Rainwater Harvesting Incentive Workshop

Presented by: Lincoln Perino

Program Goals

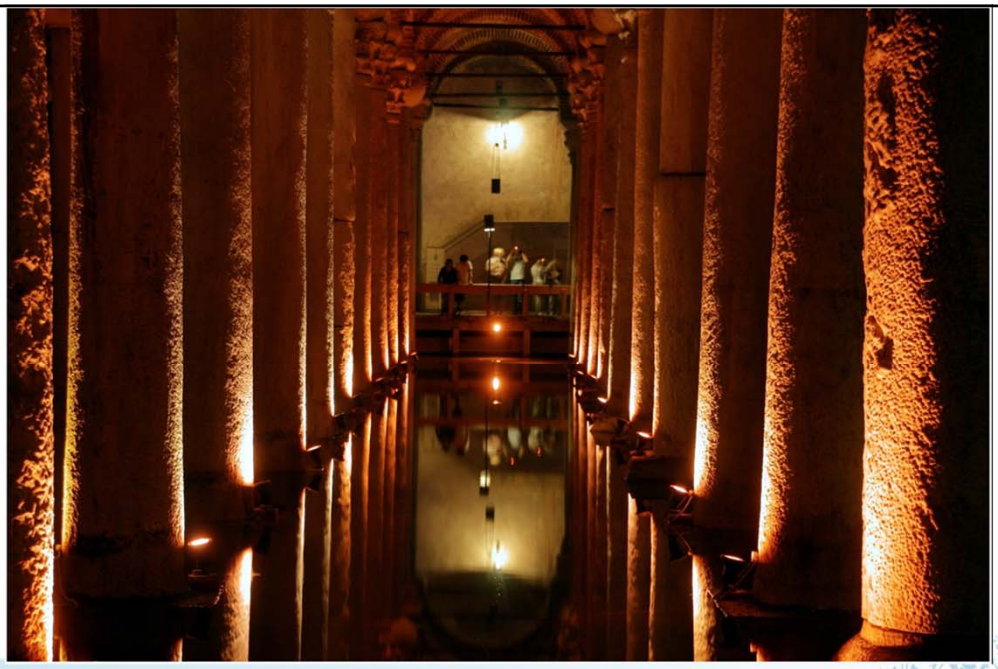
- Reduce potable water use *(demand reduction)*
- Promote and adopt Best Management Practices maximizing the effectiveness of integrated rainwater harvesting systems
- Continue evolving practices to move beyond sustainable practices towards regenerative practices/systems
- Enhance quality of life by growing right tree canopies in right place with right water

Learning Objectives

- What is rainwater harvesting and why do it?
- Best methods to conserve potable water utilizing rainwater harvesting *(organic mulch, right plant right place to eliminate need for irrigation, gravity-based irrigation systems to use tank rainwater, combine with greywater system, using low-water use trees to create shady microclimates, etc)*
- Selecting most appropriate passive and active rainwater harvesting system strategies *(1. define your goals first, 2. pair water resource with water need, 3. select appropriate strategy)*
- Ensure implementation of rainwater harvesting best management practices *(BMPs)*
- Be able to submit application for Tucson Water's rainwater harvesting incentive program and develop a rainwater harvesting project plan
- Understand basic concept of how to balance site water needs with available site resources

Why Harvest Rainwater?

- Reduce dependency on drinking water in landscapes – on average 27% of the water used goes to outdoor irrigation
- Water is a precious resource
- Rainwater is free! *(The water, not the infrastructure)*
- Water quality – rainwater is best water for soil and plants *(no salt, free natural fertilizer, helps balance pH of our alkaline soil)*
- Stormwater management – reduce on-site flooding and pollutant discharge and reduce downstream flooding



Principles of Rainwater Harvesting

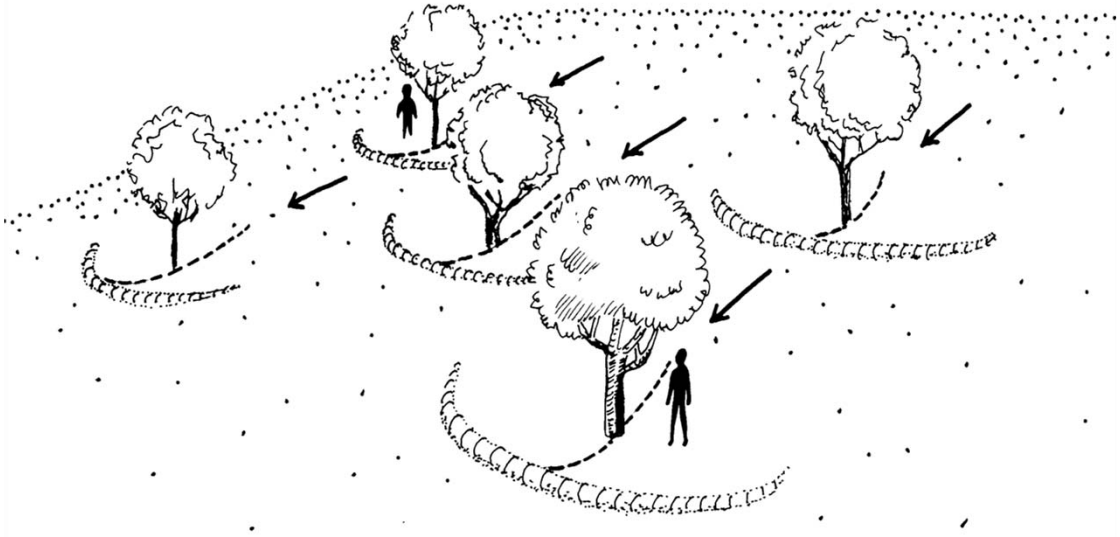
"Rainwater Harvesting for Drylands and Beyond"

1. Begin with long and thoughtful observation
2. Start at the top *(highpoint)* of your watershed and work your way down
3. Start small and simple
4. Slow, spread, and infiltrate the flow of water
5. Always plan an overflow route, and manage that overflow as a resource
6. Maximize living and organic groundcover
7. Maximize beneficial relationships and efficiency by "stacking functions"
8. Continually reassess your system: the "feedback loop"

Rainwater Harvesting System Components

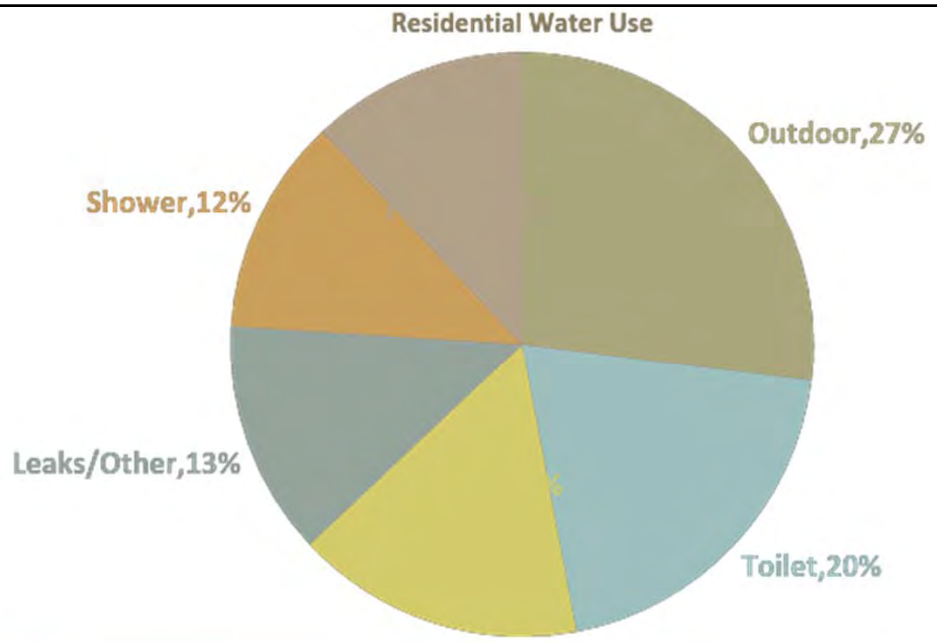
Three main components:

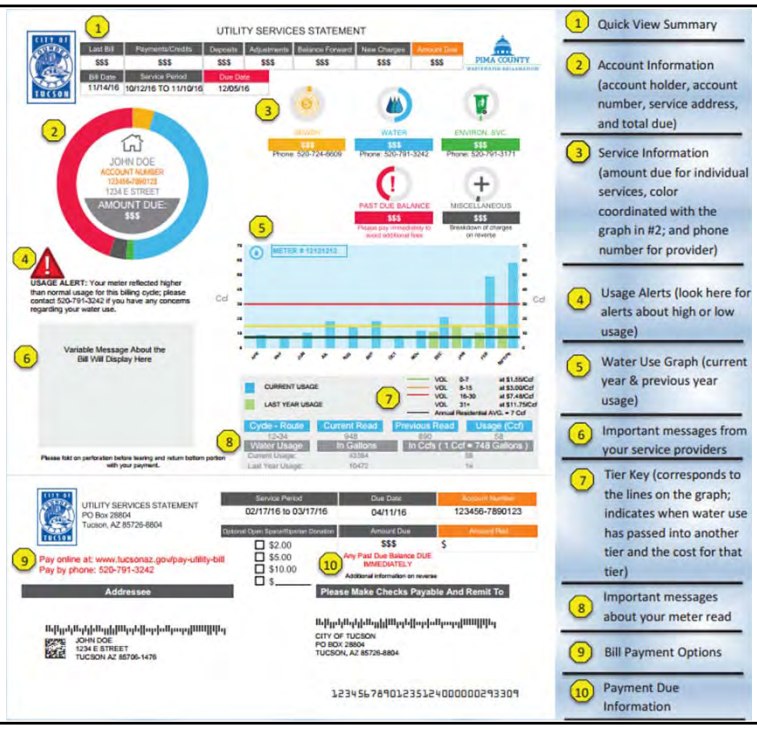
- the supply *(rainfall),*
  - runoff can be harvested *(captured and stored in tank or soil)* and used to water plants
- the demand *(plant water requirements),*
  - water use *(typical plant water requirements)*
- and the system that moves water to the plants *(water collection and distribution system)*
  - catchments, gutter, pipes, swales, basins

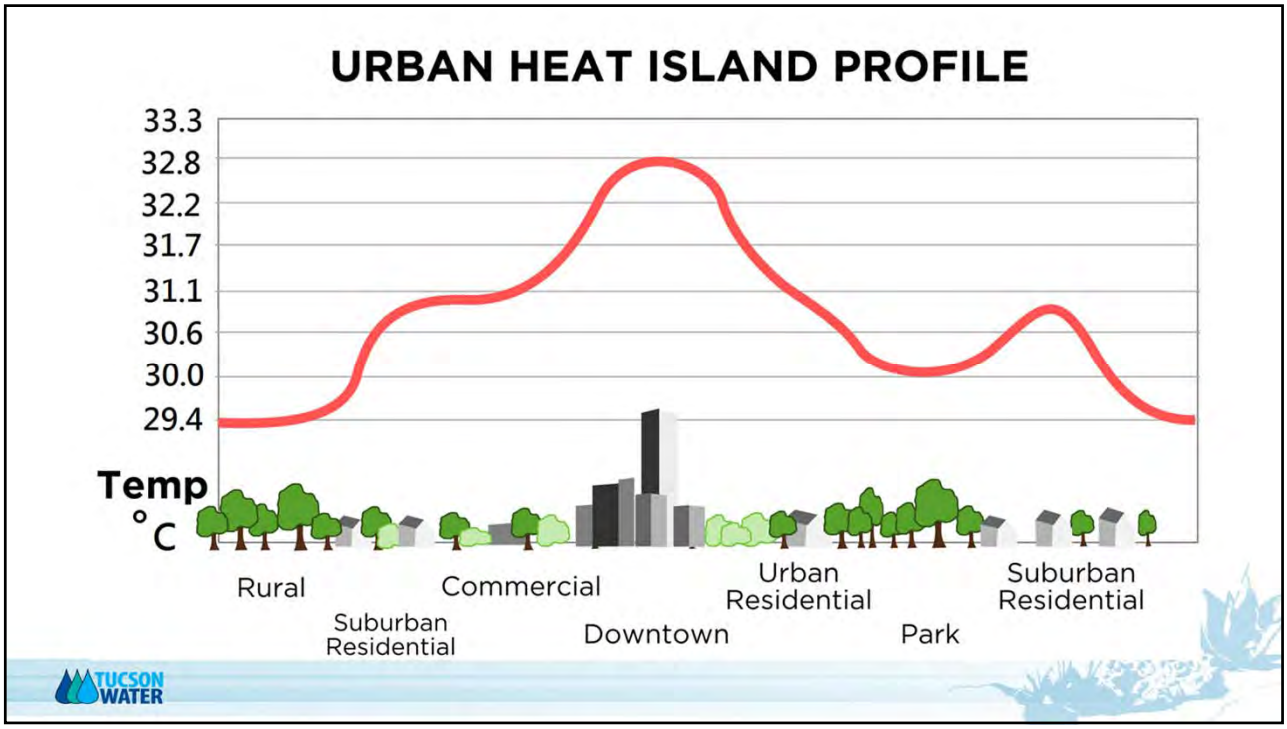


How much water are we using right now? Where does it come from?

WATER IN RECENT TIMES



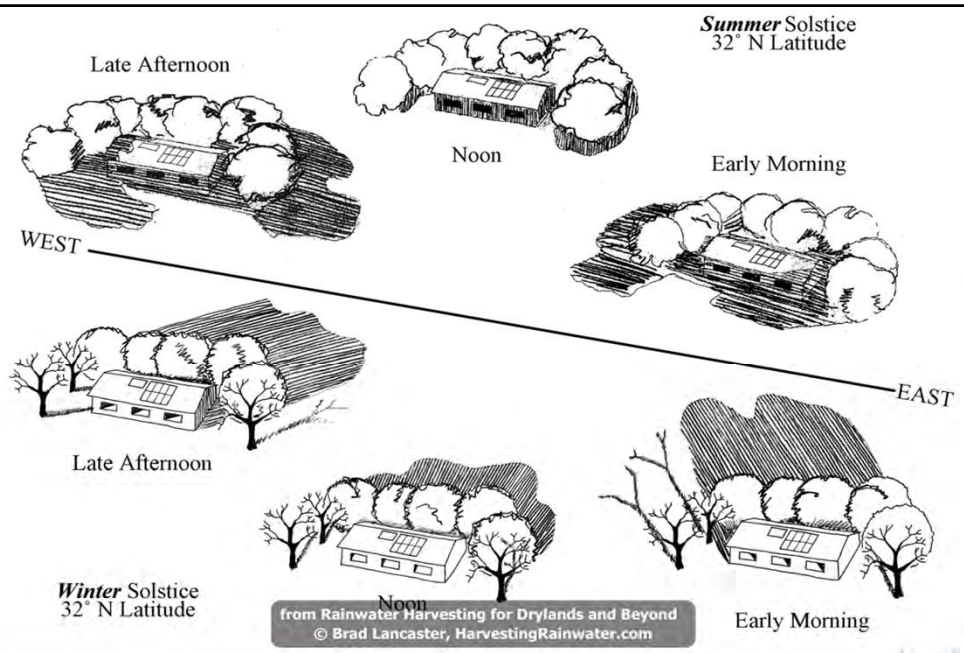

UTILITY SERVICES STATEMENT
JOHN DOE
AMOUNT DUE:
USAGE ALERT: Your meter reflected higher than normal usage for this billing cycle; please contact 520-791-3242 if you have any concerns regarding your water use.
Variable Message About the Bill Will Display Here
CURRENT USAGE
LAST YEAR USAGE
Pay online at: www.tucsonaz.gov/pay-utility-bill
Pay by phone: 520-791-3242
Addressee
Please Make Checks Payable And Remit To
CITY OF TUCSON
PO BOX 28804
TUCSON, AZ 85726-8804
1 Quick View Summary
2 Account Information (account holder, account number, service address, and total due)
3 Service Information (amount due for individual services, color coordinated with the graph in #2; and phone number for provider)
4 Usage Alerts (look here for alerts about high or low usage)
5 Water Use Graph (current year & previous year usage)
6 Important messages from your service providers
7 Tier Key (corresponds to the lines on the graph; indicates when water use has passed into another tier and the cost for that tier)
8 Important messages about your meter read
9 Bill Payment Options
10 Payment Due Information


URBAN HEAT ISLAND PROFILE
33.3
32.8
32.2
31.7
31.1
30.6
30.0
29.4
Temp °C
Rural
Suburban Residential
Commercial
Downtown
Urban Residential
Park
Suburban Residential

Old ideas, new applications.

THINKING ABOUT THE FUTURE

Green Island effect
Improved soil quality and plant growth
Flood and Erosion Control


Summer Solstice
32° N Latitude
Late Afternoon
Noon
Early Morning
WEST
EAST
Late Afternoon
Winter Solstice
32° N Latitude
Noon
Early Morning
from Rainwater Harvesting for Drylands and Beyond
© Brad Lancaster, HarvestingRainwater.com

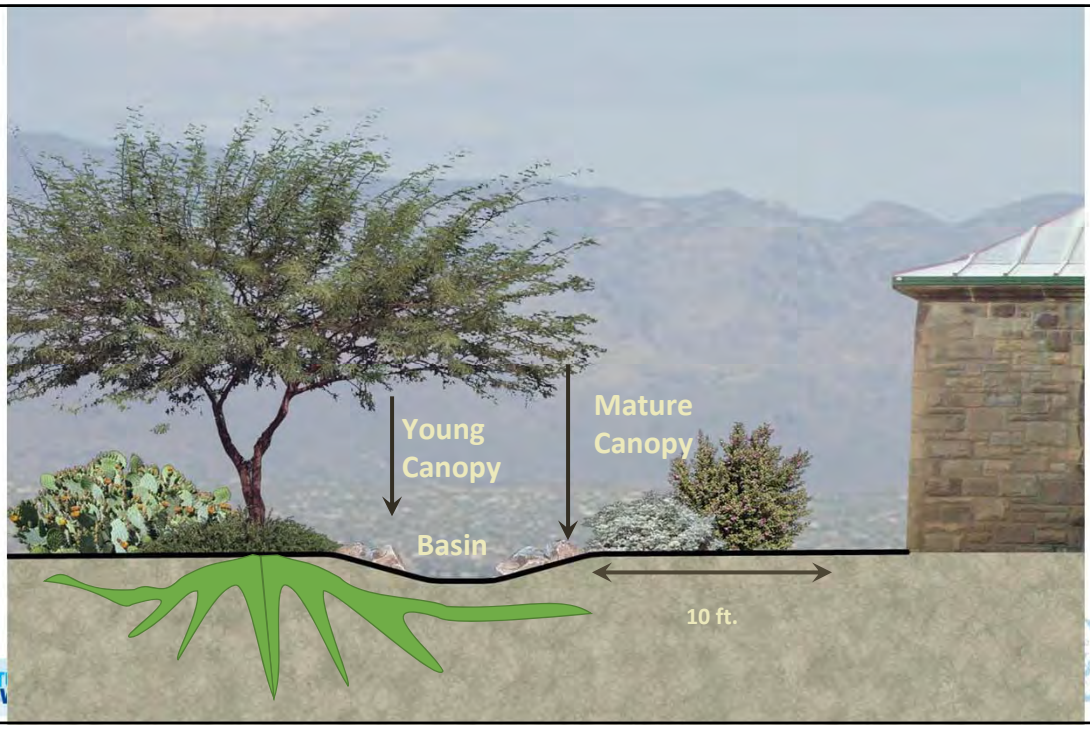
Passive Rainwater Harvesting

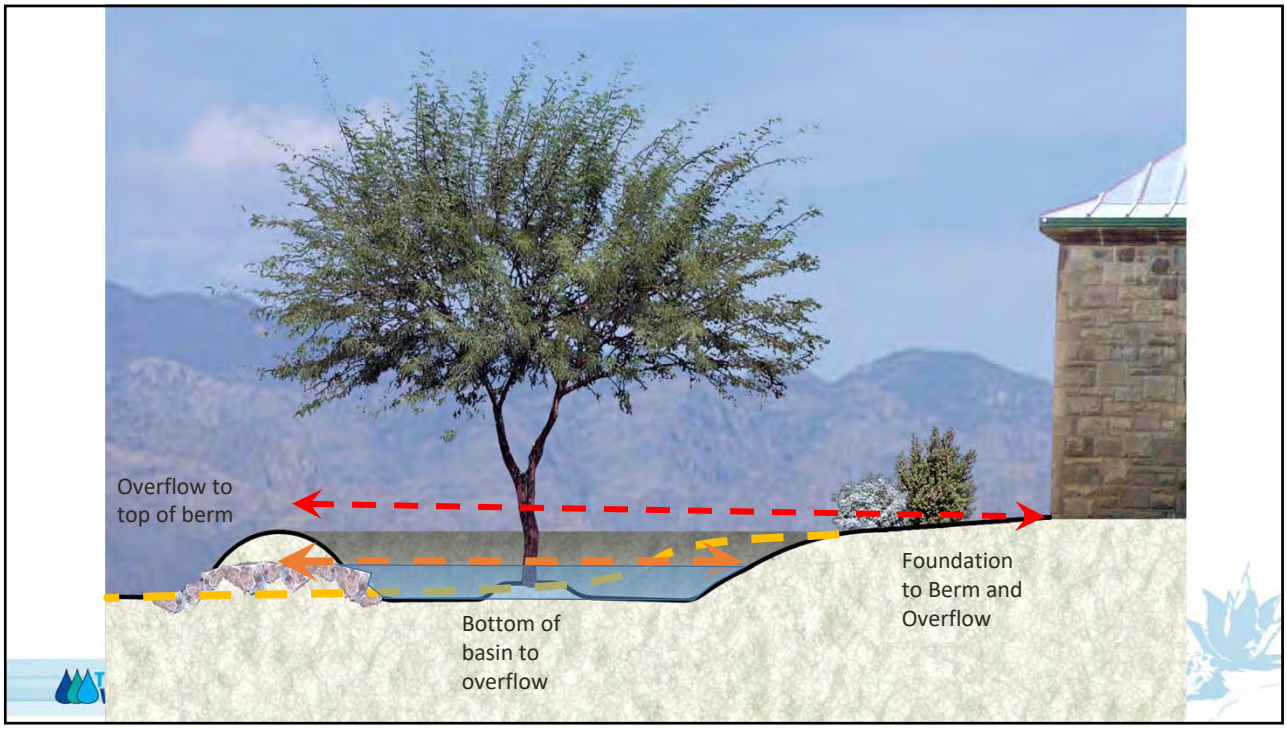
Site Analysis

- Where is water already gathering?
- How to get the water to where you need it?
- Identify other sources of water *(e.g. AC condensate, greywater, stormwater, etc)*

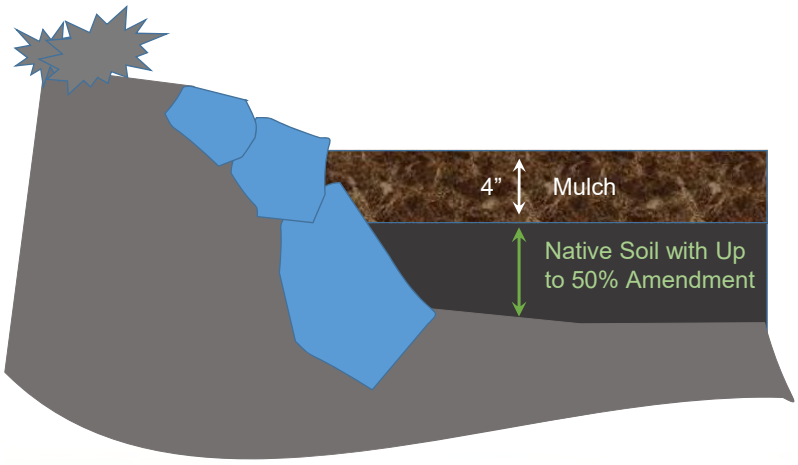
Distribution Systems

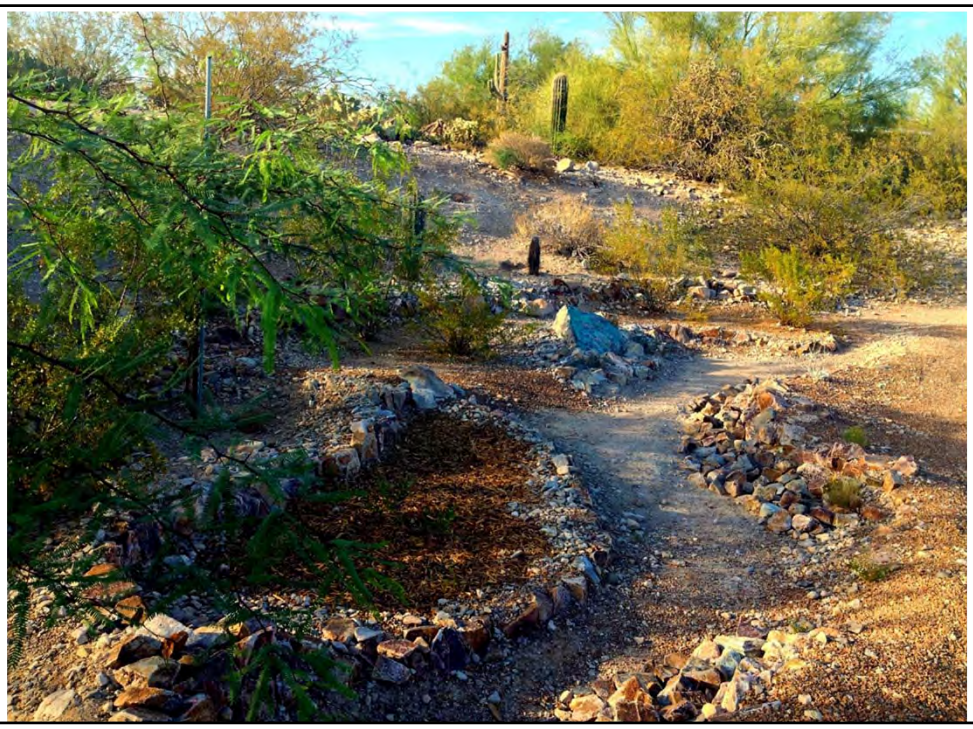
- Examples: earthworks, berms, basins, swales, channels, infiltration trenches and wicks





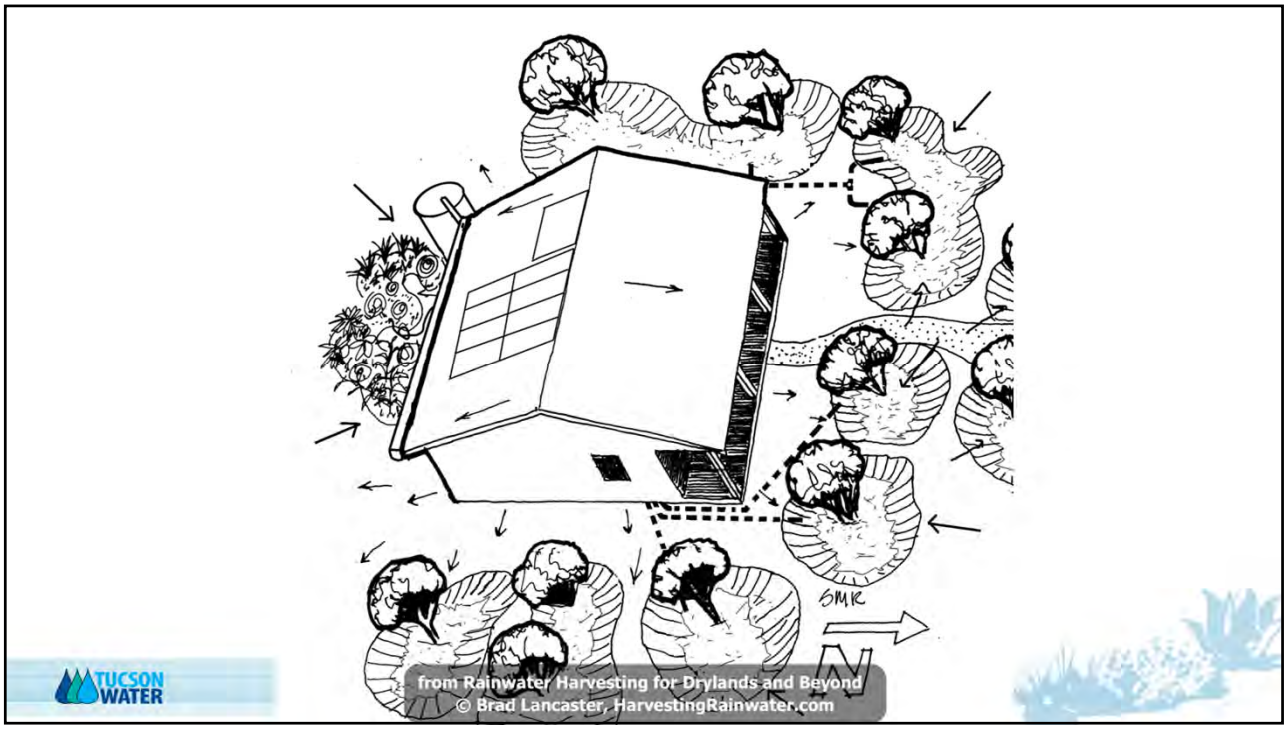
Mulched Basin Example





Design Considerations

- Uses of landscape
  - Frequent vs. Intermittent
- Sizing
- Proximity to source
- Utilities
- Future growth of plants
- Watershed characteristics
- Must have plants
- Drain within 24 hrs.


S.M.R.
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TUCSON WATER
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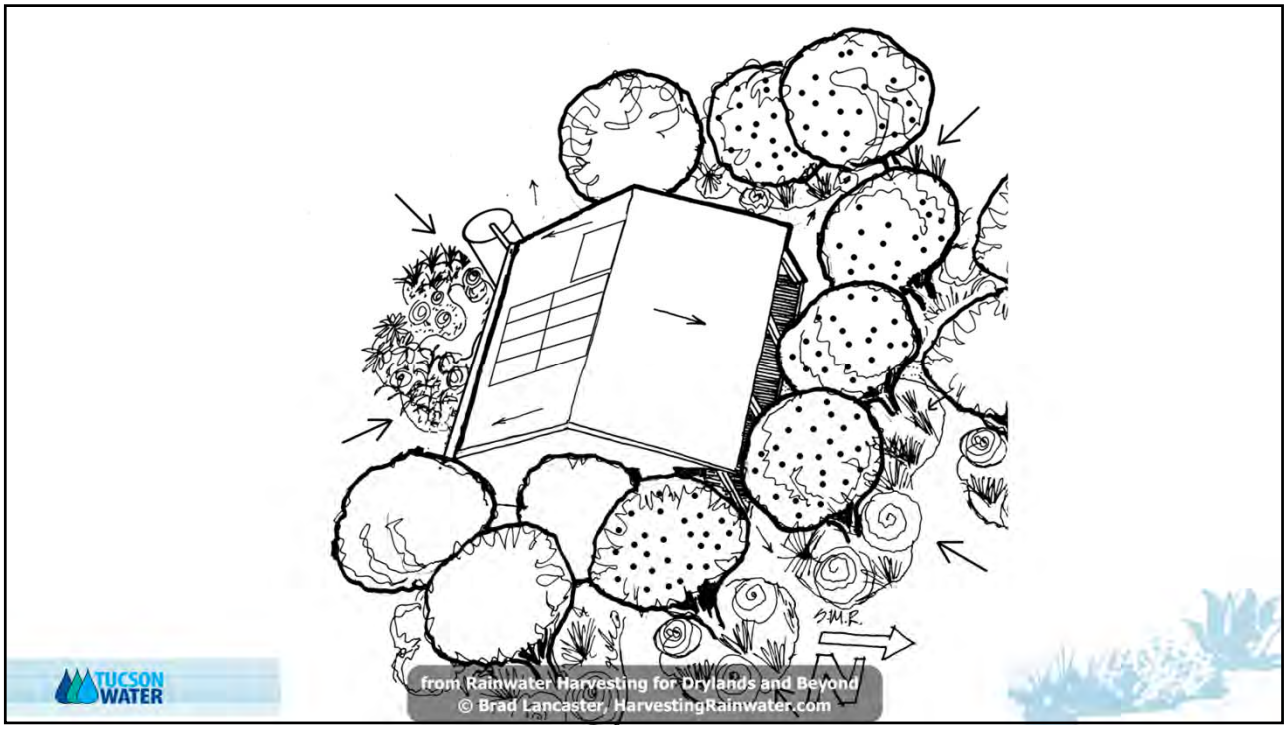
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Maintenance

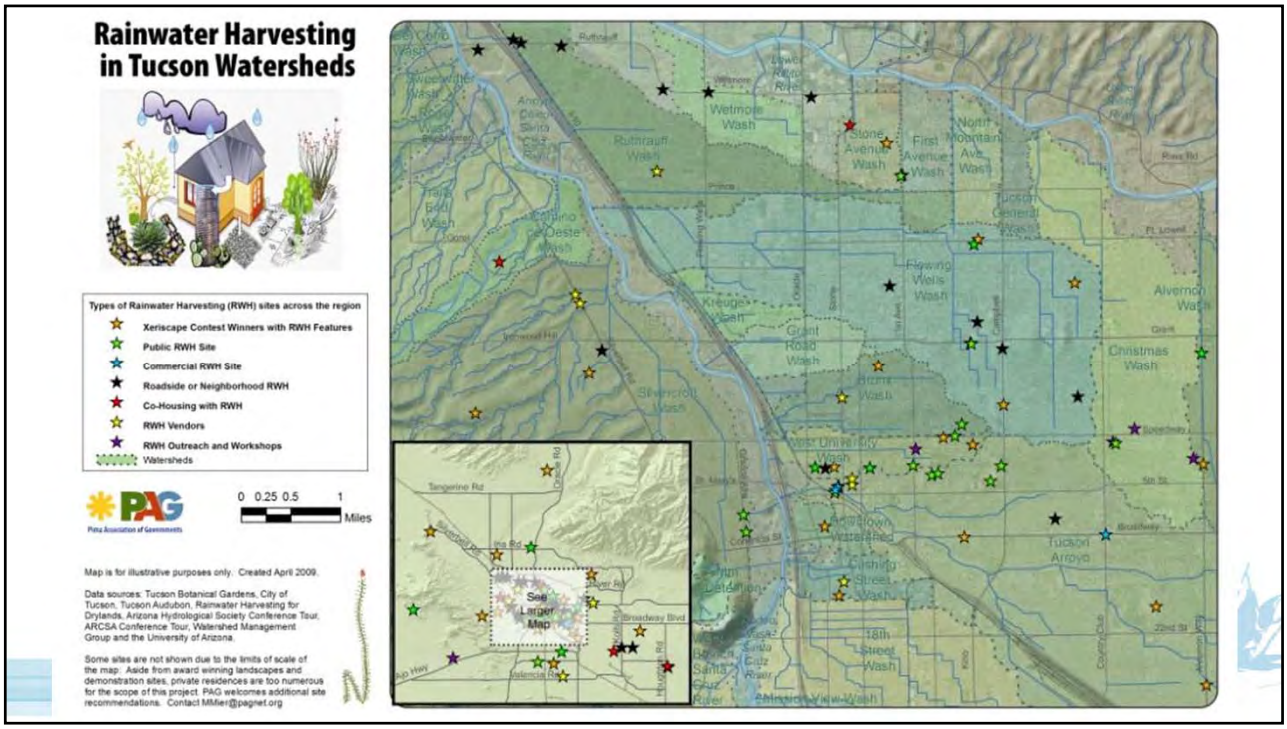
- All earthworks are susceptible to erosion
  - Basins and swales will slowly fill
  - Berms will slowly melt
- Mulch will need to be replenished
- Rock may become dislodged or settle unevenly

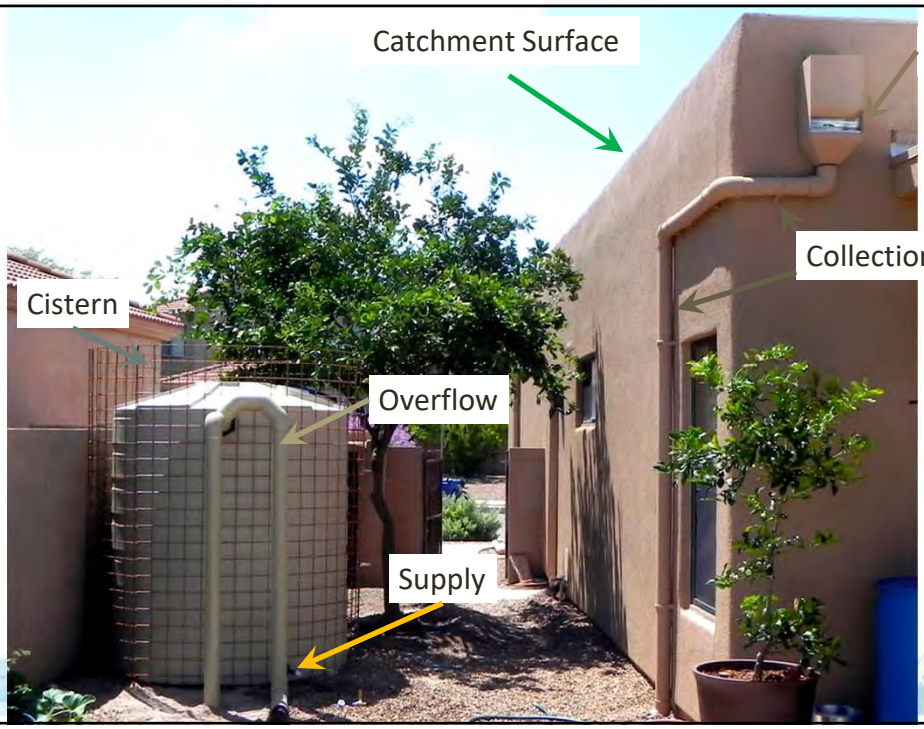
Public Demonstration Sites

The Nature Conservancy

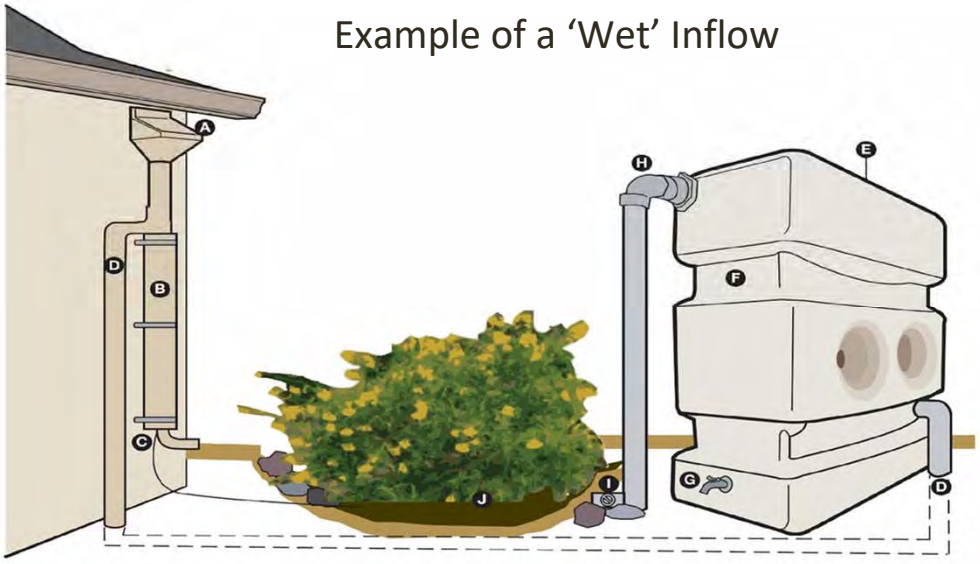
UofA Visitor Center
VISITOR CENTER

This Home Harvests the Rain

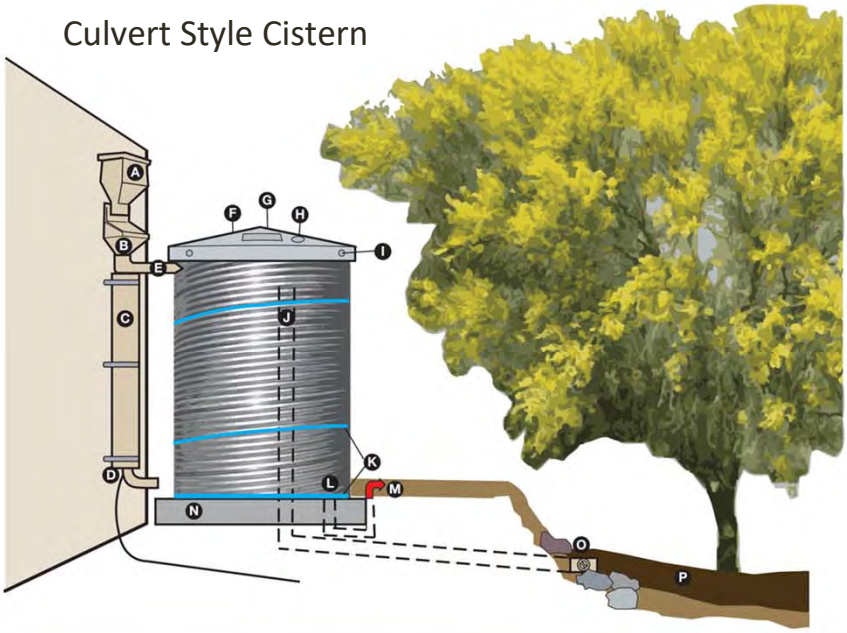

Rainwater Harvesting in Tucson Watersheds
Types of Rainwater Harvesting (RWH) sites across the region
Xeriscape Contest Winners with RWH Features
Public RWH Site
Commercial RWH Site
Roadside or Neighborhood RWH
Co-Housing with RWH
RWH Vendors
RWH Outreach and Workshops
Watersheds
PAG
Pima Association of Governments
0 0.25 0.5 1
Miles
Map is for illustrative purposes only. Created April 2009.
Data sources: Tucson Botanical Gardens, City of Tucson, Tucson Audubon, Rainwater Harvesting for Drylands, Arizona Hydrological Society Conference Tour, ARCSA Conference Tour, Watershed Management Group and the University of Arizona.
Some sites are not shown due to the limits of scale of the map. Aside from award winning landscapes and demonstration sites, private residences are too numerous for the scope of this project. PAG welcomes additional site recommendations. Contact MMier@pagnet.org
See Larger Map
Wetmore Wash
Stone Avenue Wash
First Avenue Wash
North Mountain Ave. Wash
Rillito River
Rillito Creek
Rillito Creek Wash
Rillito Creek Wash
Rillito Creek Wash



Example of a 'Wet' Inflow



Culvert Style Cistern



Active Rainwater Harvesting

Components

- Distribution
  - Full-port valves and one-inch interior diameter pipe to maximize gravity-fed flow
  - Garden hose *(no smaller than ¾-inch diameter is best for better gravity-fed flow)*
  - Drip system
    - Type of emitters
    - Timer features
- Gravity-fed vs. Pumped Systems
  - Use free gravity, rather than pumps to move your water
  - Irrigation system backflow prevention requirements *(when this is needed and when it is not)*

Active Rainwater Harvesting

Site Analysis

- Supply
  - Calculate catchment area
  - Multiply by monthly rainfall
  - Calculate yield of harvested rainwater in gallons
- Demand
  - Native and desert-adapted plants may not necessitate a cistern
  - Plant selection *(resource: Brad Lancaster's appendix 4 and the Southern AZ Rain Garden Plant Adaptation for Water Harvesting by Russ Buhrow)*
  - Appropriate use and water budget
- Sizing tank
  - Checkbook method
  - 2-4 inch rain method

Cistern Sizing

- Maximum potential capacity based on roof runoff
  - 1,000 sf can produce 620 gallons per inch of rain
- Based on water demand
  - A citrus may need 6,000 -9,000 gal. per year
- Based on physical area available
- Based on cost
- Rule of thumb for Tucson
  - Aim to catch 2"-4" for maximum utility

Cistern Location

- Proximity to downspout
- Proximity to usage area
- Top of the watershed
- Where it fits
- Integrated design

Active Rainwater Harvesting

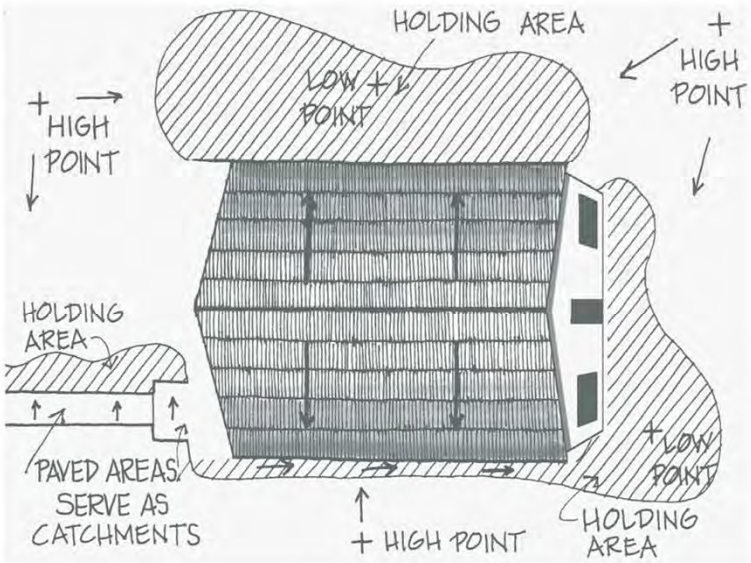
System Maintenance

- Debris Removal
  - Gutter
  - Debris filter
  - First flush
  - Cistern
- Mosquito prevention
- UV protection
- Rust prevention
- Freeze protection

ENRY
Elem.

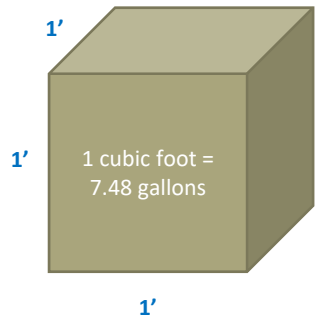
Planning Your System

- Start by observing the landscape as it is
  - Where is water entering/exiting the property?
  - Note the relative slopes
  - Can you identify where the utilities come on to the property?
  - How does the water come off of the roof?
  - Are there impermeable surfaces? Where do they slope?
  - What are the demands of the existing plant palette?



Useful Formulas

- Areas
  - Rectangle, $A = L * W$
  - Circle, $A = \pi r^2$
  - Triangle, $A = \left(\frac{1}{2}\right) b * h$
- Volume
  - Multiply the area by the height
    - Circle, $V = A * h$
- Cubic Feet to Gallons
  - $Gallons = ft^3 * 7.48$



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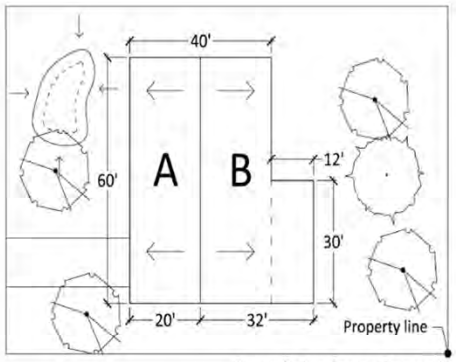
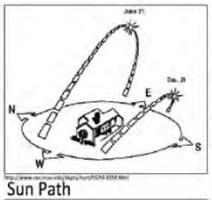


Legend - Landscape Demand



Sun Path

20' Deciduous Tree
15 In. Annu x 196 Gal/inch
=2,940 Annual Demand

20' Evergreen Tree
____ In. Annu x ____ Gal/inch
= ____ Annual Demand

Refer to Handout: Appendix 4 Boxes A4.5A or B and A4.5C.

Basin Calc: Area A
1) 60 L x 20 W = 1,200 SF
2) 1,200 SF x 7.48 = 8,976 Gallons @ 12" Rain Event
3) 8,976 Gal @ 12" / 12 = 748 Gallons @ 1" Rain Event

Basin Calc: Area B
1) 60 L x 20 W = 1,200 SF
2) 12 L x 30 W = 360 SF
3) 1,560 SF x 7.48 = 11,668 Gallons @ 12" Rain Event
4) 11,668 Gal @ 12"/ 12 = 972 Gallons @ 1" Rain Event
5) 972 Gal@ 1" * 3 = 2,917 Gallons @ 3" Rain Event

Example of Cistern Sizes

GAL	DIA (in)	HGT (in)
1550	87	67
1600	102	58
2000	64	144
2100	87	87
2500	95	89
2500	95	91
2500	102	79
2600	96	89
3000	95	107
3000	96	109
3000	102	93
3000	95	109
3000	102	93
4000	95	140
4000	102	125
4100	102	123
5000	102	152

GAL	DIA (in)	HGT (in)
300	45	60
300	36	82
305	46	80
330	47	59
500	46	76
500	47	77
500	48	73
550	45	94
550	64	46
550	67	44
650	56	70
750	46	119
850	48	124
1000	64	81
1000	69	74
1000	72	65
1100	88	53
1100	87	53
1150	48	156
1200	102	46

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Basic Water Harvesting Calculations

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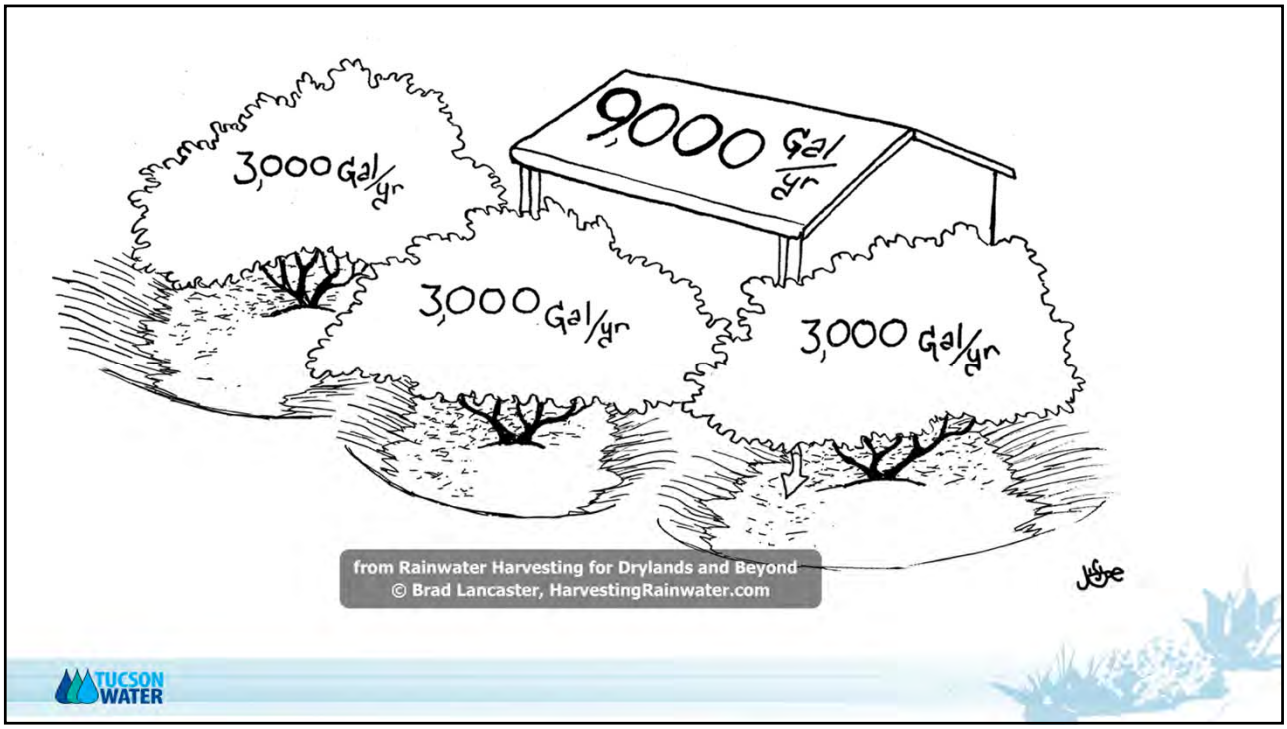
9,000 Gal/yr
3,000 Gal/yr
3,000 Gal/yr
3,000 Gal/yr
from Rainwater Harvesting for Drylands and Beyond
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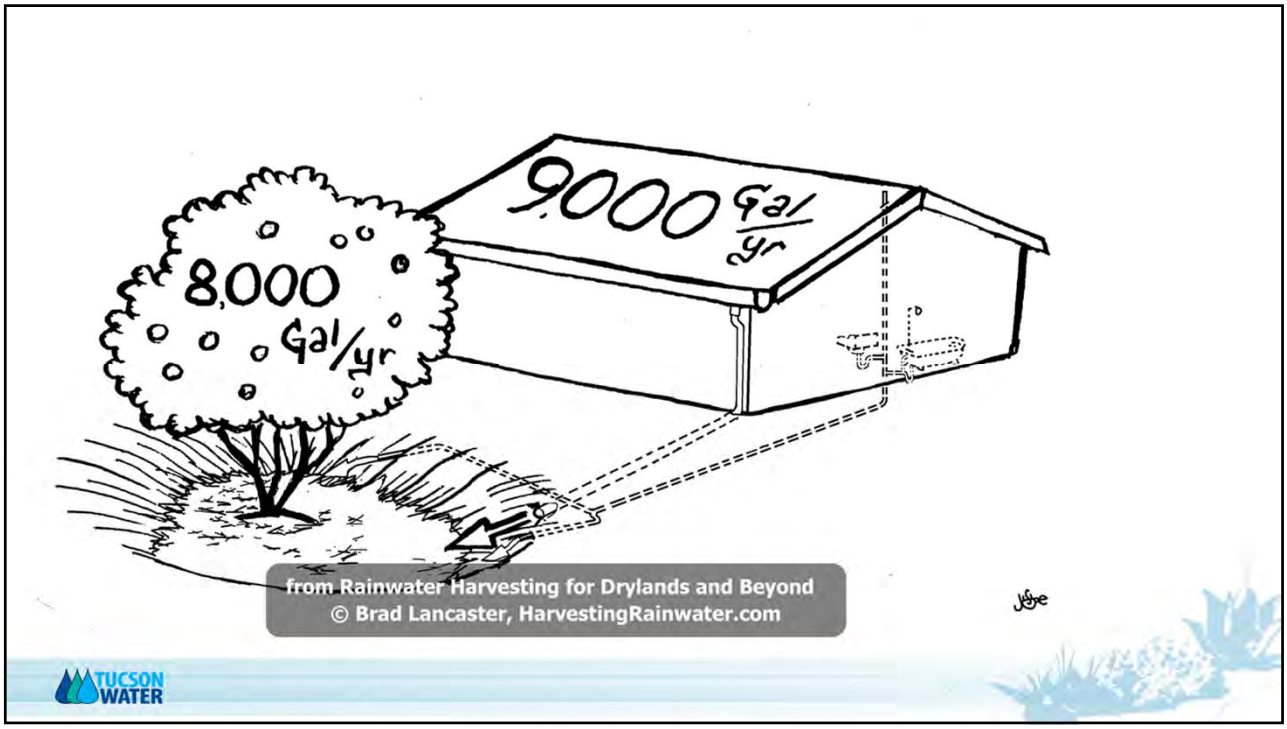
9,000 Gal/yr
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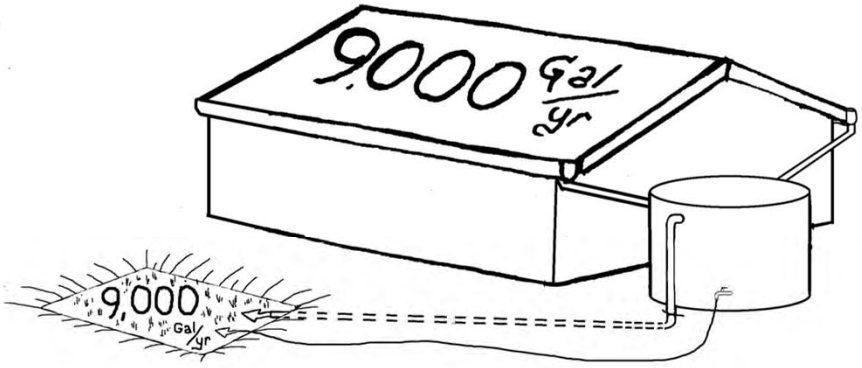

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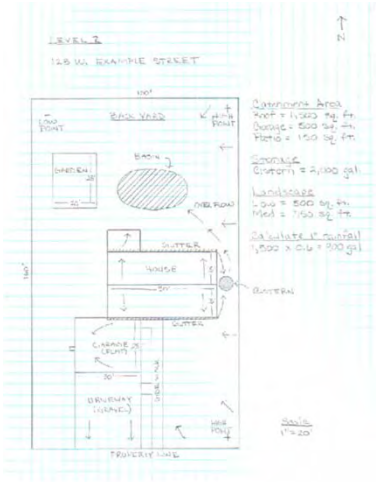
Project Plan

A project plan must be submitted with application to demonstrate the selection, use, and anticipated outcomes of the practices

- Can be hand drawn
- Does not have to be to scale
- Show catchment area(s)
- Show the conveyance
- Show the storage
- Show dimensions



Incentives Program Rebate

Who qualifies?

- Residential and small commercial Tucson Water customers
- Small commercial is a property with a single meter that is 5/8 or 3/4 inches. Properties with more than one meter or meters larger than 3/4 inches do not qualify

Two levels

- Applicants may apply for both levels *(passive and active)* not exceeding $2,000 for the combination per property

Incentives Program Rebate

Level 1 – Simple/Passive:

- Incentive – 50% of the costs of eligible materials and labor up to $500
- Practices: passive earthworks include directing and retaining water in landscape using site appropriate practices such as basins, berms, terraces, swales, infiltration trenches, and curb cuts

Incentives Program Rebate

Level 1 – Simple/Passive:

- Eligible costs for reimbursement include:
  - surface, sub-surface, and conveyance features
  - mulch, rocks/boulders for reinforcement (rock work), and soil amendments
  - equipment rental such as tillers, jackhammers, and trenchers
  - permits and costs for curb cuts and coring
  - labor from licensed contractors *(contractor must be licensed with the Arizona Registrar of Contractors in the particular trade or field for the type of work performed)*
    - The installation of rainwater harvesting and irrigation systems requires a Class CR21 license
    - Curb cuts & core drills requires a Class CR-5 license
    - Excavating requires a Class CR-2 license

Incentives Program Rebate

Level 2 – Complex/Active:

- Incentive – rebate up to $2,000 based on gallon capacity of cistern
  - $0.25 per gallon capacity of 50-799 gallon cistern
  - $1.00 per gallon capacity of 800 gallon and larger cistern
- Practices: rainwater storage tank with gravity-based supply use and overflow directed to landscape passive retention feature
  - *(The per gallon capacity rebate amount includes tank, gutter, tank foundation, overflow, and miscellaneous materials, which make up the system)*

Incentives Program Rebate

What the rainwater harvesting incentives program will **NOT** cover:

- imported or exported soil to create passive rain garden practices
- purchase and delivery of gravel or decomposed granite *(also known as DG or ¼ minus)* as a surface cover
- purchase or installation of landscaping materials such as plants, edging, decorative gravel, etc.
- installing, raising, or improving a driveway and removing concrete, asphalt, etc.
- purchase of tools such as shovels, rakes, drill bits, garden hoses, etc.
- purchase or installation of pumps or associated controls, irrigation systems, or backflow prevention devices
- purchase or installation of open, used or reconditioned tanks/cisterns
- labor completed by owner, neighbor, friend, handy man, or unlicensed contractor

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Incentives Program Rebate

Application Process:

- Must include Project Plan
  - Southern Arizona Rain Gutters Estimate and Gutter Systems of Southern Arizona LLC is not a substitute for a project plan
- Receipt(s) submitted for materials and labor must be from **licensed businesses/contractors** and show:
  - itemized work and/or materials
  - date work performed or materials purchased
  - applicable sales tax and total
- Rebates for $600 or more are subject to tax and applicant will receive a 1099-MISC for miscellaneous income

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Licensed Contractors

- Licensed Contractors are bonded – the bond protects the company and clients in case of bankruptcy or malpractice
- Licensed Contractors are insured – this is both business insurance and worker's compensation insurance
- Additionally, the contractor must be licensed in the particular trade or field for the type of work performed
  - The installation of rainwater harvesting and irrigation systems requires a Class CR21 license
  - Curb cuts & core drills requires a Class CR-5 license
  - Excavating requires a Class CR-2 license
- Search Licensed Contractors here: azroc.gov/forms/contractorsearch.html

SmartScape

Workshops available:

- Gray Water Rebate Program
- Desert Adapted Plants
- Plant Selection & Installation
- Soils, Plants, & Water
- Hands On Drip
- Landscape Irrigation Systems
- Landscape Design & Renovation

ag.arizona.edu/pima/smartscape

SAVE WATER,
SAVE RIVERS,
BUILD COMMUNITY
C2E™
conserve to enhance
Atturbury Wash
Henry Elementary
Palo Verde Neighborhood
Mitchell Park
Northwest/El Cortez Neighborhoods
Jefferson Park Neighborhood
$70,000 in C2E donations
have been *invested directly* into
community enhancement projects like
this Palo Verde Neighborhood Pocket Park.
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C2E™
conserve to enhance
Project Impacts:
Nearly 300 native shrubs & trees planted
26 water harvesting features installed
DONATE TODAY!
Be a sustaining member and support Tucson Conserve2Enhance (C2E) projects like those featured above. Donate in two ways: 1) through your Tucson Water utility bill by using the Open Space/Riparian check box, or 2) through the C2E website to make a tax-deductible contribution.
conserve2enhance.org/Tucson
JOIN TUCSON C2E
Tucson C2E provides funding to enhance our urban waterways and wildlife habitats. Connect conservation with community action and make your drops count!
SAVE WATER
Households and businesses can save water! Sign up online to learn conservation tips and track your water savings. Tucson Water customers can automatically link their water use data to their C2E account.
BECOME A LEADER
Apply to receive a Tucson C2E Grant. To date, over $60,000 has been awarded to projects that enhance local washes, reduce flooding, and increase wildlife habitat. New projects are funded annually.

Questions?

Tucsonaz.gov/water/rebate

WaterReliability

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