Canal & River Trust
Making life better by water

Code of Practice for Works Affecting the Canal & River Trust

Part 2
Detailed Information

April 2024

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1. BRIDGES

INTRODUCTION

This section refers to new bridges, bridge widening, major bridge refurbishment, temporary bridges and conveyors. Proposals for constructing new bridges or altering existing bridges across Waterways are conducted in distinct phases:

- feasibility and design
- construction
- maintenance

Feasibility and design are essentially iterations of the same process. Within this document these steps are not listed separately. It is imperative that all pertinent aspects relating to the interests of the Trust are identified at an early stage. There are aspects of construction and future maintenance, which need to be considered at the feasibility and design stages.

FEASIBILITY AND DESIGN

The bridge site should be selected by considering the needs of the proposed scheme and also the effect of the bridge on the canal corridor. The latter criterion will include consideration of the following:

- navigational needs: locations adjacent to existing locks, bridges, bends etc. should be avoided where possible
- environmental and landscape impact on the canal corridor
- the needs of towing-path users (including those with disabilities); vehicles may be used for towing-path maintenance or access
- the protection and/or relocation of services in the towing path
- deterrence of vandalism

The use of Design and Build contractors needs careful consideration. Unless the critical parameters are defined before a contractor is appointed, an unsatisfactory result and/or escalating costs to the Promoter might result. The Promoter remains responsible for the proposals.

Navigational clearances need to be established. These will vary from navigation to navigation and from site to site owing to considerations of craft dimensions, one or two way boat working, horizontal alignment and visibility, proximity to other structures, dredging and other maintenance activities. In each case the

The Works Engineer will agree the following:

- headroom over navigation
- headroom over towing-path (minimum usually accepted 2.7m)
- navigation width
- towing-path width
- navigation depth
- forward visibility

Headroom will normally be defined relative to maximum navigable flood level on river navigations or overflow weir level on a canal. On river navigations the clearance must be maintained over the full width of the navigation channel. Minimised headroom leads to difficulty in maintaining the waterway and constructing and maintaining the bridge. These problems include:

- temporary works clearances during construction
- temporary works clearances during maintenance
- access for dredging plant

If sufficient headroom for these purposes cannot be achieved, a low maintenance structure is needed. Dredging can sometimes be simplified by separating carriageways (i.e., introducing a light well in-between sections of the bridge, or by providing alternative means of dredging other than the use of waterborne plant. See Part 1, section 7 for guidance on contamination.

In order to maximise the time before dredging becomes required it may be necessary to dredge before construction, at the promoters expense. Where dredging occurs, ensure that the dredged material that requires disposal is done so in an environmentally friendly and sustainable manner and in compliance with current legislation for contaminated material.

Headroom clearances relating to arched bridges need careful consideration. A profile, which will achieve the desired visual and clearance objectives, is needed. It is usual to use parabolic arches, with raised and set back spring points to achieve the optimum result.

Super elevated roads requiring bridges with less than generous headroom should be avoided, because of safety considerations. Waterway users can be misled regarding the clearance and be unprepared for the headroom reduction.

The Works Engineer may require physical or mathematical modelling of the navigation to ensure that safe passage of craft can be maintained at all times.

If the Works Engineer permits any narrowing of the canal, such narrowing will normally take place symmetrically about the centre line of the navigation. The alignment of the canal banks is of particular interest to the Trust. The drawings must illustrate a sufficient length of the canal to enable the realignment works to be viewed in context. Any re-alignment must be designed to 120 year design life.

Consideration must be given to aspects of the forward visibility for waterway users. It may, for instance, be necessary to increase the span of a bridge when a new structure is constructed in the vicinity of a bend on the Waterway.

If it is essential to build bridges in close proximity to locks it may be desirable to increase the vertical clearance or install open parapet rails in order that vessels approaching the lock from below can determine in advance if the lock is in use. The lock landing will need to be maintained at all times or a suitable alternative agreed with the works engineer.

Bridges across river navigations should generally clear the navigation in a single span. Where it is necessary to have piers within the river, special attention will be needed to ensure that such piers have a minimal effect on the navigation and are adequately fendered, signed and lit. Aspects to be considered include:

- clearances
- proximity to adjacent structures
- speed of flow in flood conditions & scour protection
- fendering
- signing the correct navigational channel
- any lighting within Harbour Areas or Tidal Waters should be compliant with IALA (International Association of Lighthouse Authorities) regulations

Construction methods and the effect on navigation must be considered at the design stage. The towpath should generally pass under the same span as the navigation.

The towpath under the bridge should be surfaced in material consistent with the character of the Waterway. Surfacing (including gradients, cross fall or width) should not hinder the use of the path by people with disabilities and should offer access compatible with or superior to surrounding towpath.

Weep holes should be laid to a back fall with drainage at the rear of the abutment. They must not be designed to drain onto the towpath or into the waterway without a utilities agreement and suitable outfall design.

In urban areas, where pigeon nuisance is a problem, the matter should be addressed through appropriate detailing.

Towpath accesses from highways must be retained and should be improved or provided where appropriate. These should be enhanced for people with disabilities, where possible and appropriate.

There should be no 'dead areas' prone to vandalism in towing-paths under bridges, and where possible access to water's edge should not be fenced off.

It is preferable that there be no pedestrian access to offside abutments of canal bridges in order to prevent graffiti.

Bridges over 15 m in length will be treated as tunnels as far as safety precautions are concerned. Please consult with the works engineer.

It will generally be necessary to provide bank protection, durable for the life of the bridge, under the new bridge owing to considerations of:

- increased navigation depth
- difficulty in installing such protection later in limited headroom circumstance
- protection of the structure from scour
- fendering
- support to the towing path
- the new bank protection must interface with the existing with a detail designed to minimise the possibility of erosion and leakage at this point

Piles should be capped to match the local vernacular. Mitigation measures will be needed where bank protection affects wildlife habitats.

Bridge abutments and spans have been found to be ideal bat roosts, especially where there are small crevices leading to voids within the structure. It is an offence, intentionally or recklessly, to damage or destroy any structure used by bats, or to disturb them whilst occupying the structure. Professional surveys of existing structures are recommended at an early stage of any widening or refurbishment scheme to avoid delays. Where possible the provision of bat habitat within or near to bridges should be included in bridge design.

The noise impact upon the canal environment resulting from the new bridge crossing must be considered. If noise levels are too great mitigation measures must be introduced. It may be necessary to install noise control measures.

The impact of the bridge on the canal environment will require detailed consultation. Not only are bridge aesthetics of great importance but also the setting of the bridge on the local and wider landscape must be considered. Offsite planting should be considered; however, planting should avoid the use of plants / trees with intrusive root systems.

When considering the aesthetics of the bridge there are two main options. The bridge should either be a striking dramatic modern structure or it should reflect the scale, style material, proportions and heritage of the navigation as a whole. In either case the Trust requires a high quality, well designed and detailed proposal.

The waterway corridor is a linear one. Bridges are seen by waterway users as part of a sequence of structures, most of which are contemporary with the construction of the waterway. Users view bridges at leisure whether travelling on foot, at walking pace from a boat, fishing at close quarters or from a distance.

Aspects which must be considered with regard to bridge aesthetics include:

- expression of function e.g., a beam bridge should not have false arch facades
- scale - proportions and mass

- order - avoid chaos
- materials and facings. There is a presumption towards an appropriate brick or stone. The facing material and bond pattern, which will reflect local themes, must be selected in agreement with the Trust before a contractor is appointed. Where appropriate, the incorporation of recycled materials should be considered by the Promoter. The sourcing of local materials is also important in achieving a sustainable project
- colour
- architectural features such as string courses, pilasters, pilaster caps and patterned brickwork; it is important that the bridge expresses its structural form and that such architectural features are inherent in the design and not 'add-on extras'
- parapet type: open parapets allow road users a view of the canal and have the advantage of a weight saving over masonry parapets. On small scale canal bridges solid parapets are usually appropriate. In some cases, it may be appropriate to "box in" an open parapet above the deck with masonry parapets above the wing walls – the 'masonry book-end': in areas of high vandalism special measures will be needed to protect waterway visitors from abuse
- wingwall direction and skew angle: the wingwall direction should generally be parallel to the transport mode being carried across the canal; wingwalls to skewed bridges must not be parallel with the canal; traditionally wingwalls are curved in plan and battered; consideration should be given to curved wing walls particularly on pastiche structures
- the effect of road alignment and super-elevation
- embankment landscaping, which should be integral with the design of the bridge; native plants appropriate to the area and location should be used; if possible, the planting should be carried out in advance of the works and should extend beyond the site to provide screening, avoidance of intrusive root systems is required
- street / towpath lighting
- bridge name/number and date plates – the Trust require the bridge to be numbered on both sides and the works engineer will provide details of the style and actual number
- parapet/approach safety fence interface
- access ramps, steps, barriers, gates, stiles etc.

Computer generated images of proposed bridges gives an excellent view of the impact of new structures on the landscape and should be provided where necessary or on request.

Further reading on bridge aesthetics is available as follows:

Highways Agency	'The Appearance of Bridges and other Highway Structures' HMSO (1996)
Graham Tilly	'Conservation of Bridges' (Gifford / Highways Agency) Spon (2002)
Fritz Leonhardt	'Brücken Bridges - Aesthetics and Design' Architectural Press (1982)
Conference papers	'The Architecture of Bridge Design' (1994)
Conference papers	'The Aesthetic Refurbishment of Bridges' (1995)
Conference papers	'Good Looking Bridges' (1993)

CONSTRUCTION

The design of the structure should take into account the bridge construction method.

Continuity of navigation and towing-path usage is presumed. It may be possible, in some circumstances, where it is necessary in the interests of safety or otherwise, to carry out a local towing-path diversion.

Such a diversion should be safe, commodious, maintained and signed. Pedestrians should be allowed to use the towing-path as soon as it becomes possible for them so to do.

Bed profiling should be carried out before and after the works in order to confirm that construction debris is removed.

It is usually possible to place bridge beams without interfering with traffic, by performing the lifts in the intervals between passing boats. In such circumstances a method statement will need to be agreed with the Works Engineer. Lookouts must be provided. The presumption is that canal traffic should not be delayed. Construction taking place adjacent to and above the navigation must be carried out with the clearances specified at the design stage. Fendering, lighting, screening and signing will be necessary where appropriate.

Experience indicates that piling lines, which are acceptable on a drawing, are not satisfactory on site, without minor amendment. It is imperative therefore that all piling lines are agreed with the Works Engineer before piles are driven.

Throughout the construction phase all possible measures should be taken to reduce environmental impacts on the waterway and surroundings (see Part 1, section 7).

MAINTENANCE

The bridge should be designed to minimise the need for future maintenance to those parts of the bridge, which affect navigation and to address how essential maintenance is to be carried out without affecting the interests of the Trust.

Where permanent access gantries are provided, a full operational agreement with the Trust is needed, even where there are generous navigation clearances. A safe system of work must be agreed, incorporating, where necessary, lookouts, catch nets etc. The Trust must be advised when access gantries are to be used.

Method statements, programmes and temporary works drawings must be agreed before carrying out any significant aspects of bridge maintenance.

Hard and soft landscaping must be maintained in accordance with a predefined plan.

2. SERVICE CROSSINGS

INTRODUCTION

This section refers to all services (e.g., pipes, cables etc.) installed on the Trust's land perpendicular to or crossing the waterway, either overhead or beneath. See section 4 of this document for services beneath the tow path.

This section primarily relates to canals, where considerations of integrity and water tightness are paramount, however it is relevant to river navigations.

Proposals for the installation, enlargement or maintenance of underground services should be considered in the following distinct phases:

- feasibility/design
- construction
- maintenance

It is imperative that all relevant issues relating to the interests of the Trust are identified at an early stage. Also, there are aspects of construction and future maintenance which need to be considered at the feasibility and design stages.

Note: Overhead crossings are not permissible on environmental grounds. Whenever the opportunity arises to remove an existing service crossing, for instance when it is in need of renewal, the service will be diverted under the waterway.

Crossings will normally be perpendicular to the waterway.

Trenchless techniques will be presumed. Only if trenchless schemes cannot be carried out can other methods be considered. It is very unlikely that open cut techniques will be permitted. Other methods need to be justified and discussed in detail with the Works Engineer. The use of any other method must not cause damage to or rely on the strength of canal beds or walls. Some methods of coffer dam can cause damage to the bed of the canal (e.g., sheet piles) it is highly unlikely that the Works Engineer would deem these methods as suitable for purpose.

In some circumstances it may be possible to carry services in the surfacing over bridges, be they owned by the Trust or others. It may also be possible to install ducts between beams. The option of external attachment should not be considered. The Trust would raise strong objections on environmental, aesthetic and bridge maintenance grounds. There is usually minimal cover over bridges. Services must be laid on sand to distribute loads. Services are likely to be disrupted by bridge maintenance.

Where services are to be abandoned, they should be removed to the satisfaction of the works engineer. This is particularly important for services under the canal which may need to be remediated.

FEASIBILITY – ALL TECHNIQUES

In principle, services should be installed with minimum of disruption to the Waterway, either during construction or during subsequent maintenance and use. In addition, normal operational activities such as bank protection and dredging should not be hindered by the presence of such installations.

Trenchless construction includes such construction methods as tunnelling, micro-tunnelling (MTM), horizontal directional drilling (HDD) also known as directional boring, pipe ramming (PR), pipe jacking (PJ), moling, horizontal auger boring (HAB) and other methods for the installation of pipelines or cables below the ground with minimal excavation. Large diameter tunnels such as those constructed by a tunnel boring machine (TBM) may be considered but blasting techniques are unlikely to be considered.

The service crossing site should be selected by considering actual ground conditions, existing infrastructure and the needs of the underground service.

A site investigation will be required, involving a minimum of two boreholes with appropriate lab testing to verify the strata (one on each side of the canal) to a depth agreed in consultation with the Works Engineer, but should be a minimum of 3 m below the anticipated invert depth of the crossing. A drawing showing depth profile across the full width of the canal or river will be required. The drawing should show the depth of water, the depth of silt and the level and material of the hard bed of the canal borehole information on each side of the waterway. The information should be related not only to Ordnance Datum but also to canal weir level, or in the case of a river low summer level. In mining subsidence areas, the canal can be over 10 m deep, sometimes part filled with loose unconsolidated settlement.

The Works Engineer will require impact assessments and strain calculations to be submitted to prove that negligible short- and long-term ground settlement will occur due to the installation. The impact assessment must consider all infrastructure within the installations zone of influence (i.e., canal walls/supporting structures, weirs, culverts, locks etc.) This is very relevant to drilling techniques where ducts are not inserted during the drilling process but are inserted once the ground has been reamed out. The importance of a thorough geotechnical investigation cannot be over-emphasised.

Because of their industrial heritage, land in the corridor of some waterways, including bed silts, may be contaminated. A contamination assessment is necessary before any works are carried out which involve the excavation or disturbance of potentially contaminated materials, see Part 1, section 7. Consultation with the Environment Agency is recommended.

It should not be assumed that there is any impermeable lining in the canal. In medium / high risk locations, to be determined by the Works Engineer, the canal may need to be drained prior to any works. A condition survey should be completed before works start, after completion of the works and after an agreed maintenance period.

After receiving copies of the logs of the boreholes, bed survey and such other information as he or she may require the Works Engineer shall inform the Promoter whether the proposed method of construction can be considered and, if so, if the proposed depth is acceptable. The depth given at this stage may be modified by the Works Engineer depending on the soil strata revealed in the thrust and reception pits, in trenchless systems or during piling for open excavations. If the method is not permitted or if the Promoter considers the depth too great, he should submit an alternative method of construction for the Works Engineer's consideration.

DESIGN – TRENCHLESS TECHNIQUES

Trenchless techniques are accomplished without excavation or disturbance, therefore reducing the overall operational, maintenance and capital costs associated with projects, while also minimising environmental concerns.

The principal criterion of the Trust is leakage from the canal. Very small settlements can often be accommodated in the absence of structures. The Works Engineer may request settlement calculations.

Directional drilling has proved successful for small diameter flexible services such as cables and water pipes in soft and hard ground. Difficulties have been experienced with larger bores needing multiple reams.

Auger boring can lead to the creation of voids in granular ground and collapse of the bed has occurred.

Success has been achieved with earth-pressure balance micro–tunnelling machines used under unlined canals in soft ground.

When man entry techniques are proposed the safety of the miners must be paramount. Draining and closure of the canal may have to be considered.

If compressed air working is envisaged, the possibility of a blowout disrupting the bed and lining must be considered.

Difficulties of accuracy of the bore have been experienced when pipe ramming.

Pipe bursting of existing culverts is not normally viable due to considerations of disrupting the bed and creating an annular leakage path through the rubble.

In trenchless systems, the minimum depth to the crown of the pipe shall be of the order of 3.5 metres below hard bed level. This dimension will be varied as necessary depending on ground and trenchless techniques.

No part of a thrust or reception pit or shaft is to be nearer than 5.0 metres to water's edge or impinge on any embankment, but in areas of high risk the Works Engineer will likely require a greater offset. In Instances where this risk can be designed out, a suitable detailed design is required. It should be noted that this design may require external checks at the promoter's expense.

The method statement must consider and address possible eventualities, such as seepage or leakage from the canal.

Pits or shafts should be raised by at least 300 mm above maximum canal water level, so that, if water from the canal were to enter the bore, it would be contained. In directional drilling a bund may be needed to contain leakage.

Any Contractor carrying out boring operations must be a member of the relevant approved trade association (e.g., the Pipe Jacking Association).

Where blasting is deemed necessary for the construction of the service the Promoter shall submit a full method statement which includes blasting arrangements and impact details. Agreement with the Works Engineer will need to be reached on frequency limits and the predicted Peak Particle Velocities. Vibrograph monitoring will be required during the Works.

Generally, back grouting of overbreak is necessary. The details of the proposed grout mix, phasing and pressures must be agreed. Mixtures particularly injurious to an aquatic environment should not be considered, although all cement-based grouts are potentially polluting due to their lime content. Under no circumstances shall the pressure be allowed to exceed overburden pressure. Grouting records should be submitted to the Works Engineer as work proceeds. Constant monitoring of grout-take should be maintained and if there is any evidence of grout leak to the canal, the operation should be suspended immediately.

If any leaks to the waterway are discovered, they should be reported immediately to the Works Engineer who may have to inform the Environment.

CONSTRUCTION – TRENCHLESS TECHNIQUES

The Works Engineer shall be given a minimum of 48 hours' notice to allow the engineer to inspect:

- the location of sheet piling for the thrust and reception pits and their approach trenches before piling commences
- the completed thrust and reception pits
- the completed work before the contractor leaves the site

A record of the penetration of each pile in the thrust and reception pits and approach trenches as described above shall be kept on site and made available to the Works Engineer on request.

Pumping from any bore or pit is to be carried out only with prior consent from the Works Engineer and if found necessary, it must be passed through a settling tank to determine whether an undue proportion of fines is being withdrawn. Hoses are to be taken over the top of shafts and under no circumstances are holes to be cut in the piles. No contaminated water must be recirculated to the canal. Environment Agency consent for the disposal of this water may be required.

The boring and jacking operation once commenced is to be continuous and carried out in accordance with safe, standard practice. Unless otherwise agreed 24-hour working will be required.

Where pipe-jacking, pipe ramming or auguring techniques are employed, it is required that the progress of the bore be kept under constant supervision, distances from the head of the boring pit are to be painted at 500 mm intervals on the pipes. The points at which the pipe shall pass beneath each of the two canal banks and the deepest part of the canal are also to be indicated on the pipe.

Where an approved directional drilling technique is employed, constant monitoring shall be carried out to confirm the depth and alignment of the bore.

Surface monitoring of settlement will generally be required.

Under no circumstances must an auger be projected forward of the jacking shield.

In the event of canal water appearing at the face of a tunnel or in the boring pit in remote techniques, whatever action is necessary must be taken immediately and the Works Engineer informed of the incident and action taken before any work can then continue. It should be noted that face boards must be available for boarding up the exposed face of a thrust bore or tunnel.

A contingency plan inclusive of containment strategies must be in place should any break out of drilling fluid occur during the works.

In the event of a bore proving abortive, work shall not be recommenced until after the Works Engineer has accepted alternative proposals. In such cases the pipe is to remain in position and be filled along with any over break with grout of an agreed mix.

The removal of piles and backfilling and adequate backfilling of pits employed within the Works and associated reinstatement is to be carried out to the satisfaction of the Works Engineer, in order that support is not lost.

Before any disturbance is caused to the canal structure, the Works Engineer may require a line of permanent interlocking steel sheet piles or reinforced vegetative bank protection, usually for at least 5 metres either side of the centreline of the crossing to be installed to each side of the canal, but in high-risk areas a greater length of protection may be required. This permanent piling may be required to provide an area of protection within the canal bank against possible leakage or breaching, or to relieve the need to pile subsequently in the vicinity of the crossing. Where piling is essential for design reasons it may be appropriate that they be hidden for landscape and environmental reasons. Permanent sheet piling must be agreed with the Works Engineer as to length, section, depth, alignment, capping, ties, anchors and marrying-in with any existing canal bank protection and shall be shown on the approved drawings.

Permanent piling or walling, such as specified bank protection, must be designed by a competent person to withstand all external forces. The Works Engineer may require calculations. These calculations should clearly give design details of both the permanent and temporary conditions.

A suitable valve system, to enable a rapid shut down to be affected in the case of emergency, shall be provided where appropriate. The valves are to be fixed at least 5 m clear of the Trust's land. Any sleeve or carrier pipe must withstand all normal canal, towing path and access road loading, and must extend to 3 m beyond the Trust's land. These isolation points must be able to be utilised upon request from the Trusts engineers, and potentially at short notice – it is not the responsibility of the Trust to ensure your networks are backfed and you must be prepared to implement shut down upon request.

Any concrete surround or sleeve must extend a distance of not less than 3 m beyond either water's edge.

All electricity, telecommunication, etc. cables should generally be placed within a strong and durable duct of a suitable material that shall not cause any interaction with other live infrastructure (galvanised steel, thick-walled Polyethylene type or similar material). In the case of electricity cables, metallic ducts must be plastic lined. Normally all pipes will be grouted in position in the duct.

All pipes carrying pressurised material, which in the case of pipe failure may affect the Trust's property, must at the Works Engineer's discretion be placed within a suitable sleeve or duct.

The contractor shall install a permanent marker on both sides the waterway to indicate the line of the crossing. Details to be agreed with the Works Engineer.

An as laid drawing should also be submitted to the Works Engineer.

The Works Engineer shall be empowered to order the work to be suspended at any stage for any express reason and this instruction must be acted upon immediately. The Works Engineer shall not accept any liability for any costs or claims, which may arise by the Promoter as a result.

The contractor shall install a permanent marker on both sides the waterway to indicate the line of the crossing. Details to be agreed with the Works Engineer.

3. WATER DISCHARGE

This section is applicable to canals and navigable rivers where the Trust is riparian owner and those navigations identified in Statutory Instrument No 1195 'The Inland Waterways of British Waterways Board Order 1965' as amended. The requirements relating to navigation are applicable to other river navigations.

INTRODUCTION

The Trust is not a land drainage authority. Water levels in canals are maintained in dry spells using reservoirs, river abstractions, pumping from ground water sources and re-circulatory pumping at locks ('back pumping'). Water levels are controlled in wet periods using overflow weirs and manually controlled sluices. Without these, the canal would overtop and may breach its banks, causing damage to property and possible loss of life. When the canals were constructed, they were usually a closed system, isolated from the effects of storms. Therefore, storm water discharges do not assist in dry periods and can cause severe difficulties in wet conditions. Where a new (or modified) discharge is proposed, it will be reviewed to determine if the benefits to the Trust outweigh the risks of acceptance and approval by Water Management and Environment Teams, the Waterway and the Utilities Team will be required. In the majority of situations, there is no obligation on the Trust to accept discharges.

Any surface water outfalls or otherwise draining into or affecting the Trust navigation without the permission of the Trust and or the Environment Agency could be liable to a penalty charge and or removal of the outfall.

FEASIBILITY, DESIGN, OPERATIONS & MAINTENANCE – FLOOD RISK CONSIDERATION

The only discharge which will normally be considered is uncontaminated surface water in small quantities at suitable locations. The Canal and River Trust undertakes a staged process to review the impact of all new or modified discharges to its network, in addition to any considerations that are made by the Environment Agency and/or the Local Planning Authority via the normal planning process.

If the applicant, as part of their site drainage plan, wish to discharge surface water into an inland waterway owned or managed by the Trust then an application should be submitted to the Trust who will provide details of the application review process and associated fees. In order to deliver a successful outcome for all parties it is vital that the Trust is consulted as early in the process as possible, potentially even before the land is purchased.

The Trust supports the principles of Sustainable Drainage Systems (SUDS) which should be followed. Guidance is given in the CIRIA publication C523 'Sustainable Urban Drainage Systems – Best Practice Manual' – This refers to the CIRIA Sustainable Urban Drainage Design Manuals C522 for England and Wales. The Flood & Water Management Act 2010 introduces changes to the legislation relating to SUDS, and subsequent editions of this document will reflect those changes, once enacted/commenced.

The details of on-site flow attenuation measures (such as SUDS) giving details of design, information about storage or drainage of water in excess of attenuation should be provided as well as any details of maintenance and adoption agreements for SUDS. If the SUDS are not maintained in the long term, then they will fail to provide the design attenuation and the Trust will be exposed to the full un-attenuated additional flood risk. Any SUDS such as underground storage, ponds, soakaways, flow restrictors etc. must have a suitable maintenance regime in place to ensure their effective operation over the life expectancy of the development.

In addition to the above information, the details of the proposed connection with the canal should be provided together with an estimate of the peak velocity of the discharge orthogonal to boat movement.

Discharges are not usually permissible directly above and below locks, adjacent to moving bridges and at mooring sites. Navigational difficulties would ensue as a result of the transverse flows. In order to minimise navigational difficulties associated with transverse flows of water the discharge energy must be minimised in the discharge structure design or by storage. Discharge velocity generally must not exceed 0.3 m/s measured at 90° to the direction of the navigable channel.

Discharges into the Waterway will require consent from both the Environment Agency (EA) and Canal & River Trust. The Promoter will be responsible for obtaining any necessary consent and providing proof to

the Works Engineer that this has been done. It must not be presumed that EA consent confers the Trust consent.

New developments must be designed in accordance with the National Planning Policy Framework (NPPF), along with its associated Technical Guidance and Practice Guide. In addition, the planning practice guidance 'Flood risk and coastal change' 2014 in England or "Technical Advice Note (TAN) 15" for Wales still applies. These documents set out how flood risk is to be managed during the design and planning process.

If mitigation measures are required, it must be agreed at an early stage whether the new or modified structures are to be procured by the Trust or the Promoter and which party will own and maintain them in the long term. It is usual that the structures are designed and built by the Promoter to an acceptable design and that the Trust assumes long term responsibility for the water control structures only, on its own land, on acceptance of an agreed commuted sum.

Discharges are not usually permissible in short canal pounds between locks. Difficulties could result from the capacity of by-wash weirs, surcharging the pounds and dewatering for the maintenance of locks.

FEASIBILITY, DESIGN, OPERATION & MAINTENANCE – POLLUTION/WATER QUALITY

The Trust will not generally accept sewage or trade effluent. Only in exceptional circumstances where there is adequate treatment, evidence of a treatment plant maintenance schedule and adequate dilution will applications be considered.

For **surface water drainage** applications, Form 6 & Pro Forma will need to be completed. There is an expectation that pollution control measures such as traps, gullies, oil separators, silt traps, swales or detention ponds will be required where appropriate. All pollution control measures should conform to the relevant Environment Agency publications and Pollution Prevention Guidance (PPG) notes. It is unlikely that these will be permitted to be built on land owned by the Trust. Normal practice would be to construct them on the Promoters land with adequate access provided to allow them to be regularly maintained.

The Promoter must supply their long-term maintenance plan, with emergency contact numbers for all oil separators, silt traps, swales and other pollution control devices for approval by the Trust. Suitable isolating systems such as valves must be included at the design stage, to allow maintenance and provide protection to the receiving waterway from pollution incidents.

During operation, it may be necessary to require that water samples are taken at intervals and analysed. It may be necessary for the Trust or its agents to inspect from time to time the area drained to the Waterway to ensure that the pollution risks remain acceptable. Alternatively, it may be acceptable for the inspection to be carried out by the discharger using a standard self-assessment procedure.

Calculations and plans will be required for the drainage network. The plans should define the pipe runs and illustrate the uses to which the drained areas are to be put and any other factors that may affect the quality of the surface run-off.

Where **water is discharged at a higher temperature** to that of the normal canal water, consideration will have to be given to the environmental impact. This will involve modelling outputs, with consideration to the size of the receiving waterway, flow, design of the discharge outlet, and hot water plume dispersal from the outfall. In some cases, additional water may have to be passed along the waterway at the Promoters expense to give the required dilution of the discharge. Any additional water required for dilution will be treated as an abstraction, and also included in the discharge quantity for design of mitigation measures.

FEASIBILITY, DESIGN, OPERATION & MAINTENANCE – NAVIGATIONAL IMPACT

The point of discharge is installed perpendicularly to the canal centre line in both axes. The point of discharge should not protrude past the surface of the canal wall such that it affects the mooring of a craft at the same location.

The pipe diameter for above water surface discharges is limited by the available distance between the normal water level and the underside of the coping stone. Several smaller pipes should be used where feasible.

The point of discharge must be installed such that water cannot flow from the canal or be abstracted using the point of discharge, a non-return valve could be utilised. For gravity discharges a stilling chamber / sand trap / oil interceptor is typically provided on the neighbouring land.

At locations where craft will be manoeuvring at low speed the limit to the velocity of discharge will be reduced in proportion to the reduction in craft speed. The discharge velocity generally must not exceed 0.3 m/s measured at 90° to the direction of the navigable channel. The Works Engineer will specify the craft speed. A stilling basin is usually needed to comply with this requirement. In most cases physical or mathematical modelling will be necessary.

Scour protection may be needed.

Discharge structures should be designed to minimise the visual impact on the canal, to allow the quality of the discharge to be monitored and to prevent loss of water from the canal into the drainage system. The structure should be accessible in safety for maintenance and sampling. Where this is not possible, for instance on river navigations, a remote sampling point and a flap valve are needed. Outfall structures should normally be designed for the discharge to take place below the normal water surface, preferably via a stilling chamber arrangement, wherever practicable. Above surface outfalls are only accepted in exceptional circumstances, due to the visual impact and risk of navigational difficulties, although offside outfalls above surface are less likely to cause problems than towpath side.

Fenders and signing of structures may be necessary. In particular pumped discharges will need to be signed to advise waterway users of their intermittent operation.

Discharge structures should be capable of carrying the loads imposed by the use of the towing path maintenance vehicles.

Towpath levels should not be raised to accommodate pipework.

The discharge of water to canals can lead to the transfer of water in an open channel to waste weirs. In some instances, the issues discussed under 'Water Transfer' within section 10 (Water Abstraction) of this Code of Practice may be applicable.

SURFACE WATER DISCHARGE GUIDANCE – PRODUCING AN OUTLINE AND DETAILED IMPACT ASSESSMENT

Introduction

It is extremely important for the Canal & River Trust (the Trust) that applicants wishing to discharge surface water into inland waterways follow the principles of UK planning policy and in particular that any assessments are consistent with the processes outlined in the accompanying technical guidance to those policies.

The responsibility for producing a site-specific Flood Risk Assessment (FRA), as per UK planning policy is with the applicant and the FRA should accompany any planning application.

The Trust requires that the assessment should reflect the additional risk and a two-stage process is adopted of an outline impact assessment followed by a more detailed impact assessment, if necessary. This document provides guidance to assist applicants in producing outline and detailed impact assessments which will be acceptable to the Trust.

Producing an outline impact assessment

The addition of surface water to a waterway is likely to increase the flood risk if the peak flow rate and volume are greater than the existing inflow. This increase will occur in all sections of canal until the water is discharged from the system. The purpose of the outline impact assessment is to quantify the pre and post development flow rates and volumes, for the Trust to review.

For river navigations the applicant will need to discuss with the Trust whether our agreement is required in addition to any permission from the Environment Agency, riparian landowners and planning authorities.

Determining change to inflows to the waterway

The applicant will need to determine the quantity of water currently entering the waterway (pre-development scenario) and compare that with the post development quantity (post-development scenario). For both scenarios this will include the derivation of a full flood hydrograph for the development site. Where SUDS[1] schemes are proposed the applicant should demonstrate that any increase in inflow to the waterway is acceptable to the Trust and that the long-term maintenance is adopted either by a local authority or sewerage undertaker[2] .

The use of drainage software models to produce the pre and post development hydrographs is encouraged. Various drainage simulation models are available commercially, for example the Trust currently utilise the WinDes modelling suite produced by Micro Drainage (V2013.1) when auditing drainage designs.

Calculating pre-development inflows

Greenfield Runoff

The current land use, for the development site, is important in determining the pre-development runoff. For greenfield sites the applicant will need to determine the greenfield runoff rates for the 1 in 100-year flood event (1% annual exceedance probability). The pre-development rate will include a 20%[3] increase in peak flow to account for climate change.

The methods that the Trust will accept for determining this flow are summarised in Table 1 below. These reflect recent research and are in line with EA guidance[4] that FEH methods should be used in preference to older methods (IH 124, ADAS 345 etc.). Guidance on the choice of method for small catchments (<25km2) should be based on (Faulkner et al., 2012):

"It is recommended that flood estimates on small catchments should be derived from FEH methods in preference to other existing methods. The current versions of the FEH statistical approach or the ReFH rainfall-runoff model should be used except on highly permeable catchments (BFIHOST>0.65), where ReFH should be avoided, and possibly on urban catchments (URBEXT2000>0.15), where the results of the ReFH model can be less reliable. Checks should be carried out to ensure that the flood estimates are within expected ranges based on what is known about the history of flooding and the capacity of the channel (including evidence from previous flood marks).

For catchments smaller than 0.5 km2 and small plots of land, runoff estimates should be derived from FEH methods applied to the nearest suitable catchment above 0.5 km2 for which descriptors can be derived from the FEH CD-ROM and scaled down by the ratio of catchment areas. The decision to translate FEH estimates from catchment scale to plot scale should be accompanied by an assessment of whether the study site is representative of the surrounding catchment area."

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[1] SUDS: Sustainable drainage systems or sustainable (urban) drainage systems: a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques (may also be referred to as SuDS).

[2] The Flood & Water Management Act received Royal assent in April 2010, but Schedule 3 of the Act, which is concerned with SUDS is yet to be commenced. At the county and unitary level the Act establishes a SUDS approving body (SAB). The SAB will have responsibility for the approval of proposed drainage systems in new developments and redevelopments (in accordance with National Standards for Sustainable Drainage). The Act also requires the SAB to adopt and maintain approved SUDS that serve more than one property.

[3] Technical Guidance to the National Planning Policy Framework (2012). Department for Communities and Local Government

[4] Environment Agency, Flood estimation guidelines Version 4

Table 1: Hydrological methods to determine Greenfield runoff

Method	Comments	Limitations
FEH statistical method	Use QMED equation revised in 2008 (Kjeldsen *et al.*) Use FEH CDROM version 3.0 (released in September 2009) Use WINFAP-FEH version v3.0.003 (released in November 2009) in conjunction with the current HiFlows-UK dataset (website) version 3.1.2, released in December 2011. Preferred method if catchment is highly permeable (approx. BFIHOST>0.65)	>50 ha. For catchments <50 ha, downscaling is acceptable. Return period 2-200 years. $URBEXT_{1990}$ up to 0.5.
Revitalised Flood Hydrograph Method (ReFH) (2005, 2007).	ReFH has superseded the Flood Estimation Handbook (FEH) rainfall-runoff method and tends to give results consistent with the statistical method. • Use FEH CDROM version 3.0 (released in September 2009) Analysts should refer to https://www.hydrosolutions.co.uk/software/refh-2/ for guidance on the ReFH method and software.	0.5 -1000 km^2 For catchments <50 ha, downscaling is acceptable. Calibrated for return periods up to 150 years. Only reliable for $URBEXT_{1990}$ <0.125.

The inflow hydrograph should be determined for different storm durations. As the catchments tend to be quite small the durations should start at 15 minutes and include up to 1440 minutes. These durations could be extended if the catchment size requires it.

If the development land is below the level of the waterway then the applicant will still be required to determine the 1 in 100-year return period water levels in relation to the waterway to demonstrate that there are currently no other flow paths to the waterway.

Brownfield Runoff

Where the development land is currently brownfield the applicant should determine the 1 in 100-year inflows to the waterway. If the existing drainage system is known then it should be modelled using best practice simulation modelling, to determine the peak flow rates. If the system is not known, then the brownfield runoff should be calculated using the methods for greenfield runoff, described above, but with an appropriate adjustment for BFIHOST/$URBEXT_{1990}$. The rationale for this adjustment should be provided. The pre-development rate will include a 20%[5] increase in peak flow to account for climate change.

Pumped Inflows

Where the development land is below the level of the waterway and flood water is pumped to the waterway then the capacity of the pump will be required. The applicant will also have to submit any other flow sources for the 1 in 100-year return period flood (including a 20%[6] increase in peak flow to account for climate

[5] Technical Guidance to the National Planning Policy Framework (2012)

[6] Technical Guidance to the National Planning Policy Framework (2012)

change), e.g., if the pump is only designed to cope with the 1 in 30-year flood, explain what happens to the additional water in a 1 in 100-year event.

Calculating post development inflows

The applicant should derive the 1 in 100-year return period flood flows into the waterway plus a 20%[7] increase in peak flows for climate change and a further 10%[8] increase in peak flows for urban creep (if the discharge is from a residential development or mixed-use development). For mixed developments the 10% increase for urban creep should only be applied to the residential proportion. The percentage increases are not compound and the maximum increase is 30%. The applicant will have to demonstrate all flow paths to the waterway including pipe flow, pumped flow and overland flow. For example, if a piped network is only designed for a 1 in 30-year return period flood then the applicant will need to provide details of any overland flows which will enter the waterway in the 1 in 100-year event (plus climate change and urban creep).

The inflow hydrograph will be determined for different storm durations. As the catchments tend to be quite small the durations should start at 15 minutes and include up to 1440 minutes. These durations could be extended if the catchment size requires it.

Comparing pre and post development inflows

Once the above analyses have been undertaken, the applicant will be able to complete the relevant sections within Form 6 & Pro Forma of the Code of Practice, for submission to the Trust. Upon review of this Form by the Trust, further work may be required by the applicant to assess the impact of the proposed discharge on the receiving waterway, in the form of a detailed impact assessment, guidance on which is given below. Further information on the specific submission requirements at both the outline and the detailed impact assessment stages are given at the end of this Chapter.

Producing a detailed impact assessment

The aim of the detailed impact assessment is to determine any increase in waterway water level as a result of a new/modified discharge and potentially propose mitigation works so that any change in flood risk can be reviewed by the Trust. The geographical extent of the detailed impact assessment must include the waterway length from the point of discharge into the waterway (including to the upstream lock) to the point of exit from the waterway (including the downstream lock) - see below.

[7] Technical Guidance to the National Planning Policy Framework (2012)

[8] Future Impacts on Sewer Systems in England and Wales Ofwat Report (2011) reports a median increase in impermeable area due to urban creep of 12% to 2040.

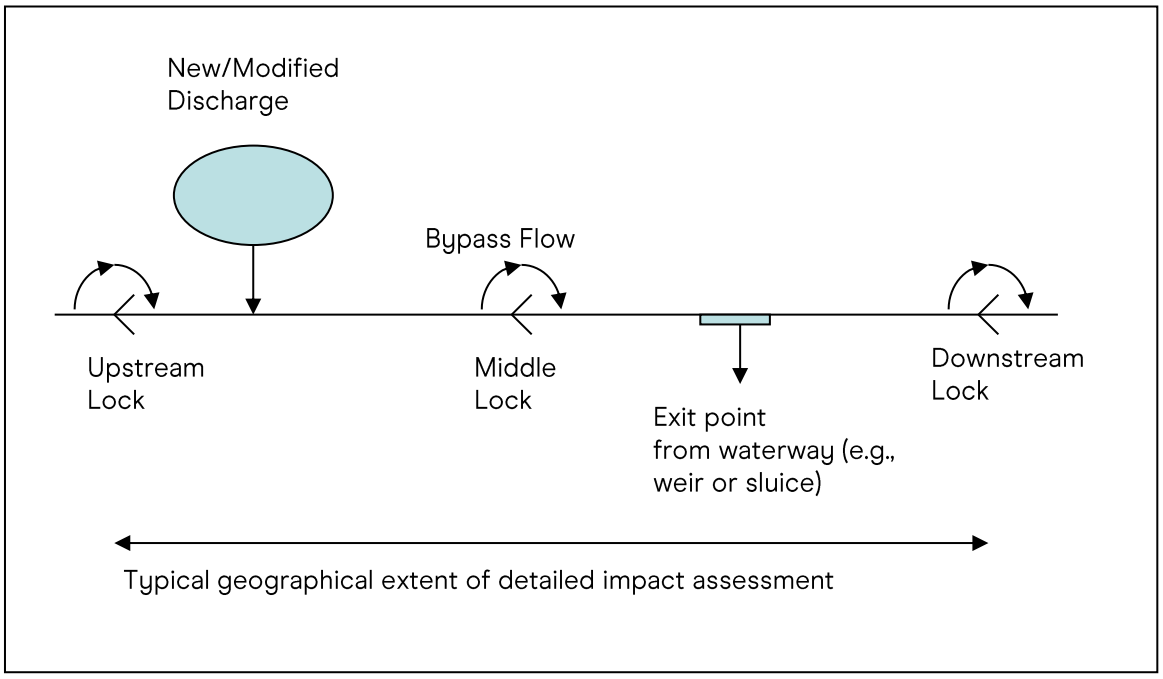


Figure 1: Illustration of typical geographical extent of a detailed impact assessment

Predicting impact on waterway water levels

The inflow for the different storm durations should be input into a hydraulic model to determine the storm duration which gives the maximum canal water level. This storm duration will be the design storm duration for any mitigation works. The methods used to determine the water levels will range in complexity depending on the required accuracy of the solution.

Steady State Models

Steady state models may be used (be it commercially produced software or via gradually varied flow backwatering calculations (Chow, 1973 and Chadwick and Morfett, 1999). However, since such methods do not incorporate temporary storage or routing effects, they will result in the conservative design of mitigation works. Generally, the degree of conservatism will be greater the longer the time of travel of flood flows along any watercourse and the greater the temporary flood storage present.

Hydrodynamic Models

The use of hydrodynamic models will not introduce the conservatism of the steady state approach in terms of the mitigation works. Various hydrodynamic models are available commercially, for example the Trust currently uses the hydraulic modelling suite ISIS produced by Halcrow (2012) when considering flood studies. The Trust has near comprehensive coverage of hydrographic data for the waterway system, which may be loaded directly into this modelling suite.

When water levels are forecast to exceed the bank levels and water would pass out of the waterway (offside or towpath on waterways) then the channel banks should be considered to act as weirs (or 'spills'). It is not acceptable to assume that all the flood water would be contained within the channel, this is commonly termed 'glass walling' of the banks.

Hydraulic Model assumptions and data requirements

When undertaking a hydraulic analysis reference should be made to BW (2012) for details of:

- How to hydraulically resolve in channel flow (e.g. guidelines for derivation of hydraulic roughness' for backwatering or hydrodynamic modelling).
- How to resolve head losses at bridges, tunnels and aqueducts.
- How to resolve hydraulic structures (e.g. side weirs, by-weirs, culverts etc.).

Table 2 below provides details of typical data requirements for the steady state, and hydrodynamic methods. The Trust often holds much of this information (available upon request) however, there may be a need for the applicant to undertake or commission a survey to supplement existing data.

Table 2: Typical data requirements for hydraulic methods

Characteristic	Typical data requirements
Watercourse	Cross sections are typically required at 50m longitudinal interval and lateral spot height separation of 1m. Bed type recorded (e.g., silt/ clay puddle, concrete, brickwork etc.). Cross sections are generally required at the centreline of each channel constriction (e.g., bridge or stop plank narrow) and at each portal of tunnel or limits of aqueduct. Bank heights (for waterways offside and towpath levels) should be defined at each cross section as well as at any low spots. Photograph of watercourse at each cross section to evaluate hydraulic roughness.
Structures Culverts	Diameter, invert levels (inlet & outlet), culvert material. Photographs of inlet chamber/ intake and outlet.
Weirs	Crest height, crest length, crest breadth, depth of channel immediately upstream of weir, any slot depths, any towpath support widths.
Locks	Effective height of top of lock gates (top beams), gate length, gate width, weir slot length, height of effective weir slots (to underside of balance beams) for both head and tail gates
Sluices	Gate opening width, maximum vertical gate opening, invert level of gate, culvert dimensions (see above) should sluice discharge into culvert.

Detailed guidance on key specific properties of each structural type is given in BW (2012); all levels should be quoted to a common datum throughout.

In addition to the model data requirements the following model boundary condition should be used. To determine the flow from the upstream pound(s), 100 mm over the upstream bypass weir crest(s) should be assumed. If this level is high enough for water to flow over the top lock gates then this should be allowed for in the modelling. If this assumption does not result in at least 50mm being discharged out of the system over storm weirs then the u/s flow(s) should be increased iteratively until this minimum level is reached.

For river navigations with higher flows and more complex water control structures the model boundary conditions should be agreed with the Trust during the application process.

Modelling Results

The outputs from the modelling should be presented as pre and post development 1in100 year water levels (including a 20% increase in peak flow to account for climate change and an additional 10% increase in peak flow to account for urban creep for the post development situation) at a spatial resolution agreed at the application stage. In general, water levels will be produced at each model cross section and reported in the

detailed impact assessment. These water levels will be reported against bank levels, both offside and towpath side.

The applicant will also submit a copy of any hydraulic calculations and/ or hydraulic model data and result files along with any topographical surveys.

Mitigation Works

The previous sections have described the technical methods for determining the changes in water level in the waterway. If the analysis shows that the proposed discharge will increase water levels then the applicant must propose mitigation measures which will limit the increase in flood risk to a level acceptable to the Trust.

Improvements to existing and proposed new infrastructure

There are a number of improvements which could be made to a waterway length to mitigate the effects of the discharge. These could include:

- raising bank levels
- increasing the capacity of existing bypass and storm weir structures
- increasing the size of a sluice
- automation of structures
- installing new weirs, culverts and sluices

These options should be discussed with the Trust and once agreed revised calculations should be made on waterway water levels.

SUDS schemes

As an alternative to waterway improvement works the applicant could propose a SUDS scheme to attenuate in part or in whole the flood inflows at source. The technical design of SUDS schemes is well understood and described in detail in CIRIA's SUDS Manual C697 (2007). The applicant should provide all relevant information so that the scheme can be technically reviewed by the Trust. In particular the applicant should comment on the maintenance requirements of the scheme and provide evidence of an agreement to adopt the scheme either with a sewerage undertaker or local authority (see footnote 2). If this evidence cannot be provided then the scheme will be assessed as if the SUDS scheme was not operational. In this instance the applicant should propose mitigation measures within the waterway.

Impacts on downstream watercourses

The identification of mitigation and improvement works could result, if built, in an increase in flow from the waterway to downstream watercourses. The consequences of this may require, in certain circumstances, the applicant extending the scope of the impact assessment to the downstream watercourse. This will be discussed and agreed with the Trust during the application process. The Trust may wish to undertake this assessment and would expect to recover the associated costs from the developer.

Submitting the impact assessment(s)

The applicant should contact the Trust as soon as possible in the development process to discuss the possibility of discharging surface water into its network, using the completed outline impact assessment as the basis for this. Table 3, below, provides a list of the required information that should be submitted, at the outline and detailed impact assessment stages, and should be read in conjunction with Form 6 & Pro Forma of the Code of Practice. Table 3 can be used as a check list for submission.

Table 3: Requirements for submission to the Trust

Impact Assessment stage	Information to be provided by applicant/promoter	Included? (Yes/No)
Outline	Written description of the development site (accompanied by photographs if appropriate) detailing: Pre-development use and proposed development extent and characteristics of the site. Existing site drainage arrangements and proposed drainage scheme Relationship of site to the Trust's waterway	
Outline	Plan of site showing: development site catchment area, outline or detailed drainage design and relationship to any part of the Trust's system (e.g., waterway pound(s), river navigation, reservoir, feeder channel etc.).as hard copy or digitally (AutoCAD® DWG, DXF™, and DWF files)	
Outline	Details of catchment parameters: area, soil, percentage impermeable, percentage permeable etc. used to estimate pre and post development site runoff.	
Outline	Description of method of runoff estimation employed for pre and post proposed development.	
Outline	Digital copies of all pre and post development discharge hydrographs, with a summary table of peak discharge rates for all relevant scenario/return periods/durations.	
Outline	Digital copies of drainage design calculations and/ or drainage model data and result files for both pre and post proposed development.	
Detailed	Description of the method of hydraulic analysis employed (if applicable)	
Detailed	Digital copy of any survey work commissioned for the investigation (if applicable)	
Detailed	Table comparing forecast pre and post proposed development water levels (quoted to nearest mm) and flows. Table should also include bank levels (towpath and offside for waterway channels) for each location where water levels are produced and also any low spots identified (if applicable)	

Impact Assessment stage	Information to be provided by applicant/promoter	Included? (Yes/No)
Detailed	Digital copies of hydraulic calculations and/ or hydraulic model data and result files for both pre and post proposed development (if applicable)	
Detailed	Location and dimensional details of proposed mitigation works (if applicable)	

References

1. National Planning Policy Framework (2012), Department of Communities and Local Government
2. Technical Guidance to the National Planning Policy Framework (2012). Department for Communities and Local Government
3. Technical Advice Note (TAN) 15: Development and Flood Risk (2004), Planning Policy Wales, Welsh Assembly Government
4. Environment Agency Flood estimation guidelines version 4 (Issued 26/06/2012) available on request from EA.
5. Kjeldsen, T.R., Jones, D.A. and Bayliss, A.C. (2008) Improving the FEH statistical procedures for flood frequency estimation. Science Report SC050050, Environment Agency
6. Faulkner, D., Kjeldsen, T., Packman, J and Stewart, E. (2012). Estimating flood peaks and hydrographs for small catchments: Phase 1. Science Report SC090031/R, Environment Agency.
7. The revitalised FSR/FEH rainfall / runoff method, Flood Estimation Handbook Supplementary Report No.1, Kjeldsen, T.R (2007)
8. Future Impacts on Sewer Systems in England and Wales: Summary of a Hydraulic Modelling Exercise Reviewing the Impact of Climate Change, Population and Growth in Impermeable Areas up to Around 2040. Ofwat (June 2011)
9. Kjeldsen, T. R. (2009). Modelling the impact of urbanisation on flood runoff volume. Proc. Instn. Civ. Engrs. Wat. Man. 162, 329-336
10. Kjeldsen, T. R. (2010). Modelling the impact of urbanization on flood frequency relationships in the UK. Hydrol. Res. 41. 391-405
11. Chow, V.T., 1973. Open-channel hydraulics. International Edition. Published by McGraw-Hill Book Company. ISBN 0 07 085906 X.
12. Chadwick A.J. & Morfett J.C., 1999. Hydraulics in civil and environment engineering. Published by E & F.N. Spon. Third Edition. ISBN 0 419 22580 3.
13. British Waterways Approved Standard: Hydraulic Design of Canal Works v3.2 (February 2012). Available upon request from Canal & River Trust Water Management team.
14. CIRIA, C697 The SUDS Manual (2007)

4. SERVICES IN THE TOWPATH

INTRODUCTION

This section refers to all services (statutory undertakers or private pipes, cables etc.) installed within the Trusts towpaths. For service crossings please see Part 2 of this document.

This section primarily relates to canals, where considerations of integrity and water tightness are paramount however, it is also relevant to river navigations.

Works within the towpath relating to services are either works to existing services or works to install new services. With regard to the abandonment of services, the third party will be required to remove all services from Trust property.

WORKS TO EXISTING SERVICES WITHIN THE TOWPATH

A service record search shall be undertaken by the Third Party; in addition, the Works Engineer will identify any Sky Network Services apparatus in the area as per section 5 of this document.

Prior to any construction works the depth of the existing service/s should be ascertained. This could be via several techniques including but not limited to:

(a) Ground proving radar.
(b) Trial Hole/s or exploratory dig/s.
(c) Accurate as built records.

It should be noted that any surveys being undertaken on the Trusts land will also require permits to be in place prior to commencement – see section 7 of this document.

Once the depth of the service/s has been established this should be forwarded with your proposed solution to the works engineer for assessment, your submission should take account of:

- Works should be designed to where possible keep the towpath open throughout the works (temporary scaffold arrangements might be considered)
- Ensuring a towpath minimum width of 1.2m remains (where applicable)
- The depth of the excavation and any temporary works required to facilitate – are the works in an embankment or cutting?
- Trenchless techniques should be adopted where possible
- Proximity to historic and heritage structures
- Removal of arising's from the excavation
- Prevention of contaminates, solids and fluids entering the waterway
- Avoiding affecting the clay core lining of the canal
- Access to the work site
- Programme your works to minimise disruption to waterway users
- Invasive weeds such as Japanese Knotweed
- Its proximity and effect upon other services
- Re-instatement of the area, including plant access

WORKS TO INSTALL NEW SERVICES WITHIN THE TOWPATH

There are a number of factors needing to be considered when establishing the feasibility of the installation, its location, depth and size, such as:

- Proximity to the waterway wall
- Is the service within an embankment or cutting – will temporary works be required?
- Existing hedges, trees and habitats

- Presence of invasive weeds such as Japanese knotweed
- The location of the canal lining (puddle clay or otherwise)
- The location of tie rods for trench sheets both present and potential for in the future
- Mooring points including the boater's use of mooring spikes
- The presence of contaminated land
- Site accessibility
- Dewatering/drainage

A site visit with your Works Engineer might be advantageous at this point.

A service record search shall be undertaken by the proposer; in addition, Canal & River Trust will identify any Sky Network Services apparatus in the area as per section 5 of this document.

Prior to any construction works the depth of any existing services should be ascertained. This could be via several techniques including but not limited to:

(a) ground proving radar
(b) trial Hole/s or exploratory dig/s
(c) accurate as built records

It should be noted that any surveys being undertaken on the Trusts land will also require permits to be in place prior to commencement – see section 7 of this document.

Once the depth of any services has been established this should be forwarded with your proposed solution and re-instatement details to the works engineer for assessment.

Upon receipt of your proposal the Works Engineer will pass on details of your proposal to our Utilities department who will assess if:

(a) You have an existing national agreement with the Trust permitting new installations in accordance with this code of practice.
(b) You require an agreement with us for the placement of your apparatus within our land.

Should an agreement already be in place your Works Engineer will continue the assessment of your proposal. Should a new agreement be necessary then our utilities representative will contact you to begin negotiation and development of the agreement. You should note that this can be time consuming where typically 6 months is required to establish the agreement (in some instances this can be shorter or longer). Upon receipt of the signed agreement your works engineer will continue the assessment of your proposal.

Upon confirmation of an agreement being in place your Works engineer will in most cases require a site visit and a copy of your proposed method statements and risk assessments together with a copy of your Public Liability Insurance. Your method of working will then be assessed and any comments returned for your action, you will then be issued with a permit as per part 1 of this document.

5. WORKING NEAR SKY NETWORKS SERVICES CABLES AND APPARATUS

INTRODUCTION

Sky Network Services telecoms cables and apparatus are present on over 600km of the Trust's network. The Trust has a contractual obligation to allow Sky Network Services 'quiet enjoyment' of its property where Sky Network Services apparatus is present. It therefore vital to ensure that no damage whatsoever takes place to the Sky Network Services network by the Trust, its agents, contractors or customers.

Any works that are to be undertaken in the vicinity of the Sky Network Services network shall be notified to the Utilities team by a Trust member of staff, usually the Works Engineer. This process should be actioned at the planning stage of the work, in conjunction with searches made to other utility companies. **Only Trust staff are authorised to notify Sky Network Services via the Utilities Team and this information will not be available from any other source.**

EMERGENCY PROCEDURES

In the event of work classed as an emergency (leak stopping, bank slippage, etc.) requiring immediate attention, the Utilities Team should be contacted without delay; they will then contact Sky Network Services and arrange a site inspection. If an emergency occurs out of normal working hours then the Sky Network Services 24/7 emergency telephone number should be used (08000 273 242) and the Utilities Manager notified as soon as possible.

PROCEDURE

The responsibility for ensuring this pre-start on site procedure is complied with rests with the works engineer.

At the design stage your works engineer will check if Sky Network Services apparatus is within the area proposed for works and if so, a notification form will be completed and sent to the Utilities Team. This form is the prompt to Sky Network Services that work is required under, over or adjacent to their network. After being alerted by the notification form Sky Network Services will contact the nominee, sending drawings and advice regarding working next to its network. The nominee will also be contacted directly by a Sky Network Services representative to discuss the nature of the work and organise a site visit with all concerned.

A minimum of 14 days notice should be given to Sky Network Services before work is due to commence; and method statements and risk assessments should be submitted at this time.

If after meeting with Sky Network Services at the design stage it is recognised that a lift and shift operation must take place to the said network for the designated work to take place; a minimum of 3 months notice should be given to Sky Network Services.

It should be stressed that no physical exploratory work on the site should be undertaken before a joint site visit with Sky Network Services.

6. BUSINESS BOATING

Business boating means all boating related activity on the Trust's waterways that is not for personal private use. It is the role of the Business Boating Team to manage and authorise these activities. Personal private use of a boat is authorised by a Standard Boat Licence. Business boats are authorised by a Business Boat Licence. However most boating businesses require a base with moorings to operate from and these can be owned by the Trust or connected to our property in some way. It includes holiday boat hire, day boat hire, passenger boat operations, roving traders, boatyards, mooring sites and marinas. The majority of these activities require some form of property contract from the Trust and can result in the following types of works:

- off-line mooring basins (including marinas, lay-bys, navigable arms and historic widened mooring areas)
- on-line moorings (moorings along the existing line of the Trust's waterways)
- dry and wet docks connected to the Trust's waterways
- slipways
- boat lifting
- upgrades and improvement works to existing boating facilities

This Code of Practice does apply to some Business Boating proposals. These are also covered by the Business Boating Team and its procedures which include the asset protection principles included in this Code.

Applications from existing or proposed business boating customers should, in the first instance, refer to the Business Boating pages of the Trust's website at http://canalrivertrust.org.uk/boating/boating-businesses

For any applicants who do not have access to the internet, the following address should be used for correspondence:

Business Boating Team
Canal & River Trust
National Waterways Museum
South Pier Road
Ellesmere Port
Cheshire
CH65 4FW
Tel: 03030 404040

7. SITE INVESTIGATIONS

INTRODUCTION

Adequate site investigation is a requirement for the majority of works covered within this code. The information arising from site investigations forms a key part of the assessment by the Trust of the overall submission. It is therefore important that the level and quality of information is consistent with the complexity of the proposed works. The site investigation should be sufficient to reduce the risks associated with unforeseen ground conditions to a tolerable level.

In line with industry practice, the site investigation should be under the overall supervision of a competent Ground Specialist, who should have appropriate experience of the type of development proposed. The investigation must be carried out to the standards defined in BS 5930:2015 Code of practice for site investigations as a minimum: where a departure from the standard is used, justification must be provided. Soil testing must be carried out to BS EN ISO 17892-12:2018, by a UKAS accredited laboratory.

Attention is drawn to the fact that, for the purposes of the Construction, Design and Management Regulations, site investigation is considered to be a construction activity. Compliance with the regulations must be ensured by the promoter.

GEOTECHNICAL DESK STUDY

The site investigation should include a desk study phase, which should include a walk-over survey of the site. It is often found that reference to historic maps provides useful information on the history of development of a waterway site, particularly in more developed areas. A useful interactive website which can be used to supplement further desk study is http://magic.defra.gov.uk/ .

The desk study should include:

- an initial ground model
- recommendations for further investigation as appropriate, to further define the ground model
- a preliminary geotechnical hazard list and risk register, which should be updated throughout the later phases of investigation

GROUND INVESTIGATION

Prior to commencing the ground investigation, all borehole/ trial hole positions and accesses should be agreed with the Works Engineer and checked for positive identification of any services or other underground structures. A check should also be made for recorded archaeological sites, and the listed status of any structures which may be affected, together with any land designation (such as SSSI status). Details of the proposed investigation, together with any environmental or heritage impacts, must be included in the environmental appraisal for the site.

Care should be taken not to disturb wildlife when carrying out any intrusive investigations (boreholes, trial pits, etc). Of the wildlife most likely to be encountered, badgers (and their setts), nesting birds, bats, water voles and all reptiles require special attention as they are all legally protected.

No borehole shall be drilled or trial pit excavated which has the potential to conflict with the integrity of the canal corridor. All such boreholes, especially those within 5m proximity of the canal, should receive the prior authorisation of the works engineer.

Waterway walls are not structural retaining walls, merely erosion protection. They are often up to two hundred years old. Please do not assume that canal towpaths can support borehole & window sampling rigs, many of which are bulky and difficult to manoeuvre. A prior discussion with the Works Engineer would be required prior to submitting proposals which rely upon towpath access. Approval may only be issued for lightweight plant which is physically restrained from approaching the edge of the canal. A condition survey and risk assessment will be required.

The impermeable lining to the canal should be identified, located and avoided where at all possible. However, if it will be necessary to affect the navigation channel, within the existing Waterway width, for

temporary or permanent works, then bed profiling for a sufficient distance either side of the Works should be carried out. In such cases where it is necessary to carry out bed profiles, and/or identify bed materials, impermeable linings etc, any investigations must be agreed in detail with the Works Engineer in order to minimise the risk of damage to the canal. The Works Engineer may reserve the right to carry out these investigations using his or her own contractor at the Promoter's expense.

Due to the heritage and nature of the canal environment, there is always a possibility of soil being contaminated. This should be factored into the design of any Site Investigation.

Other constraints which must be observed are:

- At no time shall the Waterway or towing-path be blocked. Signage and suitable fencing or other barriers must be used to segregate the public from the working area and the operation of noisy or dust-generating plant should be supervised by banks-men.
- No plant or equipment used for the investigation works should be stored on Trust land without prior consent.
- No trial pits are to be excavated on embankment slopes below the level of the canal or within five metres of the toe of such embankments.
- No water is to be pumped into or out of the canal.
- No borehole or trial pit spoil or grout shall be allowed to enter the canal and all such arisings shall be removed from the Trust's property in compliance with waste management legislation.
- Boreholes are to be sealed and backfilled with cement-bentonite grout of an agreed specification. Where alternative backfilling is required (for example for a particular installation), this is to be by prior agreement.
- Trial pits are to be carefully backfilled and adequately compacted in layers.
- Any variations from these constraints require the written agreement of the Works Engineer.
- All plant on Trust land should use environmentally friendly fuels and oils (see Part 1, section 7).
- The contractor should refer to Part 1, section 7 with regard to the transport of materials on Trust property e.g., Bentonite.

REINSTATEMENT

All access roads used, and fences and hedges disturbed during the investigation are to be fully reinstated to the Works Engineer's satisfaction. The Works Engineer may reserve the right to carry out such work using the Trust's own contractor at the Promoter's expense.

Where it is necessary to leave apparatus such as piezometers or survey stations on the Trust's land, the design of the installations, including details of covers etc, must be acceptable to the Works Engineer. A Commercial Agreement may also be required.

PROVISION OF INFORMATION

Relevant logs, test data and other field information must be submitted. The preferred format is electronic (e.g. .pdf format) copies, as well as AGS data (current version). Where the submitted documents do not feature the details of the ground investigation contractors / consultants used, these details should be provided separately.

Interpretative reports should be provided as an electronic copy (e.g., Word or .pdf) version. All exploratory holes must be accompanied by a 12-figure national grid reference, as well as a level to Ordnance Datum.

Where it is not practical to provide levels to OD (for example where no benchmarks are present locally), then it may be acceptable to provide a relative level to an agreed datum (not water level), with a suitable witness drawing of any temporary benchmark used.

REFERENCES

ICE (1993) 'Site Investigation in Construction Series 1 to 4', ICE Site Investigation Steering Group, Thomas Telford, London.

8. DEMOLITION

INTRODUCTION

The Trust actively encourages the use of Sustainable Demolition in order to salvage as many components as possible for re-use. In addition to Sustainable Demolition, effective waste management through the reduction in waste generation during the construction phase and sustainable transportation of waste material has significant commercial benefits in addition to creating a more efficient demolition procedure.

It should be noted that the majority of demolition works will require planning consent and the Trust will be a statutory consultee.

PRE-DEMOLITION

All demolition works shall be carried out in accordance with:

- BS 6187 Demolition
- COSHH regulations
- Health and Safety Commission publications
- CDM Regulations

Method Statements and Risk Assessments should be provided to the Works Engineers. It is third parties responsibility to ensure notifications and where required consents are obtained.

The third parties Health and Safety File should include reference stating that Trust agreement must be obtained before any works of maintenance, alteration or demolition are undertaken.

The planning and undertaking of any demolition work needs to identify, assess and address risks associated with pollution & the surrounding environment, see Part 1, section 7.

As part of the planning process, desk studies, asbestos surveys, site investigations and contaminated land assessments are required to identify contaminated land issues in advance of the works. A waste management plan to deal with resulting issues must be drawn up and agreed with the Works Engineer. All surplus excavation material shall be removed from site unless prior consent has been given by the Works Engineer for on-site disposal or other use.

Many species of bats, birds and other fauna that inhabit the waterside are legally protected and surveys to establish their presence are required prior to commencing the works. In addition, demolition should not cause the spread of invasive species, see Part 1, section 7.

The use of explosives shall comply with the Home Office Regulations and shall only be permitted after full consultation with all relevant authorities including the Works Engineer.

The Trust owns and maintains many old structures, which could be adversely affected by vibration associated with certain demolition methods. An agreement on acceptable vibration allowance is required with the Works Engineer prior to works commencing. Consideration also needs to be given to nearby residents and the potential disturbance vibrations may have on wildlife.

Waterside structures often contain features of archaeological or heritage value that need to be preserved, rescued or recovered for future use. Prior to any demolition works, the Trust can provide advice as needed but the promoter should check with the local authority on any consents that are required, see Part 1, section 8.

DEMOLITION WORKS

Demolition works adjacent to and over the canal are likely to require adequate screening to prevent debris from landing on Trust property. There should be no debris encroaching upon the Trust land.

Dust suppression is likely to be required during demolition works, particularly near densely populated areas, sites with typically strong winds or mooring sites alongside the canal. Debris piles are to be kept to

manageable sizes as per the waste management plan to inhibit the release of dust into the atmosphere and, must not create run off towards the waterway.

Hot works should be undertaken away from the Trusts land boundary so far as possible. Where hot works are required to be undertaken on Trust property, it must be accompanied with relevant risk assessments. Where there is firefighting equipment, protection measures such as screening and exclusion zones must be in place between the hot works and adjacent infrastructure or personnel.

Once demolition works have been completed, a canal bed survey or similar might be required to be undertaken by the promoter to ensure that no material has entered the waterway. The promoter may wish to carry out a pre-start survey.

The passage of boats on the navigation and the use of the towpath must be maintained unless otherwise agreed.

Monitoring during demolition works is likely to be required to check design allowances are not being exceeded. If damage to a Trust structure is detected, the third party shall be responsible for the full & immediate reinstatement (to the Trust's written satisfaction) of the affected structure and any associated costs.

Extreme caution needs to be taken when removing structures located below canal water level (e.g., cellars, basements), as they may also be retaining ground water, which is associated with the Canal adjacent, furthermore the third party may need to instigate temporary works to ensure the waterway structure remains in place throughout the works.

The canal environment, particularly derelict structures, can be home to bats, birds and other protected wildlife, and consideration should be given to the need to protect them during the works.

Where contaminated material is encountered (e.g., asbestos sheeting), steps outlined in the waste management plan must be followed to protect workers and the public from contact with the material or with gases or liquids arising from it. All necessary permits remain the responsibility of the promoter.

The Promoter is encouraged to recycle construction waste, where appropriate. Additionally, the Trust requires that materials suitable for re-use in other areas of the network (e.g., such as copings and castings) must be carefully removed and transported to a storage area. The Trust retains ownership of all such materials unless agreed upon prior with the Works Engineer.

9. DIVING OPERATIONS

INTRODUCTION

All diving operations in waterways under the Trust's control must be in accordance with the Diving at Work Regulations 1997 and the Trust Mandatory Standard – Diving Operations in CRT Controlled Waters (available upon request from your Works Engineer).

No individual or organisation, other than the Emergency Services in support of an ongoing search, rescue or investigation, may conduct diving operations in waterways under the control of the Trust without first seeking prior consent to do so.

PROCEDURES

Consent should normally take the form of an exchange of documents or letters that incorporates the issue of the hazard information as a drawing or summary and in some cases may specify actions the third party is required to take to meet the requirements of the Trust.

The Trust cannot accept any responsibility for providing hazard information to any diving activity that occurs without its prior knowledge.

Once consent has been granted to conduct diving operations and any separate arrangements for isolation of plant or equipment are completed, the responsibility for authorising or controlling the diving operation remains with the promoter or contractor, not with the Trust.

THE DIVE

A validated copy of the correspondence and form AP-006 3rd Party Consent to Dive together with the authorisation for access, must be available at the proposed worksite.

The Trust will request that any diving operation be ceased at the earliest opportunity – without compromising the safety of the diver or support team - where no prior knowledge of the activity has been provided or no documented proof of consent exists at the dive site.

The responsibility for liaison between the Trust and the third party contractor/client lies with the Works Engineer. However, the consent to dive can only be authorised by one of the Trust's Dive Contract Administrators.

Third parties should allow at least four weeks to obtain the consent to dive.

The divers' 'A' flag must be displayed at all times and must be displayed either side of the works in conjunction with warning signs 'Caution – Diving Operations Ahead'.

10. WATER ABSTRACTIONS

INTRODUCTION

The Trust will consider applications for the purchase of untreated water which is surplus to its navigational requirements. The Trust can also offer the use of canal water as a cost effective and eco-friendly way of cooling and/or heating waterside developments. Water abstraction is possible subject to the availability of water and by negotiating an acceptable charge. It may be appropriate to return a proportion of the abstracted water, as in the case of cooling and/or heating buildings where no contamination has been added. Where water is to be returned at a higher temperature to that of the normal canal water, consideration will have to be given to the environmental impact. This will involve issues such as the size of the canal, the normal flow along the canal, the design of the discharge and how the plume of hot water disperses downstream of the discharge. In some cases, additional water may have to be passed along the canal at the Promoters expense to give the required dilution of the discharge.

Other points to note:

- The quality of water and the continuity of supply cannot be guaranteed.
- Information regarding typical water quality can be supplied.
- It may be necessary for maintenance and engineering purposes to de-water the canal. In such circumstances, it is usually possible to maintain continuity of water supply by over-pumping, however abstractions and discharges may have to cease if they are within the dewatered section, for the duration of the works.

Abstractions should be negotiated with the Water Sales Account Manager based at Milton Keynes, Telephone Number 01908 351884.

Internal consultations then take place with the relevant Waterway and Water Management Team to ensure that the abstraction is acceptable and installation works managed correctly. This will be the same for the return water in the case of water used for heating or cooling buildings.

Abstractions in England and Wales which take quantities of water greater than 20 m^3 per day will require a licence from the Environment Agency (Section 66 of the Water Resources Act 1991 as amended by the Water Act 2003). Abstraction Licences must be applied for, and are normally held, by the Trust. There is a statutory process under the Water Resources Act 1991 involved in obtaining an Abstraction Licence which can take around 6 months to progress; it is not therefore usually possible to abstract larger quantities at short notice.

FEASIBILTY AND DESIGN

Abstraction is not usually permissible from short canal pounds between locks, owing to the difficulty of maintaining levels.

Abstraction is not usually possible directly adjacent to locks, moving bridges and mooring sites owing to the navigational difficulties which would ensue.

Abstraction structures are normally required. The structures must have a facility to stop the abstraction flow and should have safe access for the Trust staff at all times in order to cater for eventualities and emergencies. The design of the structure should facilitate de-watering for maintenance and consider the aesthetics and heritage of the canal.

A safely accessible metering facility should be included.

The watertight lining to the canal will need to be appropriately modified to permit abstraction.

Scour protection may be needed.

Suitable isolating systems such as valves must be designed in for maintenance.

In order to minimise navigational difficulties associated with transverse velocities the maximum velocity of the abstracted flow must not exceed 0.3 m/s measured at 900 to the direction of the navigable channel.

Measures may be needed to ensure that fish and eels are not sucked in. The Environment Agency produce various documents on this subject including Diversion and Entrapment of Fish at Water Intakes and Outfalls, by Dr DJ Solomon, NRA R&D Report No 1, July 1992 is available.

Signing and Fenders may be needed.

Abstraction structures should be capable of carrying the loads imposed by the use of the towing path by maintenance vehicles.

Towing-path levels should generally not be raised.

The Promoter must undertake a full utilities search around the location of the proposed abstraction route on C&RT land.

Grilles may be needed to prevent debris entering the system. Should debris be removed from the grilles, then this should be disposed of promptly, by the third party, and not left on the canal side.

The sale of water from canals leads to the transfer of water in an open channel from feeders or other water sources to the abstraction point. In some instances, the issues discussed below under 'Water Transfer' may be applicable.

WATER TRANSFER

Where canals or rivers are being used to transfer significant volumes of water from one point to another, from a discharge to a weir, or from a feeder to an abstraction point, special consideration is needed. The works summarised below may be necessary:

- Raising of freeboard levels to a degree to be agreed with the Works Engineer; considerations of the backwater curve indicate that there should be sufficient freeboard not only between the inlet to the canal and the outlet, but also beyond the outlet and in the other direction from the inlet.
- Where freeboard levels are to be increased and the canal is carried on an embankment (i.e., proposed water level is above the surrounding land on one or both banks), consideration should be given to the impact, if any on the stability of the embankment.
- Raising of bridges to give satisfactory clearances with the increased level associated with the hydraulic gradients; reduced headroom leads to serious dangers to boat users.
- Widening and deepening areas of restricted cross-section in order that flow velocity does not lead to navigational difficulties.
- installing bank protection to prevent erosion associated with the flow.
- Raise existing puddle clay, clay trenches or other measures to counteract leakage and increased seepage.

Modification works will cause a significant environmental impact and will require careful consideration. The environmental impact will not be restricted to the immediate effect of the Works since the changes in velocity and level and mixing of different water qualities may cause long term environmental effects, both in the waterway and in inter-connected rivers, reservoirs, ground waters, etc. These will need to be assessed at the planning stage.

Consideration must be given to the consequences of interruption of the flow during for example Works of maintenance or construction.

11. VEHICLES AND PLANT ON TOWPATHS

INTRODUCTION

The towpaths alongside the waterways were generally never designed for loads any greater than pedestrians or horses and as such there should be no presumption that any vehicles, items of plant or heavy loads in general can be taken onto or placed on a towpath.

The Canal & River Trust (the Trust) has not assessed the capacity of the towpath(s) within the vicinity of the works. Wherever possible the Third Party should design the works to avoid plant and heavy equipment on towpaths. In all cases the suitability of the towpath for load bearing must be assessed by the Promoter and the assessment agreed by the Trust prior to the commencement of any works (please contact the Works Engineer for guidance). The Trust will provide site hazard details and any other information within its possession that may assist the promoter in preparing the assessment.

ACCESS ONTO THE TOWPATH

The towpath can only be accessed at certain locations. The promoter should assess these access points and consider access alongside potential conflict with other users of the waterways. The promoter should also consider the need to turn vehicles as reversing would create an unnecessary hazard to users and operators.

SERVICES IN AND OVER TOWPATHS

There shall be no load applied to utilities (typically Gas, Water, Telecommunication and Power cables), as these are superficially buried in towpaths.

Some utilities may be installed in cable troughs identifiable by the covers made of concrete slats and concrete panels and a relaxation of the prescription will be considered if it is demonstrated that the effect of the load does not exceed the safe carrying capacity of the covers.

Cables are often carried overhead above towpaths and the promoter's method of working should address this risk and include suitable precautions.

WORKING ON THE TOWPATH

The working area, including the area along which access is gained, shall be isolated to separate the works from towpath users. The means of separation shall be identified in the method statements.

The edge of plant tracks must be located outside of the 45o load line projected from the bottom of the canal wall. Refer to section drawings below. The plan distance between the tracks and canal edge is an exclusion zone which much be physically marked on the towpath to ensure plant does not encroach into the defined zone.

Loading and unloading points and parking points should be assessed for suitability and should also be separated from other users.

Vehicles should have fully reversible seats and ideally be tracked.

Vehicles should only be reversed with a banksman present.

A means of stopping rolling vehicles such as vehicle barriers should be incorporated into the method of working.

The need to store materials on the towpath should be avoided and permission to do so should not be assumed. Loads shall be spread in all cases as best practically possible.

All vehicles and plant used on the towpath must have an open cab or at least two means of escape from the cab.

The effect of vibration caused by the vehicles, plant and machinery needs to be taken into account.

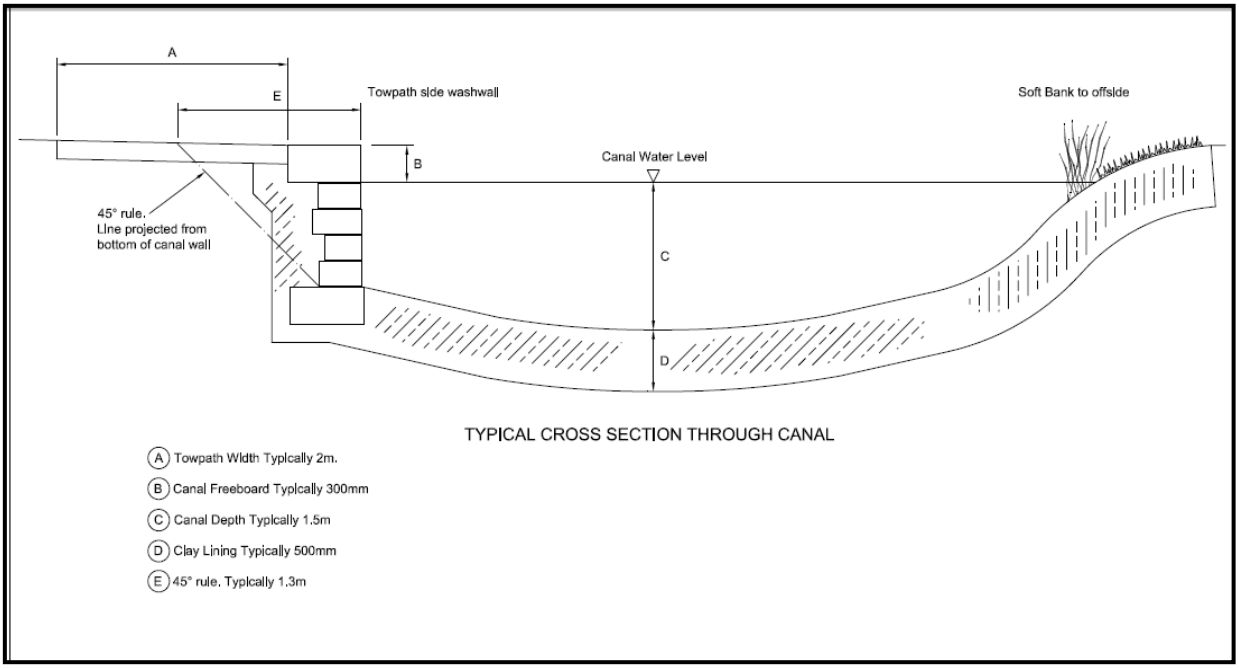
The effects of a change of water level in the watercourse should be considered as this can affect the capacity of a towpath.

CONDITIONS OF WORKING ON THE TOWPATH

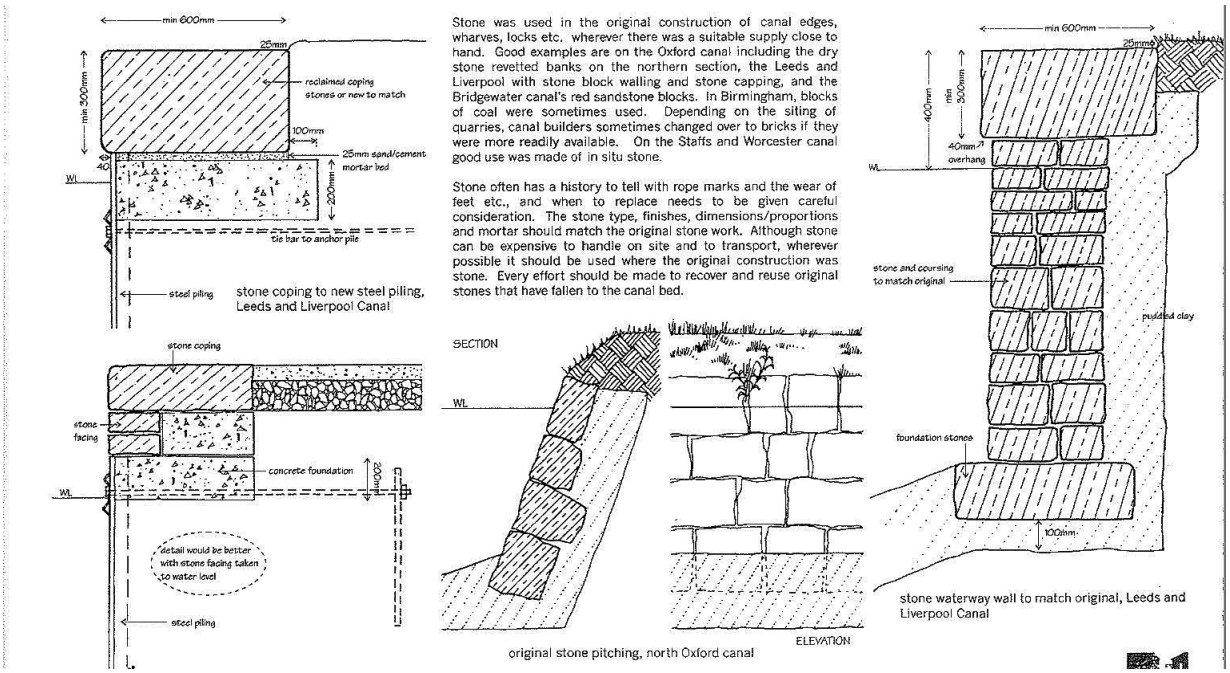
Any Towpath closures shall be the responsibility of the Promotor who is responsible for obtaining any necessary agreement to close or divert the towpath and any public right of way and to maintain all diversions and signage, design and construction of any temporary surface as required. Any access required for the Works shall be the responsibility of the promotor as agreed with the Works Engineer. (Please refer to Part 1, section 5) for further information.

Safeguards shall be imposed restricting the movements of the plant adjacent the water's edge. This is to be agreed with the Works Engineer.

All plant movements shall be coordinated with the use of banks men and limited to 4mph while traveling along the towing path.



Typical cross section through canal



Typical waterway wall details

12. SCAFFOLDING

INTRODUCTION

When working on or adjacent to the Trust's property it more often than not presents a challenge in erecting and maintaining a scaffold in the unique environment. These guidelines provide information to assist in overcoming these challenges which are not usually encountered when designing and erecting scaffolding.

This guide is to be read in conjunction with the *Part 2, section 11 – Vehicles and Plant on towpaths*, HSE standards and the British Standards for scaffolding, in particular:

- BS 5973: 1990 Code of practice for access and working scaffolds
- BS 5974: 1990 Temporarily installed suspended scaffolds and access equipment
- BS 5975: 1982 Code of practice for False-work
- BS 1139: 1990 Metal scaffolding: Tubes, Specification for aluminium tube
- BS 2482: 2009 Specification for timber scaffold boards
- BS 12811-1: 2003 Scaffolds - Performance requirement and general design
- CIRIA C686 2009 Safe access for maintenance and repair
- Regulations 6 and 7 of CHSW 1996 - Construction Health Safety and Welfare Regulations
- LBS Appendix C, The Work at Height Regulations 2005
- LOLER 1998 (Lifting Operations and Lifting Equipment Regulations)
- Provisions and Use of Work Equipment Regulations (PUWER)1992
- PPE (Personal Protective Equipment) Regulations 1992
- Manual Handling Regulations 1992
- NASC SG4:05 – National access and scaffolding convention guidance notes
- Working at Height Regulations 2005 (WAHR)
- English Heritage – Scaffolding relating to historic structures

GENERAL REQUIREMENTS

Scaffolding must not overhang or project into the navigation/towing path airspace and must be cut off and capped. The canal wash walls have never been designed or constructed to take any scaffolding loads, you should not assume that the wash wall or towpath is suitable to rest or found any scaffolding on.

Only in rare circumstances, where no alternative exists, will the Trust consider a scaffold to be founded from the canal bed. It should be noted that the coping stone should not be taken to be structurally suitable for load bearing **and under no circumstances should coping stones be drilled into.** Where scaffold is proposed to be tied to adjacent structures, due consideration must be given to pull out testing, remediation plans of tied areas and where applicable listed building consent. The third party should consider securing the structure from being struck by a boat or other canal object, this may warrant the provision of suitable fendering. Fixing bolts should face away from the navigation and towpath and where clearances are tight, it may be necessary to board the underside of the scaffolding to provide a flush soffit.

The Trust must be consulted by the user of any scaffolding in all circumstances where the scaffolding can collapse within 4m of a Trust asset or property boundary. The collapse distance, equivalent to the scaffolding height, should so far as possible be located outside of the Trusts property boundary. Where the collapse distance encroaches into the Trusts property boundary, mitigation measures to reduce the risk of collapse must be detailed for the Trusts consent.

CLEARANCES

Width on towpath: There should be a 1.2m minimum clearance between standards for pedestrian access for a run of scaffold of 10 m or less. For runs of scaffold over 10 m it likely that towpath users will need to pass each other beneath the scaffold. Therefore, minimum width will need to be 1.5m. In both cases there should be a row of standards between the pedestrian and the canal edge. The standards should be adapted to form a handrail or suitable barrier to the canal.

Where there is no row of standards between the pedestrian and the canal the minimum width is increased to 2.0 m in all cases.

Width on navigation: A minimum clearance must be agreed with the Works Engineer. Normally this will allow 2 boats to pass safely side by side and will vary depending on the canal or navigation crossed.

Height above towpath: Typically, a minimum of 2.70 m clear headroom must be maintained along the length of the scaffolding.

Height above navigation: A minimum clearance must be agreed with the Works Engineer above normal water level, this will vary depending on the canal or navigation crossed.

FENDERING

Where the scaffolding is in such a position that boat impact could arise, then a suitable protective and deflecting fender must be placed around the scaffolding. As craft can be affected by winds and currents, provision of a wide navigation channel is not enough in itself to remove the need for fenders.

The design of the fendering should take into account any likely changes in water levels, particularly to river navigations and must be agreed with the Works engineer. It should be permeable to flood water especially in areas of flood plain or Main River.

PROTECTION

When scaffolding is on the towpath, the standards and approach ledgers should be wrapped with high visibility foam. Suitable lighting arrangements might also be required to be in place.

The first boarded lift should be double boarded with polythene membrane sandwiched between boards. Where there is a possibility of materials/debris falling from scaffold then debris netting or encapsulation must be used. In special circumstances this may be reduced to brick guards. Please also ensure that on this first lift no materials/debris can fall between the scaffold and the face of the building.

MISCELLANEOUS

In addition to the signage requested within Part 1, section 9, whenever the scaffold can be reached from the water, it would be prudent to place 'WARNING – DO NOT TIE BOATS TO THE SCAFFOLD'.

Where scaffolding is permitted and erected either on or over the Trust's property, fees are applicable – see Part 1, section 11.

Scaffold designs, drawings and load bearing calculations will need to be submitted to the Works Engineer as part of the application.

You should ensure that no more than one identification banner is affixed to the scaffold – this banner should contain 24hr emergency contact details. Additional material might be permitted to be attached to the scaffold; however, the Trust will charge an advertisement fee for its use.

13. IMPROVEMENTS TO CANAL & RIVER TRUST INFRASTRUCTURE BY OTHERS

INTRODUCTION

Although this Code of Practice is written for works that are promoted by others for their benefit, there are some works that enhance our property. A typical example would be where a local authority would like to improve the surface of a towpath.

In these cases, we advocate the use of the Trust's framework contractors who have a great deal of experience and knowledge when working on our property. Further information is available on request.

The Trust however acknowledges there maybe occasions where delivery by a third party will be of benefit to the Trust and approval can be sought for this approach.

AGREEMENT

In addition to the application of this Code of Practice to the works, an agreement is required between the third party and the Trust which will include:

- Agreement that, under the CDM Regulations, the third party takes on or procures the
    - Client role
    - Principal designer role
    - Principal Contractor role
- Agreement that the Trust will be consulted and will provide engineering & design advice as to the preferred works specification but will not act as a Designer under CDM. Any costs incurred by the Trust will be recovered in accordance with this Code of Practice.
- Agreement that the third party:
    - prepares an Environmental Appraisal (the Works Engineer can advise on the level of detail needed)
    - negotiates any third party access required
    - complies with the Trust's towpath design guidance
    - carries out services checks
    - produces a materials and work specification test plan
    - secures necessary consents (e.g., footpath closures, planning permission, flood defence consent)
    - carries out external stakeholder communication (e.g., landowners, neighbours, canal societies, amenity groups, waterway partnership etc.) as agreed with the Trust
    - provides a Health and Safety File including As-built drawings and O&M Manuals (where applicable) using the Trust's templates, normally within 28 days of site completion
    - formally hands back the site to the Trust
- Confirmation of the contractor's competence to undertake the works including:
    - references
    - experience of similar work
    - appropriate insurances & indemnities in place for the works
    - Health & Safety competence, accident statistics, latest AFR
    - overview of management systems (quality, environment, health & safety)
- A Defect Correction Period of 24 months.
- Proposed agreement of future maintenance liabilities.

LICENCES

It will be necessary for the third party to enter into an Access and Maintenance Licence Agreement with the Trust in addition to any other permits and indemnities mentioned within this document. All such

licences, permits or indemnities must be entered into prior to any works commencing on the Trust's property.

FEES

Although works under this section relate to improvements to the Trust's canals and rivers, there is still a need for the Trust to supervise works and issue approvals; therefore, it should be noted that the works will still be subject to third party works fees and you are encouraged to factor this into your scheme costing's.

14. BOAT SALVAGE

INTRODUCTION

If a vessel needs to be salvaged from the waterway, although it is appreciated that it often needs to be done promptly, it should be understood that such operations need to be planned and implemented very carefully.

There could be several parties involved in the operation to salvage a vessel. To ensure a straightforward application it will be important for the Works Engineer to deal with one organisation only who will be responsible for the payment of all fees. As the application relies heavily on the production of a safe system of work, it is strongly recommended that the lead party is a contractor.

In circumstances where prompt action is required e.g., **if the navigation is blocked or there are major environmental concerns; the Trust current term craft removal Contractor should be utilised.** The Works Engineer will process an application as quickly as practical as per the Code of Practice and standard documentation.

In order to ensure prompt approval is possible, the following details need to be addressed:

- From the third party, the process should be led by a contractor able to ensure that there is an appreciation of the risk management.
- The diving contractor must be a member of The Association of Diving Contractors.
- If a craneage contractor is also used, we would assume them to be a sub-contract to the diving contractor and the lift to be carried out to BS 7121.
- Operations should be planned and implemented under a restriction notice (see Part 1, section 5) rather than a stoppage.
- The lifting procedure should only be carried out at a site approved for lifting and so towing of the vessel may well be necessary.

If the above list of points are all addressed and there are no further complications, the works engineer will be able to proceed with the approval process in a prompt fashion.