

What is river restoration?

This factsheet provides a short introduction to river restoration under the following headings:

1. What is river restoration?
2. Why is river restoration important?
3. River restoration in the UK and Europe
4. How are rivers restored?
5. How to find out more and get involved

1. What is river restoration?

River restoration is the process of managing rivers to **reinststate natural processes** and restore **biodiversity**, providing benefits to both people and wildlife. Reintroducing natural processes can reshape rivers to provide the diversity of habitats required for a healthy river ecosystem and ensure their long-term recovery by addressing the root cause of the issue.

Some rivers have been extensively modified to accommodate societal needs for food production, flood protection and economic activity so it is not always possible or desirable to restore them to pristine condition. Operating within these constraints, making improvements to river structure and habitats can still increase overall biodiversity and mitigate for some of the issues associated with modification, as in Figure 1.



Figure 1 Restoration on the River Wandle, London. The River Wandle Trust began as a small group of community members wanting to improve the health of the river. Through patient restoration works, trout are now spawning for the first time in 80 years (Images from RRC and South East Rivers Trust)

“River restoration is the re-establishment of natural physical processes (e.g. variation of flow and sediment movement), features (e.g. sediment sizes and river shape) and physical habitats of a river system (including submerged, bank and floodplain areas).”

- International Union for Conservation of Nature ‘River Restoration and Biodiversity’

2. Why is river restoration important?

The fact that most towns and cities developed near rivers illustrates their importance to humans. Naturally functioning rivers and floodplains provide ample **benefits to society** including flood regulation, freshwater supply, tourism/recreation, water purification, carbon storage and improved human health. Many of these benefits, along with the habitats and biodiversity, are compromised if rivers are modified. In the Environment Act 2021 the Government set an apex target for nature to halt the decline in species abundance by 2030. As part of the Environment Improvement Plan 2023, the Government committed to protecting 30% of land for nature by 2023. Work to restore water systems is a fundamental part of that plan. EIP23 also pledged that everyone should live within a 15-minute walk of a green or blue space.

3. River restoration in the UK and Europe

Rivers have been altered by humans for thousands of years - at first indirectly as a result of land clearance for agriculture and then in Roman Times rivers began to be purposefully diverted or channelized to protect against flooding. The Industrial Revolution put new pressures on freshwater environments causing a severe decline in water quality and a consequent loss of habitat and biodiversity. The first attempts to remediate rivers in the UK and Europe began after this in the early 1900s. Initially this involved **small-scale artificial alteration** to improve habitat but over time techniques have prioritised **working with natural processes** to restore the river functions at a catchment scale. It is thought that 40% of water bodies in the UK are artificially or heavily modified.

The 1992 European Commission (EC) **Habitats Directive** and the 2000 EC **Water Framework Directive** made river restoration a fundamental part of river management in the UK and Europe by requiring countries to improve the ecological status of their rivers. In 2023 the Department for Environment, Food and Rural Affairs published an integrated plan for delivering clean and plentiful water. In their report DEFRA committed to work towards removing redundant physical modifications, restoring natural processes, targeting water bodies where modifications are having the biggest impact on biodiversity targets, and improving artificial and heavily modified water bodies to reduce the impact of modifications where they cannot be entirely removed.

4. How are rivers restored?

Deciding appropriate river restoration techniques depends on river type, modification extent and adjacent restrictions (e.g. infrastructure). The next section highlights the main techniques carried out in the UK from large- to small-scale.

Managing catchments

Ideally, to deliver multiple benefits to society and wildlife (Figure 2), river restoration should be considered at **catchment scale** and prioritised as part of wider catchment plans. The [Catchment-Based Approach](#) is a community-led approach that engages individuals and organisations from across society to improve freshwater environments. Catchment management groups are the best place to **identify issues and agree restoration priorities**. This approach will produce the most beneficial results as the river system can be viewed as a whole - focusing on a specific reach, without a wider catchment understanding, can lead to detrimental effects elsewhere.

Restoring a more natural river course

River straightening, diverting and over-deepening has been common practice in the past, to create space for land development, enhance river navigation, improve land drainage and reduce flooding. Straightened channels generally lack flow and habitat diversity as their profile has been extensively modified and their features have been removed. Straightening can increase the risk of flooding downstream as water moves faster through the modified section and increases discharge downstream. Remeandering reinstates a more natural course and river profile with the aim of **improving habitat diversity and biodiversity**. Flow can be returned to the former river course (Figure 3) or an entirely new course can be constructed if the old channel cannot be identified or is not accessible.

Figure 3 Diagram showing remeandered channel through Inch Park, Edinburgh. Parks offer good opportunity to remeander as space is less restricted than in residential or urban areas (image from [RRC Manual of Techniques](#))

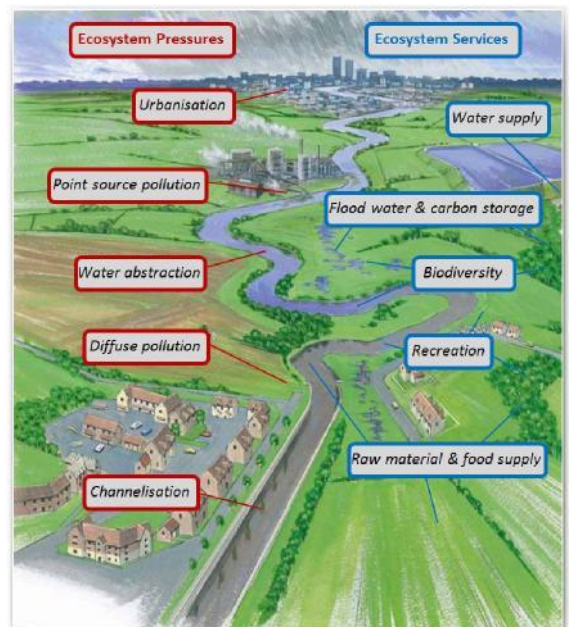
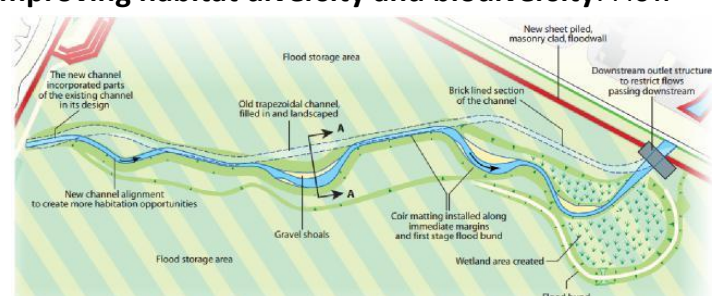


Figure 2 Ecosystem services and pressures within a river catchment (Image from RRC)



This factsheet is one of a series of guidance factsheets produced by the River Restoration Centre and funded by the Esmée Fairbairn Foundation. Find out more [here](#) and view more factsheets [here](#).

Floodplain reconnection and wetland creation

Floodplains are an important aspect of a riverine environment, providing **flood storage, fish refuge and habitat diversity** but often they have been disconnected and drained to protect housing from flooding and create land for agriculture or development. This disconnection and reduction in storage may cause a greater flood risk downstream as water moves through a catchment quicker. To restore connectivity, flood banks can be breached or set back in carefully chosen locations, allowing water to spill out onto the floodplain again. Benefits of reconnecting the floodplain include an **increase in flood storage area, recreation of wetland habitat** (Figure 4), **reintroduction of wetland species** and creation of **refuge for fish** during high flows.

In-stream enhancement

If floodplains have been reclaimed and developed, which is the case in most urban areas, it is often not feasible to make space for large-scale river restoration. If the river has a concrete bed or banks, also common in urban areas, reinstating some natural processes within the river channel can be the next best option. There are many novel in-stream enhancement techniques to consider (Section 3 of the RRC Manual of Techniques) but most involve **introducing some form of roughness in-channel**, such as woody material, **reworking gravels** or **creating berms** (Figure 5) to create flow diversity, new habitats and areas of refuge. Where an urban river has been over-widened, narrowing the channel with vegetated berms can also speed up the flow of water and reduce the build up of silt. In-stream restoration can provide a great opportunity to get **local communities involved** as it usually requires a hands-on approach.



Figure 4 Diagram illustrating the creation of floodplain along the River Thames on Pinkhill Meadow in Oxfordshire (image from [RRC Manual of Techniques](#))



During construction, just before the planting phase is due to commence – 2011

© Woodland Water & Gardens and D.Longley

One year after restoration showing development of diverse bankside vegetation – 2012



© Woodland Water & Gardens and D.Longley

Figure 5 Pictures of berm creation during construction and one year after, showing vegetation colonization on the River Somer in Midsomer Norton in Somerset

Removing or passing barriers

Barriers such as weirs and dams are common features of the riverine landscape. Barriers can restrict the passage of wildlife along a river, and alter river habitats by creating deeper and slower flows directly upstream. They also prevent transportation of sediment, which may lead to downstream erosion problems and increased maintenance costs. Where a barrier is no longer used for its initial purpose, there is a case for **complete removal** which would **restore upstream and downstream connectivity**. Where complete removal is not possible, other measures can provide some benefits, such as **lowering weirs** or creating bypass channels with **fish passes** (Figure 6).

For a full list of river restoration techniques see the [RRC Manual of Techniques](#). Remember that these examples were developed to suit site specific criteria so may not be appropriate in other locations.

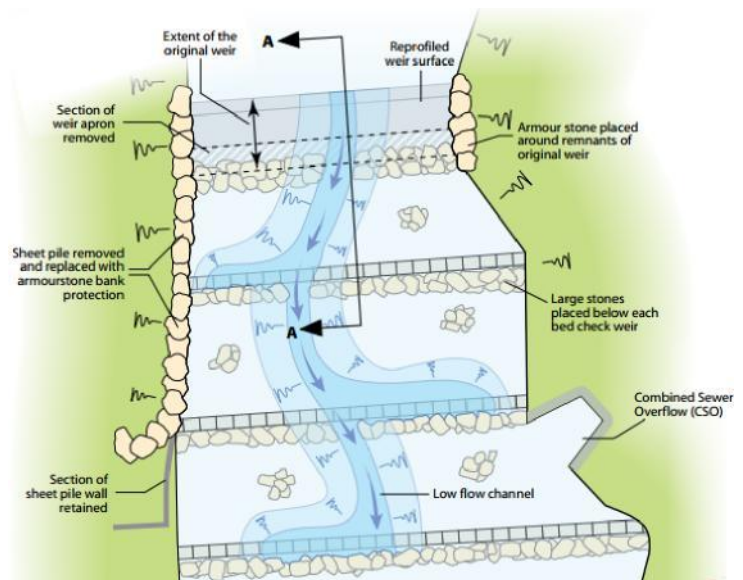


Figure 6 Diagram illustrating the creation of bed check weirs with a low flow channel for fish passage on the River Calder (image from [RRC Manual of Techniques](#))

5. How to find out more and get involved

Find out more

Restoration projects require careful planning, and being a relatively new way of managing rivers, there is a constant **need to evaluate the effectiveness of techniques** and learn from others through sharing experiences of what has worked and what has not.

The RRC have been collecting examples of river restoration projects since 1994 that are available through the online [RiverWiki](#), a tool for sharing best practices and lessons learnt on projects across Europe, and the [U.K. Projects Map](#) (Figure 7), a collation of over 4000 river restoration projects in the U.K. Search these resources to find **details of projects near you** or on specific techniques you are interested in. To find out more watch our [RiverWiki guidance video](#) and read the three [RiverWiki factsheets](#).

Figure 7 The U.K. Projects Map provides details of proposed and completed river restoration projects across the UK (Image from RRC)

Get involved

There are a number of ways to get involved in river restoration including practical works such as invasive species management or simple restoration techniques, chemical, biological and habitat monitoring which are important in identifying and understanding issues or recording the benefits of current projects.

Restoration in the UK is increasingly being **led or supported by local groups and partnerships**. We have put together a [Restoration Near You](#) webpage to help you find groups or partnerships involved in river restoration wherever you are, whether in England, Scotland, Wales or Northern Ireland. We also have information available on [how to get started](#) on a project of your own. You can also get in touch with the RRC if you are interested in a citizen science project we run called the Citizen River Habitat Survey (cRHS). Through this project we train volunteers to identify and record river features, and the data is used to help us better understand the state of UK rivers.

Through funding from the Esmée Fairbairn Foundation, the RRC can provide guidance to trusts, partnerships and community groups or individuals interested in delivering local river restoration. Click [here](#) to find out more about the support we can offer or email rrc@therrc.co.uk

This factsheet is one of a series of guidance factsheets produced by the River Restoration Centre and funded by the Esmée Fairbairn Foundation. Find out more [here](#) and view more factsheets [here](#).