Rainwater Harvesting

Early Examples of Rainwater Collection in the Middle East

Herod's Waterworks, Masada 100BC

Dam wall at Jawa, Jordan c 3000 BC
Rainwater Harvesting

Roman Water Management c. 2000 years ago

http://www.romanaqueducts.info/webteksten/waterinantiquity.htm
Rainwater Harvesting

Byzantine Water Management

Yerebatan Sarayi, Istanbul, Turkey, around 540 AD
2.4 ACRES, capacity of 21 MILLION gals.
Farther Eastern Rainwater Harvesting

Chand Baori 9th Century Osiyan
Stepped Wells in India
In 1791, Thomas Jefferson decided to implement a new, more consistent way to supply fresh water to his home, Monticello. He concluded that, in order to supplement the inconsistent water supply available from ground wells, he would need to build cisterns to catch rain water coming off of the house, the pavilions and the dependencies. Jefferson meticulously calculated the total area of the roofs of the main buildings at Monticello, multiplied them by the average yearly rainfall, recorded in his personal records, and came to the conclusion that four eight-foot cube cisterns would allow the house to gather an average of six hundred gallons of fresh water per day.
Two Types of Rainwater Collection

- Rainwater Retention
- Rainwater Harvesting
Rainwater retention is used to control the amount of rainwater sent to sewers and high flood-risk areas during heavy rains. Rainwater is subsequently released after the storm’s peak.
Rainwater Retention

Examples

Rainwater Retention Tank

Water Matrix System

Rainwater Pit
Rainwater harvesting is the storing of rainwater for future use. We will be focusing on future use for irrigation and in water features.

Rainwater harvesting can be done both above ground and below ground.
Rainwater Harvesting

Above Ground Examples

Rain Barrel

Downspout Diverter

Cistern
Rainwater Harvesting

Below Ground Examples

Water Matrix Basin

Water Tank
We will be focusing on below ground installations.

Why?
Rainwater Harvesting

Which looks better?
This:
Rainwater Harvesting

Or this?
In addition to aesthetic reasons, below ground storage systems allow you to store more water, protect the water from the elements, and not use up valuable green space in your yard.
Rainwater Harvesting

3 Main Components:

- Pre-filtration
- Tanks
- Delivery System
Pre-filtration involves the removal of contaminants from the water before it is stored. This includes dust, dirt, bird droppings and insects.

Proper pre-filtration will reduce the risk of contamination and sediment in your storage basin.

Pre-filtration can be done above or below ground.
Pre-filtration

Above Ground Examples

Screen

Clean Rain Ultra Downspout Diverter
Pre-filtration

Below Ground Examples

Downspout Filter

Filter Pit
What is “first flush”?

First flush is the initial surface runoff of a rainstorm. During this phase, water pollution entering storm drains in areas with high proportions of impervious surfaces is typically more concentrated compared to the remainder of the storm.

When harvesting rain, it is important to consider how you will handle diverting the first flush away from your storage tank.
Pre-filtration

First Flush Diverters
Storage Tanks

There are two main options for how to store your water below ground. You can choose a rigid tank or modular tanks. Each has their own advantages.
Rigid tanks have the advantage of being one, strong, durable unit. They come in a variety of sizes and are great for those who have a large, open space to excavate and/or are able to make a very deep basin.
Modular tanks offer the installer more flexibility when it comes to the size and shape of their storage tanks. Large or small, modular tanks can fit to whatever size is desired, and offer strength and durability comparable to a rigid tank.
To harvest the rainwater from your storage tank, you will need a pump. Your two options are a submersible pressure pump and an external pressure pump.

A pressure pump delivers on-demand pressurized water. When a spigot is opened, the pump senses the decrease in pressure and turns on. It then turns off when the spigot is closed.
A submersible pressure pump will sit below ground directly in your storage basin or in a pump vault near the basin.

The advantage of a submersible pump is that it is hidden from view, its noise will be muffled, and will often offer higher water pressure than an external pump.
An external pressure pump will sit above ground, giving the user easy access to the pump for any maintenance or troubleshooting.
Harvested rainwater may or may not be suitable for use inside the home, but should almost always be suitable for use in irrigation and water features.

Rainwater harvested using the materials shown here is not potable. When determining how to use your rainwater, be sure to check local codes and regulations.
Rainwater Harvesting

How much water can be collected from a rooftop?

Roof Area × Amount of Rainfall (in feet) = Water in cubic feet

Water in cubic feet × 7.48 = Water in gallons

Water in gallons × 80% efficiency = Water you can expect to harvest
Rainwater Harvesting

Example

Lawrence, KS avg. May rainfall = 5.54” (0.4616’)

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40 \times 20 \times 0.4616 = 369.28 \text{ cubic feet}
\]

\[
369.28 \times 7.48 = 2762.21 \text{ gallons of rain}
\]

\[
2762.21 \times 80\% = 2210 \text{ gallons of rainwater harvested in one month}
\]
Hybrid Systems

How can I incorporate a rainwater collection basin into a water feature?
Hybrid Systems

There are two ways to use rainwater.

1. Use rooftop water to conveniently fill your pond-free basin (directly from your downspout).

2. Incorporate a water feature into the rain harvesting system (or vice versa). The largest expense in labour and equipment in any rain harvesting or pond-free install is the basin, so if the homeowner is going to the expense of building a basin, it is easy to do both rain harvesting and a water feature for a small increase in cost.
Hybrid Systems

This example shows using rooftop rainwater to top of pond-free water features, such as a bubbling fountain.
Rainwater Harvesting

In addition to supplying water to your water features, you can use water from your storage tank to feed drip irrigation hoses in your yard and garden, or simply supply water to your garden hose or sprinkler.
food for thought...

Global Water Supply

As Impervious Surfaces Increase ➔ Water QualityDeclines ↓
mitigation vs. harvesting

55%
Legislation

ARIZONA – 1-time 25% RH credit (max $1000 residents, $200 builders)

Tucson, AZ – First to require RH to supply 50% of commercial irrigation

COLORADO – changed “first in time, first in right” to allow rural harvesting

TEXAS – allows State taxing orgs to exempt all or part or properties w/RH

Austin, TX – Subsidizes rain barrels and cisterns, up to $40K

San Antonio, TX – 50% rebates to commercial, industrial, institutional

Albuquerque, Bernadillo and Santa Fe Co, NM – Residences with 2,500 sq ft or more area must install an active rainwater catchment system comprised of cisterns. All commercial developments are required to collect all roof drainage into cisterns to be reused for landscape irrigation

California – several water districts offer rebates, SF discounts RW cisterns

Oregon – State Code Appendix M sets potable/non-potable guidelines

Illinois – SB 2549 still pending, allows for RH in plumbing codes

FL, HI, NC, OH, UT, VA, WA – all adopting either RH or SWM regulations
questions?