

Summary of Calderdale Natural Flood Management (NFM) Study (2022)

Aim

The Environment Agency commissioned a study in 2021 to ask some key questions about what could be achieved if natural flood management was scaled up across Calderdale. Atkins were appointed to do the work. The questions asked were influenced by and discussed with partners in the Calderdale NFM Operations Group

- What is the target for flood risk reduction in Calderdale, assuming the completion of the current capital schemes?
- What scale of NFM is required to meet this, to provide additional resilience on top of the existing and planned defences, and what form might these measures take?
- What is the timescale for constructing these NFM interventions?
- How much will it cost to provide these NFM interventions?

Methodology

1. NFM Studio (a tool which estimates NFM effectiveness by quantifying reduction in run-off at the field scale) was used to assess the potential for water attenuation and storage in the Upper Calder catchment through assessing:

- Different land management scenarios:
 - Land management options which would allow current land use to evolve to more natural systems e.g. arable to natural grassland.
 - Maximising moorland restoration and improving soil health on non-moorland.
 - Maximising tree planting and woodland creation.
- Temporary storage of water across the land through theoretical bunded storage where there are known surface water flow pathways, during different rainfall events.
- In- channel attenuation such as leaky dams and floodplain reconnection.

2. The projected reduced peak flows from NFM Studio (from the averaged impact of combinations of NFM measures) and different rainfall events were then fed into five existing Environment Agency hydraulic river models, covering stretches of river from Todmorden down to Brighouse. The running of the models with reduced peak flow inputs showed how NFM could reduce river flood risk in terms of number of properties at risk from flooding. An assessment of the potential economic impact for properties at reduced risk of river flooding was then made, looking at the reduced depth of flooding for those properties. This economic appraisal was carried out over 100 years and included projections based on changes due to climate change. The impact of NFM on property flood risk took a baseline scenario where all traditional flood defences in development or already constructed down the valley, are already in place.

3. An estimate of costs to scale up different types of NFM, with and without maintenance, across Calderdale was made using locally available costings from partner delivery projects, and a projected timeline to deliver measures based on delivery rates from 2016-21, to deliver a 10% reduction in peak flow.

Results

Flood Risk (NFM Studio Results)

In terms of impact on flood risk reduction, the combined averaged NFM Studio outputs estimated the potential for a reduction in river peak flow of 22% for a 1 in 2 year event (50% Annual Exceedance Probability, AEP) dropping to a 10% reduction for a 1 in 100 year event (1% AEP).

NFM Studio figures showed potential storage of between 1.8 million m³ (minimum) and 3.2 million m³ (maximum) attenuation for a 1 in 100 year event with a combination of land use change measures, bunding to store water across flow pathways and in-channel measures, carried out on fields and sections of river across the Upper Calder. The model suggests that land use change is the NFM group of measures which will deliver the greatest land run-off reduction particularly in the uplands.

Although this was a catchment level study, the NFM Studio tool allows each field parcel to be interrogated as per the types of possible NFM measures outlined above and return periods from 50% AEP to 1% AEP. This then shows potential outputs in terms of water storage and reduced water run-off, and indicative and comparative values of environmental co-benefits (Natural Capital) such as carbon storage, impact on water quality, food production and air quality. An interactive portal managed by the Environment Agency will allow access to this data.

Flood Economics

An economic evaluation in relation to reduction in river flooding alone gave a 27% reduction in present value damages (2022) with NFM measures in place. This equates to a £91 million benefit over a 100 year appraisal period. However, as this only looked at the economic benefits from reduced flooding from the main river, not all tributaries or surface water, this is likely to be an underestimate. The locations with the most properties likely to gain from reduced river flood risk are Mytholmroyd, Todmorden and Brighouse. This modelling also shows how NFM would support property resilience to increased flooding due to climate change.

Natural Capital

Looking at the modelled economic natural capital co-benefits from scaling up NFM measures the highest economic benefits are likely from woodland planting and peat restoration if the potential for carbon credits was realised. Other significant natural capital benefits include biodiversity (woodland creation > land use change) and recreation (land use change and woodland creation). A significant negative natural capital assessment was made for food production under woodland creation and to a much lesser extent bunding of flow pathways. Estimates for biodiversity natural capital benefits of in-channel interventions were also high; these are likely to be overestimated as the calculation assumes floodplain reconnection and an improvement in Water Framework Directive class, both less likely in the Upper Calder.

Cost and Rate of Delivery

The report gives the potential costs of NFM scale up of different types of measures for the whole catchment: – capital costs, capital plus maintenance over 5 years or 50 years and construction and maintenance costs standardised per m³ of water stored. There is a large range in costs of measures per m³ of water stored:

- £50-£70/m³ over 50 years of maintenance for bunds and soil recovery
- £100K- £250k/m³ for woodland schemes over 50 years of maintenance.

This significant difference in costs for different measures over the long term needs to be considered against the economic benefits from increased flood protection and potential natural capital benefits of the measures. Depending on NFM measures chosen an estimate of £86 million upwards was made to implement NFM across the upper catchment to deliver the potential flood risk reduction modelled. If rates of NFM delivery continue as per work delivered from 2016 to 2021 this could take approximately 100 years to maximise NFM potential.