date, ~£50,000 has been allocated to the project for capital works. Property level resilience: estimated at £150,000
Overall cost and cost breakdown for WWNP/NFM measures (£):	Unknown at present – the project is in its early stages
WWNP/NFM costs as a % of overall project costs:	Unknown at present – the project is in its early stages
Unit breakdown of costs for WWNP/NFM measures:	Subsoiling/aeration: ~£35 per acre + VAT Leaky dams: ~£200 + VAT (when material is available o-site)
Cost–benefit ratio (and timescale in years over which it has been estimated):	No information at present

7. Wider benefits

What wider benefits has the project achieved?

Catchment Sensitive Farming is working with landowners throughout the catchment to increase awareness of diffuse water pollution. Measures such as separating clean and dirty water, improving farm infrastructure and raising awareness of soil health will all help to reduce sediment-rich run-off from reaching watercourses and will therefore also have a positive impact on flows. There is also the opportunity to work with Natural England to amend existing agri-environment schemes or enter into the new Countryside Stewardship scheme. This approach opens up the opportunity to fund some NFM interventions through these schemes. Measures such as riparian tree planting and offline storage areas would also have wider benefits in terms of habitat creation.

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

The only physical features that have been installed to date are leaky dams. There is a plan to carry out quarterly or 6-monthly maintenance checks to make sure they continue to function well.

Is the project being monitored?

There is a gauging station at Stockdalewath, which could be used to assess the effectiveness of the scheme. Time lapse cameras have been installed to observe how the leaky dams respond during high flow events. The partnership would appreciate additional advice or help on evaluating the effectiveness of the scheme.

Has adaptive management been needed?

No adaptive management has been required as yet. The project is in the very early stages of delivery of physical features.

9. Lessons learnt

What did you learn and how could it be applied elsewhere?

- There is a very short period where is it possible to work within the streams and rivers. Therefore it is important to have landowner agreements in place and work scheduled in for the summer so that as much as possible can be done on the ground during the working window.
- There are few incentives for landowners to install NFM measures at present. Offering soil aeration in exchange for installing some leaky dams has had some success.
- Having the community as the driving force behind the project is extremely effective.
- Every flood is a learning process.

10. Bibliography

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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.