

Ready Set Grow! Water Storage Webinar 7.20.22:

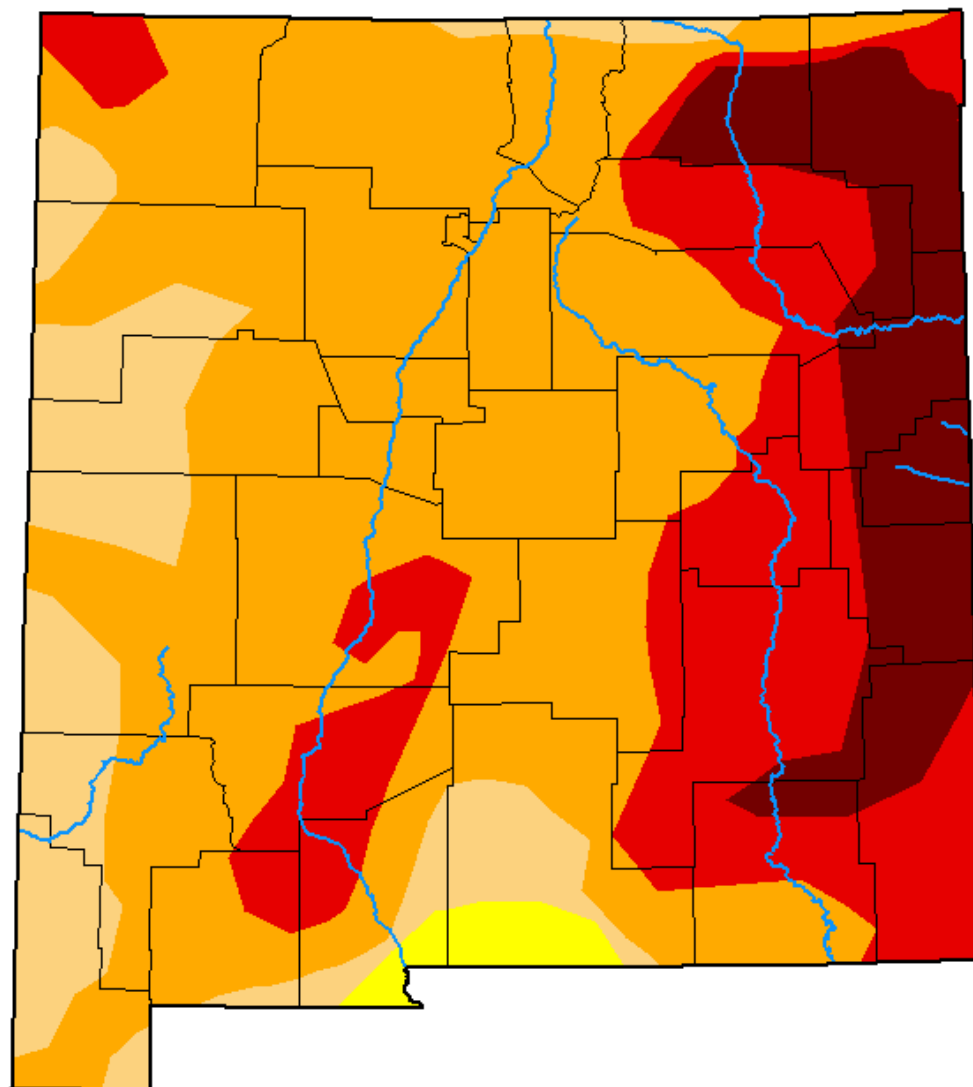
Rain Water Harvesting for the Landscape

By Sandra Liakus, Sandoval Extension Master Gardener



U.S. Drought Monitor New Mexico

July 12, 2022
(Released Thursday, Jul. 14, 2022)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|-------|--------|-------|-------|-------|-------|
| Current | 0.00 | 100.00 | 98.45 | 85.50 | 32.76 | 11.28 |
| Last Week 07-05-2022 | 0.00 | 100.00 | 98.45 | 94.89 | 57.11 | 11.35 |
| 3 Months Ago 04-12-2022 | 0.00 | 100.00 | 98.94 | 93.32 | 52.03 | 7.17 |
| Start of Calendar Year 01-04-2022 | 0.00 | 100.00 | 97.83 | 75.86 | 20.91 | 0.00 |
| Start of Water Year 09-28-2021 | 10.70 | 89.30 | 79.47 | 49.33 | 19.12 | 0.00 |
| One Year Ago 07-13-2021 | 7.10 | 92.90 | 85.44 | 70.97 | 46.81 | 24.73 |

Intensity:

| | |
|---------------------|------------------------|
| None | D2 Severe Drought |
| D0 Abnormally Dry | D3 Extreme Drought |
| D1 Moderate Drought | D4 Exceptional Drought |

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Brian Fuchs
National Drought Mitigation Center



droughtmonitor.unl.edu

Rain Water Harvesting Definition

**Collection, Storage and Diversion of Rainwater
for later or delayed usage**

- Both Active and Passive Options Exist:
 - Home Roof-top Run Off Into Storage Vessels
 - Landscape Features – Berms, Dry Creeks, swales
 - Other Hard Surfaces – Driveways; Parking areas, Patios

Seeking Alternate Sources of Water

54% of Water Usage for Single Family Residences
is Outdoor Watering –

www.ose.state.nm.us.org

“The Mighty
(Dry) Rio
Grande”

The Albuquerque
Journal Photo Summer
2013



Alternate Water Collection Sources (non-potable)

1. **Black Water** is toilet waste.
2. **Gray Water*** is untreated wastewater that has not come in contact with toilet waste or other contaminated sources.
3. **Reclaimed Water** is the tertiary treatment of domestic wastewater by a public agency and is suitable for a controlled use.
4. **Harvested Rainwater** is storm water that is conveyed from a building roof, stored in a cistern and can be diverted for landscape irrigation.

*New Mexico Gray Water Guide; ose.state.nm.us

Rain Water Harvesting (RWH)

- It may supplement existing potable water irrigation
 - passive systems/ and small rain barrels under canals, or by direct gutter run-off into landscape
- It can be a major source of outdoor irrigation – cistern systems with gravity or pumped diversions
- Theoretically, it can replace all outdoor potable irrigation - “*Roof Reliant*” Landscaping

History of RWH

Ancient Romans built large underground water reservoirs that are still evident in Turkey. Individual Roman residences had smaller cisterns to supplement aqueduct water.



History of RWH

Systems were a common sight in the US in the early 20th century. Urbanization and the availability of public water systems soon replaced RWH by the mid-20th century.

Photo: 1946 Wooden Cistern, Univ. of Louisiana Photo archives.



Today: NM *Law* Governing Water Use

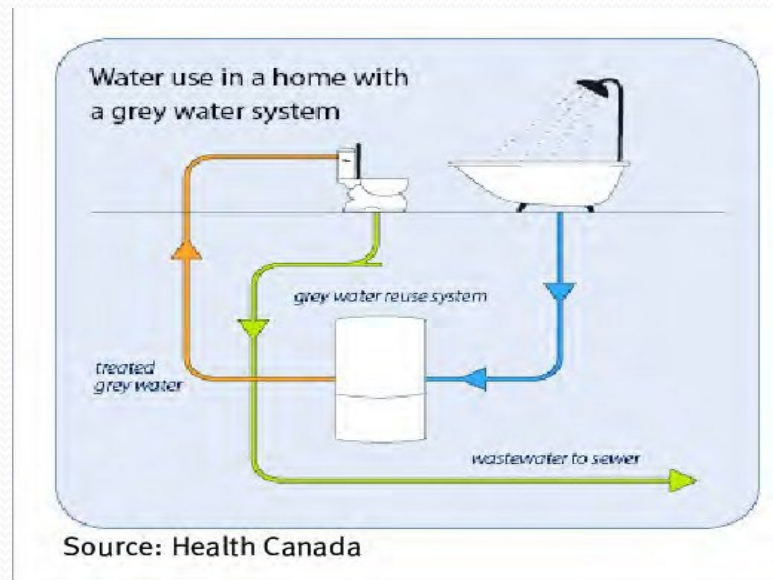
- Ground Water
 - In New Mexico all water rights are appropriated by priority - first in time, first in line.
- Grey Water and Reclaimed Water
 - Must Follow New Mexico Reuse Rules
- Harvested Rain Water for Outdoor Use
 - There are no state government requirements restricting outdoor use of rainwater for homeowners

RWH Legality in the NM

- Most homeowners can install and use a rainwater harvesting system for landscape irrigation without public health and water rights concerns. For larger-scale commercial projects, it is a good idea to check with the local OSE Water Rights Division to make sure the project does not inappropriately affect rainwater runoff into a stream system, therefore impacting a public water supply (NM OSE, 2005).
- Research Your City and Homeowners Association Codes

Grey Water Definition & Usage*

- Grey Water is wastewater from your laundry, shower, bathtubs & sinks
- Grey water is an excellent source of water to irrigate plants & compost piles
- Grey water is not wastewater from kitchen sinks and dishwashers per NM health regulations
- Half of the water you use indoors can be used as outdoor irrigation water during times of shortages (“drought proofing”)



*Grey Water Guide and Using Grey Water in Residential Landscape: ose.state.nm.us

RWH Works Best with the 7 Water Wise Principles of Xeriscaping

- Planning
- Soil Improvement
- Appropriate Turf
- Low Water Use Plants
- Efficient Irrigation
- Mulching
- Maintenance
- Add: Landscape Features to prevent run-off



Advantages of Harvesting Rain Water

- Conserves Water (Municipal and Well Sources) **“Protects our River and Aquifer”**
- RW is *FREE*
- RWH Conserves Energy
- Naturally Low in Salts
- Can Reduce Erosion by reducing water run-off from structures and landscape

Passive Rain Water Harvesting

- Landscape surface features that divert and slow rainwater flow to remote planting areas.
- Will often have the dual purpose of preventing property erosion
- Will always take advantage of gravitational flow and containment

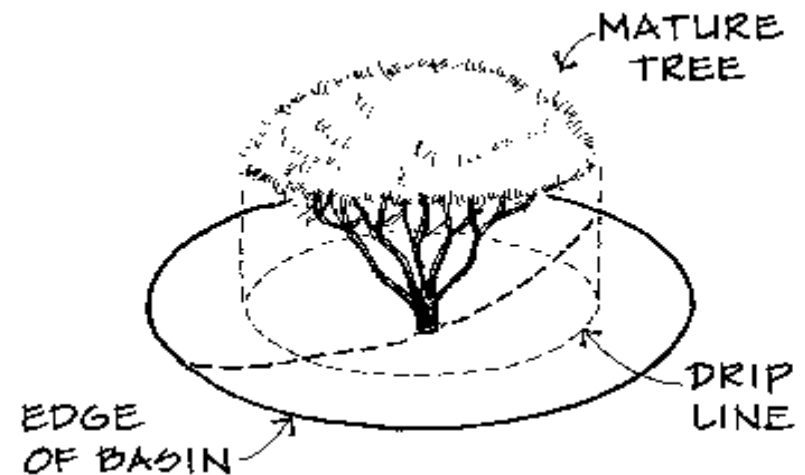
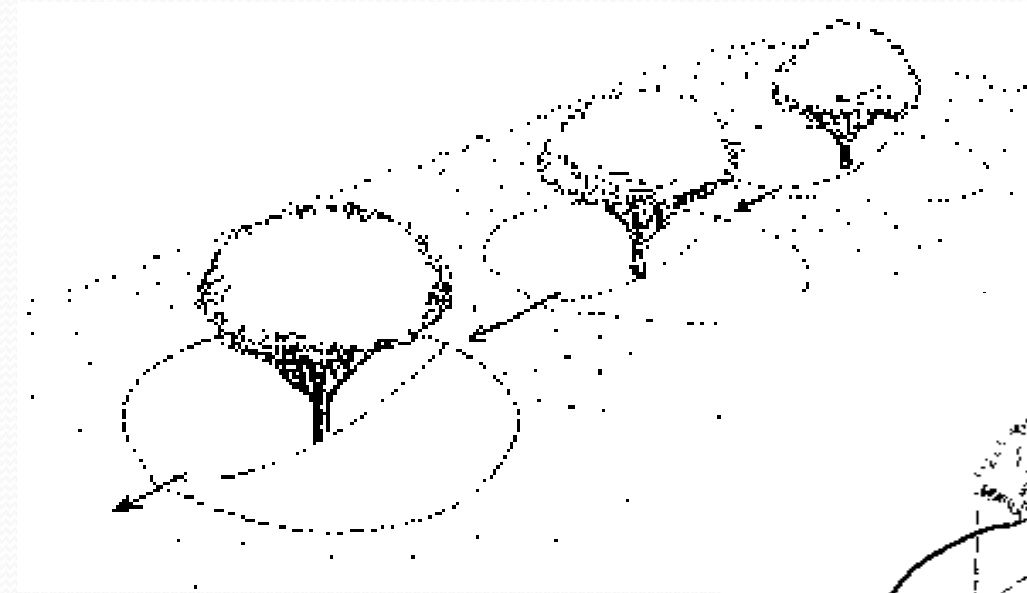
Passive Rain Water Harvesting

Landscape Catchment Basin/ Dry Creek/ Swale



Passive Rain Water Harvesting

Berms Provide Catchments for Rain or Irrigation



Images Source:

<https://www.ose.state.nm.us/WUC/brochures/rainwater-harvesting.pdf>

Passive RWH Systems

Terracing of Steep Slopes, Planting and Mulching



Passive RWH System

Driveway Catchment Run-off into a Concave
Landscaped Area Bordered by a Bermed Rim

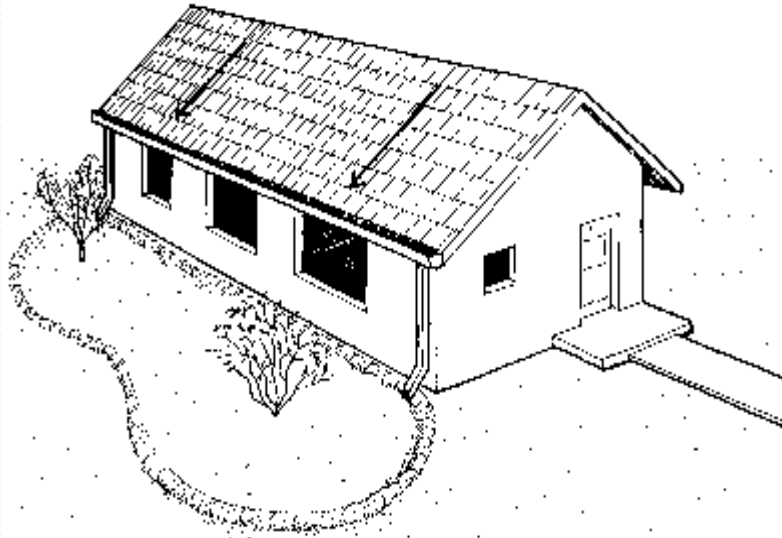


Active Rain Water Harvesting

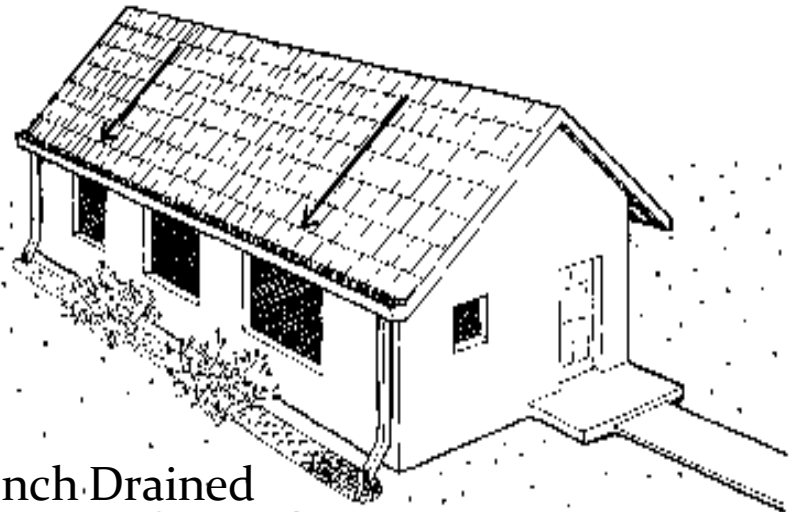
- Involves the Following Minimal Components (CC&D):
 - **Collection** of rain and snow melt water from roof-top
 - **Conveyance** of collected water by Canales or Gutters
 - **Diversion** of the water to the Landscape
- Usually paired with a Passive RWH landscape features to deliver water to specific landscape locations

Simple Active RWH System

Roof Run-off & Gutters Provide Direct Flow into Planted Areas



Bermed Landscape



French Drained
Landscaped

Images Source:

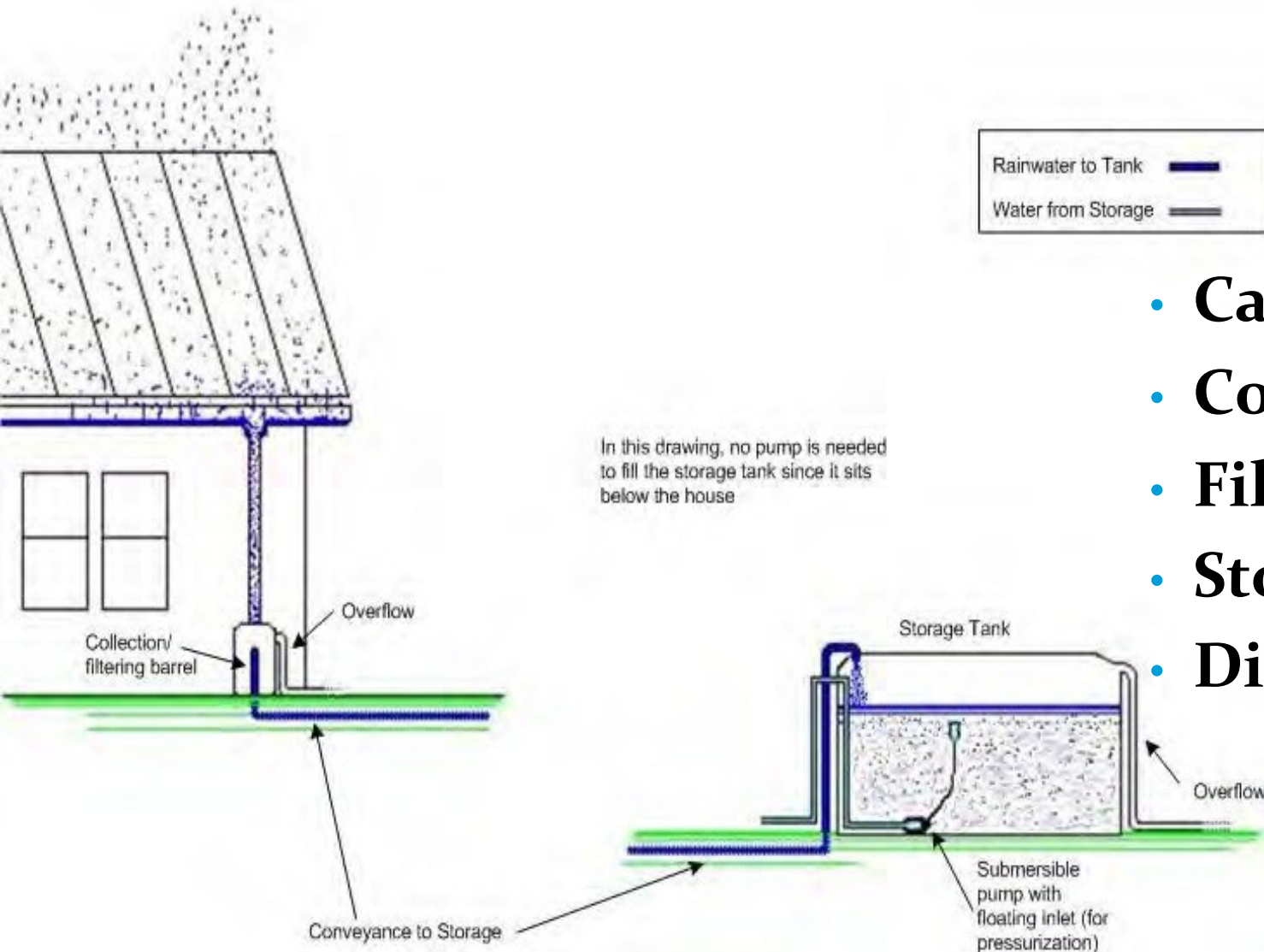
<https://www.ose.state.nm.us/WUC/brochures/rainwater-harvesting.pdf>

French Drain: May be Part of a Passive or Active RWH Collection System

- Subsurface pipe/ porous material that collects and moves water from one area to another using gravity.
- Water is moved to a remote storage cistern for active storage or to a remote planted area for passive landscape watering



Complex Active RWH System Example



- Catchment
- Conveyance
- Filtering
- Storage
- Distribution

Simple active Local RWH Storm System



Complex Active RWH Storm System (SSCAFCA) in Rio Rancho



SSCAFCA RWH Roof and Catchment Near Reliance

WHY WORRY ABOUT STORMWATER RUNOFF?

RUNOFF CAUSES FLOODING AND EROSION:
Local agencies spend a significant amount of taxpayer dollars each year to repair damage to public property caused by uncontrolled stormwater runoff.

RUNOFF IMPAIRS WATER QUALITY:
Stormwater runoff is recognized nationally as the leading cause of all water pollution today. Runoff can carry a collection of harmful agents such as sediment, bacteria, and chemicals that can threaten our water sources.



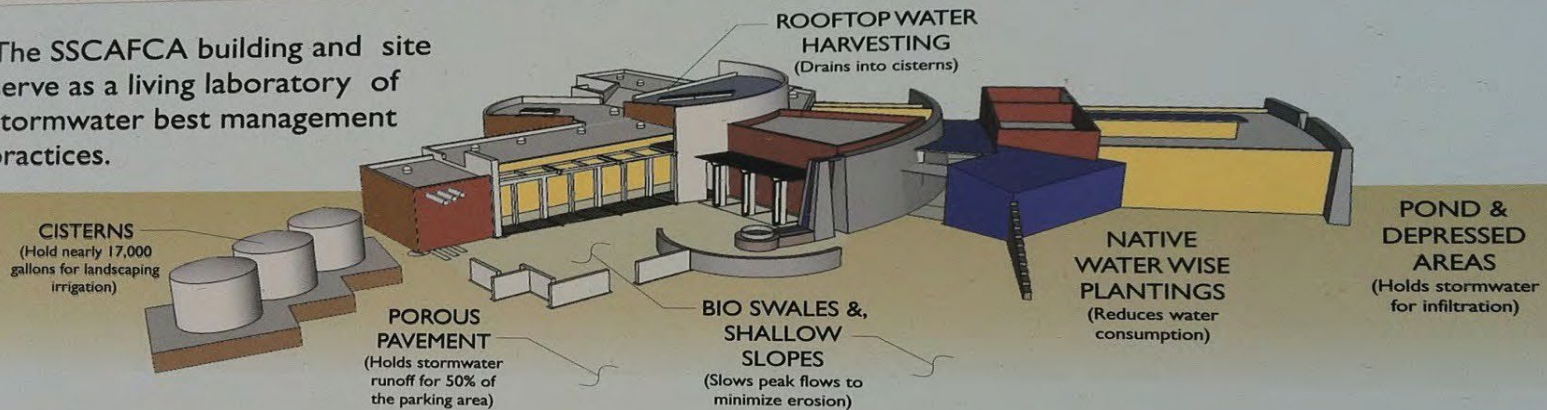
Chihuahua Rd. after a major storm,
July 2006



Chihuahua Rd. after drainage improvements,
August 2009

MANAGING STORMWATER RUNOFF AT SSCAFCA

The SSCAFCA building and site serve as a living laboratory of stormwater best management practices.



WHAT YOU CAN DO!

RAINFALL: USE IT, DON'T LOSE IT!

Capture the rainfall from your roof and yard and use it to water your landscaping. This reduces runoff and can lower your irrigation costs. Try these ideas:

BELOW: A simple ("passive") rainwater harvesting system, with no water storage.



RUNOFF: SLOW THE FLOW!

Reduce the speed of runoff entering and leaving your property.

SSCAFCA (Southern Sandoval County Arroyo Flood Control Authority) Sustainable Design

- Collection of Rainwater for Irrigation and Wildlife Pond
 - 8000 Gallons in the front
 - 5000 Gallons in the back
- Permeable Parking Surface
- Reduction of Storm Water Run-Off through Collection and Landscape Features

Building Location at 1041 Commercial Dr. SE in Rio Rancho

Active RWH System using Gravity

- Double Rain Barrel with overflow, stacked on cement Blocks to make room For watering cans



Active RWH System With Barrel

- 500 gal. custom plastic rain barrel placed under a roof canale with run-off to a fountain swale and ball valve shut-off fitting for connection to a pump



Active RWH System Barrel Delivery

Pump assembly attachment used to deliver stored barrel water to plants at higher elevation



Active RWH System – Large Tanks

Active Rainwater Systems Use of large Containment Tanks to Store Water for Later Use



Underground Cistern System

Better Suited for New Construction. Consult City or Housing Development Codes



Underground Cisterns (2)



How Much Rain Water Can I Collect?

- Limited by the Size of the Storage Vessel
 - Barrels range from 25 Gal – 1000 Gallons
 - Cisterns - Tanks 1500 Gallons and Above (Above Ground or Underground and Closed)

“You can only collect what you can store”

Roof Catchment Areas- Flat vs. Sloped Roof



Flat Roof Section -actual
rectangular area ($l \times w$)

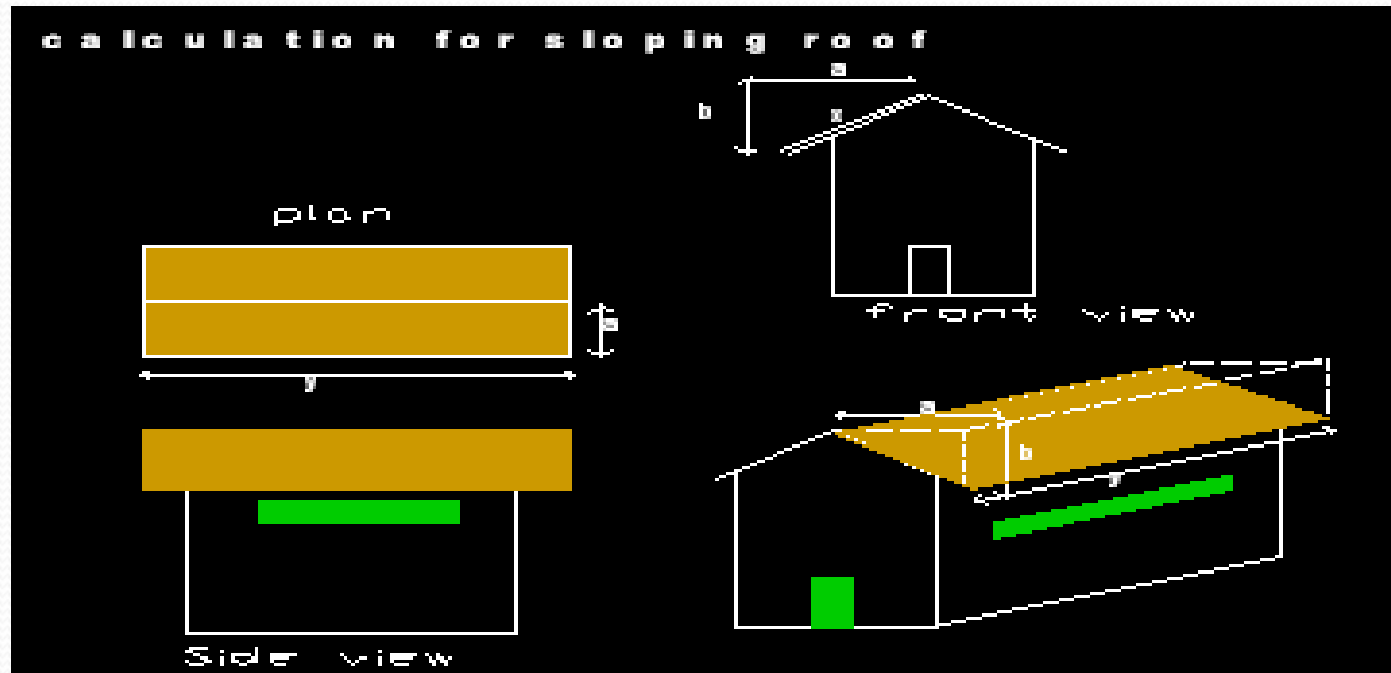


Sloped Roof - Sum of
Horizontal Projected Areas

How Much Rain Water Can I Collect?

- Calculate Run-off from the Catchment Surface
 - Flat Roof – use sum of rectangular area(s)
 - Sloped Roof – use the effective area or horizontal projected area ($a \times y$). *This is the area projected by the roof.*
 - Break Irregular Roof Sections into smaller rectangles and triangles

Sloped Roof Effective Area



Calculating Roof Top Runoff for Storage

Flat roof example:

- 1000 square foot catchment surface
- 1" rain X 1/12" / feet = 0.083 feet
- 1000 sq. ft X 0.083 ft = 83 cubic feet
- 83 cubic ft X 7.48 gallons/ cubic ft = 623 gallons – *loss due to runoff coefficient**)

*Note: *loss due to roof surface texture and irregularities*

Estimating Roof Top Runoff for Yearly Storage

- Multiply the total catchment area by the anticipated rainfall over the desired time period. For every 1 inch of rain falling on each square foot of roof, you will catch 0.62 gallons of water.
- For example, the average rainfall in New Mexico for a good year is 12 inches (*perfect efficient system assumption*)
 - 800 square foot roof results in a water catchment of 5,952 gallons/year
 - $800 \times 12 \times 0.62 = 5,952$ gallons
 - 2000 square foot of roof results in a water catchment of 14,880 gallons/year
 - $2000 \times 12 \times 0.62 = 14,880$ gallons

NM OSE Publications Provide Charts for Estimating Roof Top Runoff

Conveyance of Roof Top Water

- Canale or Gutter System
- A properly designed Gutter System is required for efficient Rainwater Collection
- Watch for Gutter Spill-Over where Sloped Roof Sections Intersect
- Gutters Must be Kept Clear of Debris

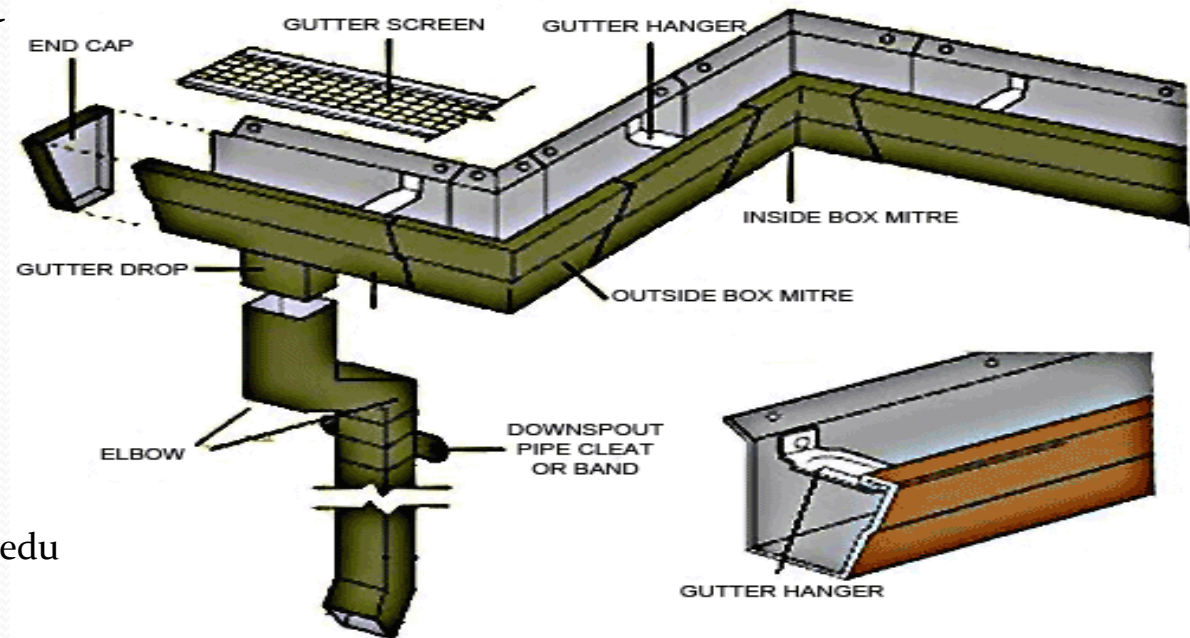


Image: catalog.extension.oregonstate.edu

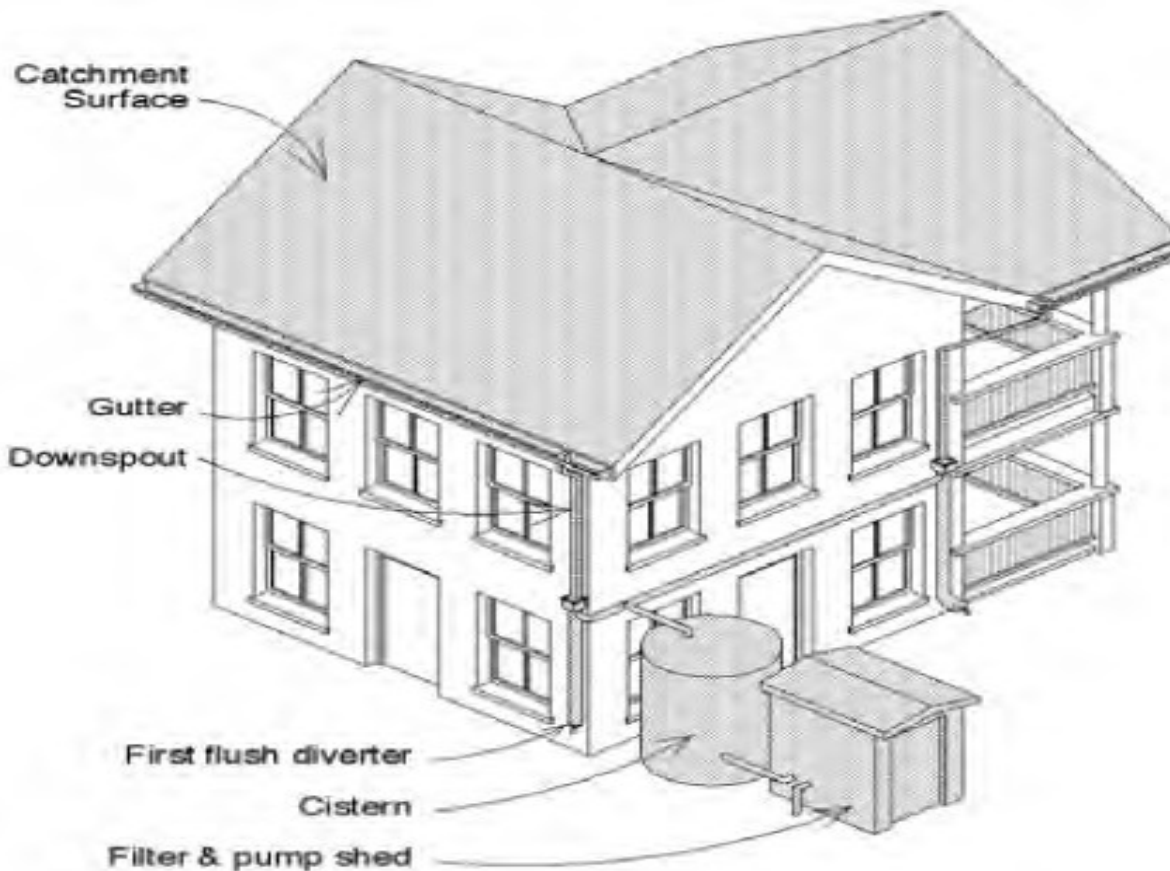
Conveyance of Roof Top Water

- A Closed or Guttered Canale Conveyance System



RWH System: How Clean is the Water?

- Use a First Flush Diversion



- **Rule of Thumb: Divert the first 10 gallons collected .**

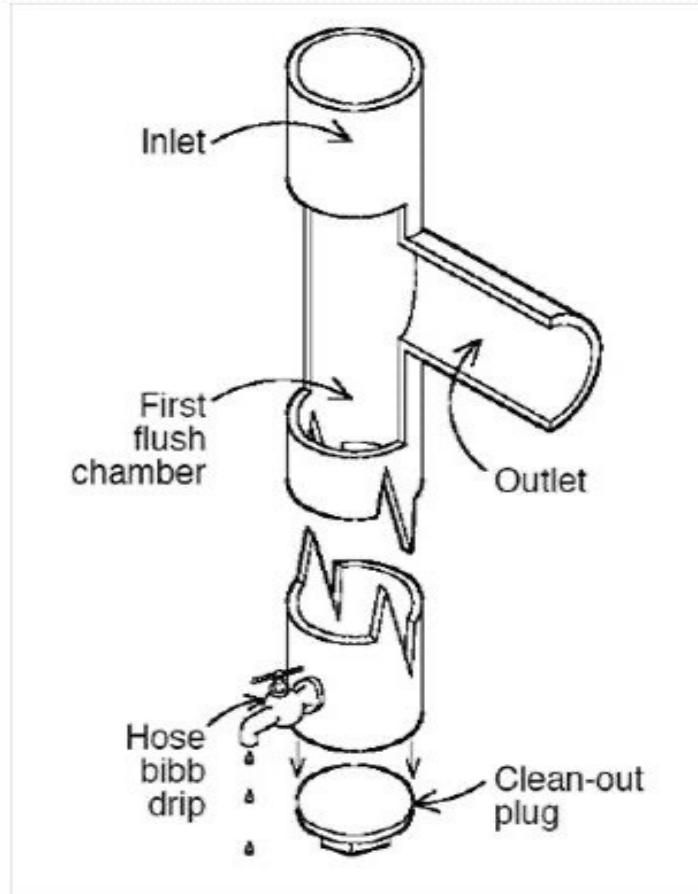
- **Ideal rate is 1 gal/ 100 sq. ft. of surface to reach clarity.**

- **First-flush volumes vary with the amount of dust and debris on the surface**

- function of the number of dry days
- the amount and type of debris

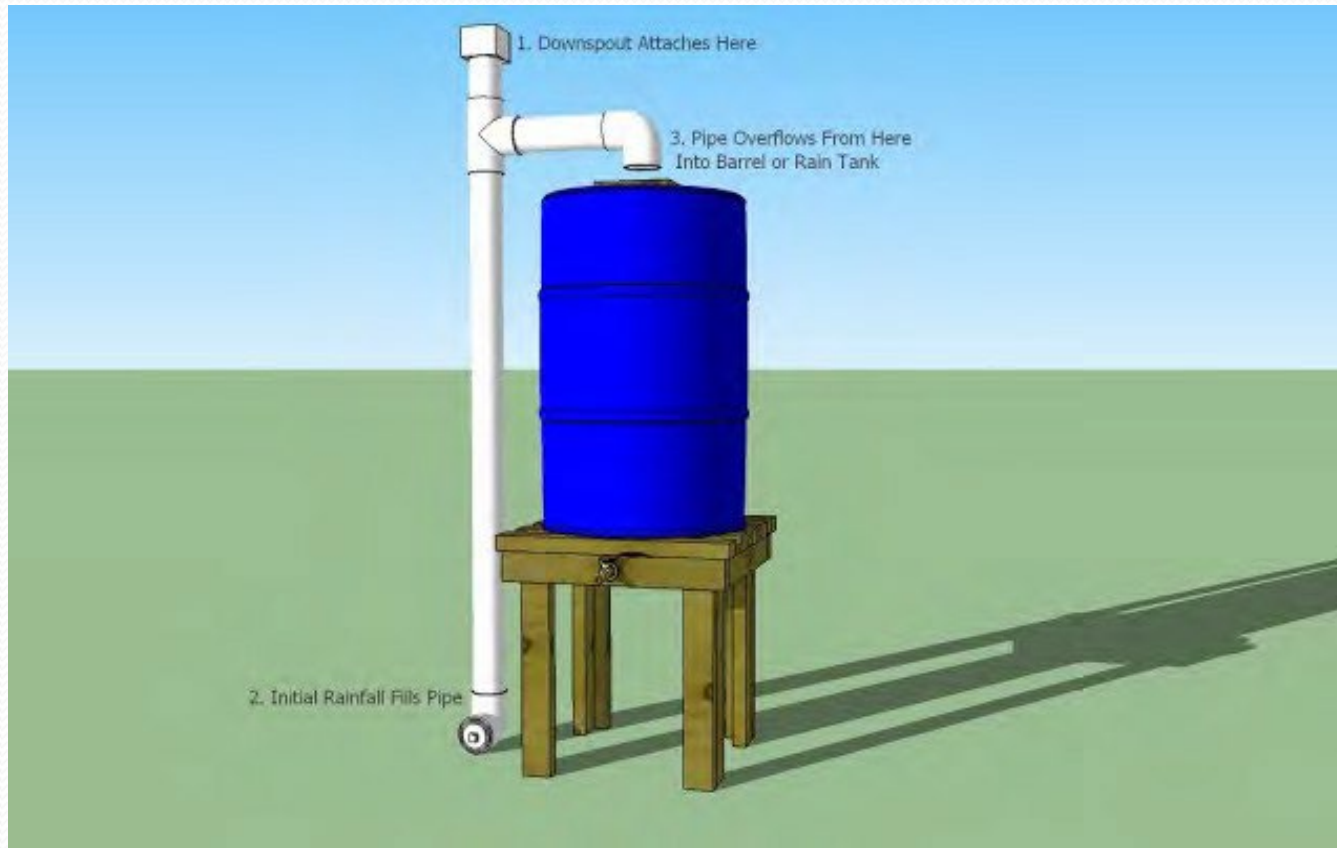
- **Sloped Roofs are more efficient in flushing than flat roofs.**

First Flush Diverter Pipe Cross Section



- The simplest first-flush diverter is a 6- or 8-inch Dia. PVC standpipe
- It fills with water first, backs up, and then allows water to flow into the main outlet to be collected
- The fitting at the bottom is emptied and cleaned out after each rainfall.

First Flush Standpipe Diverter Design

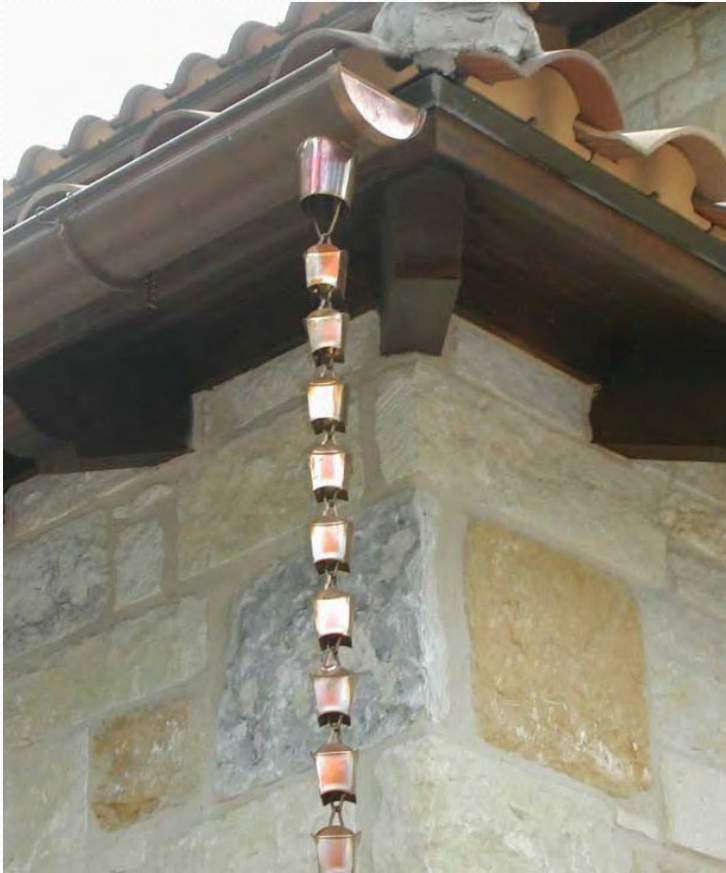


- Diameter Pipes and Lengths to Collect a Gallon of Water:
 - 3" diameter PVC or similar pipe needs 33" length
 - 4" diameter pipe needs only 18" length
 - 6" diameter pipe needs only 8" length

RWH System Accessories

- Water Chains to slow and direct roof run-off to container
- Screens for Rain Barrels
- Pumps/ Solenoid Valves/Back Flow Regulators
- Filters of all types – from simple screens to more complicated systems for potable water use (*not allowed by state law in New Mexico*)

Rain Chain from Gutter



Directs Run Off from
Gutter to Storage
without Splashing

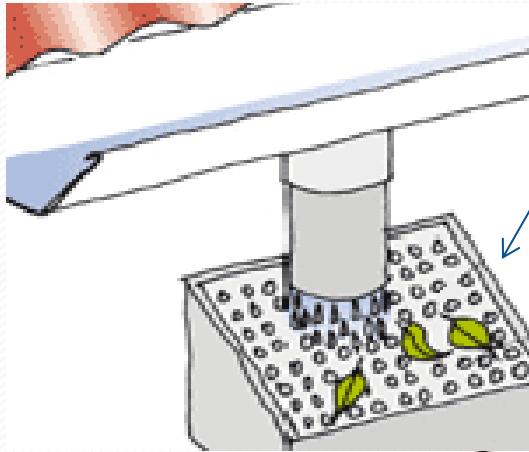
Rain Barrel Tops/ Screens



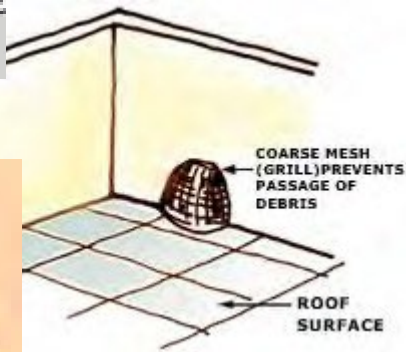
Homemade Top with Screen



Filtering Run-off from Roof



Leaf Catching
Screen Under
Down Spout



Water Purification Filter
Prior to Storage or
Diversion

RWH Storage Safety Concerns

- Use Leach Free Surface Barrels or Cisterns
- Clean Rain Barrels at Least Once per Season
- Use screened covers on barrels to prevent mosquito breeding and other contaminants
- It may be necessary to treat long term stored water with dilute bleach solution to reduce bacterial and fungal growth

RWH Storage Safety Issues!

- Cover Rain Barrels to prevent pets and children from entering
- Beware of Unstable Rain Barrels

The weight of a 55 gallon barrel filled to the rim with rainwater is:

- $55 \text{ gallons} \times 8.34 \text{ lbs/gal} = 458.7 \text{ lbs} + \text{Barrel weight}$
- Secure Your Rain Barrels!

“Roof Reliant Landscaping”

Technically speaking it is possible to rely on RWH for the irrigation of a prudently xeriscaped landscape without use of municipal water.

- Most cost effective for new or rural areas.
- May take years to develop

Ref: Roof-Reliant Landscaping Manual NM OSE

Do the Analysis!

“Roof Reliant Landscaping”

- Estimate yearly precipitation (min.) and calculate run-off volume from Catchment surfaces
- Design and Set Up - Gutter System or Other Conveyance
- Provide - Sufficient storage vessel(s) – large cisterns the best choice to collect run-off

Ref: Roof-Reliant Landscaping Manual NM OSE

Do the Analysis!

“Roof Reliant Landscaping” (cont.)

- Xeriscape - favor native plants and avoid overcrowding – planted over a 5-year period
- Landscape to promote the flow of water to plants and to reduce evaporation
- Set up Drip system - automated or by gravitational means



Ref: Roof-Reliant Landscaping Manual NM OSE

Remote Catchment RWH Systems

- Remote Catchment Surfaces may be utilized for gardens, orchards, livestock and wildlife remote water needs

Example: 1" Rainfall on a 10' x 10' Catchment Surface yields ~62 gal.



Remote Catchment RWH Systems



Remote Catchment RWH Systems



Wildlife Water Guzzlers

- Offset Collectors
- Above and In-ground storage



Water Storage: (RWH) Resources for the Landscape References

7.20.22 NMSU Ready Set Grow Presentation by S. Liakus, Sandoval Extension Master Gardener

Roof- Reliant Landscaping: Rainwater Harvesting with Cistern Systems in New Mexico,
www.ose.state.nm.us/wucp_RoofReliantLandscaping.html

Rainwater Harvesting in the Southwestern United States
A policy review of the Four Corners states
A research paper by Todd L. Gaston; May 6, 2012

A Water Wise Guide to Rain Water Harvesting; Water Use and Conservation Bureau, NM Office of the State Engineer

The Texas Manual on Rainwater Harvesting Texas Water Development Board in cooperation with Chris Brown Consulting Jan Gerston Consulting Stephen Colley/Architecture
www.twdb.state.tx.us/publications/reports/Rainwater_

HarvestH2o.com :: Regulations - The HarvestH2O .com
State by State Laws on Alternate Water Use
www.harvesth2o.com/statues_regulations.shtml

Albuquerque, New Mexico Rainwater Harvesting Manual

Albuquerque, New Mexico Rainwater Harvesting Manual ... Albuquerque, New Mexico Rainwater Harvesting Manual Document Transcript. A PUBLICATION OF THE CITY OF ALBUQUERQUE

Water Harvesting Calculations and Equations: Appendix 3 in “Rain- Water Harvesting for Drylands” – Volume 1 by Brad Lancaster

Photos by S. Liakus

Thanks to Cheryl Ganch for allowing me to show photos of her home erosion control landscape and water harvesting features that were inspired by the Rio Rancho Erosion Control and Water Harvesting Project 2008