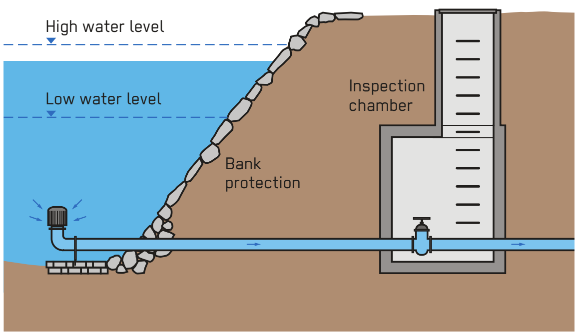
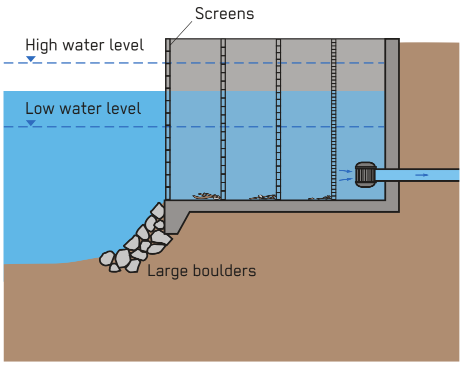
River and Lake Water Intake

Response Phase	Application Level	Management Level	Objectives / Key Features
** Acute Response ** Stabilisation ** Recovery	Household ** Neighbourhood ** City	Household ** Shared ** Public	Abstraction of better-quality water, mitigates seasonal variations
Local Availability	**Technical Complexity**	**Maturity Level**	
*** High	** Medium	*** High	

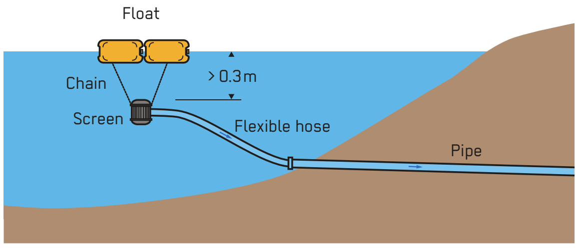
UNPROTECTED INTAKE



PROTECTED INTAKE



FLOATING INTAKE



River and Lake Water Intakes are used in surface water bodies to abstract raw water that is pumped to a water treatment facility. In acute emergencies, unless these structures are already permanently installed, they tend to be simple temporary floating intakes. For longer-term use, more permanent structures might be considered.

River and Lake Water Intakes should be designed to abstract the required volume without damage, clogging or silting of the intake whilst minimising turbidity to facilitate subsequent water treatment. To ensure this, the design must be based on the characteristics of the source, such as riverbed stability, water depth, variability of water level, and speed of flow.

Design Considerations: An intake and treatment plant are often sited together, partly to reduce pumping costs (as more raw water needs to be pumped than treated water due to water losses during treatment). To minimise silting, pollution and structural damage, particularly when withdrawing water from rivers, the intake site should be located upstream of silt/pollution sources (e.g. wastewater outfalls, urban and agricultural areas), upstream of obstructions that cause turbulent flow (e.g. bridges) and on the outside of river bends where there is less riverbed load and deposition.
Where water velocity and gravel loads are low (e.g. slow-moving rivers or lakes) and where water levels do not change much during the year, an unprotected intake might be possible. However, this type of intake is often unsuitable, particularly in areas with intermittent, high-intensity rainfall, which is likely to become more common with climate change. Here, river velocity can surge periodically (e.g. flash floods), and water levels can fluctuate greatly throughout the year, increasing the risk of damage to the intake from rolling boulders or floating debris, with the added problem of abstracting water at low flow periods. In these cases, water velocities can be slowed with a submerged weir or partial/full dam that protects the structure, decreases the sediment load and stabilises

the water levels. To reduce the length and expense of the structure, it is ideally located at a stretch of river that is not too wide or shallow. Weirs/dams are combined with a protected side intake (which can also be used without a weir) that is built into the riverbank with reinforced walls, with a wing wall on the upstream side, large stones at the entrance and an angled steel bar screen to block large debris. A sand trap and spillway can also be added. If the intake is installed on a straight section of river, material transported in the river can accumulate on the intake side. This can be reduced by placing groins (angled walls) on the opposite riverbank to deflect water flow. The water level within the intake after the screen will normally be 0.2 metre lower, but it is better to design a water level drop of up to 1 metre in case maintenance is infrequently carried out. An alternative approach for handling variable water levels is a floating intake (which can also be combined with suction or sump intakes) consisting of a flexible pipe connected to a float that is held in position through mooring cables. For small intakes, the float can simply be an empty jerrycan with the pipe inlet and weight attached underneath. For larger intakes, the inlet can be located under a pontoon (a steel or wooden frame) attached to empty drums. In all cases, the inlet should be a minimum of 0.3 metre below the water surface to prevent air entering the pump. The advantages of a floating intake are that water taken from near the surface has a lower turbidity, making water treatment more consistent, and the intake can be readily retrieved for cleaning. Floating intakes are, however, vulnerable to damage from floating debris.
Depending on the volume of water required, the turbidity can be further reduced by having either an infiltration intake within the riverbed or riverbanks **(see I.6)** or using other measures to protect the source **(see S.3)**. For all intakes, silt and suspended matter can be reduced by a slower flow at the intake (less than 0.1 m/s before any screens). The type of pump chosen needs to be designed to be resistant to pumping solids.

Materials: Generally, local materials and skills can be used to construct intakes, including weirs or dams when needed. These do not necessarily have to be built from concrete or masonry, and can be made from wooden poles, cement-filled jute sacks, sandbags or stone mounds covered with plastic sheeting.

Applicability: River and Lake Water Intakes are suited to all stages of an emergency, with the design depending on the characteristics of the source and the volume to be abstracted. In the acute response phase, even temporary weirs can be made quickly in low-flowing rivers using whatever material is locally available, including sandbags, felled trees and rocks.

Operation and Maintenance: Strainers, screens and approach channels to intakes need regular checks to prevent or remove clogging and/or silting, and the structural integrity of the intake should be checked at the same time. For protected side intakes with angled screens, lowering the angle of the screen (e.g. to 30–45 degrees from horizontal, rather than 60 degrees) can make it easier to rake the screen clean where large amounts of coarse solid material is expected. Silt also needs to be flushed from larger dams or weirs several times per year, depending on the silt load of the water source. Any metal parts, such as screen bars, will need to be either made from corrosion-resistant material or treated regularly. A double intake structure at a site allows for maintenance while the intake remains functional.

Health and Safety: When a weir is built, the downstream risk of flooding, loss of property and loss of life resulting from a possible failure of the structure must be considered, as even small weirs can accommodate large volumes of water that can cause considerable damage. Water stored behind a weir or small dam may encourage the breeding of mosquitoes or other parasites upstream, which can negatively impact the health of families near to or using the water. The quality of surface water collected at intakes is generally poor and requires further treatment.

Costs: Cost will depend on the type of intake. Simple intakes can be very cheap, but cost will increase according to the size and complexity.

Social and Environmental Considerations: With a dam, there is a risk of flooding in upstream areas or, where it is included as part of the intake, an impact on downstream users, both of which may be problematic for local people. There can also be a risk of damage to the intake from people using the river or lake (e.g. children playing can damage floating intakes), as well as a drowning risk. Certain intakes might be more prone to failure or poor performance as a result of climate change.

Strengths and Weaknesses:

(+) Can have low material costs
(+) Certain types are fairly easy to implement (e.g. floating intakes)

(−) Can be easily damaged in unstable riverbeds
(−) Requires significant maintenance to clean frequently clogged screens and strainers
(−) Difficult to position intake to avoid silting up where there is a large variation in water levels throughout the year, and intakes in such areas require constant monitoring of water levels
(−) Surface water will always require further treatment

→ **References and further reading material for this technology can be found on page 214**