



Practical Aspects of Stormwater Capture and Use

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“[California] is a civilization whose success has been achieved on the pretension that natural obstacles do not exist.”

–Marc Reisner

Cadillac Desert

Necessary Details

- Quantify Demand
 - For Irrigation Supplement:
 - *Traditional Turf Areas, 1 Inch Per Week – 27,000 gal/ acre of turf/week*
 - *“Xeriscaping” & Drought Tolerant Species, 0.25 Inch Per Week*
 - *Refer Also to WUCOLS Water Use Classification of Landscape Species (UC Berkeley Extension, 1994)*
 - For Indoor Non Potable Use Consider 1- 2 Day Minimum (Refer to CPC Chapter 6 Section 601.1) storage
 - *Laundry Estimate at 55 Gallons Per Load*
 - *Toilet Estimate at 20 Gallon Per Person Per Day*

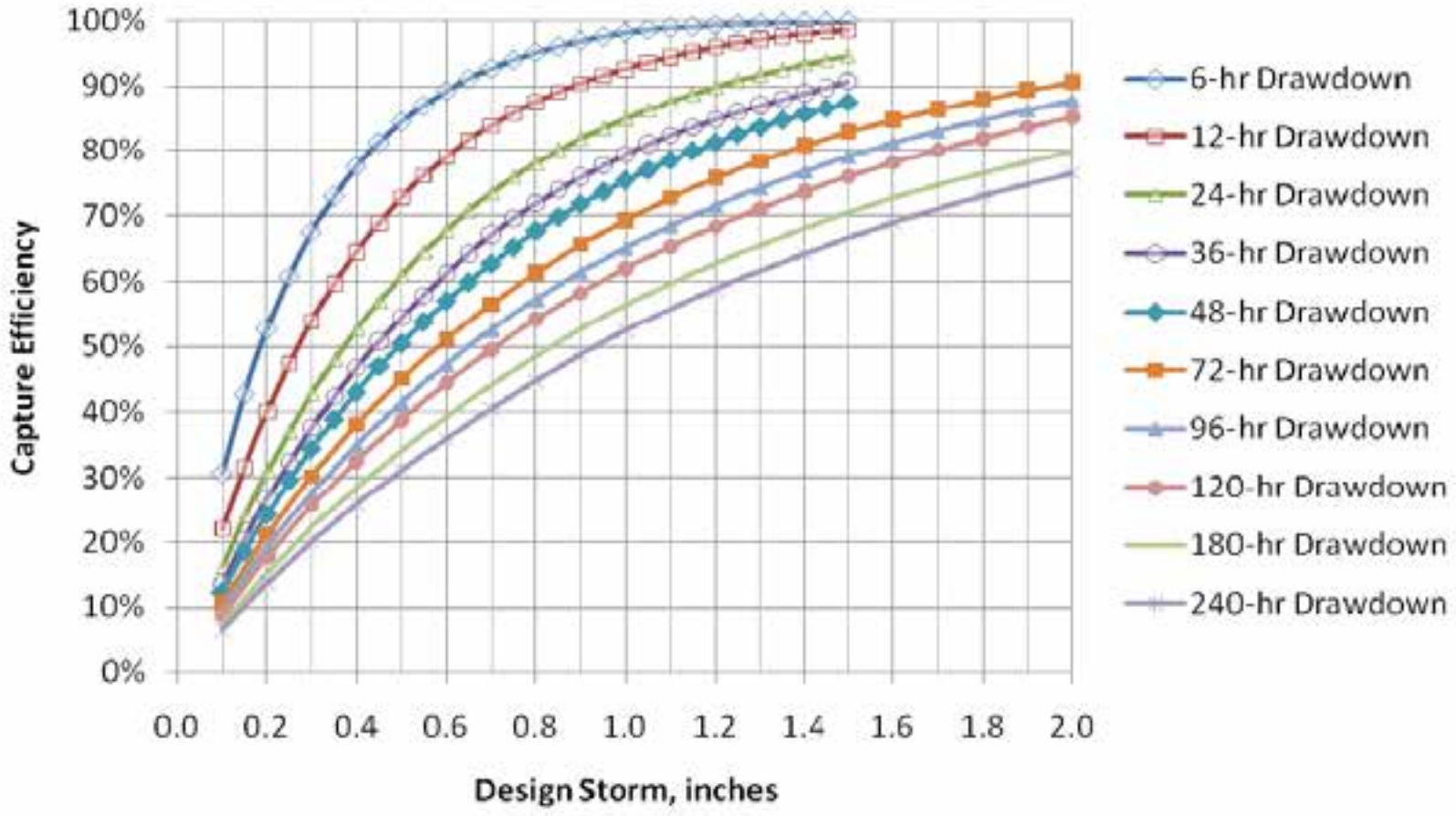
More Necessary Details

- Quantify Storage
 - To maximize the system, storage should be exhausted by demand during the storm inter-event period.
 - Regulatory requirement: Storage must equal or exceed effective precipitation for 85th event

Summary of the Details

- Key to successful harvesting is recovery of the storage area following a rain event (use the water)
- In southern California, this means recovering the storage capacity within 2 – 4 days
- The inter-event times drive the storage need in our area.
- **Example:** 5 acre area generates 65,200 gallons, need about 22,000 gallons/day of demand.

Lowland Region - Constant Drawdown



The Last of the Details

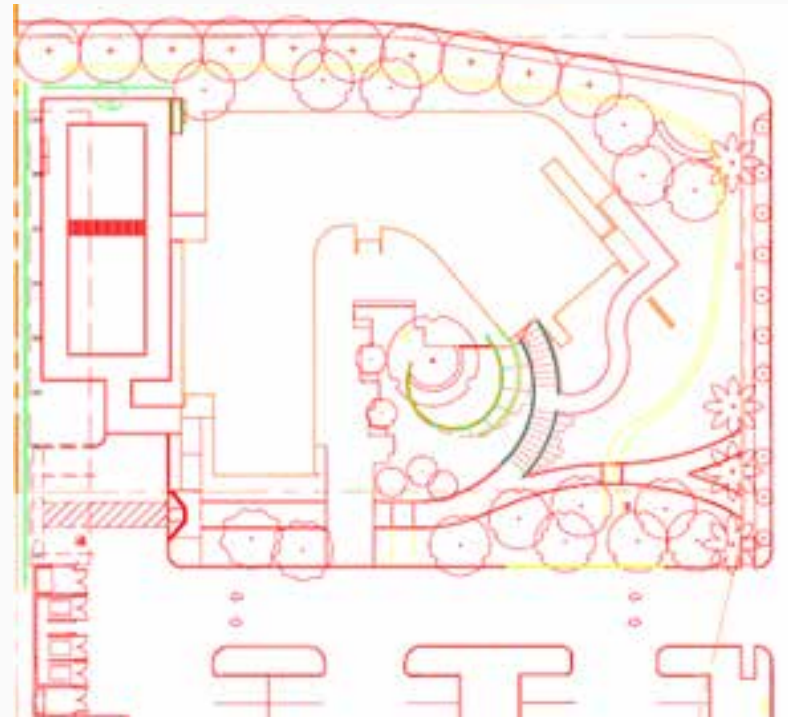
Minimum Standards for Harvested Rainwater

Application	Min. Treatment	Min. Water Quality
Car washing	<ul style="list-style-type: none"> • Debris excluder (1702.9.10) • Filtration <100 microns (1702.9.11) 	N/A
Non-Spray irrigation: Surface, subsurface, and drip irrigation	<ul style="list-style-type: none"> • Debris excluder (1702.9.10) • Filtration <100 microns (1702.9.11) 	N/A
Spray irrigation: storage volume < 360 gallons	<ul style="list-style-type: none"> • Debris excluder (1702.9.10) 	N/A
Spray irrigation: storage volume ≥ 360 gallons	<ul style="list-style-type: none"> • Debris excluder (1702.9.10) 	<ul style="list-style-type: none"> • E-Coli: < 100 CFU / 100 mL • Turbidity: < 10 NTU
Dual-Plumbing: Urinal and Water Closet Flushing, Clothes Washing, and Trap Priming	<ul style="list-style-type: none"> • Debris excluder (1702.9.10) • Filtration <100 microns (1702.9.11) 	<ul style="list-style-type: none"> • E-Coli: < 100 CFU / 100 mL • Turbidity: < 10 NTU
Water features: Ornamental / Decorative fountains	<ul style="list-style-type: none"> • Debris excluder (1702.9.10) 	<ul style="list-style-type: none"> • E-Coli: < 100 CFU / 100 mL • Turbidity: < 10 NTU
Cooling tower make-up water	<ul style="list-style-type: none"> • Debris excluder (1702.9.10) • Filtration <100 microns (1702.9.11) 	<ul style="list-style-type: none"> • E-Coli: < 100 CFU / 100 mL • Turbidity: < 10 NTU

- Source 2013 California Plumbing Code (1702.9.45)

Example Project – What Can Be Done!

- Cucamonga Valley Water District *Frontier Project*
- 0.7 acre development site
 - 14,400 S.F. building
 - *Office Space*
 - *Meeting Facilities*
 - *Public Demonstration Space*
 - Courtyards
 - Walkways & Sidewalks
 - Landscaped Areas



A Focus on Runoff Use

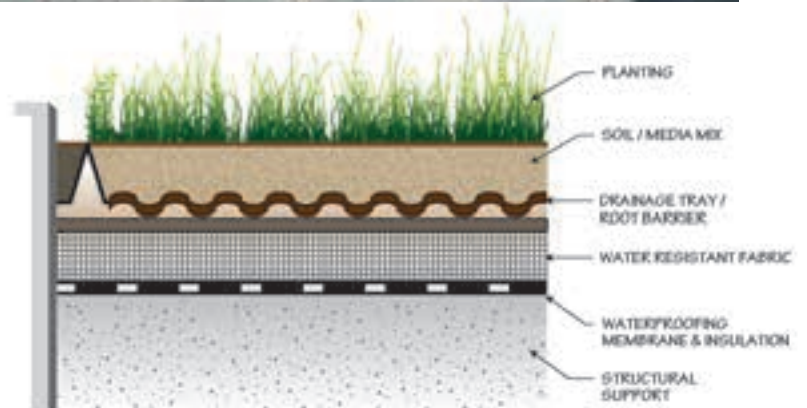
- Rainwater Harvesting
 - Meet Water District Goals of :
 - *Water Conservation*
 - *Groundwater Recharge*
 - Meet Irrigation Needs
 - Runoff Reductions
 - Pollutant Removal
 - LEED Credits 6.1 & 6.2
- Low Impact Development
 - Runoff Reductions
 - Pollutant Removal
 - LEED Credits 6.1 & 6.2

LID & Water Harvesting Measures

- Green Roof
- Porous Pavement
- Decomposed Granite Walkways
- Bioretention/Rain Garden
- Cistern/Rain Tank (Water Harvesting)
- Underground Infiltration Device



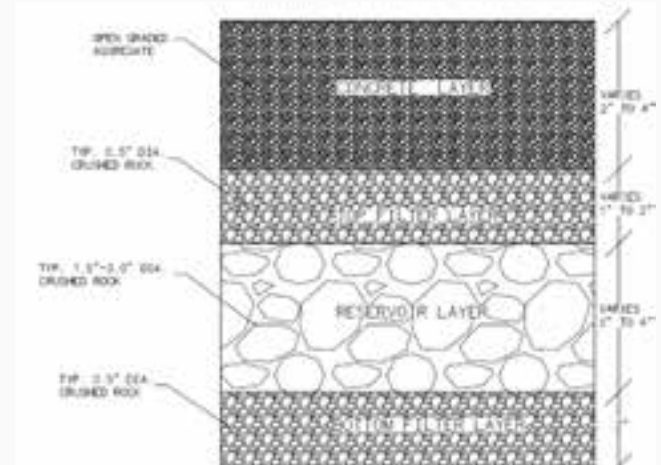
Green Roof



Green Roof

- Specifications
 - Extensive (18 inches of soil media)
 - Partial roof coverage
 - Bitumen waterproof membrane
 - Plants: Aloe, Hesperaloe
 - Soil mix: 25% topsoil, 25% compost, 50% sand
 - Green roof area: 55% reduction in annual runoff
- Costs
 - \$50,000 (1,614 sf: \$30 per square foot)

Porous Concrete



- Porous Concrete selected due to:
LEED Heat Island Effect Credit
- Runoff Coefficient 0.1
- Cost - \$50,000
(1300 S.F. - \$38 per square foot)



Decomposed Granite Walkways

- Runoff Coefficient – 0.5
- Depth of 1.5 inches
- Cost \$30,000 (4235 sq ft.
\$7 per square foot)



Bioretention/RainGarden

- Specifications
 - 8 inches of soil media
 - Plants: Lamb's Ears, Senecio, Echeveria, Blue Fescue
 - Soil mix: 50% sand, 20% compost, 30% soil
 - Under drain
 - Costs - \$12 per square foot

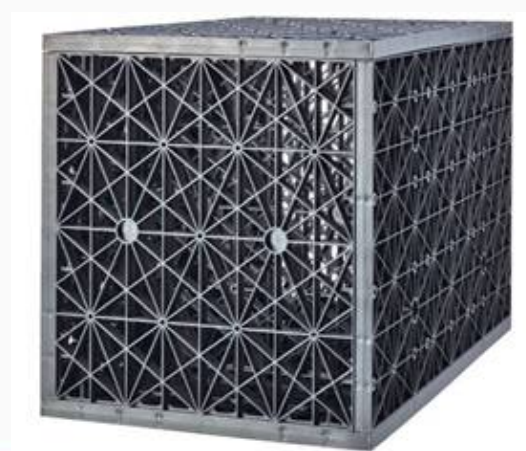


Cistern/ Rain Tank

- Xeres brand
- Capacity 1,600 gallons (6,056 liters)
- Irrigation for 1 day
- Cost: \$40,000

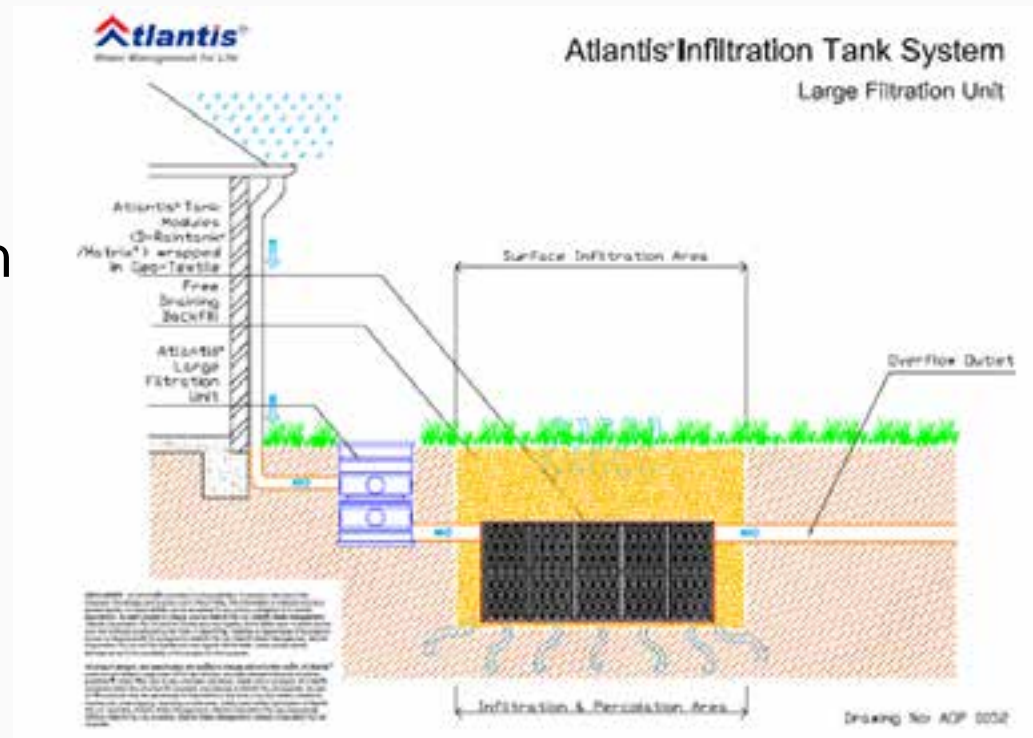


Underground Infiltration Device Atlantis® Infiltration Tank



Atlantis® Infiltration Tank

- 100% Pollutant Removal
- 90% Void Space
 - Smaller footprint than aggregate trenches
- Capacity:
7,200 Cubic Feet
(6,164 cf = 5 year event Pre/Post)
- Cost: \$98,000



Some Interesting Facts

- Cost for 'green' design: 2 – 4% over conventional design – sometimes lower than conventional
- Rainwater use on site is difficult in CA if you just look at \$:
 - Value of water in tank - \$4.20
 - Payback for tank – 560 years
- Infiltration has better numbers:
 - Value of water infiltrated per year: \$1,050
 - Payback of infiltration system: 93 years
- But, we must start to value water appropriately

The Important Things to Consider

- Need to view water use from an integrated system perspective
- Consider all scales and ranges of solutions
- Need to maximize the use of existing assets in these new solutions
- The built environment does not reflect the value of water – we need to change this
- Centralized systems are vulnerable, not robust
- Stormwater is not used consistently as an integral part of water supply – we need to change this