

Safety at weirs



Treat weirs with respect. If in doubt, keep out.

Exit the river well above the weir, follow warnings and information signs.
Portage (carry) your boat around the weir and put in a safe distance below the weir.
Inspect. Only if you are an experienced white water canoeist, inspect and understand the hazards before deciding whether to shoot.
Continue safely down river.

What is a weir?

A weir is a structure within a watercourse that impounds water upstream over a range of flows, over which water may flow. Weirs are a regular feature of British rivers and at least 13,000 weirs are known to exist in England and Wales alone.

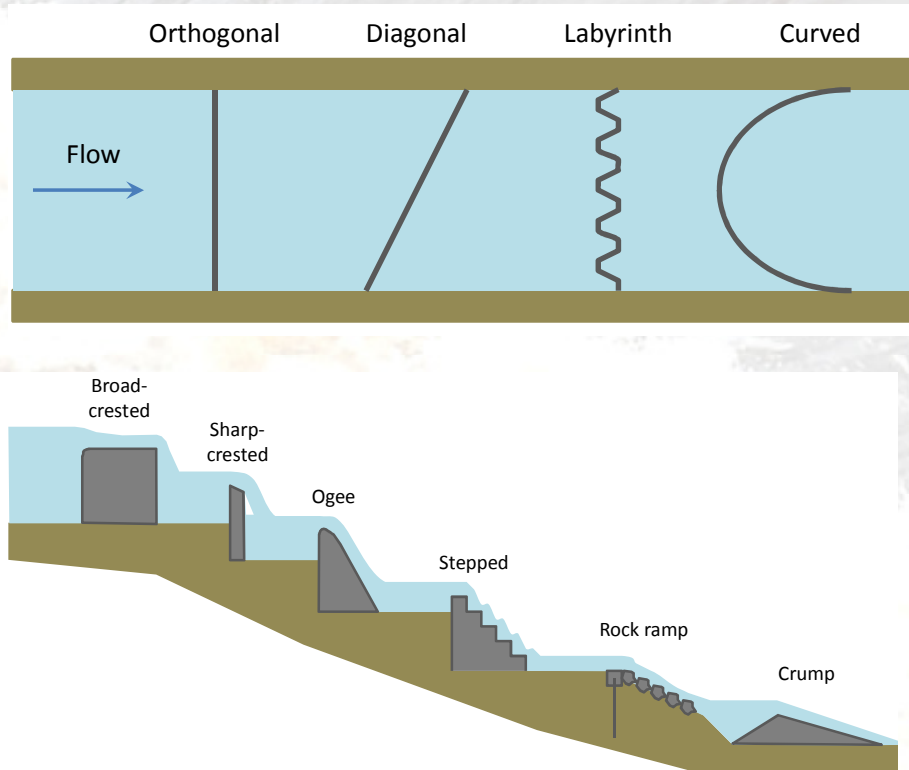
Why are they built?

Weirs may be built to perform one or more of the following functions.

- **Water level management:** to maintain deeper water levels for navigation or to divert flows into flood storage areas. Some weirs are movable and reduce water levels for land drainage or flood risk management.
- **Flow measurement:** to provide an accurate relationship between water level and flow to inform water supply or flood risk management.
- **Channel stabilisation:** to control erosion on steep watercourses by reducing the water surface slope and flow velocity, and focussing energy loss at the weir structure itself.
- **Environmental enhancement:** to enhance the landscape (e.g. Pulteney Weir at Bath), prevent the river channel from drying out upstream or divert flow into wetlands or water meadows.
- **Commercial:** to impound water to generate power or for abstraction (water supply, irrigation or cooling) - many historic weirs are located next to watermills. Weirs can also be used to assist with fish counting or to direct fish, for example, towards a fish ladder. Historically, weirs were installed to provide deep water for fish holding and angling, particularly in catchments prone to low flows, and around 8,000 years ago, basketwork fishing weirs were used to trap fish and eels as they migrated along a watercourse.

How are they constructed?

Weirs may be constructed in many different ways and from a large variety of materials, depending on their function, age, size, type and the local environment. Some common plan forms and sections are given below.

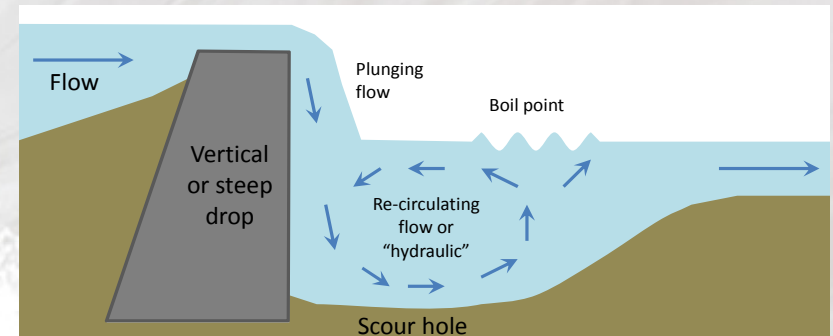


Historically, weirs were constructed from timber, rubble and masonry. Modern weirs may be constructed from stone, stone-filled gabion baskets, sheet piles, or for larger structures, steel-reinforced concrete. Brick or stone cladding may disguise concrete or steel sheet piling in an urban or historic environment. Some weirs include movable gates for improved control over water level.

Hazards at weirs

People drown in weirs every year in the United Kingdom. At least 13 people have died at weirs between 2010 and 2015. In the United States weirs (or 'low head dams') have earned the term 'drowning machine'.

The greatest hazard is often the strong re-circulating flow (or towback) immediately downstream of a weir. This can trap a person, animal or object, leading to exhaustion and drowning. The flow is often highly aerated with reduced buoyancy, making it hard to stay afloat.



Other hazards can include:

- Submerged hazards (difficult to spot, especially if the water is murky)
- Deep scour holes
- Strong currents or strainers
- Open spillways not visible from upstream
- Movable sluice gates with sudden changes in conditions
- Vertical wingwalls, steep or slippery surfaces and riverbanks
- Deep, cold water

The hazard at a weir can vary over time as a result of disrepair, heavy rainfall or varying river conditions. Not all weirs are dangerous, but some weirs are dangerous some or all of the time.

Who is at risk?

Both land and water users are at risk. Weirs can be a hazard to canoeists, kayakers, stand-up paddleboarders, swimmers and users of other unpowered craft. They can also be a hazard to walkers and other land users, including animals and birds.

Guidance for water users

If you are planning a journey in or along a river you should check for weirs first and plan your route at each weir, so that you are not forced to negotiate a dangerous weir. Weirs are often marked on Ordnance Survey maps and/or visible on aerial photographs/Google Earth. River guidebooks aimed at canoeists provide advice on weirs (see *Where to find out more*).

If you are unfamiliar with a weir or the water conditions, get out a safe distance upstream and inspect it from the bank to determine the best approach. Always comply with any safety signage that is present. Signs that you are approaching a weir include:

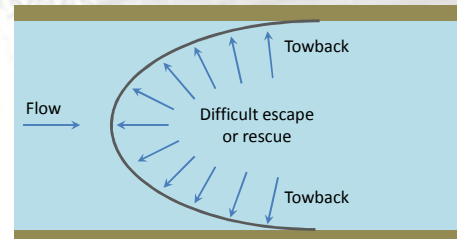
- deep, calm water upstream
- a horizon line marking a sudden change in water level
- wingwalls, sluices, mill buildings or a change in river bank level
- noise



Always walk round (portage) the weir, along the river bank. Put in a safe distance downstream, away from the re-circulating flow. Don't approach a weir from downstream as the re-circulating flow can suck you back upstream. Signs of a potentially hazardous weir include:

- Curved or horseshoe weir
- Vertical or near-vertical drop
- Strong, uniform towback with no breaks or irregularities
- Vertical side walls
- Steps, ledges or walls
- Underwater spikes
- Debris accumulation or entrapment features

Experienced canoeists, equipped for white water, can shoot a weir at speed and may be able to overshoot (or 'boof') the towback. This is risky and inadvisable if the length of the towback exceeds half the length of the canoe.



Horseshoe weir with towback to both limbs. Slot features create similar conditions. The shape is visually pleasing but escape from the towback or access for rescue would be difficult.



Vertical drop orthogonal weir with a strong, uniform towback. Self-rescue would be difficult due to the lack of breaks or irregularities. Rescue from the side would be impaired by the vertical side walls and the width of the weir.



Compound weir with steps, vertical drops, sills and walls. In high flows, water would flow over the full width of the weir. A canoe negotiating the vertical drop could become trapped against the sill (in red). The central walls would create edges and challenging circulating flows.



Irregular rock weir with sloping downstream face, non-uniform hydraulic jump and little towback. This weir is unlikely to trap someone in these flow conditions.

Guidance for land users

If you are walking near a weir, keep your dog under control so that it doesn't enter the water and get into difficulty. Beware of treating weirs swimming pools or as slides - they may have submerged hazards or hidden currents.

Guidance for owners and designers

Weir owners have a duty of care to visitors and must manage the safety risks caused by a weir. Sadly, the wider uses of rivers and safety of river users was often not considered in the past and we now have a legacy of hazardous weirs.

For existing weirs, you should assess the risk to land and water users, and consider measures to eliminate or reduce the risk. New or replacement weirs should be designed to minimise risk, with hazards eliminated or reduced as far as reasonably practicable. See *Where to find out more* for guidance.

If someone gets into difficulty

Call the emergency services on 999.

Do not enter the water, you may put yourself and others at risk.

If the swimmer is close to the bank or there is a bridge above the weir, you may be able to present a long object, such as a paddle or pole, to the victim as a rescue aid, or throw a line or rope out to the victim. Make sure that you have a secure footing before attempting a rescue. In attempting any rescue make sure you do not put yourself at risk. If the weir is wide or the swimmer is out of reach, rescue may need trained specialists.

If you are unfortunate enough to become trapped in a weir yourself, you should attempt to swim along the weir to a break or weakness in the hydraulic jump, if one exists. You may be able to push off the riverbed to escape the towback, but there is a risk of foot entrapment.

Where to find out more

River guidebooks and canoe trails

www.britishcanoeing.org.uk

www.canoescotland.org

www.canoewales.com

www.ukriversguidebook.co.uk

Risk assessment for weirs

NRW and Rescue 3 UK Weir assessment system (www.rescue3europe.com)

Operation of weirs and use of rivers

River weirs: design, maintenance, modification and removal, CIRIA, C763. Free to download from www.ciria.org/weirs.



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Supported by British Canoeing

