Appendix C: Rainwater Catchment Installations

Introduction

UWP rainwater catchment systems consist of a 10,000L (2,600 gallon) polyethylene tank placed on a cement base with a gutter system that is attached to an existing metal roof. UWP systems are installed over two days, using a four-man crew and a driver. All building materials are procured in Uganda, with bricks, hardcore, small stones, and sand sourced locally as a part of the community's contribution.

Rainwater catchment system installations can be broken down into five phases:

1. Constructing the base
2. Installing the tank
3. Hanging faceboards, gutters, downspouts, and the first flush
4. Constructing the protective wall and valve box
5. Building the tap stand

Each phase can be broken down into smaller steps, which are described below. Figure 1 provides a schematic diagram of a rainwater catchment system installed by UWP.

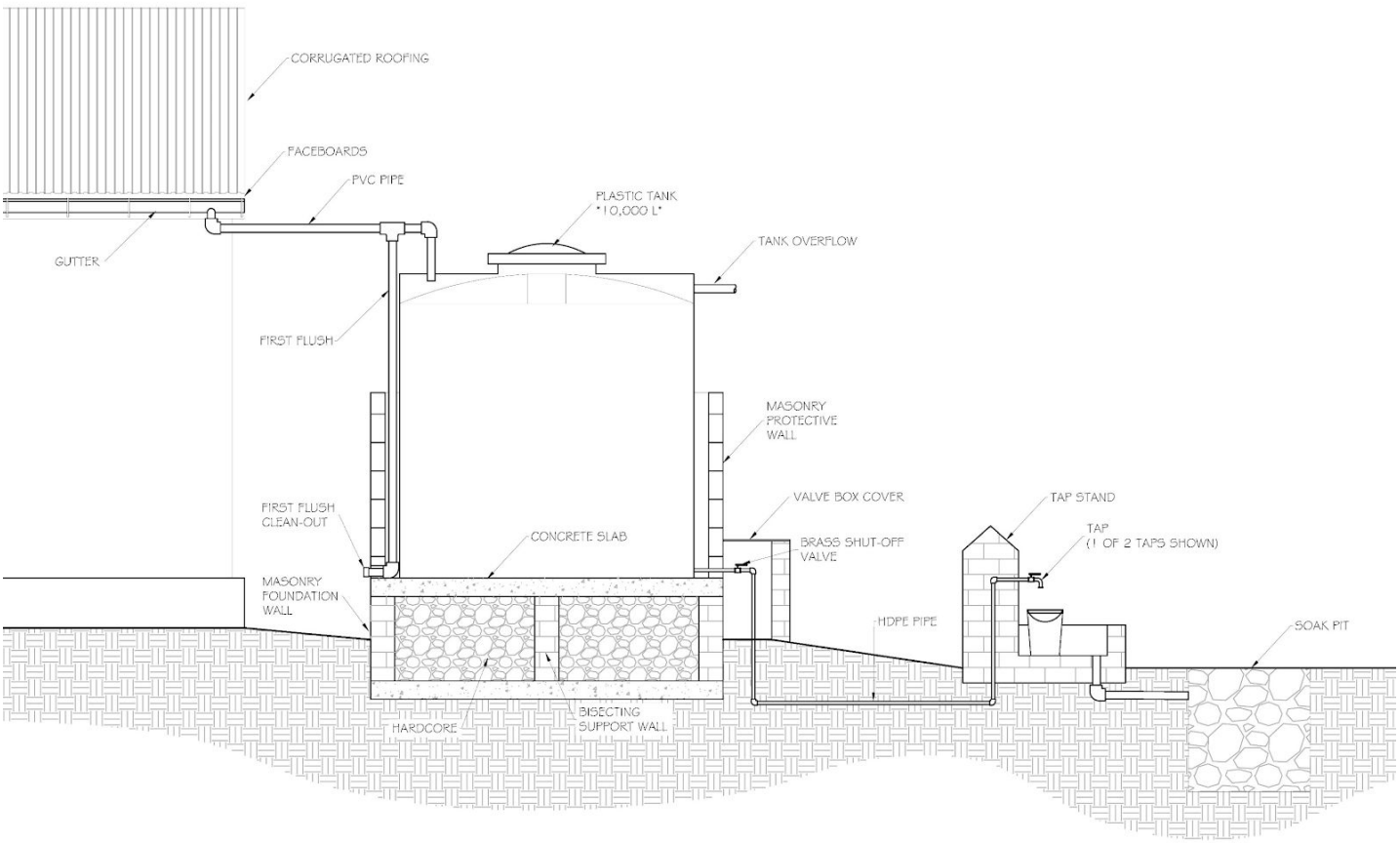

Figure 1: Schematic diagram of a UWP rainwater catchment system

Phase 1: Constructing the Base

A base is constructed to provide a solid and level platform upon which the tank can rest. The base must be constructed on the first day of the installation so the cement slab can cure overnight. This allows the tank to be positioned on the base at the beginning of the second day.

Key Steps

- **Selecting a Location for the Base** - The base must be located such that the top of the tank remains below the edge of the roof. To ensure this, the top of the base must be positioned at least 8.5 feet below the roof's edge. Location is decided by the crew, in consultation with facility leadership.
- **Leveling the Ground -** Once selected, the location for the center of the base is marked with a stake. Measurements are taken to determine the base's perimeter, which is outlined using sand. The selected location is dug out until a solid foundation is reached. The foundation is subsequently leveled.
- **Building the Base -** The base is constructed using brick, hard core, and small stones. First, bricks are used to construct the perimeter wall and bisecting support walls, forming four quadrants inside the base. The space within the quadrants is subsequently filled with hard core and covered with small stones to make level.
- **Pouring the Platform -** Cement is mixed and poured atop the small stones. The surface is smoothed and left to cure overnight.

Phase 2: Installing the Tank

At the beginning of the second day, once the cement platform has cured, the 10,000L polyethylene tank is positioned atop the platform. At this point, outlet and overflow holes are drilled. The overflow hole allows excess water to exit the tank in the event that rainfall continues after the tank has reached capacity. The outlet hole, which is equipped with a shut off valve, allows water to flow from the tank to the tapstand.

Key Steps

- **Positioning the Tank -** The tank is rolled onto the base, stood upright, centered, and rotated such that the position of the tank inlet enables downspout connection.
- **Installing the Overflow -** A hole is drilled near the top of the tank and a two foot overflow pipe is attached. The overflow pipe is designed to extend beyond the perimeter of the base to prevent erosion caused by the overflow stream.
- **Installing the Outlet -** Approximately two inches from the base of the tank, an outlet hole is drilled and a shut off valve attached. The outlet is positioned slightly above the base of the tank to prevent settled sediments from passing to the tap stand.

Phase 3: Hanging Faceboards, Gutters, Downspouts, and the First Flush

A system of faceboards, gutters, downspouts, and the first flush are installed. The gutters and downspouts channel water from the roof to the first flush and subsequently into the tank. The first flush is a rudimentary sedimentation system that reduces the amount of debris and contaminants entering the tank by intercepting the first wave of water coming off the roof after rainfall (Figure 2). When the first flush becomes filled, water flows freely into the tank. The bottom of the first flush is sealed with a removable cap, which should be removed after each rainfall to drain diverted water.

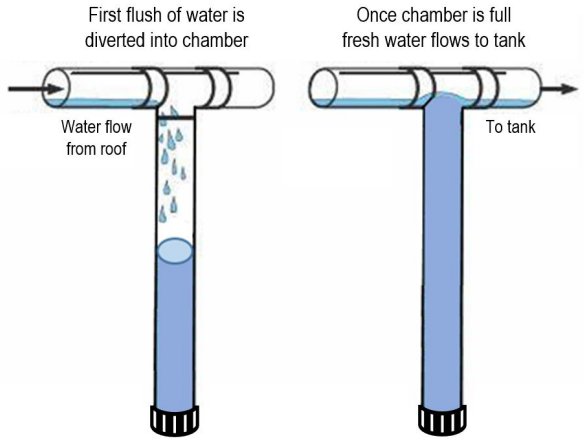

Figure 2: Basic diagram of a first flush system

Key Steps

- **Attaching Faceboards -** Faceboards are attached to the roof, which allows gutters to subsequently be hung. To maximize gutter run while maintaining appropriate slope minimums, extra-wide wooden faceboards are installed.
- **Hanging Gutters -** After faceboards are hung, plastic gutter clips are installed on the faceboards. Gutter clips are positioned between 19 and 20 inches apart and must permit a gutter drop of at least 0.5 inches for every four feet of run. After gutter clips are installed, PVC gutters are hung and all joints are secured with PVC cement.
- **Connecting Downspouts -** Downspouts are attached using appropriate joints such that all pipes have a downward slope and run towards the tank inlet. PVC pipes and joints are used for all downspouts and secured using PVC cement.
- **Installing the First Flush -** Just before the last downspout reaches the tank, a “T” joint is installed. From this junction, PVC pipe is run towards the ground along the edge of the tank. At the bottom of the tank the first flush angles outwards using an elbow joint, with a removable cap attached. The first flush is subsequently secured by the protective wall.

Phase 4: Constructing the Protective Wall and Valve Box

To protect the tank and first flush from damage, a protective wall is constructed around the tank and first flush using bricks. A valve box protruding from the protective wall is added to protect the outlet valve without completely restricting access to it.

Key Steps

- **Constructing the Protective Wall -** A brick wall is built approximately four feet high, with four to six inches of space between the tank and the inner surface of the wall to permit tank expansion. The wall is constructed such that the first flush protrudes through the wall, permitting access to the removable cap. In addition to the first flush outlet, drainage holes are built into the wall, allowing for water between the wall and the tank to drain. The protective wall is plastered to provide a finished appearance.
- **Building a Valve Box -** A brick valve box is constructed around the tank outlet valve and is built into the protective wall. The valve box is secured with a lockable metal cover and given a plaster finish.

Phase 5: Building the Tap Stand

In the UWP rainwater collection system design, the water access point is separated from the tank. This innovation reduces traffic at the tank itself, increasing the lifespan of UWP systems by reducing the likelihood of tank damage. By necessity, the tap stand must be positioned downhill of the tank to permit gravity-fed flow.

Key Steps

- **Laying HDPE Pipe -** A trench, approximately one foot deep, is dug between the valve box and the tap stand. After the trench is dug, HDPE pipe is laid in the trench, connecting the tank to the tap stand. After the tap stand is constructed and the HDPE pipe connected, the trench is backfilled.
- **Constructing the Tap Stand -** Tap stands are constructed using bricks, with appropriate plumbing embedded within the masonry. Each tap stand is equipped with two taps and is wide enough to accommodate two jerrycans. Taps must be positioned below the lowest part of the tank but at least 50 cm above the base of the tap stand, which allows jerrycans to rest comfortably underneath. A drain is installed and the entire tapstand is given a plaster finish. A lockbox is added to each tap to provide security.
- **Building a Soak Pit -** A soak pit is built to facilitate drainage and prevent the pooling of stagnant water. The soak pit is constructed adjacent to the tap stand and connected to the tap stand drain using PVC pipe. To build a tap stand soak pit, a hole is dug waist deep, filled with hard core, covered in a plastic sheet, and then covered in soil.