Greenpaper©

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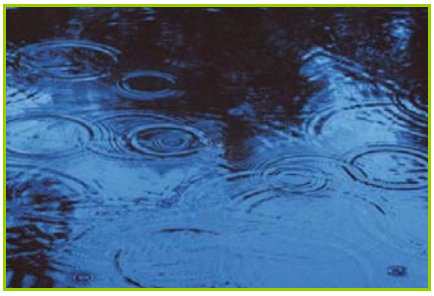
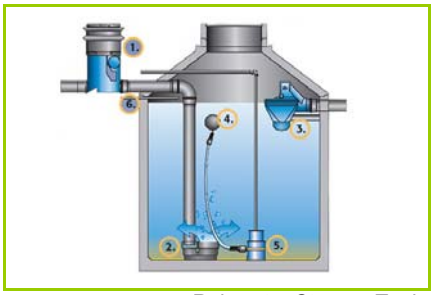
Rainwater Harvesting



Prepared For:
The Los Angeles Community College District



Rainwater Storage Tank

Rainwater Storage Tank

INTRODUCTION

This paper addresses the process of, and potential for, rainwater harvesting on the LACCD campuses. Rainwater harvesting potential is affected by available rainfall, roof type, reuse opportunities and local codes.

The Los Angeles area gets between 12-14 inches of rainfall a year, with the majority falling in the winter months. This results in 8300 gallons of water per year, per 1000 square feet of roof area.

Rainwater harvesting reuses captured rainwater for non-potable applications such as irrigation and toilet flushing. This strategy would reduce the amount of municipal water used on the LACCD campuses, as well as reduce the amount of effluent drained to the sewer system.

DESCRIPTION OF TECHNOLOGY

Rainwater is collected from roofs and terraces of buildings and routed to concrete cisterns. The initial run off of any storm event is routed directly to the storm drainage system to “wash” the roof. Subsequent rain fall is then routed to a cistern.

The collected rainwater can be used either for irrigation or for flushing toilet fixtures. Prior to reuse, the rainwater is pumped through a filtering system. For toilet use, ultraviolet light is used in a closed loop configuration to treat the water in the tank. For irrigation use, no UV treatment is necessary.

Although irrigation requires the least amount of treatment, it requires a larger tank. The tank is sized for the rainwater available and needed over the year. Because rain typically is collected in the winter months for use in the dryer, summer months, the tank must be large enough to accommodate a larger amount of rainwater to be stored.

For toilet use, collected rainwater is routed into a treatment tank from the cistern. Although more treatment is required, using rainwater for toilet flushing allows for smaller tank sizes, as water is continually used from the tank, rather than needing to store a large amount for later use. Make up water is introduced through a reduced pressure principal back flow preventer when rain water is not available.

By intercepting the rain water prior to connection to the sewer, the total effluent (storm and sewer) leaving the site is reduced by over 8,000 gallons per every 1000 square feet of roof area.

Irrigation System Components

Rain is collected in conventional storm water piping system and routed through a pre-cleaner or roof washer prior to entering the tank. Pre-cleaning systems are usually one of three types, although vortex and roof washers are recommended:

Rainwater Vortex Filter


Purification Skid with Pump, 1-micron Filter, UV Light, and Carbon Filter

- Vortex Filters: Vortex filters receive rainwater and route it to a self cleaning screen. The initial storm water is discharged to the storm system. Once the screen is saturated, the subsequent rain fall is directed into a second discharge pipe connected to the storage cistern.
- Roof Washers: Roof washers are similar to dirt legs in other piping systems. A large section of pipe or container fills with the first discharge from the roof drainage system and fills up to a point where it overflows into the cistern. After the storm event, the remaining water is drained via a small pipe at the bottom of the washer. The washer is sized using 10 gallons per every 1000 square feet of roof area. This has been shown to effectively wash the roof at the beginning of any storm event and reduce the debris from going into the tank.
- Bag Filters: Bag filters are the most effective and costly means to pre-wash storm water. Bag filters, resembling long socks are housed in a stainless steel vessel and connected in-line to the storm drain system. They have the advantage of cleaning all the water going into the cistern, but have to be replaced frequently.

Water is then led to a storage tank, which is typically constructed of concrete, plastic or fiberglass. For larger systems required by irrigation, concrete is most cost effective. The tank size takes into consideration the available rainfall and the usage requirements. This data is analyzed month by month to select a tank optimally sized to meet the requirements. To provide 100% irrigation typically requires tanks to be 10-25 gallons per irrigated square foot.

A distribution pump is used to supply the irrigation system. A variable frequency drive pump is not required as there is little fluctuation in the supply pressure from the tank. The pump discharge is routed through a cartridge filter and on to the irrigation system. A drip system is used, as code prohibits aerosoling recovered rain water in conventional sprinkler heads.

Toilet Flushing System Components

Using harvested rainwater for toilet flushing uses the same components as required above plus some additional safeguards.

The cistern can be reduced in size from that required by the irrigation-only system. One advantage of the toilet use option for colleges is that demand is lowest at the same time as supply. This results in a reduced tank size.

Water from the cistern is routed to a treatment tank usually sized for one day's use. The water is then treated, either by chemicals or ultraviolet radiation. For applications on LACCD campuses, ultraviolet radiation will be used, in the interest of minimizing the usage of chemicals. Water is drawn from the day tank, routed through an ultraviolet light continuously, and returned to the tank.

CODE CONSIDERATIONS

Local and state codes are constantly under revision, particularly regarding new sustainable technologies such as rainwater harvesting. Design teams must review the latest code requirements related to the opportunities and requirements outlined in this Green Paper.