

RAINWATER HARVESTING FOR SMART HEALTH CARE FACILITIES

AUTHOR: ADRIANUS VLUGMAN, PAHO/WHO

TYPES OF RAIN WATER HARVESTING SYSTEMS

- **Water Butt** – This is the most basic form of rainwater harvesting where water collects in the container from the drain pipes and/or natural rainfall.
- **Direct-Pumped**
 - **Submersible** – Mostly used for domestic purposes, the pump is located within the storage tank and is pumped directly to the Water closets or other fixtures and appliances.
 - **Suction** – This type of system is commonly used in Health Care facilities where the pump system is kept within a control unit (e.g. utility room) and a draw line pulls water from the storage tank; directly to the Water closets or other fixtures.
- **Indirect Gravity** – With this arrangement, water is pumped to a high-level tank (header tank) and then allowed to supply the outlets by gravity alone. The pumps will only be required when the tank needs filling.
- **Indirect Pumped** – This system first pumps the harvested water to a tank which can be located at any level in the facility. Then a booster pump is used to provide a pressurized supply which can be tailored to suit the floor and pressure demands of the facility.
- **Gravity Only** – This system is only possible where the storage tank can be located below the level of the gutters, yet higher than the outlets that it will supply. Only the power of gravity is needed to feed collected and filtered water making it a desirable and ultra-energy efficient option.

PLUMBING REQUIREMENTS

It is important that there must be a continuity of water supply in Healthcare facilities especially when utilizing dual supply between rain water harvesting and potable water. A seamless automatic switching system with dual plumbing must be achieved. Such methods include:

- A ball float control valve installed and connected to the rainwater storage tank, so it introduces a small amount of backup water when the tank is near empty to maintain a supply of water to the toilets, etc.
- A “Water Mark” switching valve or device which automatically switches between the rainwater and the Potable water supply.
- The piping system for the rainwater supply must be clearly marked at intervals not exceeding 24 inches with contrasting colored wording “RAINWATER”. It can also be indicated in green with the letters “RW”.
- A backflow prevention device must be installed to protect the mains water supply from the rainwater supply (dual check valve). If rainwater is only supplying the toilets, this device can be used.
- If the intent is to prevent uncontrolled potable water from the flowing into the rainwater tanks and pipes, a single-check non-return valve must be installed.
- When applying dual plumbing to indicate which pipes are drinking water and which are rain water, using a combination of different pipe sizes, colors and identification tags or stickers must be considered.

COMPONENTS OF RAIN WATER HARVESTING

- **Leaf Separator and Mosquito Proofing**
 - Filters are needed to prevent sediment build-up and clogging from large debris like leaves and twigs.
 - All downpipes from the roof to the rainwater tanks must be provided with a self-cleaning leaf separator and all inlet pipes must be equipped with screens.
 - All overflow pipes from cisterns or storage tanks must be secured with mosquito screens and affixed with tie straps or clamps.
 - The use of non-corrosive or non-deteriorating materials must be considered in our tropical climate. Vinyl coated screens are works well and does not corrode.
 - Pipe inlets into storage tanks must be properly sealed with silicone to prevent mosquito infestation.
- **First Flush Diverters**
 - Also known as a roof washer diverts the first flow of water away from the rainwater catchment system to ensure cleaner water into the tanks.
 - Such systems are recommended for rainwater harvesting systems (CARPHA, Handbook Rainwater Harvesting, CEHI-2009)

- **UV Disinfection**
 - If the rainwater is required to be of a potable standard or where there is a risk of contamination, this is usually done using Ultra-Violet light treatment coupled with additional fine sediment filtration.
- **Gutter systems**
 - To collect rainwater efficiently, the guttering system must be both well designed and maintained.
 - Trapezoidal or K-Style guttering systems provide the greatest capacity for water catchment.
- **Water Level Indicators**
 - The project may consider two basic water level indicator mechanisms
 - Pully and rope - This requires an extra hole in the tank for the rope, so care must be taken to prevent mosquitoes entering/leaving by adding a rubber seal with punctured hole through which the rope fits tightly.
 - Clear tube attached at bottom of the tank and visible on the outside with a red floater to indicate water level. There is the risk that if tube damages the tank could empty. However, the tube will develop algae growth and the floater might get stuck. Using a tight-fitting floater is needed otherwise mosquitoes will breed in tube.
- **Maintenance of components**
 - Once adequate filtration is present, sediment build-up will be minimal and maintenance times will be reduced as a result.
 - Filter cleaning will need to be completed at regular intervals and should include annual cleaning of down spout and gutter screens. Pump filters should also be thoroughly cleaned yearly.
- **Water Storage Tanks**
 - The tank size is important where a larger tank can potentially store more water after a downpour but will incur a higher initial cost and for much of the time will only be partly full. It may also have limitation on the property especially for above-ground tanks and may not be aesthetically pleasing.
 - The smaller the roof size and the lower the annual rainfall, the less the volume of water to be collected. *For facilities with no beds, a minimum of 10 imperial gallons per square foot of roof catchment area times 3 days for capacity may be used to adequately size the storage tanks. This information can be compared with water data collected and analyzed and/or water usage calculations of the facility.*
 - The placement of water tanks is critical especially when it must be located below the guttering system. Another concern is the weight of the water tanks and the structure available to handle the weight. A roof void may be seeming to be an ideal location but may not be structural feasible. *For example, every 1000 liters (220 imperial gallons) of water weighs one ton.*

- A proper overflow drainage from the water storage tanks must be considered to prevent erosion.
- Tank security is important when it is exposed to high winds, theft and contamination. Seismic and Wind restraints provide a cable assembly of vertical restraints that are challenged by wind and earthquakes. In the event of theft, the tank can be enclosed in a concrete structure or secured by adequate fencing.