Rainwater collection and storage

A rainwater collection and storage system consists of a catchment area (usually the roof of a permanent structure), guttering channels, and downpipes that direct rainwater into a water collection vessel (e.g. storage tank, pot, bucket).

Though rainwater sources are generally considered to be of a higher quality than surface water sources, appropriate disinfection/treatment of rainwater is recommended where there is a risk of contamination.

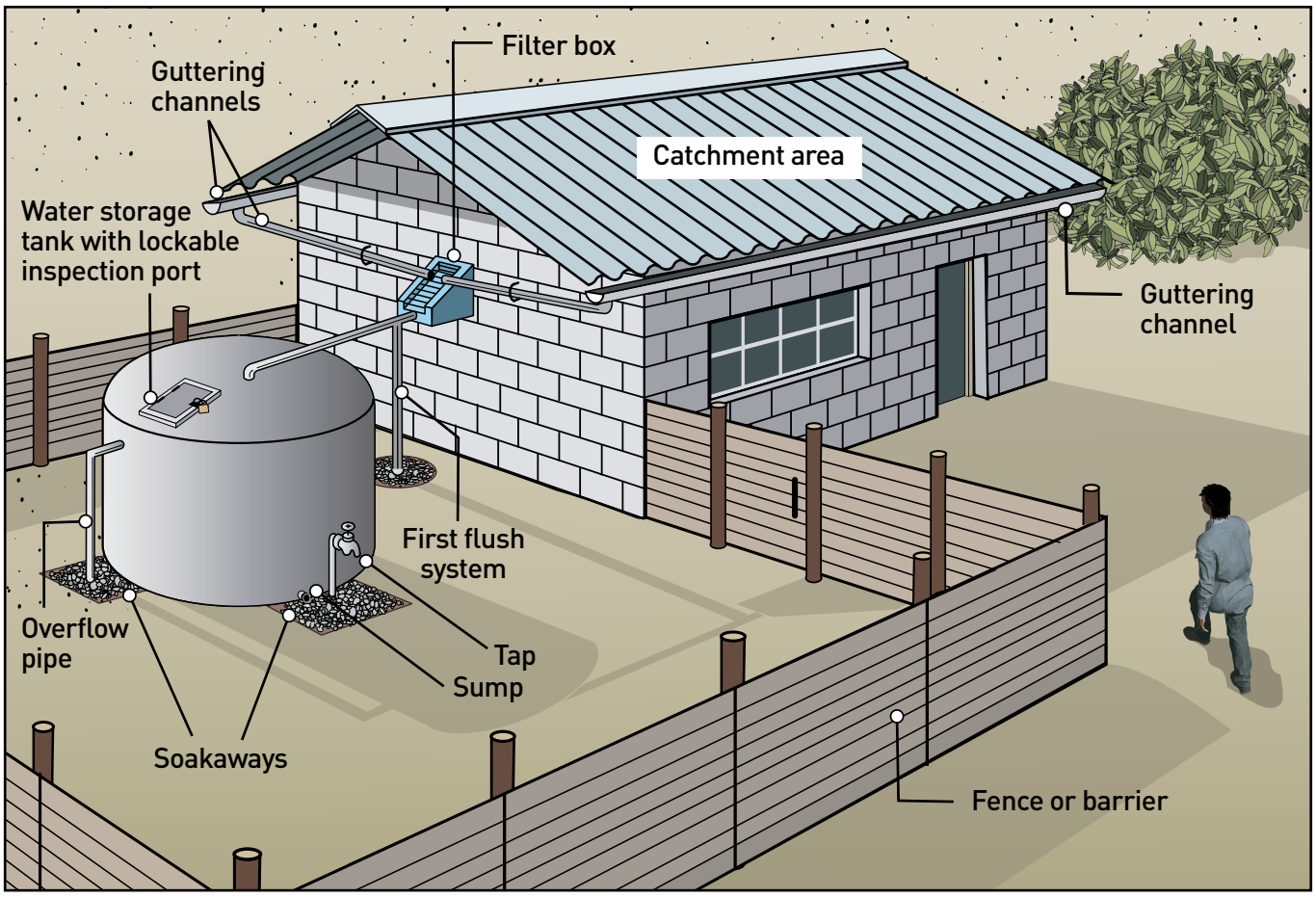


Figure 1 A common rainwater collection and storage system for drinking-water

Rainwater collection is a flexible approach that can be applied under a wide range of conditions. Where climatic conditions are appropriate, rainwater can be used as the primary source of drinking-water, provided the rainwater collection and storage system has the capacity to supply sufficient quantities of safe drinking-water to meet user needs. Commonly in seasonal climates, rainwater collection is used to supplement other water sources.

Figure 1 illustrates an appropriately designed rainwater collection and storage system that is commonly encountered. Although this figure represents a typical rainwater collection and storage system, different designs exist that may also be appropriate for the provision of safe drinking-water.

Rainwater collection yields measured in litres (L) are typically estimated by multiplying the rainfall (mm) by the roof catchment area (m^2) by a run-off coefficient, which is influenced by the roof material, and considers water losses due to, for example, evaporation, gutter overflow, leaks from pipes etc. The coefficient may range from >0.9 for metal roofing to 0.2 for organic materials (e.g. thatch).[a]

Supply (L/year) = Rainfall (mm/year) * Roof Area (m^2) * Run-off coefficient

Typical risks (or hazards) associated with rainwater collection and storage systems are presented in the corresponding sanitary inspection form.

Note that these risk factors do not represent all possible risks that may be present.

Rainwater collection and storage systems usually consist of the following main components:

- **Catchment area:** A non-permeable surface (typically the roof of a structure such as a house, school or shed) that slopes towards a channelling system (usually roof guttering). Galvanized corrugated iron, aluminium sheets, stones, tiles, slates and plastic sheeting are all materials commonly used to construct catchment areas.
- **Guttering channels:** Gathers and directs water collected from the catchment area to a water storage tank. PVC, zinc and aluminium are commonly used to manufacture guttering channels.
- **Filter box:** Consists of a coarse filter that prevents larger pieces of debris from entering the water storage tank.
- **First flush system** (Figure 2)**:** Reduces the potential for contamination by redirecting the first flush of rainwater (which is typically of lesser quality due to the accumulation of contaminants on the catchment area between rainfalls) away from the water storage tank. This first flush should be appropriately sized relative to the roof catchment area to effectively manage the first flush of rainwater and should drain to waste (or other non-drinking-water uses).

  Ideally, the first flush system should drain automatically (e.g. via a drip valve) as opposed to manually, to minimise operational inputs from the user and the potential for contamination. The first flush system should be located downstream of the filter box to prevent larger debris entering/blocking the first flush device.
- **Water storage tank:** Stores rainwater that is collected within the catchment area. The tank should be sealed and covered to protect stored water against contamination, ideally with a lockable lid. PVC and concrete storage tanks are commonly used for rainwater storage.
- **Tap:** Allows users to draw/collect water from the tank with minimal wastage or risk of contamination. To prevent greater exposure to contaminants, the tap should not be located too close to the ground. In addition, a low tap may withdraw settled sediment from the tank during operation if the tank is not regularly cleaned.
- **Overflow pipe:** Prevents the tank from overfilling by diverting excess water out of the tank via a downpipe.
- **Drain sump** (Figure 2)**:** Ideally, the floor of the tank will be sloped towards a drain sump, where a sump plug can be removed to drain the tank for cleaning and maintenance.
- **Fence or barrier:** A physical barrier to keep animals away from the collection area, which may prevent animals from excreting close to the collection area or damaging the system components. May also prevent unauthorized access to the collection area. Ideally, the fence or barrier should be constructed at least 15 meters[b] from the storage tank.
- **Drainage soakaway:** A defined drainage area (typically located beneath the overflow pipe, first flush system and tap) consisting of a hole in the ground filled with coarse material (e.g. rubble, stones) which allows water from the tank or first flush device to drain back into the earth. A soakaway prevents water from pooling and stagnating in the vicinity of the water collection area.

Additional considerations for rainwater collection systems

Certain construction materials can impact the quality of the drinking-water from rainwater harvesting systems (e.g. lead, copper, certain metallic paints). As such, appropriate construction materials should be used, ideally those that are certified as safe for contact with drinking-water where such schemes are in place.

After a new rainwater collection system is constructed, disinfection (e.g. with a chlorine solution) of the storage tank is required before the water is used.[c] Periodic disinfection of the tank may also be required (e.g. after long periods without rain).

Gutters should be kept clean to prevent ponding of stagnant water during short dry spells that may encourage mosquito breeding.

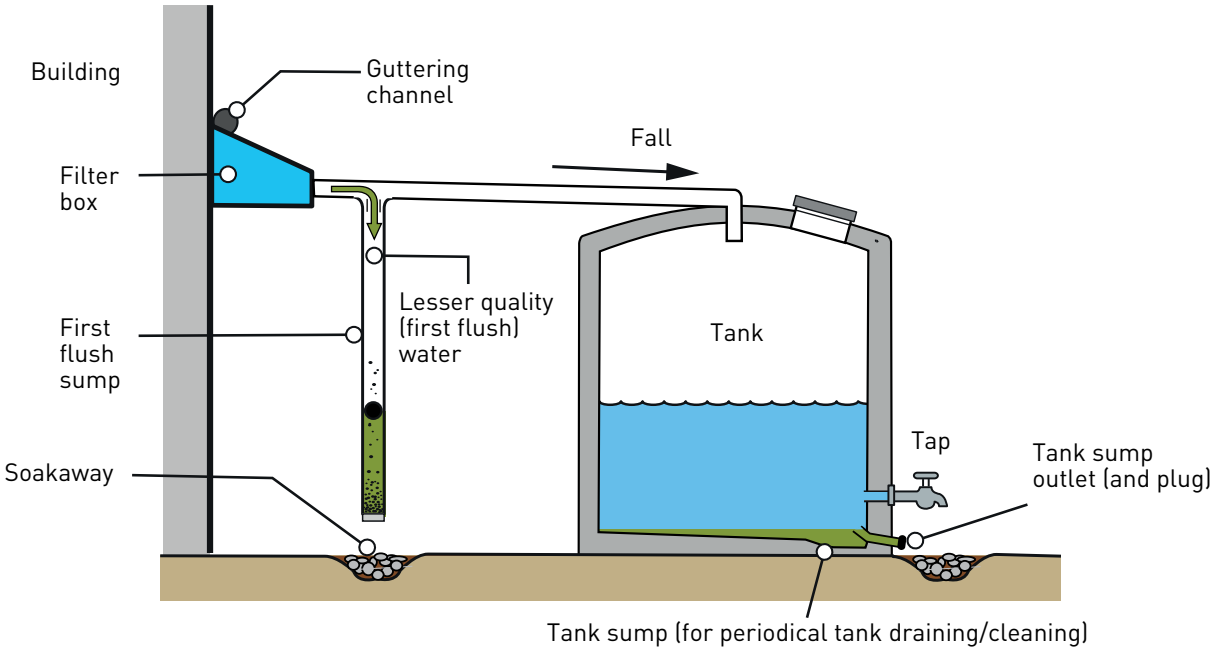
Activities that may result in airborne contaminants such as spray drifts from local agricultural practices (e.g. crop spraying, manure spreading, burning) should be carried out at a safe distance from the roof catchment area (preferably downwind), in consultation with the local environmental authority. The impact from other events such as contamination from bushfires or volcanic eruptions should also be considered.

Activities other than water collection (e.g. laundry, washing, bathing etc.) should be carried out at a safe distance[b] from the water collection area (preferably downhill).

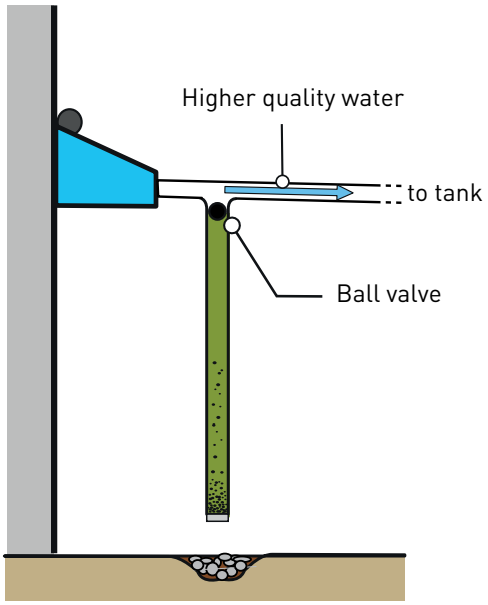
a. See *Roofwater harvesting: A handbook for practitioners* (IRC, 2007).

b. For guidance on determining appropriate minimum safe distances for potentially contaminating activities, refer to the *Guidelines for drinking-water quality, 2nd edition: Volume 3 - Surveillance and control of community supplies* (WHO, 1997).

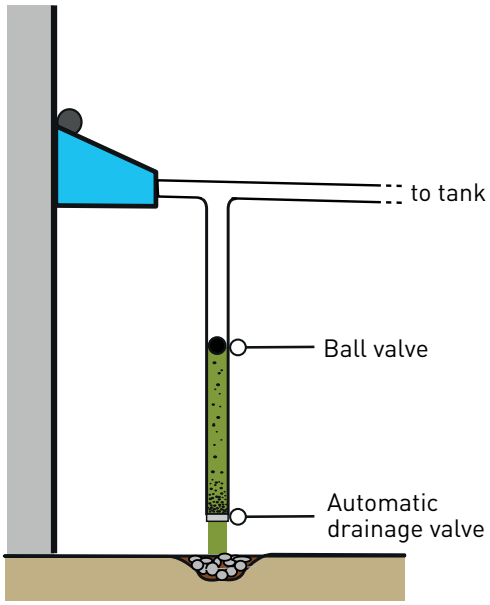
c. Guidance for disinfecting storage tanks may be found in *Technical notes on drinking-water, sanitation and hygiene in emergencies: Cleaning and disinfecting water storage tanks and tankers* (WHO/WEDC, 2013).



a: The first flow of captured rainwater and any suspended debris enter the first flush sump rather than the tank.



b: Later flows, which should contain much less debris, pass into the tank because the first flush sump is full. A ball valve should be in place to prevent any carry over of water from the sump to the tank once the first flush sump is full.



c: An automatic drainage valve cleans out the lesser quality water and sediment in the first flush sump preparing it for the next rainfall event.

Figure 2 Typical "first flush" system for rainwater collection

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