6.9 Rainwater Harvesting and Use

Figure 6-40: Rainwater is collected and used for flushing toilets at Mills College, Oakland.

Best Uses

- High density residential or office towers with high toilet flushing demand.
- Park or low density development with high irrigation demand.
- Industrial use with high non-potable water demand.

Advantages

- Helps obtain LEED or other credits for green building.

Limitations

- High installation and maintenance costs.
- High toilet flushing or irrigation demand needed to use design volume
- Low return on investment.
- Municipal permitting requirements not standardized.

Rainwater harvesting systems area engineered to store a specified volume of water with no discharge until this volume is exceeded. Storage facilities that can be used to harvest rainwater include above-ground or below-ground cisterns, open storage reservoirs (e.g., ponds and lakes), and various underground storage devices (tanks, vaults, pipes, arch spans, and proprietary storage systems). Rooftop runoff is the stormwater most often collected in harvesting/use system, because it often contains lower pollutant loads than surface runoff, and it provides accessible locations for collection. Rainwater can also be stored under hardscape elements, such as paths and walkways, by using structural plastic storage units, such as RainTank, or other proprietary storage products. Water stored in this way can be used to supplement onsite irrigation needs, typically requiring pumps to connect to the irrigation system. Rain barrels are often used in residential installations, but typically collect only 55 to 120 gallons per barrel; whereas systems that are sized to meet Provision C.3 stormwater treatment requirements typically require thousands of gallons of storage.

Uses of Harvested Water

Uses of captured water may potentially include irrigation, indoor non-potable use such as toilet flushing, industrial processing, or other uses. In the Bay Area, toilet flushing is the use that is most likely to generate sufficient demand to use the C.3.d amount of runoff. The demand for indoor toilet flushing is most likely to equal to the C.3.d amount

of stormwater in high rise residential or office projects, and in schools. Irrigation demand may equal the C.3.d amount of runoff in projects with a very high percentage of landscaping.

System Components

Rainwater harvesting systems typically include several components: (1) methods to divert stormwater runoff to the storage device, (2) an overflow for when the storage device is full, and (3) a distribution system to get the water to where it is intended to be used. Filtration and treatment systems (see Treatment Requirements below).

LEAF SCREENS, FIRST-FLUSH DIVERTERS, AND ROOF WASHERS

These features may be installed to remove debris and dust from the captured rainwater before it goes to the tank. The initial rainfall of any storm often picks up the most pollutants from dust, bird droppings and other particles that accumulate on the roof surface between rain events. Leaf screens remove larger debris, such as leaves, twigs, and blooms that fall on the roof. A first-flush diverter routes the first flow of water from the catchment surface away from the storage tank to remove accumulated smaller contaminants, such as dust, pollen, and bird and rodent droppings. A roof washer may be placed just ahead of the storage tank and filters small debris for systems using drip irrigation. Roof washers consist of a tank, usually between 30- and 50-gallon capacity, with leaf strainers and a filter.

CODES AND STANDARDS

The State of California adopted a new plumbing code on January 1, 2014 which includes Rainwater harvesting and graywater regulations. The new code (Chapter 17) allows rainwater to be harvested from roof tops for use in outdoor irrigation and some non-potable indoor uses. Rainwater collected from parking lots or other impervious surfaces at or below grade is considered graywater and subject to the water quality requirements for graywater in Chapter 16 of the code. Some small catchment systems (5,000 gallons or less) being used for non-spray irrigation do not require permits – see Chapter 17 for more details[1].

The Plumbing Code defines rainwater as “precipitation on any public or private parcel that has not entered an offsite storm drain system or channel, a flood control channel, or any other stream channel, and has not previously been put to beneficial use.”[2] The Rainwater Capture Act of 2013, which took effect January 1, 2013, specifically states that the use of rainwater collected from rooftops does not require a water right permit from the State Water Resources Control Board.

The ARCSA/ASPE Rainwater Catchment Design and Installation Standard[3] may also be used as a resource.

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[1] www.iapmo.org/Pages/2013CaliforniaPlumbingCode.aspx click on Chapter 17

[2] www.iapmo.org/Pages/2013CaliforniaPlumbingCode.aspx click on Chapter 2

[3] American Rainwater Catchment Systems Association (ARCSA) and American Society of Plumbing Engineers (ASPE), August 2009. Rainwater Catchment Design and Installation. See: www.harvesth2o.com/adobe_files/ARCSA_Rainwater%20Code.pdf.

TREATMENT REQUIREMENTS

Rainwater catchment system treatment requirements in the code vary depending on the use. Small systems described above are not required to treat rainwater. Other systems may be required to remove turbidity, bacteria, particulates and/or debris. Uses of rainwater for car washing, drip irrigation and small volume spray irrigation require filtration, while uses for large volume spray irrigation, toilet flushing, ornamental water features and cooling tower makeup water require filtration and disinfection. More details are provided in Plumbing Code Chapter 17, Table 1702.9.4.

The 2013 California Plumbing Code contains minimum treatment and water quality standards for rainwater, which are summarized in Table 6-3 below.

Table 6-3
Summary of Minimum Treatment and Water Quality Standards for Rainwater

Application	Minimum Treatment	Minimum Water Quality
Non-spray irrigation (less than 5,000 gallons of storage)	No treatment required if tank is supported directly on grade and height:width ratio < 2:1	N/A
Spray irrigation (less than 360 gallons of storage);	Debris excluder or other approved means	N/A
Surface, subsurface, and drip irrigation; car washing	Debris excluder or other approved means; 100 micron filter for drip irrigation	N/A
Spray irrigation (360 gallons or more of storage); ornamental fountains and other water features	Debris excluder or other approved means	Turbidity < 10 NTU; Escherichia coli < 100 CFU/100 ml
Toilet flushing, clothes washing, and trap priming; cooling tower make-up water	Debris excluder or other approved means; 100 micron filter for drip irrigation	Turbidity < 10 NTU; Escherichia coli < 100 CFU/100 ml
Source: 2013 California Plumbing Code, Table 1702.9.4, Chapter 17, page 329.		

Design and Sizing Guidelines

HYDRAULIC SIZING

- If a rainwater harvesting system will be designed to meet Provision C.3 stormwater requirements, there must be sufficient demand to use 80 percent of the average annual rainfall runoff, as specified in Provision C.3.d. Appendix I provides guidance on how the estimate the required landscaping or toilet flushing demand to meet C.3.d. requirements.
- If the project appears to have sufficient demand for rainwater, size the cistern (or other storage device) to achieve the appropriate combination of drawdown time and cistern volume indicated in the sizing curves.

DESIGN GUIDELINES FOR ALL SYSTEMS

- Equip water storage facilities covers with tight seals, to reduce mosquito-breeding risk. Follow mosquito control guidance in Appendix F.
- Water storage systems in proximity to the building may be subject to approval by the building official. The use of waterproofing as defined in the building code may be required for some systems, and the municipality may require periodic inspection. Check with municipal staff for the local jurisdiction's requirements.
- Do not install rainwater storage devices in locations where geotechnical/stability concerns may prohibit the storage of large quantities of water. Above-ground cisterns should be located in a stable, flat area, and anchored for earthquake safety.
- To avoid excess hydraulic pressure on subsurface cisterns:
    1. The depth to seasonal high groundwater level should be at least 5 feet from the bottom of the cistern.
    2. A geotechnical engineer should be consulted for situations where the bottom of the cistern is less than 5 feet from the seasonal high groundwater level.
- Provide separate piping without direct connection to potable water piping. Dedicated piping should be color coded and labeled as harvested rainwater, not for consumption. Faucets supplied with non-potable rainwater should include signage identifying the water source as non-potable and not for consumption.
- The harvesting system must not be directly connected to the potable water system at any time.
- When make-up water is provided to the harvest/reuse system from the municipal system, prevent cross contamination by providing a backflow prevention assembly on the potable water supply line, an air gap, or both, to prevent harvested water from entering the potable supply. Contact local water system authorities to determine specific requirements.
- The rainwater storage facility should be constructed using opaque, UV resistant materials, such as heavily tinted plastic, lined metal, concrete, or wood, or protected from sunlight by a structure or roof to prevent algae growth. Check with municipal staff for local building code requirements.
- Storage facilities should be provided with access for maintenance, and with a means of draining and cleaning.

DESIGN GUIDELINES FOR INDOOR USE

- Avoid harvesting water for indoor use from roofs with architectural copper, which may discolor porcelain plumbing fixtures.
- Provide filtration of rainwater harvested for indoor non-potable use, as required by the California Plumbing Code (Table 6-3) and any municipality-specific requirements.

DESIGN GUIDELINES FOR IRRIGATION USE

- Water diverted by a first flush diverter may be routed to a landscaped area large enough to accommodate the volume, or a hydraulically-sized treatment measure.
- First flush diverters should be installed in such a way that they will be easily accessible for regular maintenance.

- Do not direct to food-producing gardens rainwater harvested from roofs with wood shingles or shakes (due to the leaching of compounds), asphalt shingles, tar, lead, or other materials that may adversely affect food for human consumption.

MAINTENANCE CONSIDERATIONS FOR ALL TREATMENT MEASURES

- See Chapter 8 for specific maintenance guidance.
- A Maintenance Agreement should be provided and should state the parties' responsibility for maintenance and upkeep.
- Prepare a maintenance plan and submit with Maintenance Agreement.

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