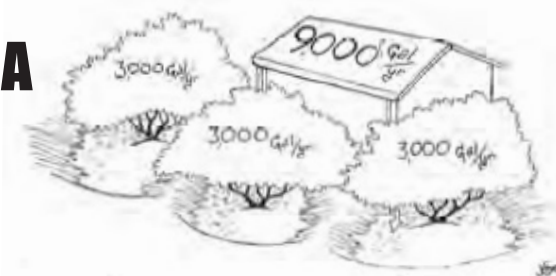


Rain Water and Gray Water Worksheet



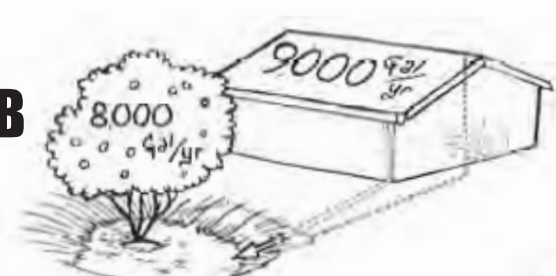
1. Match the best source to the HIGHEST AND BEST USE!
Write letter next to the water source and use on the right.

A



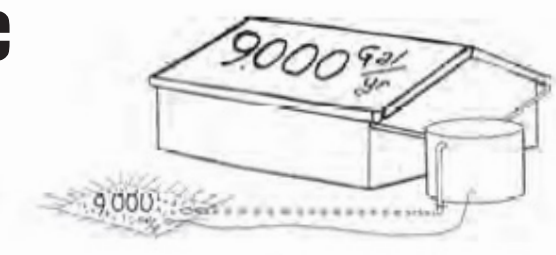
___ **Passive Water Harvesting**
for native plants

B



___ **Active Rain Harvesting**
for vegetables

C

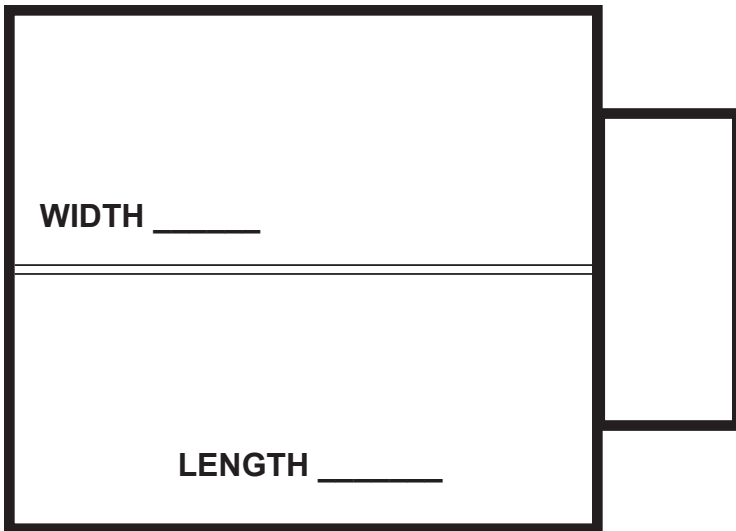


___ **Gray Water**
for fruit trees

Rain Water and Gray Water Worksheet

Active Rain Harvesting

Use this formula to determine how much rain you can capture from a roof surface.



1. This is a peaked roof. Draw arrows to indicate where the water will flow.
2. Draw gutter and downspout locations.
3. Add roof dimensions in feet.
4. Determine the area of your roof catchment in square feet.
Length x Width = _____ Area ft²
5. Will you harvest all or part of this roof?

HOW MUCH CAN YOU HARVEST?

1. Use the RWH formula to determine the amount of water you can harvest.

Roof Catchment Area X Conversion Factor x Runoff Coefficient x Rain in Inches = Gallons

Example: Catchment area **900** sq ft x **.623** conversion factor x **.90** Runoff Coefficient x **1** inch rainfall depth = **504.63** gallons.

2. Plug in the numbers for your roof.
_____ square feet x .623 x .90 x 1 inch rain = _____ gallons/inch rain
3. Now do it again for 2 inches.
Double your answer for number 2. Gallons for 1 inch x 2 = _____ gallons/2 inch rain
4. Finally, do it again for the annual rainfall in our area: 18 inches/year
_____ square feet x .623 x .90 x 18 inches/year = _____ gallons/year

2-3 inches of rain is a good volume to harvest and can help determine your tank size.

Why multiply by .623? .623 is a conversion factor based on finding the volume in cubic feet of one inch of rain on one square foot of roof. 1 inch (0.8333 ft) x 1 square foot = 0.8333 cubic feet (ft³). Cubic feet are then converted to gallons. There are 7.48 gallons in a cubic foot. 0.8333 ft³ x 7.48 gallon/ft³ = .623

Why multiply by .90? .90 is an average runoff coefficient that represents the percent of rain that actually makes it into a tank from a metal, concrete or asphalt roof surface. 10% of the rain is lost to evaporation, wind, gutter overflow or caught in small spaces on the roof surface. For a tar roof use a coefficient of .85.

Annual Rainfall: 18 inches is the average rainfall in Bisbee AZ

Rain Water and Gray Water Worksheet

Active Rain Harvesting

How big a tank or tanks should I install?

Using the volume for a 2 inch rain (see prior page) check the Oasis Water Harvesting, Inc. price list to pick out a tank! Enter your tank choice!

| | Gallons | Dimensions | OASIS cost | Retail Price per gallon |
|---------|---------|------------|------------|-------------------------|
| e.g. | 870 | 60 x 78 | \$996 | 1.14 |
| My tank | _____ | _____ | \$_____ | _____ |

Where else can I purchase a tank?

NEW

- ACE Hardware, 1120 S. Kolb Road, Tucson, AZ 520-747-1996, a big yard full of tanks
- Cal Ranch, 673 AZ-90, Sierra Vista, AZ 85635 (520) 417-5632
- Plastic Mart, www.plastic-mart.com/water_tanks.aspx, (866) 310-2556 (Ask for shipping costs)
- Holcim Hardware, 15 Avenida 6, 84200 Agua Prieta, Sonora, MX phone +52 63 333 80348 (Good prices. Fittings must be adapted to change these *Rotoplas* water storage tanks to rain harvesting tanks.)

USED

- IBC Totes in Douglas, 230 and 270 gallon sizes, call Lorenzo (520) 255-4865
- Used tanks for sale on The Cochise Trading Post, Craig's List, local papers, The Next Door app
- Check local drink distributors like Coke or Pepsi for food grade drums
- Fiesta Canning (55-gallon food-grade drums) 7978 N Central Hwy, McNeal, AZ (520) 642-3366

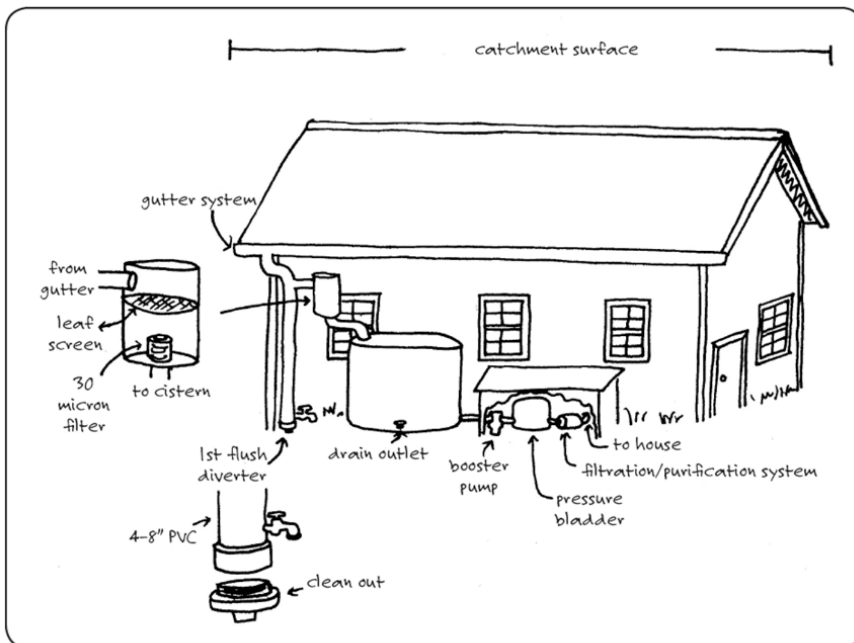


FIG. 8.2. Typical components of a whole-house rainwater harvesting system.



IBC Totes: Intermediate bulk container

Rain Water and Gray Water Worksheet

Active Rain Harvesting

What will you use the stored rain water for? **A Veggie Garden!**

Veggie Garden
10 feet long x 5 feet wide



| | Month | Vegetables: Square Feet of Beds | Monthly Demand Vegetable Garden | Vegetables: # of Waterings per Month |
|--------|-------|---------------------------------|---------------------------------|--------------------------------------|
| Annual | Jan | 0 | 0 | 2 |
| | Feb | 0 | 0 | 3 |
| | Mar | 50 | 109 | 7 |
| | Apr | 50 | 140 | 9 |
| | May | 50 | 171 | 11 |
| | Jun | 50 | 202 | 13 |
| | Jul | 50 | 171 | 11 |
| | Aug | 50 | 156 | 10 |
| | Sep | 50 | 125 | 8 |
| | Oct | 50 | 93 | 6 |
| | Nov | 0 | 0 | 4 |
| | Dec | 0 | 0 | 5 |

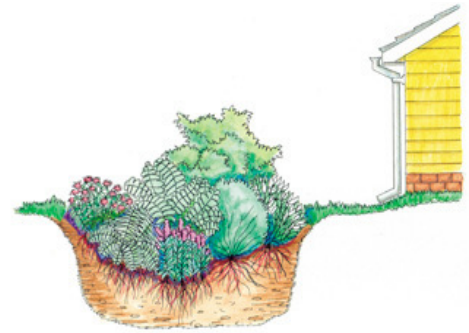
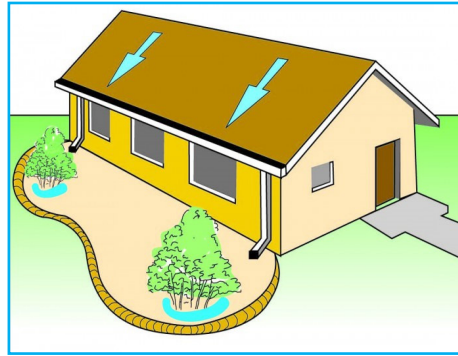
Annual Demand Vegetables: 1168 gallons

Water Budget (870 gallon tank filled by twice a year by rains)
 1740 gallons (collected rain)+ 47 gallons (18" of rain falling on garden) - 1168 veggie plant demand
 = 619 gallons a year balance

Rain Water and Gray Water Worksheet

Passive Rain Harvesting

What will you use the captured run-off for? **Native landscaping!**



**SLOW
SPREAD
SINK!
Keep the
rain on your**

Landscape areas can be sculpted with depressions to capture lots of rain in basins. Directing gutter flow to a rain basin, is the cheapest way to harvest rain!

Stormwater runoff draining from higher to lower parts of your property.

A lower coefficient (e.g. .40) accounts for absorption before the storm water reaches its destination.

1000sf landscape x .623 x .40 = 249 gallons in an inch of rain

1000sf landscape x .623 x .40 x 18 inches = 4,486 gallons yearly

Use your roof measurements to determine the volume of rain coming from a downspout going to a rain basin.

Three rain basin design rules:

- The basin should absorb all stormwater within 48 hours of a rain event. Think mosquitos!
- The basin should be filled with mulch to increase absorption.
- An overflow at the highest level in the basin should guide the water out in case of large rains.

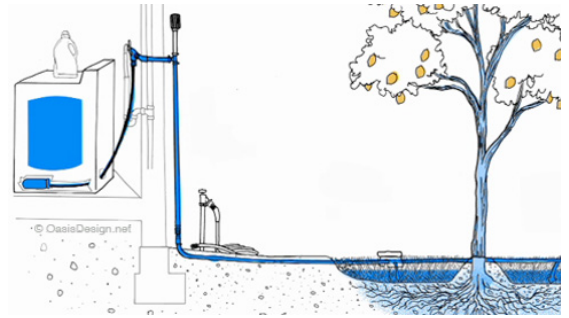
| Enter # of Plants | Plant Type (select from pull-down list) | Plant (select from pull-down list) | Plant Recommended Water Requirement | Mature Plant diameter (ft) | Plant diameter (ft) ☉ | Gallons per plant each watering | Total gallons needed at each watering | Irrigation Zone (select from pull-down list) |
|------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------------------|-------------------------------------|----------------------------|-----------------------|---------------------------------|---------------------------------------|----------------------------------------------|
| 2 | Tree | Desert Willow* <i>Chilopsis linearis</i> | L-M | 20 | 20 | 125.6 | 251 | 1 |
| 4 | Tree | Mesquite (species) <i>Prosopis spp.</i> | L-M | 35 | 35 | 219.8 | 879 | 2 |
| 8 | Shrub | Salvia, Lipstick Autumn Sage (light) <i>Salvia greggii</i> 'Lipstick' | M | 4 | 4 | 7 | 56 | 3 |
| 6 | Flower/Groundcover/Vine | Agastache, New Mexico <i>Agastache neomexicana</i> | M | 1.5 | 1.5 | 1.5 | 9 | 3 |
| Annual Native Landscape Demand: 6,735 gallons | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Water Budget for a 600 ft² area roof and a 1000 ft² landscape area with 18 inches rain a year.
 6,056 gallons (from roof) + 4,486 gallons (rain falling on 1000 ft² landscape) - 6,735 gallons native landscape plant demand = 3,807 gallons a year balance

Rain Water and Gray Water Worksheet

Gray Water Reuse

How much graywater do you generate?



| Average per person per day demand by fixture type: | gpcd = gallons per capita (person) per day |
|----------------------------------------------------|----------------------------------------------|
| Drinking (2 gpcd) | Water is consumed |
| Kitchen (2 gpcd) | Dark gray water not legal to reuse |
| Bath/shower (6 gpcd) | Gray water legal to reuse |
| Bath Faucets (2 gpcd) | Gray water legal to reuse |
| Toilets (8 gpcd) | Black water not legal to reuse |
| Clothes washer (4 gpcd) | Gray water legal to reuse |
| Household members = 2 | |
| Total Indoor Use = 24 gallons/day, 12 gpcd | Total graywater 8 gallons/day, 4 gpcd |

| Calculate available graywater supplies to specified area: | |
|-----------------------------------------------------------------------------------------------|--|
| Bath sink: _____ (gallons) x _____ (# of users) x 365 (days/year) = _____ (gallons/year) | |
| Shower: _____ (gallons) x _____ (# of users) x 365 (days/year) = _____ (gallons/year) | |
| Laundry: _____ (gallons/load) x _____ (# loads/week) x 52 (weeks/year) = _____ (gallons/year) | |
| Total Annual Available Graywater Runoff = _____ (gallons/year) | |

How much laundry graywater do you create?

Assume you have a washer that uses 20 gallons per load. Do the math above!

What is your annual total? _____ gallons. Do the math for **one month** _____ gallons.

Annual demand for an Apple Tree:

2870 gallons year

410 gallons month of June

Do you make enough laundry graywater to water an apple tree? Fruit trees seem to like graywater!

Yes _____ No _____ Not in June! _____

Rain Water and Gray Water Worksheet

Gray Water Reuse

What will you use the gray water for? Fruit Trees!



| | | | |
|-----------------------------|-------------------------------------|--------------------------------|----------------------|
| # Standard Size Fruit Trees | 3 | | |
| # Semi-Dwarf Fruit Trees | 1 | Estimates based on: | Rainfall Bisbee 2018 |
| # of Dwarf Fruit Trees | 0 | # of Waterings per Month (gal) | |
| Month | Montly demand Fruit Trees (gallons) | | |
| Jan | 440 | 1.5 | |
| Feb | 440 | 1.5 | |
| Mar | 586 | 2 | |
| Apr | 1026 | 3.5 | |
| May | 1465 | 5 | |
| Jun | 1465 | 5 | |
| Jul | 1172 | 4 | |
| Aug | 1172 | 4 | |
| Sep | 1026 | 3.5 | |
| Oct | 586 | 2 | |
| Nov | 440 | 1.5 | |
| Dec | 440 | 1.5 | |
| Annual Total | 10,255 | | 1 |

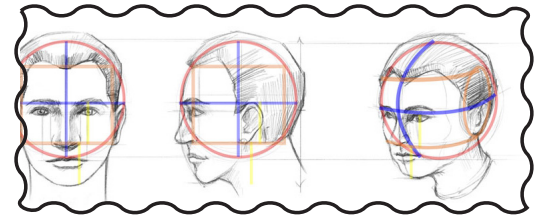
Fruit Tree Watering based on 6/26/09 watering guidelines - wetting band for:

| | | |
|----------------------------------------------------------------------|--|--|
| Standard Fruit Trees 14' Canopy Diameter at 82 gallons per watering | | |
| Semi-Dwarf Fruit Trees 8' Canopy Diameter at 47 gallons per watering | | |
| Dwarf Fruit Trees 3' Canopy at 18 gallons per watering | | |

Rain Water and Gray Water Worksheet

How can I track my water use?

Track your water use by calculating your gpcd monthly using your water bill! Did you know that 30% - 80% of residential water is used outdoors. Look at a winter bill to estimate how much you use indoors versus outdoors when your watering is at its lowest.



In the water world, how much water a person uses each day is known as GPCD—gallons-per-capita-per-day.

'Per capita' means 'per head' or 'per person.'

Quite recently, it was reported that residents used **58.1** gallons each per day, on average, during January 2017—the lowest amount ever recorded in the state! The state of **CALIFORNIA!** **ARIZONA** residents use about **100** gallons per day—making our state-average **GPCD 100**. Can we **Arizonans** pull ahead of the **Nanny State!**!?

Take out your water bill-or pull it up on-line-and plug in your numbers.

| | Gallons used this month | | Number of people in household | | Number of days in month | | GPCD |
|------------------------------|-----------------------------------|---|-----------------------------------|---|----------------------------------|---|-------------------------|
| If in CCF units | 17 ccf 17 x 748 = 12,716 | ÷ | 4 people 12,716 ÷ 4 = 3179 | ÷ | 30 days 3179 ÷ 30 = 105.96 | = | 106 gal. per person/day |
| If in 1000 gal. units | 15 units 15 x 1000 = 15,000 | ÷ | 5 people 15,000 ÷ 5 = 3,000 | ÷ | 30 days 3,500 ÷ 30 = 100 | = | 100 gal. per person/day |
| Insert your numbers | | ÷ | | ÷ | | = | |

YOUR SCORE

Excellent: 30-80 GPCD
Good: 81-150 GPCD
Fair: 151-300 GPCD
You Need Help! 300 GPCD or above

For help calculating or bringing down your GPCD, call Water Wise at 520-458-8278 x2139 or go to <https://waterwise.arizona.edu/>

MaryAnn Capehart
 Water Wise Community
 (520) 458-8278 x2139
 1140 N Colombo Avenue
 Sierra Vista, AZ 85635
 Email: capehart@email.arizona.edu
 Website: waterwise.arizona.edu



Cooperative Extension
 Cochise County