CHAPTER 2

Rainwater Harvesting System

Water and Environmental Management

The country is subjected to continuous growth of population, expansion in urbanization, industrialization and irrigated agriculture. This phenomenon is imposing growing demand and pressure on water resources while contributing to water pollution.

A new development of water resources such as new water supply scheme results in rising costs and significant impact to the environment. The potential problems include deforestation, rise in sea level, decreasing crop yields, water conflicts, increase severity/frequency of tropical storms and declining fish population.

An integrated approach is essential to pursue a more effective water management. A multifunctional approach that can be adapted widening the scope of water quantity and quality controls in urban drainage system and integrating it with the rainwater harvesting system for non-consumptive uses.

The increase demand for clean water supply is on the rise in parallel with the economic growth of the country. The practicable limit of surface water resources development has already been reached in region of high demand.

Current approaches towards water management in cities are supply driven, where a new resource will be developed to manage a water shortage. As there will be an ever increasing demand, there is a possibility that the major cities will face a water crisis situation. Hence, water demand management that focuses on conservation measures utilizing demand driven approaches will make better use of our limited potential water supply. Water demand management that seeks to maximize the usage of water also conserves water and thus limits the needs for new water supply schemes.

An approach of rainwater harvesting collected from the roof of a building provides the practical and effective utilization of rainwater. This is appropriate as more than 30% of domestic water use does not require treated water quality.

Quantity Control Consideration

The rainwater harvesting system should be integrated with on-site detention facilities to serve a minor storm event. On-site detention storage-cum-rainwater harvesting system may be provided as above-ground storages, below-ground storages, or a combination of both.

The main advantages of above-ground storages are, they can generally easily incorporated into the site by slight modification to the design and are relatively inexpensive compared to below ground storages.

Landscape areas such as lawns and garden beds, impervious area such as car parks, driveways, paved storage yards, and other paved surfaces offer a wide range of possibilities for providing surface storage for on-site detention-cum-rainwater harvesting storage and can enhance the aesthetic of a site.

The below-ground storages can be concealed and occupy less physical space as illustrated in Figure 2.1

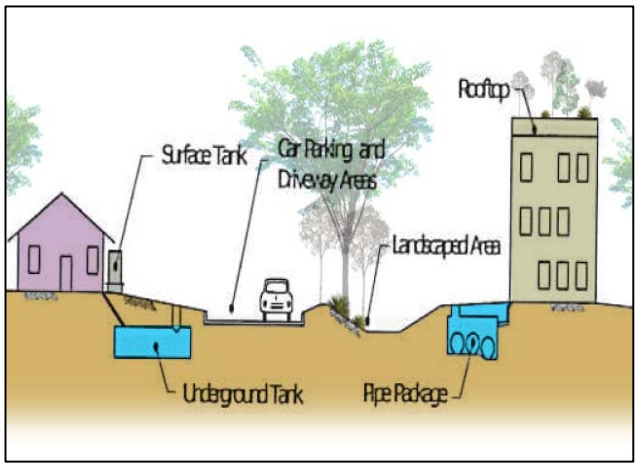

Figure 2.1 Typical On-Site Detention Storages

Stormwater can be detained on flat roof provided that adequate protection against leakage is provided in the structural design of the building. This type of storage has limited application in residential areas and is more suited to commercial and industrial buildings where flat roof are more common as shown in Figure 2.2.

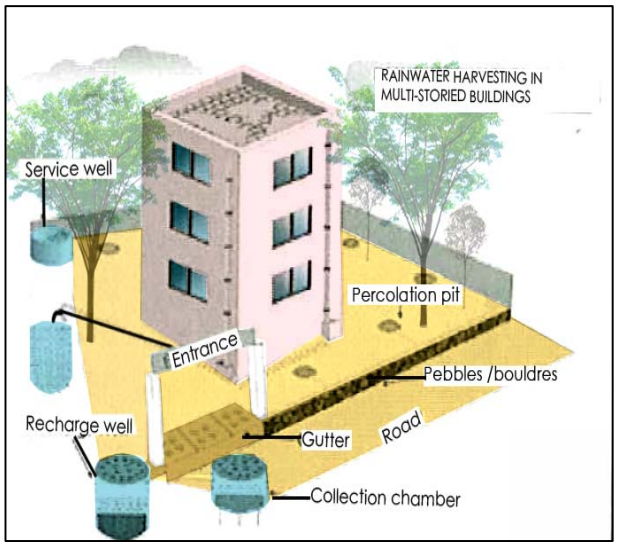

Figure 2.2 Typical Rainwater Harvesting for Multi-Storey Building.

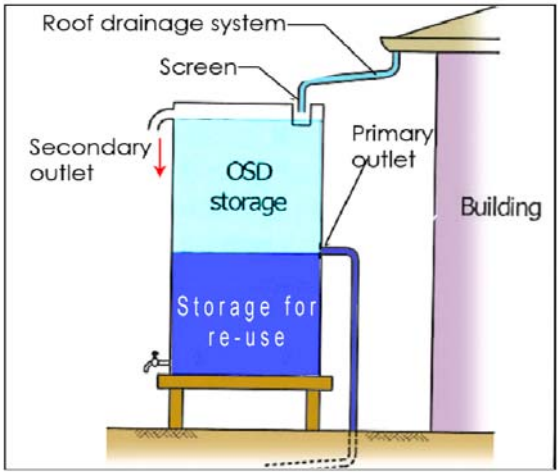

Figure 2.3 Typical Multi-Purpose Surface Tank

Surface tanks are normally provided on residential, commercial or industrial lots for rainwater harvesting system. These tanks collect rainwater from the rooftop of the building and store it for intended domestic use. Surface tanks may be integrated as on-site detention and rainwater harvesting as illustrated in Figure 2.3.

Typical below-ground storage tanks are either circular or rectangular in plan and/or cross section (Figure 2.4).

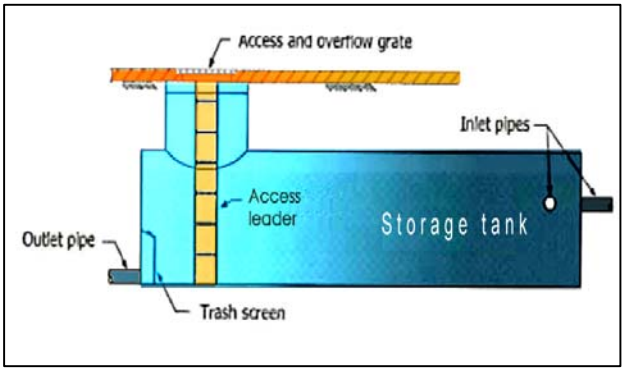

Figure 2.4 Typical Below-Ground Storage Tank

A pipe package is a below-ground rainwater storage consisting of one or more parallel rows of buried pipes connected by a common inlet and outlet chamber (Figure 2.5). The size of a pipe-package is determined by the storage volume requirements and the physical availability of space on the site. The pipe package shall be installed using minimum 900mm diameter pipe size to facilitate inspection and maintenance. Pipes should be laid at a minimum longitudinal grade of 2% to avoid standing pockets of water which can occur due to lack of precision during construction.

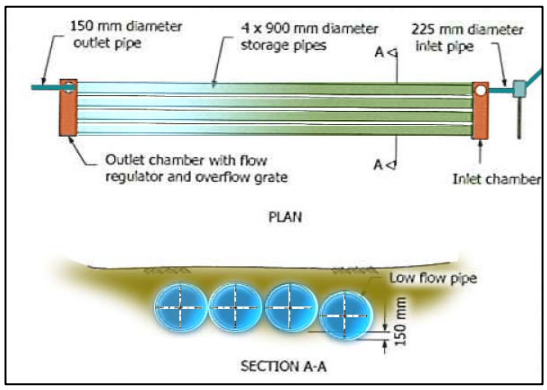

Figure 2.5 Typical layout of Pipe Package Storage.

Designers have the option to combine either above or underground system as illustrated in Figure 2.6.

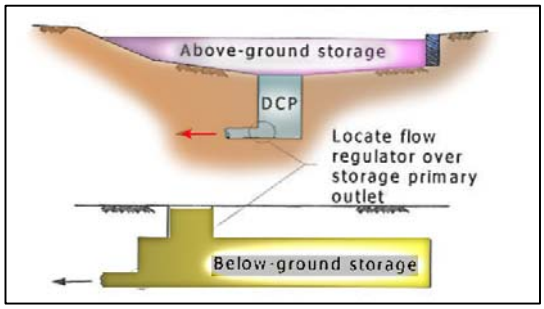

Figure 2.6 Typical of Above and Below-Ground Storage

Quality Control Consideration

The planning and design of rainwater harvesting system not only provide the water for various intended uses but it can also provide the stormwater quality control aspect in urban stormwater management i.e. first flush system, thus capable of providing a clean, safe and reliable water source.

First flush system remove and wash accumulated contaminants such as bacteria, molds, protozoa and heavy metals e.g. lead and arsenic.

For portable usage, filtration and disinfection systems are required. For non portable usage, the first flush system is sufficient.