



National  
Operational  
Guidance

# Hazard

## Water management systems



**NFCC**

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## Contents

Hazard - Water management systems .....	3
<i>Control measure - Specialist advice: Water Management systems</i> .....	4
<i>Control measure - Isolate equipment: Water management systems</i> .....	5
<i>Control measure - Cordons: Water rescue and flooding</i> .....	6
<i>Control measure - Appropriate techniques: Water management systems</i> .....	8
<i>Control measure - Check river conditions</i> .....	9



## Hazard - Water management systems

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### Hazard Knowledge

Water management systems are used to stabilise channels and manage water levels. The systems are used to manage flooding, maintain water supplies for irrigation, impound water for navigation and to control levels up or downstream of the system for ecological or other purposes.

Water management systems include sluices, weirs, pumping stations and locks. Individual features may appear in isolation, especially static weirs, but usually form part of a system of water management features. Where structures prevent navigation of the channel locks or man-made channels that bypass the system are usually present.

Locks are structures that allow navigation of a channel by vessels. Although lock gates are operated either manually or automatically by someone on site, it is possible for them to move as water pressure changes. This occurs if the gates have not been secured properly, have been poorly maintained or due to a failure of part of the system. Personnel should not work in the water near a lock gate without first taking control of the gates. In addition to the movement of lock gates themselves guillotine gates, used to reduce pressure to allow lock gates to open, can release water forming strong currents.

Pumping stations manage water levels between two separated bodies of water, for example a drain or dyke and a river. The size and design of pumping stations vary greatly, but most operate using an impeller system protected by a weed screen and secure hatches to prevent entry. Impellers may operate with little or no warning and will achieve a hazardous velocity almost immediately. The volume of water moved per second can be substantial, creating hazards upstream and downstream of the system. An upstream pull towards a filter designed to safeguard operating equipment can generate enough pressure to pin or trap a casualty, or rescuer, in a similar fashion to a strainer in fast flowing water. Downstream, large volumes of water can be released creating fast flows, recirculations, eddies and stoppers.

Sluices and weirs may be fixed in position but can often be lowered or raised, changing level depending on local requirements or weather conditions. Weirs are man-made features designed to regulate the flow of water downstream. The regulation of water can create increases in speed and dangerous currents. Changing levels can cause the formation of undertows, hydraulics or recirculations downstream of a weir. A person or object in the water may be drawn towards the face of the weir and forced under the surface. See Hazard [Hydrology](#) for further information on recirculations. Depending on the design and the presence of undercutting, a person caught in a recirculation may be flushed out further downstream or held below the surface. The recirculating



water may also hold a person within it; self extrication from recirculations can be extremely difficult as the aerated water, strength of flow and disorientation caused makes swimming difficult. Personnel should avoid entering these features unless a well-informed risk assessment identifies that it is safe to do so.

Sluices operate in a similar manner to weirs but allow water to run underneath rather than over the top of the gate. Changes in position and conditions created are harder to identify and are likely to be submerged. Sluice gates restrict flow, by allowing the release of water below the surface which can create dangerous eddies, unseen recirculation, siphons and undertows.

Water management systems may be fixed, be operated manually, automatically or remotely. Activation of automated systems can be based on water level triggers, timed or seasonal programmes. Any decrease or increase in water levels will affect the flow and hydrology of a body of water. Decreasing or increasing flow rates can be hazardous, as unexpected hydrological features may form. When water levels decrease sub-surface objects may come closer to the surface and the risk of entrapment may. Any risk assessment of a water management system has limited currency. Changes in level and operation of the system will change the hazards associated with the system.

Although systems may have visual or audible warnings when activated, it is commonplace for no activation warning to be given. Changes in conditions may not be obvious, for example a sluice gate raised incrementally may not be obvious but conditions may change significantly enough to prohibit entry into an area that was previously safe.



## Control measure - Specialist advice: Water Management systems

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### Control measure knowledge

Water management systems are usually operated by either an environmental agency, canal trust or an internal drainage board. Contact details for engineers and responsible persons for water management systems should be displayed nearby. Fire and rescue services should maintain a database of managers of known water management risks and contact details as appropriate.

In certain regions warnings of increased activation of water management systems, such as Strong Stream Advice notifications given by the Environment Agency in certain regions of England. Warnings will give an indication of an increased likelihood of activation.

## Strategic actions

Fire and rescue services should:

- Establish methods of identifying and sharing information on water management systems

## Tactical actions

Incident commanders should:

- Liaise with the responsible person on water management systems



# Control measure - Isolate equipment: Water management systems

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## Control measure knowledge

Automated water management systems may have on-site isolation switches or control panels. To prevent public access, they are usually in a secure location. Activating these systems may affect hydrology in unexpected ways and the effects will vary with levels and speed of flow. Activation will also affect areas remote from the system, including the potential to cause flooding or damage to vessels located up or downstream. Activation should only ever be considered with the permission and advice of the managing agency.

See National Operational Guidance: Operations – Isolate and lock out power systems

## Strategic actions

Fire and rescue services should:

- Identify appropriate control measures for high-risk water management facilities
- Establish protocols with responsible bodies for the isolation and control of water management systems where appropriate

## Tactical actions

Incident commanders should:

- Liaise with the responsible person to isolate or control the water management system



## Control measure - Cordons: Water rescue and flooding

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### Control measure knowledge

When working near, on or in water, it may be appropriate to establish hazard zones to restrict movement of personnel depending on levels of training and available equipment. Where possible, areas should be indicated using physical barriers and access should be controlled but due to the large geographical area covered by some flooding and water incidents this may not be feasible. Where cordons or hazard zones are required it may be necessary to control access using comprehensive briefings and physical landmarks.

Hazard zones are separated into hot, warm and cold zones. It may not always be appropriate to establish any zones, or access to the hot zone may be prevented depending on the risk assessment. Known bodies of water, with limited risk may not require any hazard zones to be established.

The hot zone is usually defined as the area of water or unstable surface. This area may be expanded based on the risk assessment of the incident commander. The hot zone is the area of greatest risk where rescues will be carried out and should only be entered by rescuers with the appropriate training and personal protective equipment (PPE).

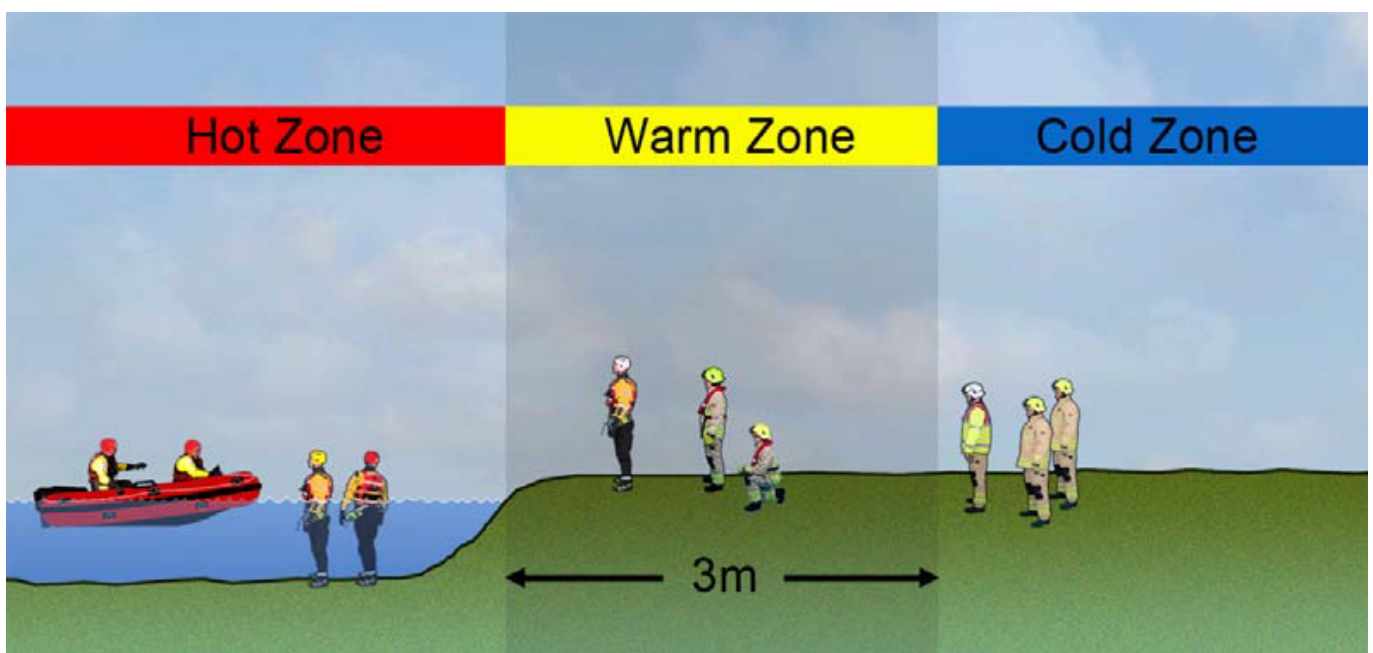
The warm zone is the working area adjacent to the hazard, usually within three metres but this distance may be extended or reduced following a risk assessment. There may be a significant risk of uncontrolled entry into the water in this area. A warm zone may not be required when accidental entry into water can be prevented, or the hazard from entry is minimal such as still bodies of water with known depths. Personnel working in the area should be suitably trained, equipped and briefed to carry out specific tasks.

The cold zone is the safe area located outside the hazard zones. Equipment dumps, holding areas, casualty reception centres and marshalling areas should all be located in this area.



The cold zone is usually established 3 metres from the water's edge, but this distance will depend on the ground conditions, slope and presence of barriers around the edge of the water and may be extended or reduced depending on the hazard and risk of uncontrolled entry.

It is important that control zones are established, effectively implemented and communicated to all emergency responders as early as possible to maintain safe working areas and to assist in defining role responsibilities and objectives.



Hazard zones for water related incidents

The geographic scale of operations during responses to wide area flooding can make management of personnel difficult. To establish greater levels of command and control incident commanders should consider logging the number of personnel committed to the risk area. This should include the times of entry of personnel, assigned tasks and equipment. If necessary, consider placing appropriate limits on durations committed to the risk area. The duration of commitment will depend on the required tasks and environmental conditions. Regular radio contact should be maintained and where possible a dedicated officer appointed to manage the safety of personnel.

## Strategic actions

Fire and rescue services should:

- Provide appropriate means of implementing control zones and cordons at incidents involving water



- Provide all operational firefighters with water awareness training

## Tactical actions

Incident commanders should:

- Consider establishing control zones at incidents involving water and communicate to all responders
- Consider using cordon control gateways at incidents involving flooding
- Ensure that personnel operate on the safe side of existing guarding near water or unstable surfaces
- Consider establishing an exclusion zone around any body of water or unstable surface where no guarding exists
- Manage hazards in the working environment that could lead to slips, trips and falls into bodies of water or unstable surfaces



## Control measure - Appropriate techniques: Water management systems

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### Control measure knowledge

When attending incidents on canals, all lock gates and paddles should be completely closed before any rescue attempt. Personnel should not attempt to open the lock gates or paddles to empty the lock. When a sluice or lock gate is opened to release water, strong currents and turbulence can occur downstream.

Where possible, an exclusion zone should be established on the high-pressure side of the lock gates and paddles. Access to the lock should be via the fixed raking ladder. Mud and silt will be present on the canal bottom and lock walls





Any attempt to drain the lock should consider the potential of trapping the casualty. A 50mm gap will create sufficient pressure to pin a person. Where the incident involves a casualty below the surface of the water and it is not possible to assist without sub-surface equipment then a specialist underwater rescue and recovery team should be requested.

More information on canals can be found here:

<http://canalrivertrust.org.uk/about-us/for-businesses>

<http://canalrivertrust.org.uk/boating/navigating-the-waterways/boaters-handbook>

Responders should not enter the operating areas of the pumping station unless confirmation that isolation has been achieved is received from a responsible person. Any related machinery including weed screen cleaners should be isolated prior to a rescue attempt.

Weirs and sluice gates vary greatly in their potential for harm. Fire and rescue services should identify appropriate means of rescue, control measures and exclusion zones for water management systems in their area.

## Strategic actions

Fire and rescue services should:

- Identify high-risk water management facilities and systems and put in place arrangements and safe systems of work where appropriate

## Tactical actions

Incident commanders should:

- Consider taking control of lock systems when working near or rescuing casualties from water management systems



## Control measure - Check river conditions

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## Control measure knowledge

Where available, fire and rescue services should receive notification of strong stream advice, tide predictions and river level warnings. This information can be used to predict likely changes in river levels that may affect tactical plans.

Information regarding river conditions in a fire and rescue service's area may be provided by environmental agencies, the Met Office, the Rivers Agency or local water management groups such as the Canal Trust or local drainage boards.

## Strategic actions

Fire and rescue services should:

- Establish mechanisms to receive and share notifications of changes in river conditions

## Tactical actions

Incident commanders should:

- Access all available information sources on river levels and conditions
- Consider contacting environmental agencies or other responsible bodies for information on changes in conditions and water levels