



Landscapes Use Rain, Gray, and Reclaimed Water Workbook



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Rainwater Capture Options

Offset Potable Water Use with Rain, Gray, and Reclaimed Water



Permeable Surfaces



Passive Capture in Soil Sponge



Active Capture in Cisterns



Gray and Reclaimed Water

To reduce the use of potable (drinking) water for irrigation we use Supplemental Sources including rainwater and gray or reclaimed water. The difficulty of capturing this water varies from very simple **PASSIVE options** (Permeable Surfaces) to more complex **ACTIVE options** (Cisterns or Graywater).

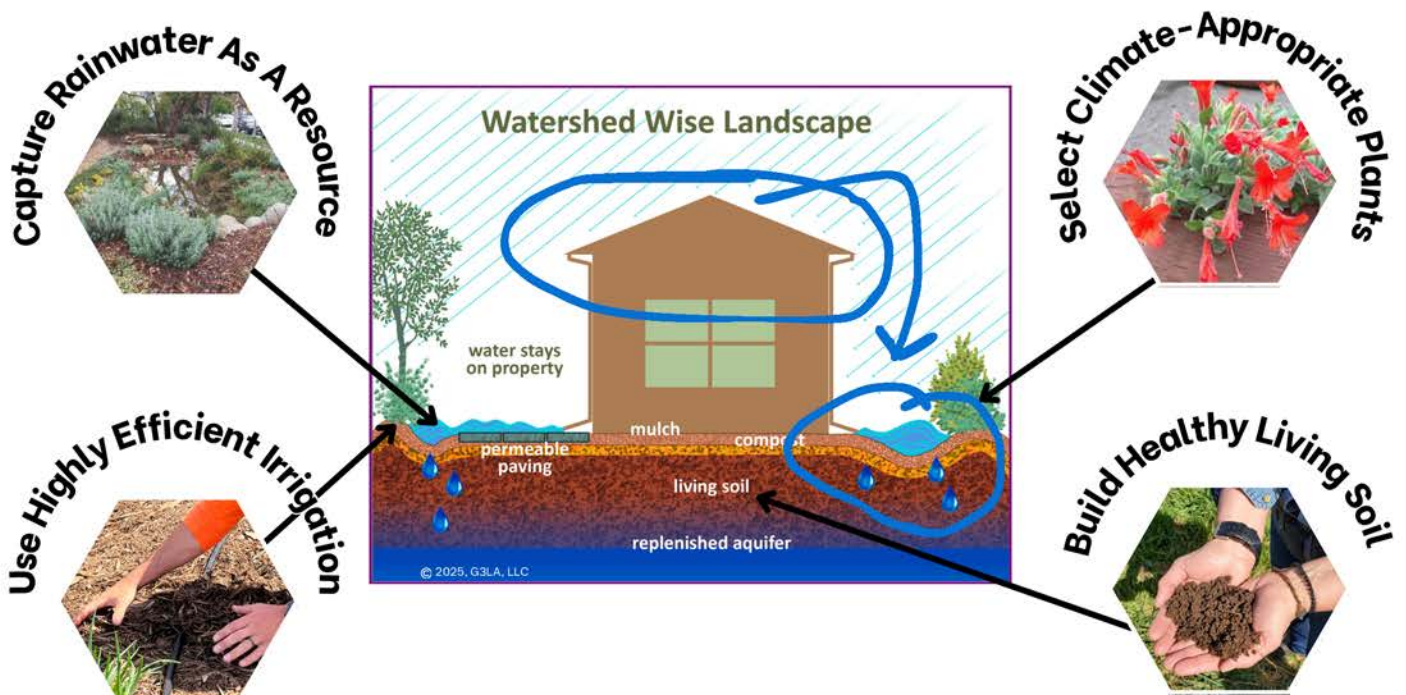
PASSIVE CAPTURE

- Healthy Soil Sponge
- Permeable Hardscape
- Bioswale or Rain Garden
- Dry Creek or Rock Garden

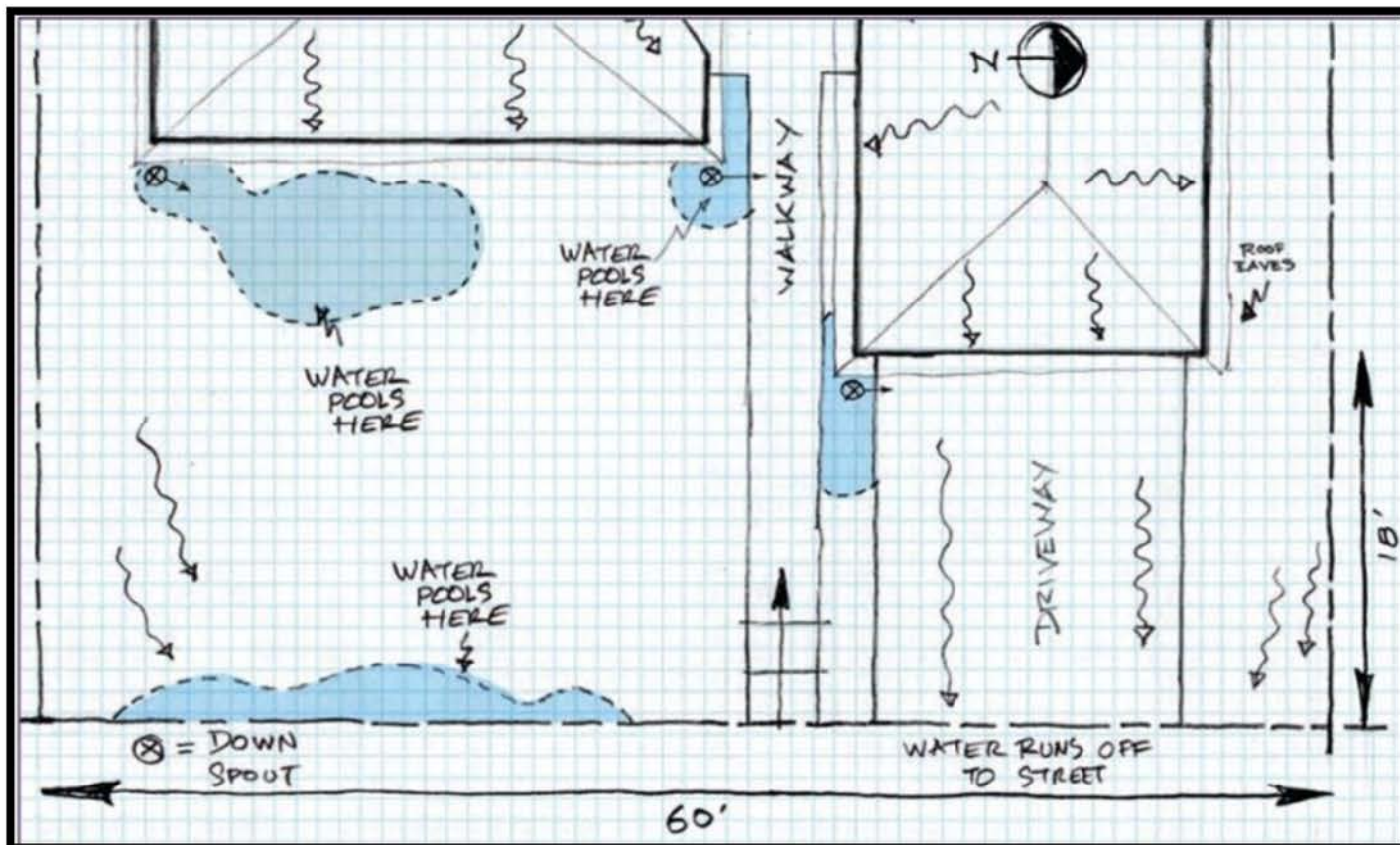
ACTIVE CAPTURE

- Dry Well or Infiltration Basin
- Rain Barrel
- Cisterns
- Laundry-to-Landscape

Watershed Approach Slow, Spread and Sink the Rain



Create Your Site Water Map



Watch what happens when water comes off the roof of your home and moves across your property. Think of your roof as the **TOP** of your mini-watershed and where the water finally runs off your property is the **BOTTOM**. We will find places in the landscape that could receive water coming from the roof.

Capture "FIRST FLUSH" the First Inch of rainwater after a dry period. It is the most polluted, so we want to keep it out of our water ways.



- Note the direction of any water moving around the property. Do you have low spots in which water pools?
- What happens to water on the driveway or other hard surfaces like the walkways?
- Does water run onto the property from a neighbor or the street?
- Do any buildings or hard surfaces appear to be water damaged? If yes, does it appear to be the result of irrigation or rain, or both?
- Take a look at your roof and how it relates to the landscape. Start to think about areas of the landscape that could receive water coming from the roof.

Create Your Own Site Water Map

Make Notes About Where Water Moves on Your Property

Calculate the Gallons to be Captured



The shape of your roof doesn't matter in the calculation of square footage of roof area. Measure the outside edges and calculate the square footage:

Area of the Roof = Length of Side A in Ft. x Length of Side B in Ft.

Area of the Roof = Square Feet



**Roof Sq. Ft. x Rainfall Inches x 0.62 =
Total Rainwater Available from Roof
(In Gallons)**

**A 1,000 Sq. Ft. Roof generates
620 Gallons of Water in a 1" Rain Event.**

Over the course of a year, that rainfall adds up quickly.

1,000 Sq. Ft. Roof x 10 Annual Inches x 0.62 = 6,200 Gallons of Water/Yr.

6,200 Gallons of water is enough water for an approximately 1,000 Sq. Ft. landscape in the EMWD service area for a whole year!

Calculate the Gallons Generated by Your Roof

What is the Square Footage of Your Roof?

HINT: Length of Side A x Length of Side B

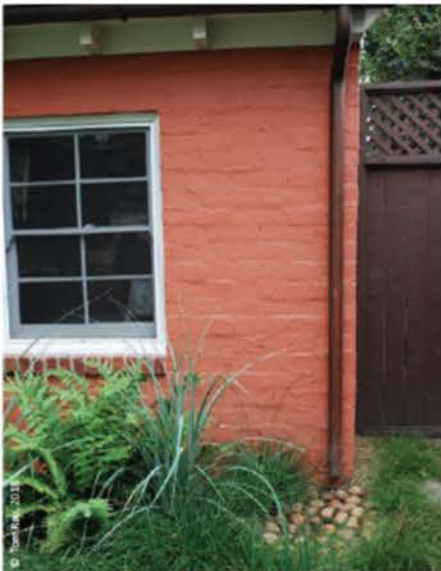
How Much Water Can You Capture from Your Roof?



**Sq. Ft. x 1" x 0.62 =
First Flush Total Gallons**



**Sq. Ft. x 10" x 0.62 =
Total Annual Gallons**



How Much Water Per Downspout?

Contribution Area is the Sq. Ft. of the portion of the roof that contributes to each downspout. The formula for calculating the gallons is the same, the area will be smaller because you are dividing the roof into smaller areas.

If your 1,000 Sq. Ft. roof was divided into two equal sections, the Contribution Area of each downspout would be 500 Sq. Ft. In a one inch First Flush rain event, each downspout would generate:

500 Sq. Ft. x 1" First Flush x 0.62 = 310 Gallons of Water

Turn Gallons into **Cubic Feet** so we can figure out how much surface area and how deep to dig to capture all the rain.

$$\text{Cubic Feet of Water} = \frac{\text{First Flush Total Gallons}}{7.48 \text{ Gallons / Cu. Ft.}}$$

Passive Capture - Rain Gardens (and More)

Rain Gardens can be simple swales or depressions in the landscape, bordered by berms or raised planter areas; they can be filled with rock, mulch, or just densely planted.

ROCK-ENHANCED DRY CREEK.



VEGETATED SWALE.



Calculate the Surface Area and Depth Required

$$\text{Cubic Feet of Water} = \frac{\text{First Flush Total Gallons}}{7.48 \text{ Gallons / Cu. Ft.}}$$

Receiving Area is the landscape area (Sq. Ft.) needed to capture the Cubic Feet of water calculated from the gallons running off the roof. Concentrate on capturing First Flush (One Inch). Over time, as your soil becomes healthier and your plants become deeper rooted, the water holding capacity of your Rain Garden will increase. Capturing that first polluted water in each rain event is all you need to do to hydrate your landscape!

REMEMBER: Cu. Ft. = Sq. Ft. Surface Area x Ft. Depth

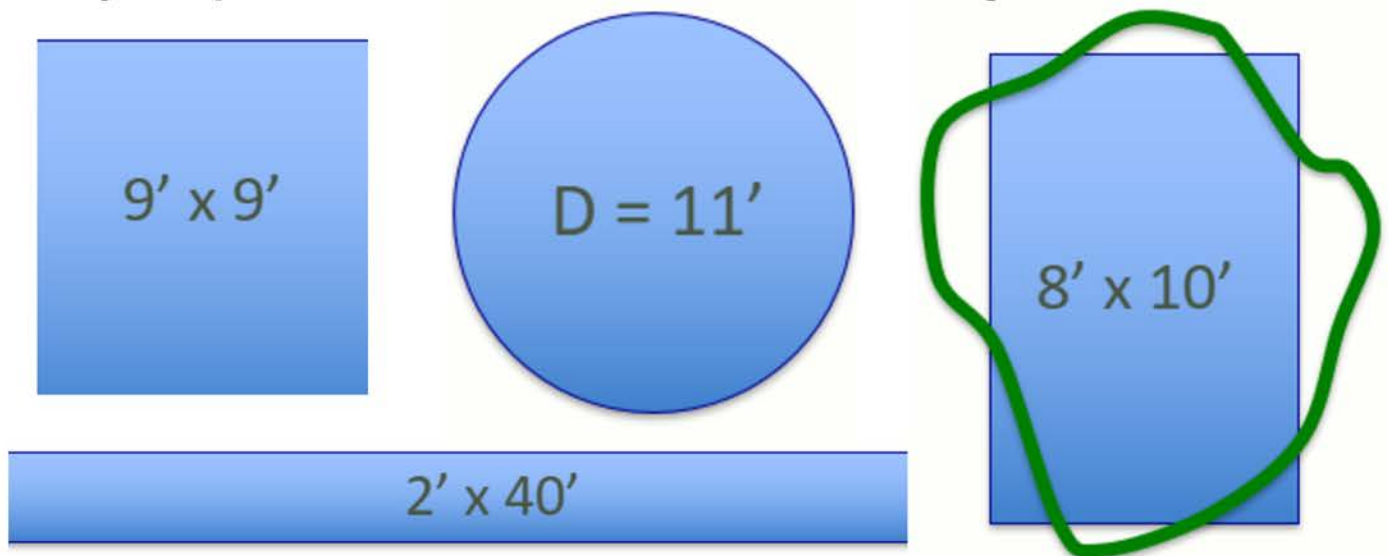
1,000 Sq. Ft. Roof generates 620 Gallons per Inch of Rain. How many Cubic Feet does that equal?

620 Gallons / 7.48 Gal./Cu.Ft. = 83 Cu. Ft. of Water for a 1,000 Sq. Ft. Roof

How Many Cu. Ft. are needed to capture your roof's First Flush?

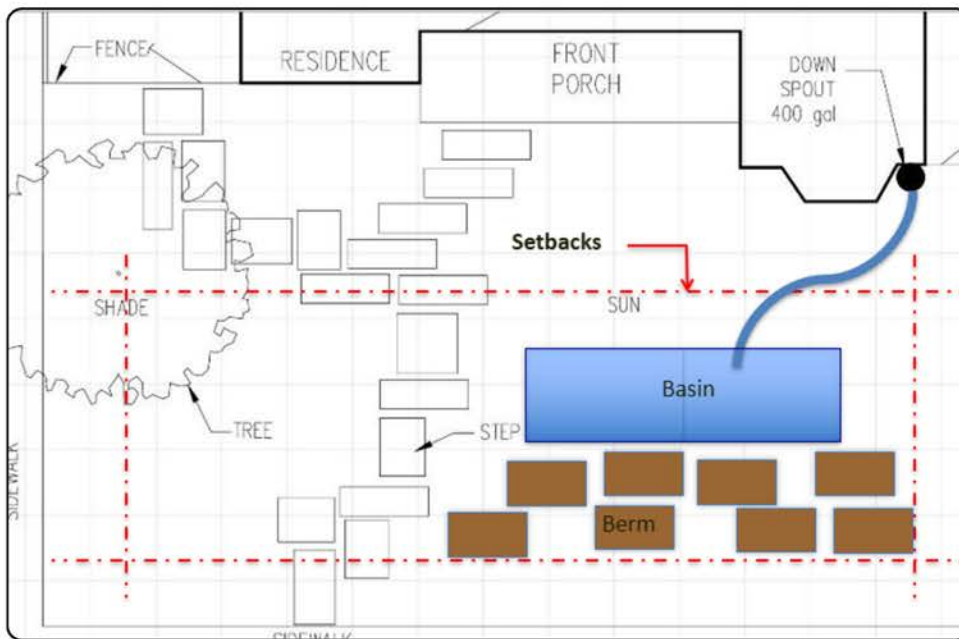
Divide Cu. Ft. by 1 Ft. to get the Landscape Area needed to capture it all.

Any Shape Will Work Provided There is Enough Surface Area



At One Foot Deep (12") all of these shapes provide approx. 83 Sq. Ft.

Where Do You Put the Basin and Berm?

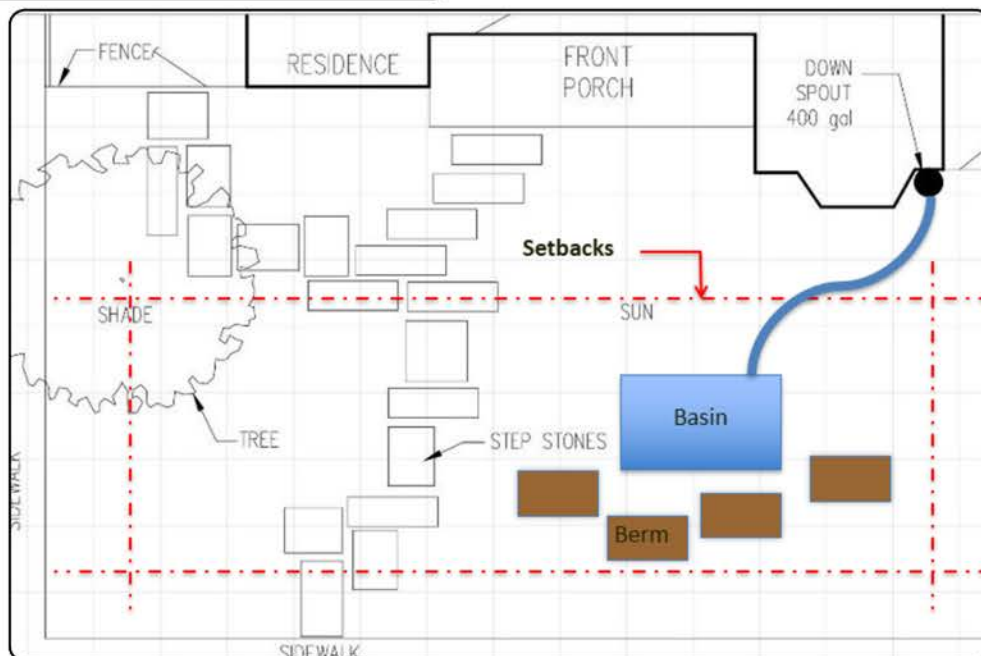


Shallow Basin

- No more than 6" - 12" deep.
- Needs more surface area (wider and less concentrated.)
- Need more area in the setback.
- Good candidate for a vegetated swale, dry creek or rock garden.

Deeper Basin

- No more than 18" deep or you will need a building permit and expert help!
- Needs less surface area (more concentrated.)
- Better for areas that are constrained by setbacks or trees.
- Good candidate for dry well or infiltration basin.



Good Design Rules:

1. Keep all soil on site: Basin excavations = Bermed planter areas.
2. Do not import extra soil or gravel.
3. Maintain a 2% slope away from the foundation of your home to keep water moving into the basin (drop the grade 1" for every 4' you move away from the foundation.)
4. **Locate basins at least 5' - 10' away from the foundation of your home and your neighbor. Berms may be closer.**
5. **Keep basins 3' away from sidewalks and walkways. Berms may be closer.**
6. Shallow basins need more surface area. Deeper basins may fit into tighter set backs.
7. Clay soils? Keep it shallow.
8. Using rock? Make it bigger and keep some open areas for water to seep into soil.

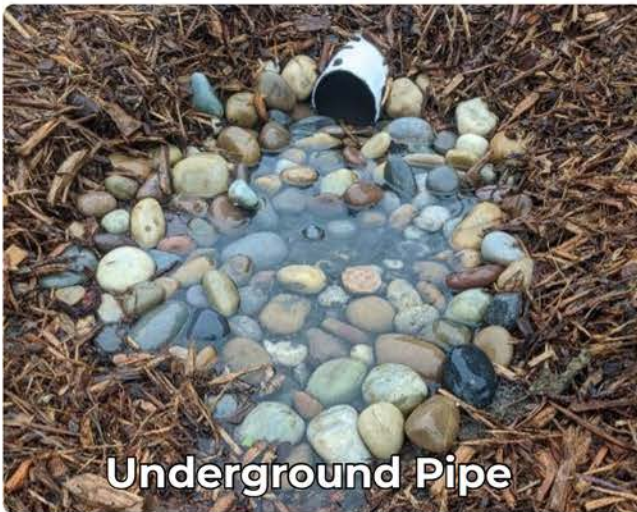
Moving Water Into the Landscape



Downspout Extender



Rain Barrel with Overflow

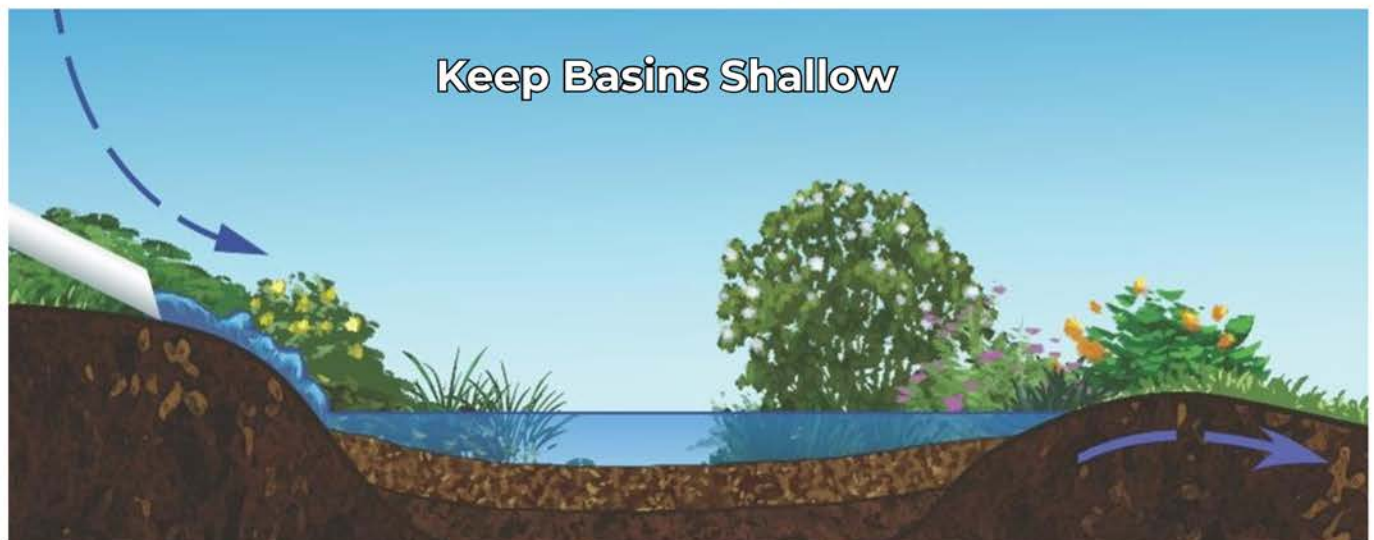


Underground Pipe

Keep Water Away from the Foundation of your Home. Use these simple options and rules to redirect downspouts into the landscape.

- Rain Barrel slows down water and allows overflow into landscape through a hose.
- Underground Pipe directs water further distances and under hardscape.
- Downspout Extender can be removed during the dry season.

2% Grade is needed to move water. That's 1" down for every 4' away from structures.



Keep Basins Shallow

Permeable Everywhere

Keep Hardscape Surfaces Permeable to Slow and Spread Water



What is Hugelkultur (Mound Culture)?



Hugels are mounds constructed of “waste” organic materials allowed to decompose and nurture young plants.

Rainwater and graywater are directed into basins surrounded by soil-covered mounds of decomposing organic material and densely planted with climate-appropriate plants. These become giant sponges that hold massive quantities of water.

Images: 1. Building the basins. 2. Artfully placing wood into mounds covered with soil. 3. Plants find niches. 4. Plants flourish atop the decomposing mounds.

All Images this page from **No Flat Yards: Hugelkultur**
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5. What Organic Material Can You Find for Your Hugels?

Active Capture - Infiltration or Cisterns

Caution must be exercised when water is concentrated into deep infiltration basins (sometimes called **Dry Wells**). These require permits and the expertise of a soils engineer.

CONCENTRATED INFILTRATION AND DRY WELLS.



Dry Well



Infiltration Chamber



Infiltration Chamber



Downspout Redirect

Before you start, be sure to consult with a soils engineer or local City zoning or grading inspectors. There are reasons why you may not be able to actively infiltrate:

1. High water table
2. Soil salinity hazards
3. Wind blown loose sands that clog system
4. Clay soils that collapse with water
5. Too difficult to site away from buildings.

RAIN BARRELS AND CISTERNS.



Rain Barrel 50 Gal.



Rain Barrel 200 Gal.



Cistern 200 Gal.

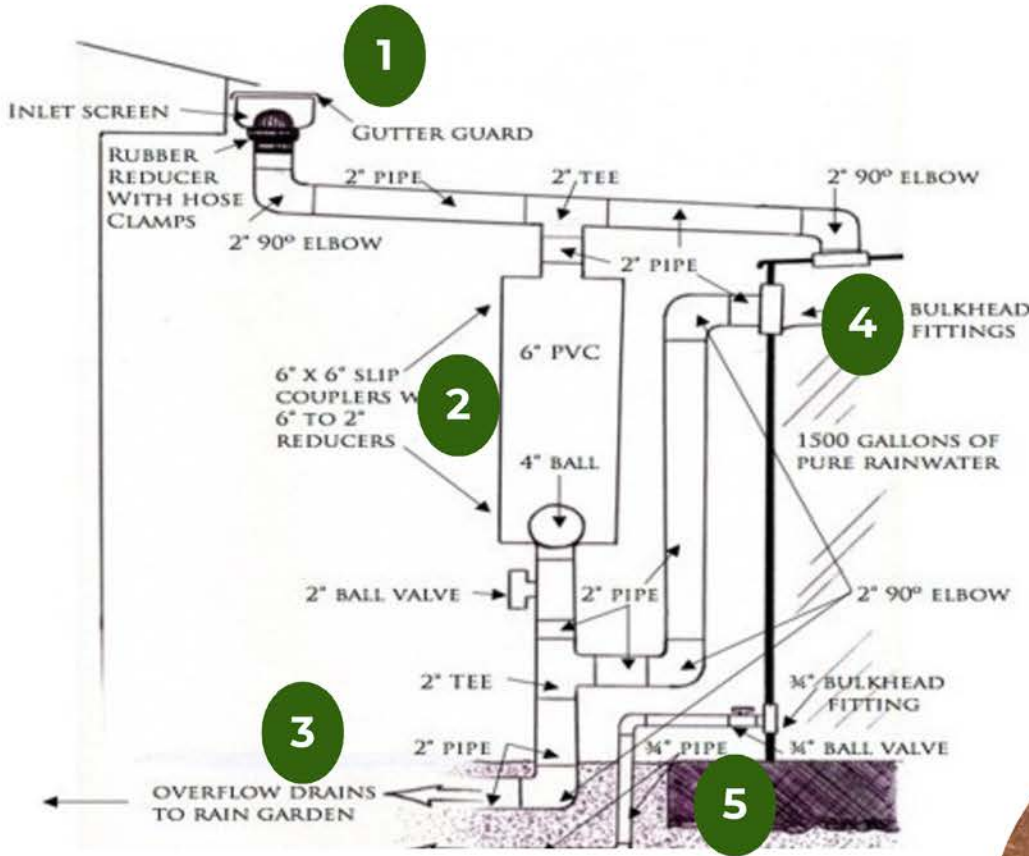


Cistern 2,000 Gal.

Rain barrels are not effective rainwater storage devices; rather, they should be considered **SLOWING** devices that facilitate your moving water away from hardscape or into a more permeable area of the landscape. Each rain barrel holds only 50-75 gallons, so several would be needed just for the First Flush.

Cisterns, starting at 200 gallons or more, are sometimes good alternatives to rain gardens because they have a smaller footprint. Also, if your property is on a hillside and your infiltration options are limited, cisterns can help store water to reduce irrigation demand or to keep runoff from creating erosion.

Key Components of a Cistern Installation



Inlet Screens are used to keep leaves and mosquitoes from fouling the tank. A **First Flush Diverter** keeps the first 1" of rain out of the tank and overflows directly to the Rain Garden. The **Overflow** has a small drip emitter that releases the water slowly into the landscape. Finally, the water after the First Flush flows into the top of the Cistern.

Water from the Cistern can flow into the landscape when it is released with a **Manual Valve**.



Inlet Screen



First Flush Diverter

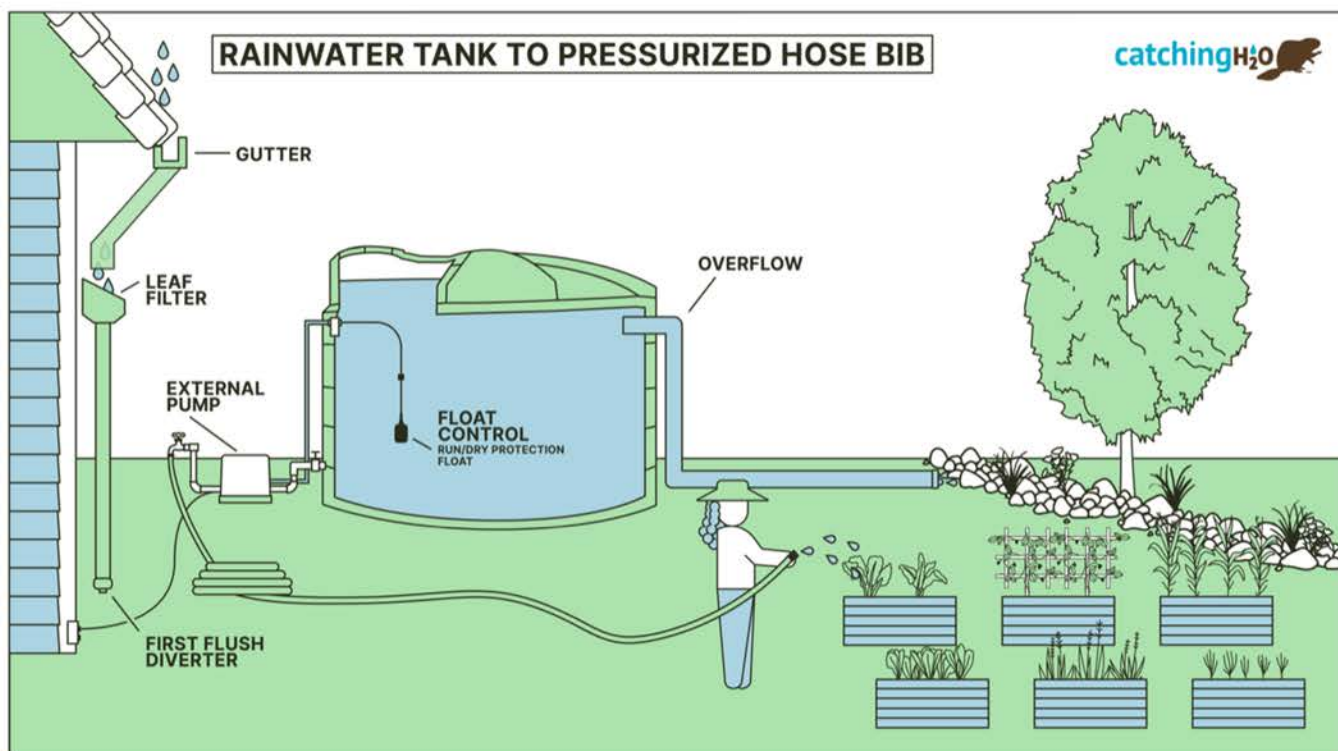


Overflow Drains to Rain Garden



Rain After First Flush Into Tank

Sizing Your Cistern and Other Considerations



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Your goals determine the size of the cistern and the subsequent cost for installation.

- Flood Control - Store 1" minimum requires a tank 1,000 gallons or more
- Hand Watering - Store 2-3" requires a tank 2,000 gallons or more
- Fire Suppression - Store > 5" requires at least 5,000 gallons (may be required for fire insurance)
- Irrigation - Store > 5" requires at least 5,000 gallons
- Indoor non-potable use - Store > 5" requires at least 5,000 gallons

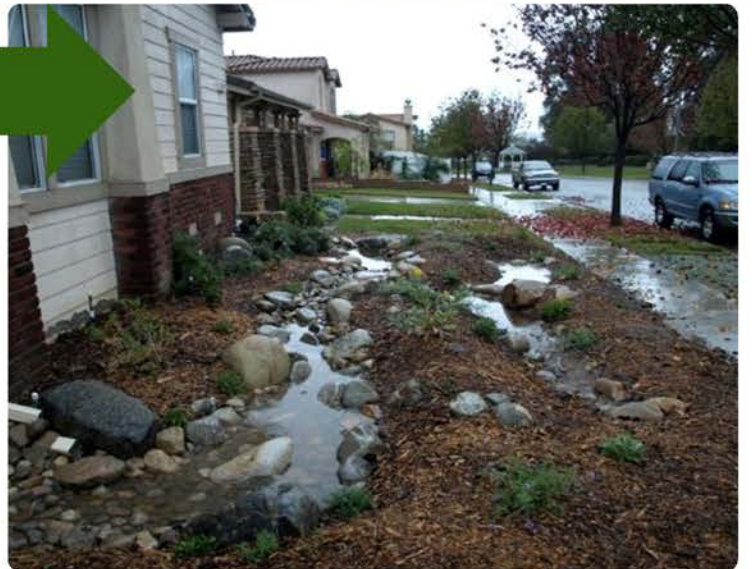
Tank Placement requires consideration of other elements when developing a cistern for rainwater catchment include the following:

- Further away from roof needs a "Wet System" to move the water
- Room required for setbacks and emergency egress
- Above ground or below ground ?
- Does it need to be screened from view?
- Concrete foundation may be required by code.

Other considerations include:

- Permitting for larger tanks and all underground tanks
- Signage on pipes indicating reclaimed water
- Air gap needed if potable water makes up deficits in the tank
- Electrical required for pumped systems
- Water may be stored, but It should be screened before entering the tank to limit biological activity.

Discharge Cistern Water Into the Landscape!



Graywater Options

What is Graywater?

Graywater is a supplemental water source that accesses “gently used” water from bathroom sinks, showers, and clothes washers and directs it into the landscape to provide a dependable, local source of water throughout the dry season. This is especially important for fruit-bearing and shade trees, which may suffer in times of drought. **Graywater is NOT dishwasher, kitchen sink, or toilet water.**

Chapter 19 of the California Plumbing Code allows systems that do not alter the household plumbing to be installed without a special permit, provided basic guidelines are followed. **Laundry to Landscape Systems (L2L Systems)** capture the graywater from the clothes washer's drain hose and connect to a diverter valve, which allows the graywater to be directed to either the landscape or the sewer. It is one of the easiest graywater systems to construct and is very easy to maintain.

Reclaimed water (or Recycled water) is highly treated wastewater that has undergone rigorous cleaning and disinfection making it safe for non-potable uses like irrigation, industrial cooling, and wetland restoration. Although it has undergone secondary and tertiary treatment, it is not considered safe for drinking without additional processing by a drinking water treatment facility. Reclaimed water typically is associated with commercial, institutional, and industrial properties such as HOA common areas and industrial parks.



Purple pipe is used to indicate the water is reclaimed.

Reasons to use graywater include:

- Reduce reliance on Municipal water supplies
- Less strain on septic tanks or treatment plants
- Healthy soil can be more efficient water treatment
- Recharge groundwater
- Promote plant growth in edible or Moderate water requiring plants
- Reduce energy and chemical use

Considerations for graywater use:

- Must use **biocompatible** soaps
- Cannot be stored more than 24 hours
- May NOT be sprayed
- Must be released under 2"+ of living mulch
- Diverter valve to sewer must be used
- May NOT be allowed to pond
- Located only on your property with proper setbacks

Calculate the Gallons Generated by Graywater System How Much Graywater is Available?



Large top loading washing machine



Front loading washing machine

Estimate Total Household Graywater: Gallons Per Household Occupant

15 Gallons Per Day / Occupant - Laundry

Remember Graywater cannot be stored and must be put into the landscape right away, so daily use estimate must equal daily plant requirement.

The graywater will be put into the landscape. Therefore, we must calculate the “footprint” or square footage of basin area that will be made to accept the graywater. Soil type ultimately determines the basin’s footprint to prevent ponding or runoff from the property.

Basin Square Footage Needed = Total Gallons Per Day x Soil Type Adjustment



Adjustment Factor = 1.10

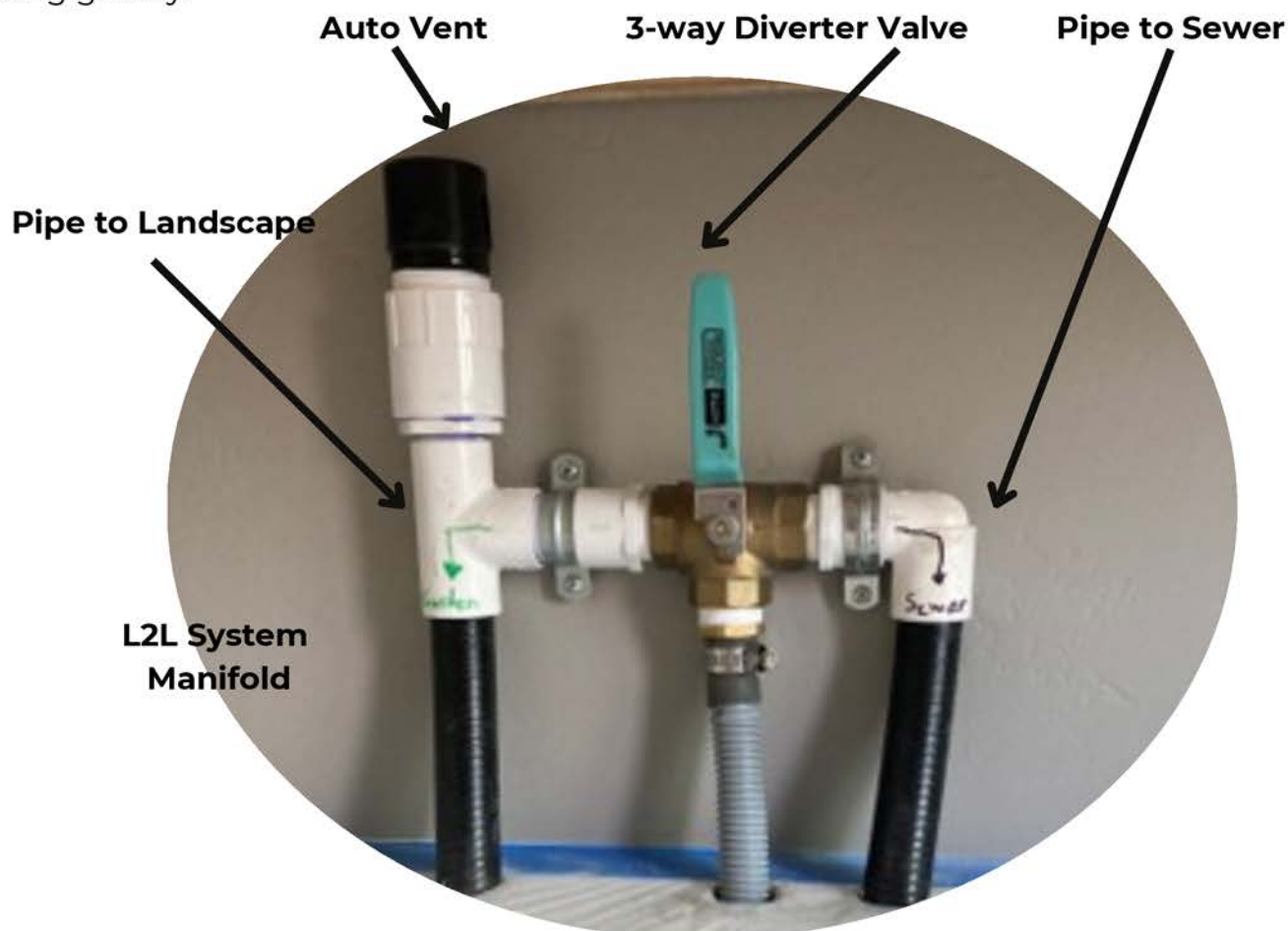


Adjustment Factor = 5.00

Estimate Your Required Basin Size Based on Total Household Daily Usage and Soil Type:

Laundry to Landscape (L2L) Systems

Laundry to Landscape systems do not require permits in California to capture the water from your laundry machine and direct it into mulch-covered basins in the landscape using gravity.



Considerations for the L2L Manifold:

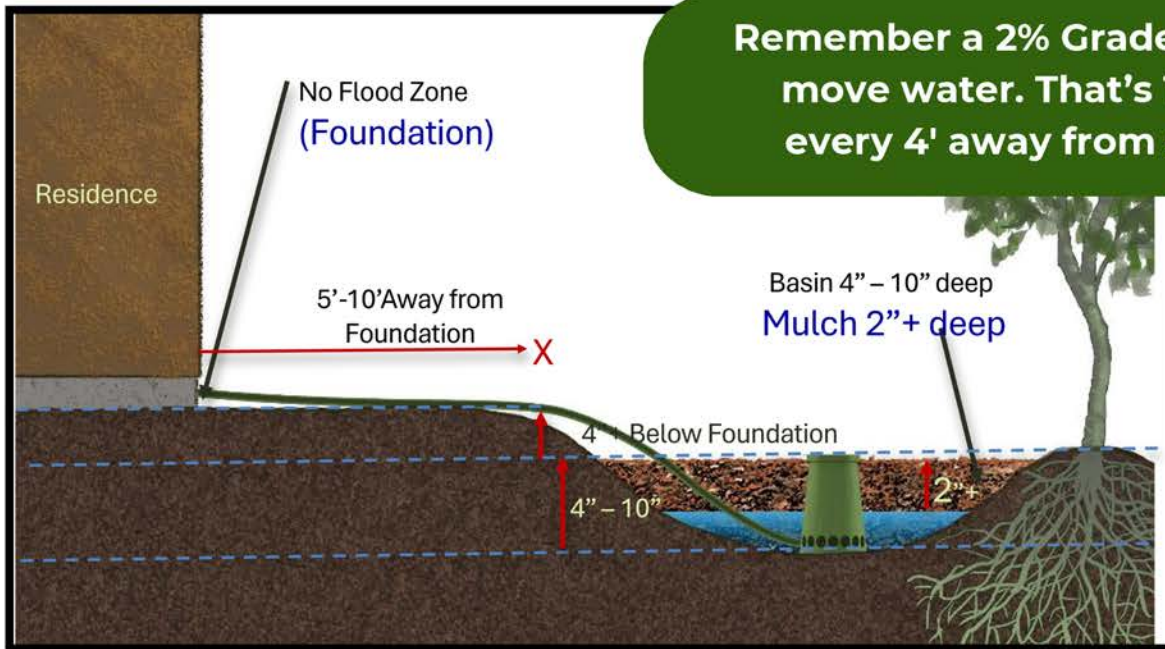
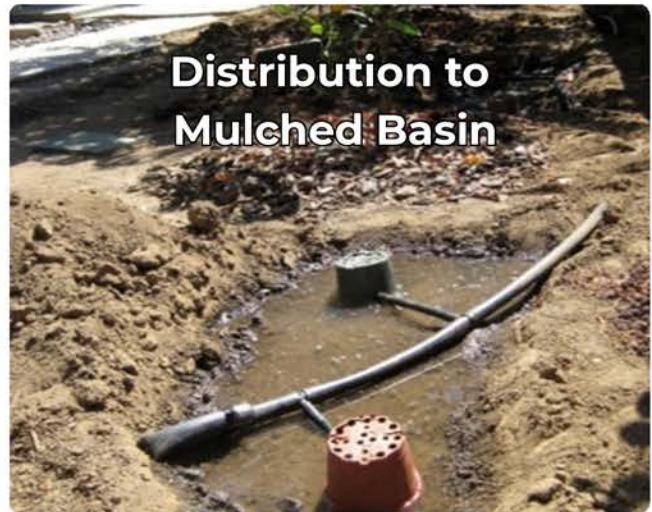
- Where does it fit?
- Keep it clearly labeled
- Keep it easy to access
- Brace to the wall
- Connect to existing drain
- Keep it simple!

The 3-way Diverter Valve is an important part of the system as it allows you to divert water into the sewer whenever you don't want it going to the landscape. Here are some reasons you may choose to divert water to the sewer:

- Using bleach or dye in the laundry
- Landscape is too wet from recent rain events
- Landscape is too wet from increased laundry use
- Poopy diapers or sanitary laundry during illness
- Other toxic stuff like gasoline, paint, or oil

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Directing Graywater Into the Landscape



Remember a 2% Grade is needed to move water. That's 1" down for every 4' away from structures.

Ensure Successful Projects



Any project capturing rainwater or installing an L2L System should remember to Keep It Simple! Less is always MORE in these situations. Focus on **Slowing** water down with a **Rainchain**, **Spreading** it out wherever possible, **Sinking** it in the landscape, and **Storing** it in Cisterns when appropriate.



Keep all soil on site. Do not remove organic material; instead, build Hugel and keep that carbon on site. Plant densely and diversely. Keep hard surfaces as permeable as possible. Remember the heirarchy of landscape water:

1. Rainwater Kept in Landscape
2. Graywater Supplementing Rain
3. Municipal Reclaimed Water Supply
4. Potable Water

Remember These For Rain, Gray, or Reclaimed Water



Plants that Like Wet Feet Go in Basins



Juncus patens



Zephyranthes candida



Iris douglasiana

As you contour the landscape stay aware of the water needs of the plants and be sure to hydrozone. Plants that like their feet wet during winter months can be placed directly in basins. These could be planted in swales where there is standing water in winter and very dry conditions in summer. Plants that do not like wet feet must go up on the berms in well-draining soils.

Plants that Like Dry Feet Go on Berms



Epilobium canum



Ceanothus



Achillea

Not all plants like graywater or reclaimed water. Leafy greens and root vegetables are not appropriate. Stick with fruit trees and moderate or high water need perennials including tropical plants.

Plants that Like Graywater or Reclaimed Water



Musa (Banana)



Hemerocalis (Daylily)



Citrus

Remember These For Rain, Gray, or Reclaimed Water

You Will Need:



1. Dig a hole about 12" deep and 12" wide (that's a little larger than a 1 gal. plant container).
2. Fill the hole with water and wait. Note how long it takes to drain completely. This is necessary to completely saturate the soil.
3. Fill the hole all the way when all the water has drained out from first filling, and see how long it takes to drain out again.
4. Lay a stick or shovel handle across the hole and measure the distance from the top of the water to the stick each hour until it has drained completely.

Do a **Percolation Test** to determine compaction and then minimize it by working the steps for making a healthy living soil sponge including **Sheet Mulching, Planting Densely and Diversely, and Eliminating Fertilizer, Pesticides, and Herbicides**. Using an **Auger** can help open channels in compacted soils. A hand drill with a bit 3-5/8" dia. x 18" long can poke holes like a worm in soil. Follow immediately with compost and top with 3" of mulch. Larger problems may need a larger auger, but the principles are the same - always follow up with organic matter.

Compaction kills projects. Check percolation before digging and remediate if you can!



Hand Drill as Auger

Keep Gutters, Downspouts, and All Pipes Debris-Free



Clean Out Gutters



Use Debris Screens



Flush Pipes

Take Notes Here

