# The IWA Sustainable Boating Group
# The Environmental Case for Improved Canal Dredging

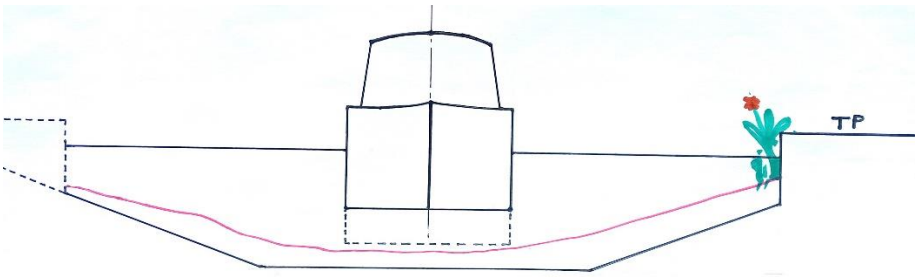
## 1: Introduction

A principal responsibility of a navigation authority is to maintain the channel to size – dimensions and shape, that enables the efficient movement of all craft expected.

The largest and deepest-draughted of the many types of boat on the canals are of course of the traditional steel design, used for carrying freight or passengers, or for maintenance such as dredgers, cranes or lock gates, or tugs to tow them with:

1. Traditional – hundreds remain, some restored, many used to capacity.
2. Freight – fuel and supply craft operating commercially. Aggregates, bulk potential. Some freight traffic still commercially viable on the larger canals of the NE, and main rivers.
3. Passengers – many trip boats, both commercial and charity run, throughout the country.
4. Maintenance – spoil-hoppers, dredgers, lock-gate delivery, tugs, general purpose.

These examples of 'largest size', require a depth of water that is clear of the deepest level that the vessels can be loaded to. The design of many heritage canals, particularly the 'narrow' ones, was in days of the horse, usually to a 'gauge' depth of at least 4 feet (1.2m), meaning that the canal was deeper than that (about 5 feet, or 1.5m), allowing boats to carry up to about 25 tons (= tonnes) on both narrow canals and shorter but wider Yorkshire waterways like the Leads & Liverpool. (later, improved waterways of the NE were enlarged to a depth of 7'6" for 700 tonne barges (2.3m, 1.8m to Sheffield), and then again to 2.4m for part of the route later, but now sadly lacking maintenance.

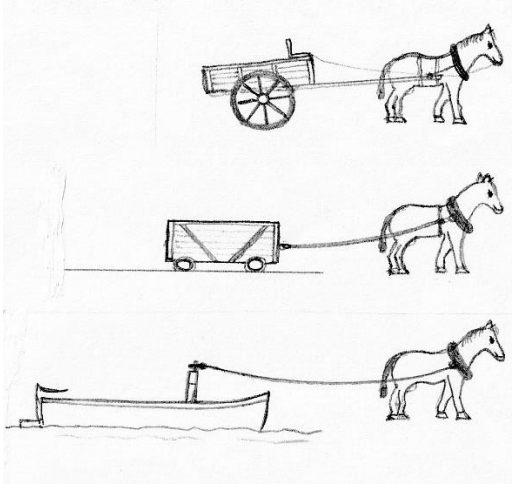



## 2: Moving boat in a channel

A vessel moving along a channel causes the water to pass back in the other direction to fill the space left; so the 'cross-section area' of the channel should be many times greater than the cross-section of the part of the vessel which is in the water. If the channel is restricted, because of siltation or other reduction in area, the water must pass faster relative to the speed of the vessel. For example boaters notice that they move slower in tunnels. Thus the energy required to move the vessel is inversely proportional to the cross-sectional area of *water* compared to that of the immersed part of the *vessel*. There are documented cases of silted canals causing twice as much or more fuel to be used to move a given distance because of lack of dredging, and whilst some of these cases are simply a lack of depth, in fact any reduction in cross-sectional area will increase fuel

consumption from the nominal expected in canal transport, by all vessels. If the needs of the larger craft are met – then all other craft will find ease of movement and economy of fuel use that we can associate with canal boating activity.

## 3: The environmental case for canal transport



Horse pulling cart = 1 ton load

Horse pulling truck on rails = 5 tons

Horse pulling barge = 25 tons

This illustrates the relative efficiency of transport by water, compared to road or rail, albeit at 3 miles per hour - the norm when our canals were built. The message is that due to economies of scale, the energy required to move goods remains in this approximate relationship.

The Heritage aspects of canal transport are of course the main reason for the tourist industry activities such as holiday hire craft, passenger boats and the many privately owned craft around the country – together with the natural environment which has been mostly maintained throughout. Water, the banks and adjacent land forms a precious resource, allowing a variety of ecologies to thrive – if maintained in a sustainable state. Like so much of British countryside, it is somewhat artificial, with man-made fields, roads and urban development over hundreds of years, so this finely balanced ribbon of nature needs to be protected from further closure, in both urban and rural settings.

## 4: Safety considerations

- Manoeuvring of boats is greatly eased by having sufficient depth of water. If the water is shallow: reversing, turning, mooring up, or avoiding other craft can be difficult especially for the inexperienced, as the boat will tend to remain in a straight line if shallow.
- Several unfortunate accidents can be quoted of steerers falling into the water by leaning over the side when in difficulty (one quite recent, in Birmingham).
- Clearer water is also safer, as boat movement, and the bottom for fallen objects (and persons!) may be seen or located more easily, as well as being a healthier water-space.
- Flood relief: any excess water entering any canal must be assured of the largest channel possible for movement to downstream weirs.

## 5: Water supply and levels

During periods of high use, or drought conditions, variation in level is inevitable between locks, particularly on summit levels, where a greater depth is usually designed in. Overflow weirs should also be maintained to pass any excess or floodwater, from whatever cause.

## 6: Other uses for canal water

In many cases, over short distances and in some for longer distances, canals are used to convey water being used for navigation to a water supply reservoir. The Llangollen branch of the Shropshire Union system conveys water from the River Dee above Llangollen to a reservoir at Hurleston, for use in the Cheshire area water supply. Also, Gloucester & Sharpness Ship Canal water from the Severn is passed towards Bristol for water supply. There are others for such use, but all should require a maintained canal profile in order to:

- ensure cleanest water,
- minimise disturbance for other uses e.g. maximising cross-section minimises water velocity.
- to minimise level drop along a pound. A new water transfer scheme for the Grand Union Canal is presently under consideration – and if pursued will require maximum cross section.

In urban or industrial areas, canal water is sometimes used for cooling or other industrial applications where the water can be returned (clean!) to the canal. A more recent development is to use the canal water as a heat-source in heat-pump systems, with both domestic and commercial applications to heating (and sometimes cooling, or 'air conditioning') being considered. A scheme in Liverpool is currently being developed. This is most appropriate where there is a nearby canal, would reduce capital costs over ground-sourced systems and could be of a higher capacity compared to air-sourced systems. Either way, heat-pump systems use less energy to produce heating than any other system other than geothermal. Unlike cleaning uses, heating or cooling applications take water through pipes and heat-exchangers and return it to the canal in a clean condition. Thus there are no losses of water, unlike 'open use' applications like cleaning, where losses due to evaporation and other disposals (wet refuse, ground) uses some of the water supplied, and cleaning the water before return has to be incorporated.

## 7: The need for cleaner water

As a result of these considerations, it can be seen that relatively 'clean' water is expected in each canal – in spite of there being in some areas natural 'staining' present from iron or other geological influences, such as in the Stoke on Trent Potteries area. The sources of canal water are principally from reservoirs situated to collect water from headwaters – normally expected to require little treatment other than control weirs and perhaps 'sump and screen' debris catchment, and feeding a 'summit level', or sometimes a 'long pound'. Other sources include groundwater entering tunnels, and convenient streams feeding directly into a canal – which *do* require monitoring, because sometimes sediment can concentrate after periods of excessive run-off or flooding. These are sometimes addressed by 'spot-dredging', rather than awaiting a longer dredging programme for the whole canal. There are also some groundwater sources from disused mines (e.g. the Birmingham canals, from mines at Bradley).

In order to minimise sediment arising from the canal itself, several aspects of the dredging work must be addressed:

- Sufficient cross-sectional area: e.g. the normally achievable narrow canal cross section dimensions provide a ratio of at least five times that of a boat loaded to a draught of 3ft 4" (1m).
- Sufficient depth – it is important to achieve a width of two boats (for passing) at the minimum depth – ideally 1.5m on the narrow canals. Often only 1.2m or less is achieved.
- Sufficient maintenance of the bank – Any *reduction* in maintenance of both the bank and appropriate depths results in increased *rates* of erosion – and therefore non-clear water and more frequent dredging being required.
- Tree-cover maintenance in cuttings and off-side. Whilst healthy looking trees offering shade can be left for a while, continuous or regular monitoring of all arboreal encroachment *over* the water surface is important, and removal of branches and trees where appropriate, to reduce accumulation of debris, and therefore dredging frequency.

## 8: Ecology of the canal corridor

Whilst obvious in many rural lengths, the canal corridor through urban, and even industrial areas, is often found to be a conduit for flora and fauna, connecting adjacent parks and green land by trees, hedges and waste or currently unused land as well as the water and it's margins: and provides a valuable habitat for a range of wildlife. It is also important to remember that much of a canal route follows closely that of a river, stream or other water-course, which will have its established ecology influencing that of the canal (as evidenced by the continual re-spreading of Himalayan Balsam). Whilst the main 'design' of navigable canals includes a 'tow-path', and space for each lock operation, it is important to maintain a 'green' dimension to the surroundings throughout the canal's length. Thus hedges, trees, grass, rather than brick walls & concrete (even fences), and planning precautions to limit encroachment into this space are all important. The forestry and shrub-cover in cuttings and embankments respectively are particularly likely to cause problems if not monitored and managed appropriately (e.g. problems on the Shropshire Union Canal). This aspect is quite separate from routine towpath maintenance and grass-cutting, which has to be carried out on a seasonal programme anyway.

## 9. Change

Either 'restoration' e.g. from a derelict or unused state, or 'development' e.g. building of houses or factories, should be seen as *opportunities* to restore *or improve* both channel and natural corridor. Unfortunately, resistance to any proposed 'changes' for such improvement results in financial aspects taking priority, or sometimes other protections prevent any change. Generally speaking, the opportunity for a *regularly maintained* navigation is certainly preferable to dereliction or abandonment – but it must include the 'green' element in order to ensure both local and tourism support as well as to justify built heritage and full canal use.

## 10: Species of interest

The presence of fish generally helps water quality. Species found in neighbouring watercourses are probably the most appropriate to encourage, although where the angling interest is present there may be good reason to transfer popular fish from other places, if compatible. Aquatic plants found in the region can also be encouraged, as well as ferns, grasses and small ground covering plants, which would form good habitat for fauna. Any restoration programme requires some disturbance to the ecology. This has sometimes been addressed with adjacent 'wild-life refuges' or conservation areas specifically for endangered habitats. Examples on the Montgomery Canal and Droitwich Barge Canal have shown some successes in this respect but have also experienced some problems with maintenance.

It is a sad reflection on our national agricultural policies over the years, that have led to the decimation of many sensitive species. It is also unfortunate that the nature of various 'protection' schemes such as SSSIs might only include areas seen to be under threat, rather than the wider corridor which would include the total habitat and thus more readily allow restoration of previously stable existing ecologies with the built heritage structures restored.

## 11: Measurement and planning for dredging

Several improvements in surveying techniques to establish profile in a watercourse are now available – radar or ultrasonics used to scan the canal bottom from a moving boat, avoiding the need for manual measuring with sticks, measuring tape etc. Useful when planning a long length for efficient use of dredging equipment. It is observed however, that current expenditure appears to be often spent on dredging where 'problem-spots' are identified by boaters and not planned maintenance dredging to avoid such scenarios. This is due almost entirely to lack of funding to catch up with the back-log identified several times over the years. (in particular Fraenkel, 1975)

## 12: Contractors

Recent years have seen navigation authorities abandoning out-dated equipment in favour of contracting out the task of dredging, a sad situation when each Region requires immediate action from time to time as well as a continuous programme of 'catch-up' with de-silting. The very recent change (2025) to commissioning new work-boats to enable CRT's own staff to dredge and dispose is welcome. This needs urgent expansion to cover all canals. (not to denigrate the usual contractors – Land & Water, and Rothen, both excellent companies, but they have a wide area of application and do not *rely* on CRT or other navigation authorities' contracts).

**Crick 2025**

A new workboat, commissioned by the CRT, with its own power supply for hydraulic feet and a platform for a tracked dredging machine, was shown off at the Crick Boat Show this year... The return to navigation authority staff being able to manage dredging operations is vital to reducing the costs of contracting, not to mention the improvements to programming sensible long-term dredging within the organisation.

## 13: Conclusions

In terms of the current emphasis on climate change it is the 'energy efficiency' of canal transport, which includes all craft of a motorised nature, such as cruising or working narrow boats and motor yachts, and their fuel consumption, which is to gain from any improvement in dredging. Dredging of reservoirs and feeders is also important, as these also silt over time, and need maintenance to reduce unexpected short-fall, failure of supply, or passing debris into the canal.

The demise in recent years of the concept of 'maintenance' means that a great deal of the 'backlog of maintenance' will take a lot of resource and effort to cover the whole of our navigable waterway network. It is doubly unfortunate that, because there is so much to do now (in 2025/6), that some environmental disadvantages will also occur, hopefully temporarily. Any improved rate of dredging will need to be planned to minimise disturbance in each area of operation.

*Clean and sufficient canal water is beneficial for all waterway applications including water supply, industrial and domestic heating and cooling etc, environmental stability, provision for excess or limited supplies, such as flood or low-flow, safety and navigation. This re-enforces the need for a thorough and sufficiently funded dredging regime, distinct from other maintenance responsibilities.*

**David W Struckett**
**16/11/25**

## References:


1. 'Hydraulic aspects of the Montgomery Canal Restoration', British Waterways, 2006
2. 'Review of UK inland waterways transportation from a hydrodynamics point of view'; Momchil Terziev[1,*], Jonathan Mosse[2], Rosemary Norman[3], Richard Lord[4], Tahsin Tezdogan[5], Atilla Incecik[1] 2024
3. www.canalrivertrust.org.uk/specialist-teams/engineering/dredging A web-page describing and illustrating CRT's dredging programme, with some good video.