



Water Conservation & Reuse Strategies for Southern California

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September 23, 2010

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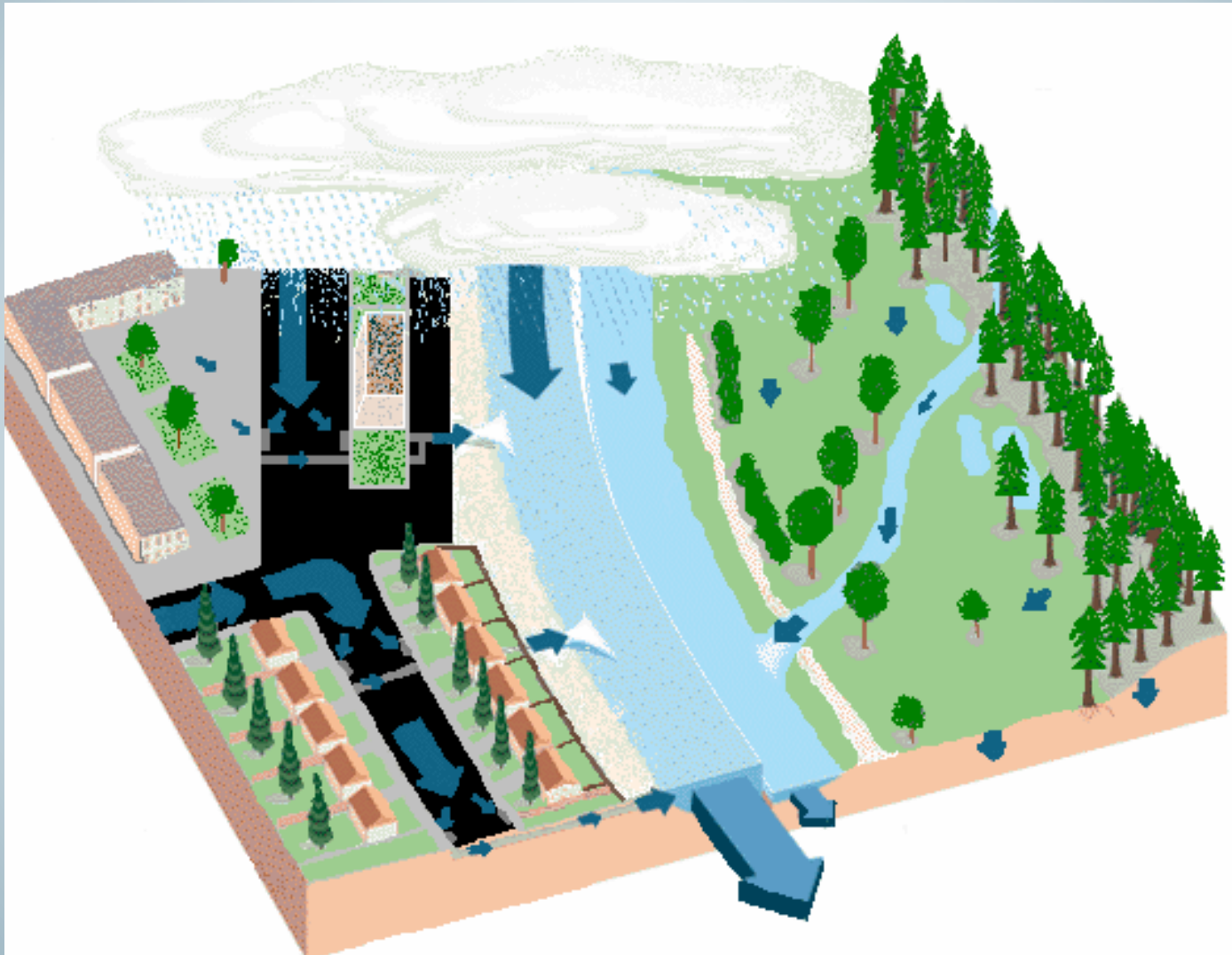




Stormwater

According to the EPA, non-point source pollution(from stormwater runoff) is the leading remaining cause of water quality problems

Water Run-off: developed vs. natural



Water Usage

Location	Water use GPC/day
San Diego	164
US average	152
Japan	99
Germany	51
Nigeria	10
Uganda	4
Water scarcity	<13

Source: SDWA Annual Report 2009

Table 1. Typical Domestic Daily per Capita Water Use.³

Use	Gallons per Capita	% of Daily Total
Potable indoor uses		
• Showers	11.6	7.0%
• Dishwashers	1.0	0.6%
• Baths	1.2	0.8%
• Faucets	10.9	6.6%
• Other uses, leaks	11.1	6.7%
Subtotal	35.8	21.7%
Non-potable indoor uses		
• Clothes washers	15.0	9.1%
• Toilets	18.5	11.2%
Subtotal	33.5	20.3%
Outdoor uses	95.7	58.0%

Source: American Waterworks Association Research Foundation (AWWARF)
Residential End Uses of Water, Denver, CO; 1999

Example Commercial Building Indoor Rainwater Application

Fixture type	Daily uses	Flowrate (GPF)	Occupants	Sewage Generation (gal)	
Water closet (Male)	1	1.6	35	56	
Water closet (Female)	3	1.6	24	115.2	
Urinal (Male)	2	1	35	70	
		Total Daily Volume (gal)		241.2	
		Annual Work Days		260	
		TOTAL ANNUAL VOLUME (gal)		62,712	
Option 1: hi efficiency fixtures					
Fixture type (Low flow)	Daily uses	Flowrate (GPF)	Occupants	Sewage Generation (gal)	
Water closet (Male)	1	1.1	35	38.5	
Water closet (Female)	3	1.1	24	79.2	
Urinal (Male)	2	0.5	35	35	
		Total Daily Volume (gal)		152.7	
		Annual Work Days		260	
		TOTAL ANNUAL VOLUME (gal)		39,702	37% decrease
Option 2: rainwater usage					
Roof area = 12,690 sq ft					
Annual Collection Volume = $0.9 \times 7.48 \text{ gal/ft}^3 \times 1\text{ft}/12'' \times 10'' \text{ rain} \times 12690 \text{ sq ft} = \mathbf{71,153 \text{ gallons}}$					
To meet this standard: 50% reduction would require 31,356 gallons					
		TOTAL ANNUAL VOLUME (gal)		31,356	50% decrease



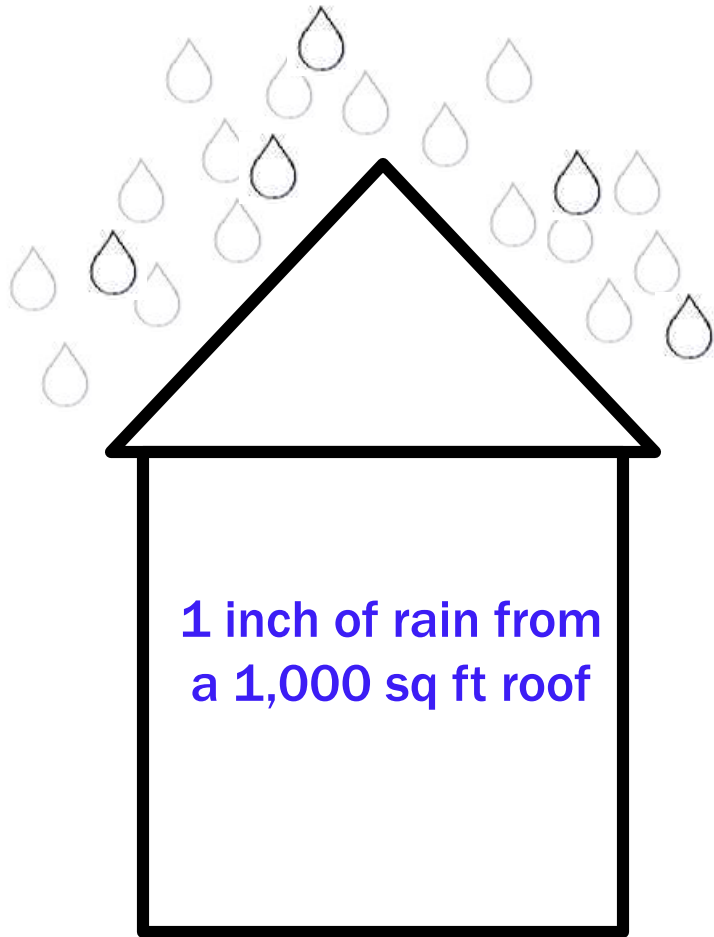
Benefits of Rainwater Harvesting

COMMUNITY

- Storm water management (reduces run off to storm drains)
- Reduces summer peak water demands (conserves water)

INDIVIDUAL

- Superior water for irrigation (soft, non-alkaline)
- Lower water bills (1st tier)
- Possible rebates/incentives (AB 1834)



1 inch of rain from
a 1,000 sq ft roof

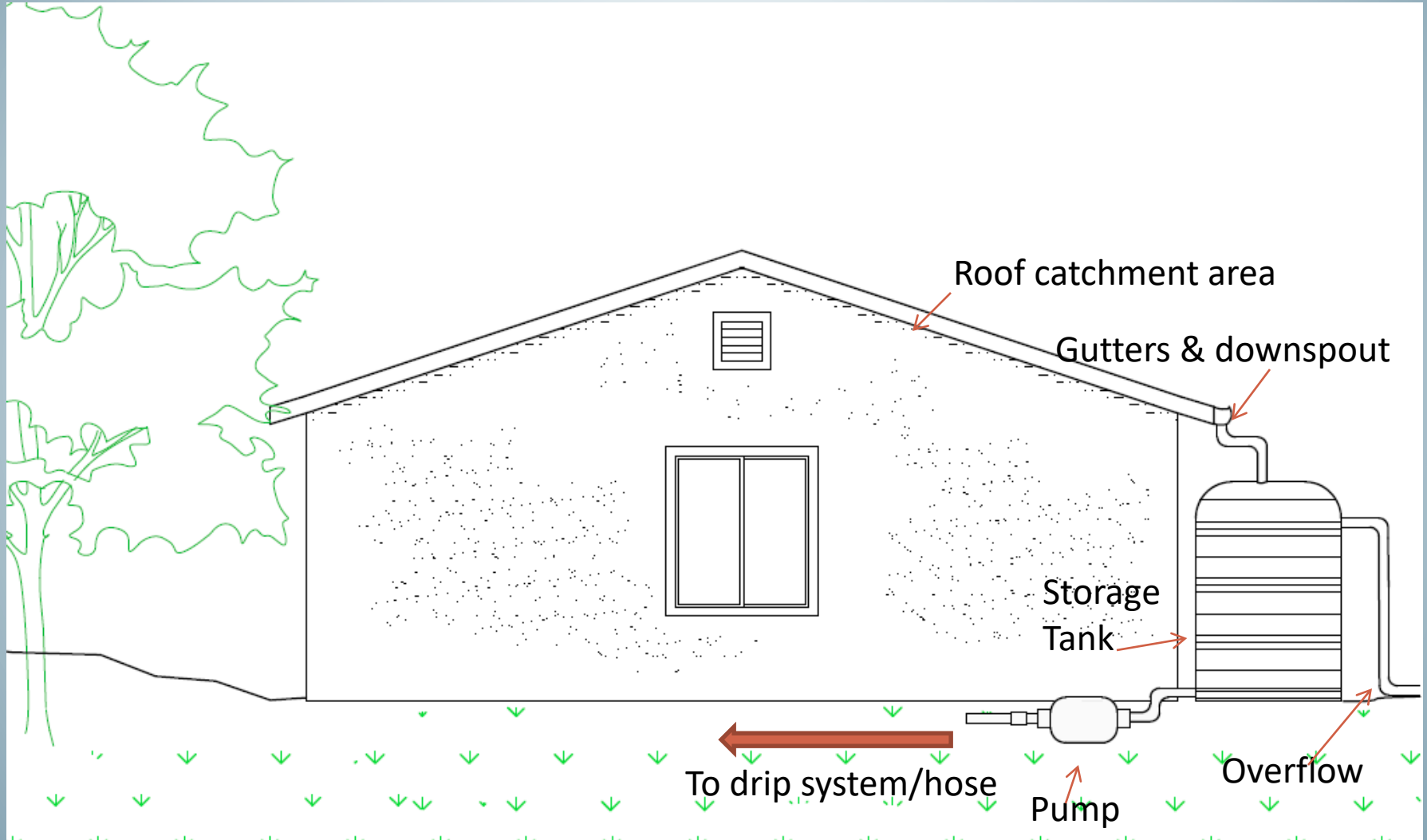
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600 gallons
of water

**With 10 inches of rain in San Diego, this adds up to
> 12,000 gallons per year for a typical 2,000 sq ft home!**

Components of Rainwater Harvesting for Irrigation



Above-ground Tanks



Source: RainHarvest Systems



Source: Tankworks Australia



Source: BH Tanks Inc.



Source: Bushman Tanks USA

Below-ground Tanks



Source: Rainwater Collection Solutions



Source: Graf Rainwater Tanks



Source: Xerxes Fiberglass Tanks

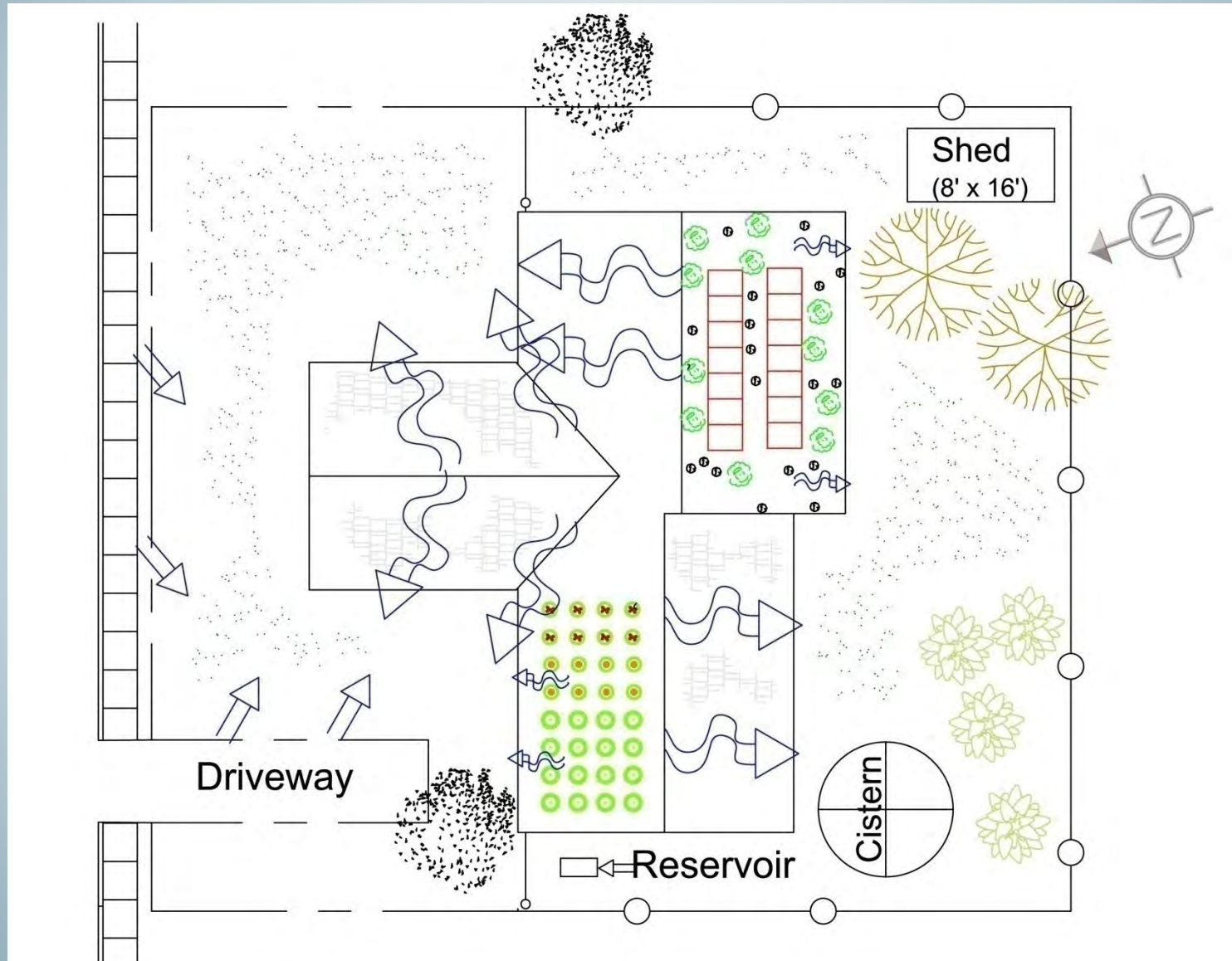


Source: Atlantis Water Management

Using Earthworks



Sustainable Water Management



Estimating Supply & Demand

Supply and Demand for 1000 sf Roof Area Inland San Diego												
	rainfall	rainfall	CA	convert			ET _o	Plant	Area	Convert		
month	inches	feet	sq feet	gallons	gallons		month	feet	factor	sq ft	gallons	gallons
Jan	2.3	0.19	1000	7.48	1290		Jan	0.2	0.3	1000	7.48	448.8
Feb	2	0.17	1000	7.48	1122		Feb	0.2	0.3	1000	7.48	448.8
Mar	2.3	0.19	1000	7.48	1290		Mar	0.3	0.3	1000	7.48	673.2
April	0.8	0.07	1000	7.48	448.8		April	0.4	0.3	1000	7.48	897.6
May	0.2	0.02	1000	7.48	112.2		May	0.5	0.3	1000	7.48	1122
June	0.1	0.01	1000	7.48	56.1		June	0.5	0.3	1000	7.48	1122
July	0	0.00	1000	7.48	0		July	0.5	0.3	1000	7.48	1122
Aug	0.1	0.01	1000	7.48	56.1		Aug	0.5	0.3	1000	7.48	1122
Sept	0.2	0.02	1000	7.48	112.2		Sept	0.4	0.3	1000	7.48	897.6
Oct	0.4	0.03	1000	7.48	224.4		Oct	0.3	0.3	1000	7.48	673.2
Nov	1.1	0.09	1000	7.48	617.1		Nov	0.2	0.3	1000	7.48	448.8
Dec	1.3	0.11	1000	7.48	729.3		Dec	0.2	0.3	1000	7.48	448.8
Total	10.8	0.90			6059		Total	4.2				9425

Project 1: An Above-ground System with a 550 gallon tank



Project 2: An Above-ground System with (2) 2,000 gallon tanks and French drains to landscape



Project 3: a Rainwater Pillow





Project 4: A Modular Underground Storage System





Resources

- <http://www.sandiego.gov/water/conservation>
Rainwater harvesting information; residential water surveys (free)
- <http://www.bewaterwise.com> ; Rebates and incentives (So Cal Metropolitan Water District)
- <http://socalwatersmart.com/index.php>;
Rebates/incentives
- <http://www.harvesth2o.com/> ; Online rainwater harvesting community
- <http://www.arcsa.org/Rainwater-10-09.pdf>;
Rainwater Catchment Standards ARCSA and ASPE

Resources; continued

- http://www.epa.gov/npdes/pubs/gi_munich_andbook_harvesting.pdf; EPA Rainwater Harvesting Guidelines
- <http://www.whollyh2o.org>; California's Integrated Water Reuse Management Center
- <http://www.h2ouse.org>; California's Urban Water Conservation Council
- <http://www.oasisdesign.net/greywater/law/california/>; California Graywater Policy Center
- *Rainwater Harvesting for Drylands* vol 1-3 by Brad Lancaster, Rainsource Press (2005-2011)

