

Rainwater Harvesting

A strategy for water conservation, stormwater management and sustainable development in the City of Tucson



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The Problem



- **Potable water depletion**
- **Deflection of stormwater from urban areas**
- **Flashy flood peaks, erosion**
- **NPDES stormwater quality issues**





The Solution
Capture rainfall and
put it to beneficial
use



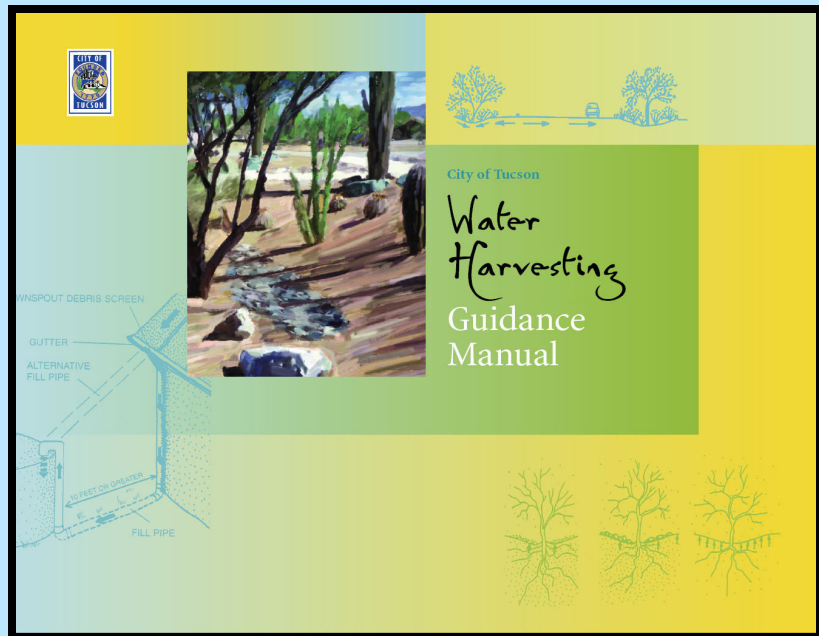
Tucson's current water harvesting requirement:

"...make maximum use of site storm water runoff for supplemental irrigation..."

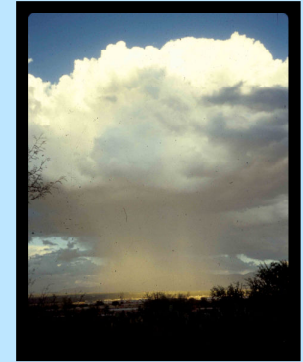
Applies to:

New or redeveloped,

- Commercial sites
- Subdivisions
- Public buildings
- Public rights-of-way



Tucson's newly adopted Water Harvesting Ordinance



Title: Commercial Rainwater Harvesting Ordinance (Ordinance No. 10597)

Adopted: October 14, 2008

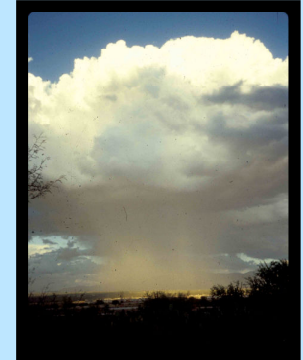
Effective: June 1, 2010

Applies to:

New Commercial development that is non-residential

Primary requirement: Offset 50% of landscape water demand using harvesting rainwater

Major Elements of New Water Harvesting Ordinance



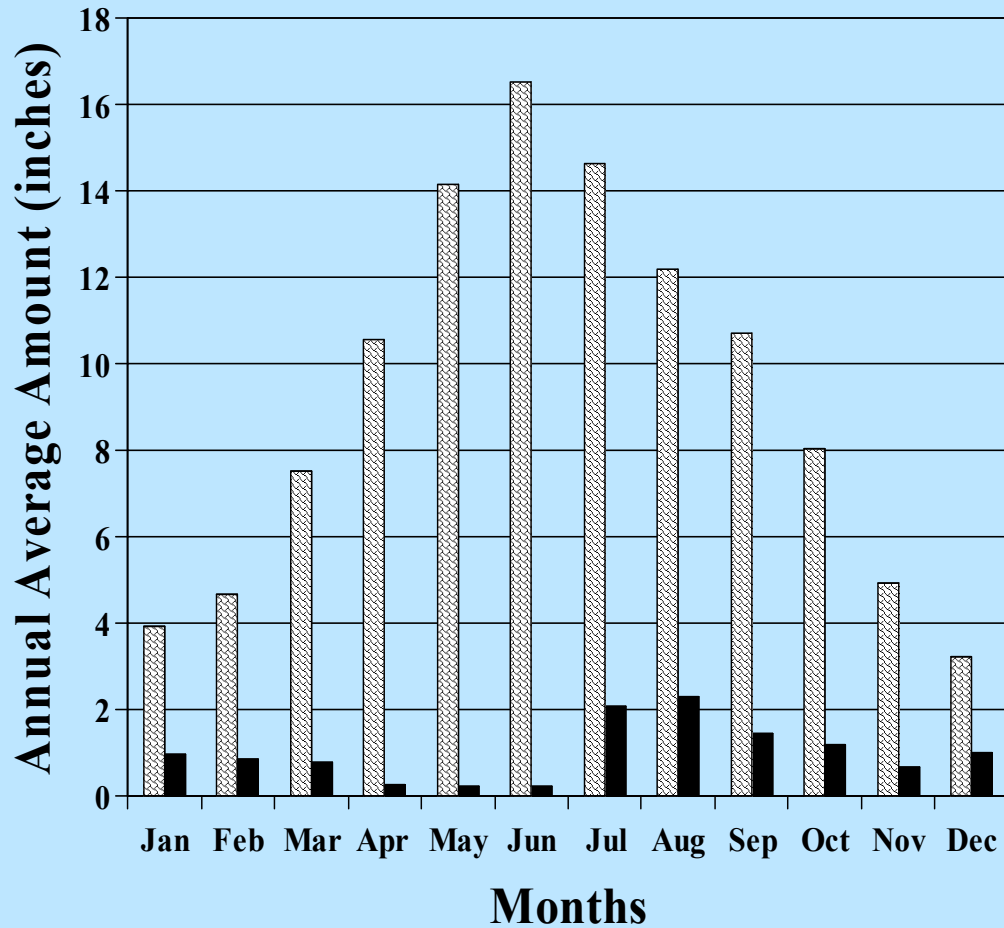
Detailed Requirements:

- Rainwater Harvesting Plan
- Water budget
- Metering of outdoor water use
- Soil moisture-based irrigation control
- Annual reporting

Allows:

- Three years to establish plants
- Relief from 50% requirement during drought

Average Monthly Rainfall vs Pan Evaporation, Tucson, Arizona

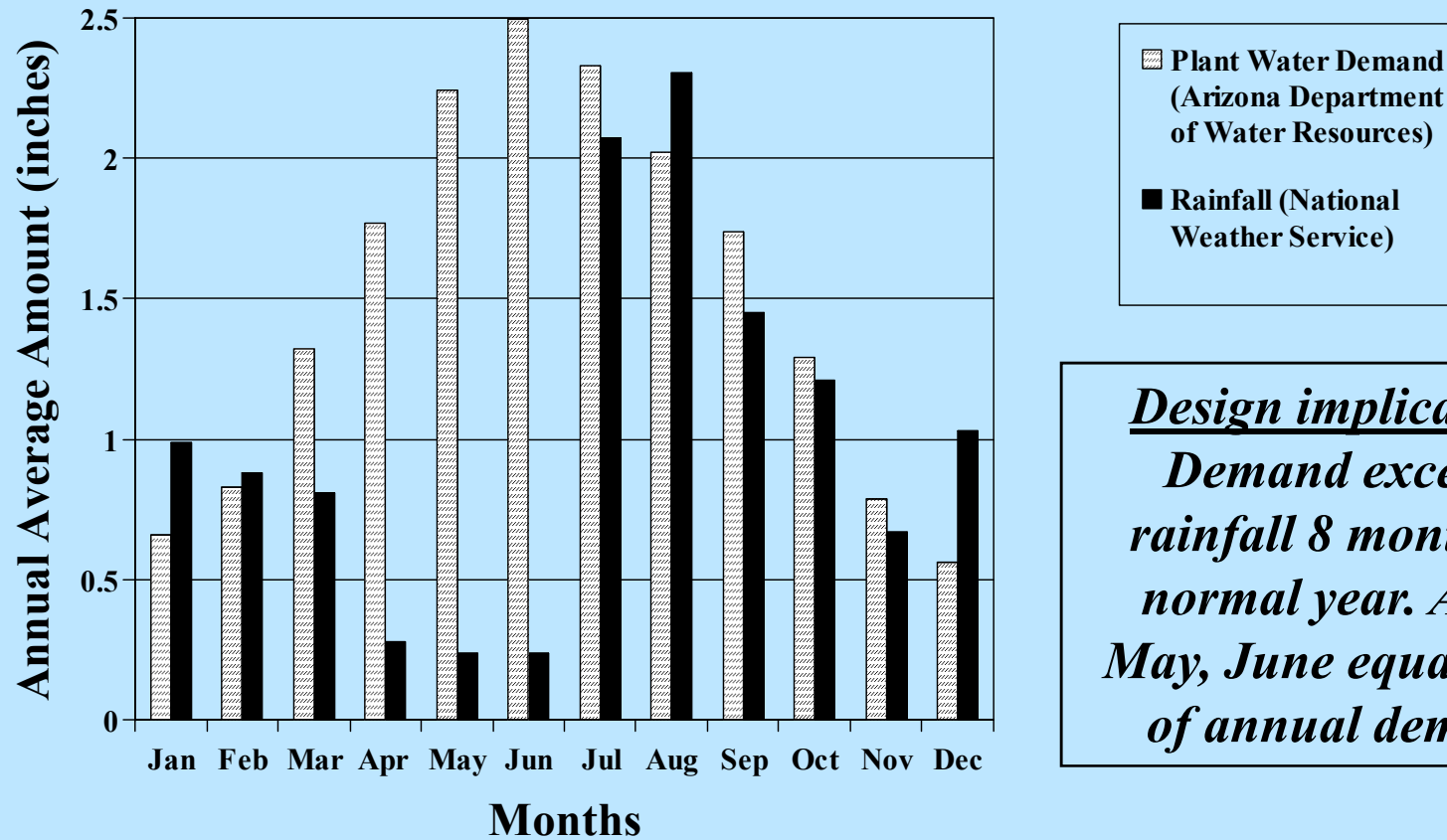


■ Pan Evaporation
(Oregon Climate
Services)

■ Rainfall (National
Weather Service)

Design implications
***Mulch soil to reduce
evaporation loss; note
extreme difference in
April, May, June***

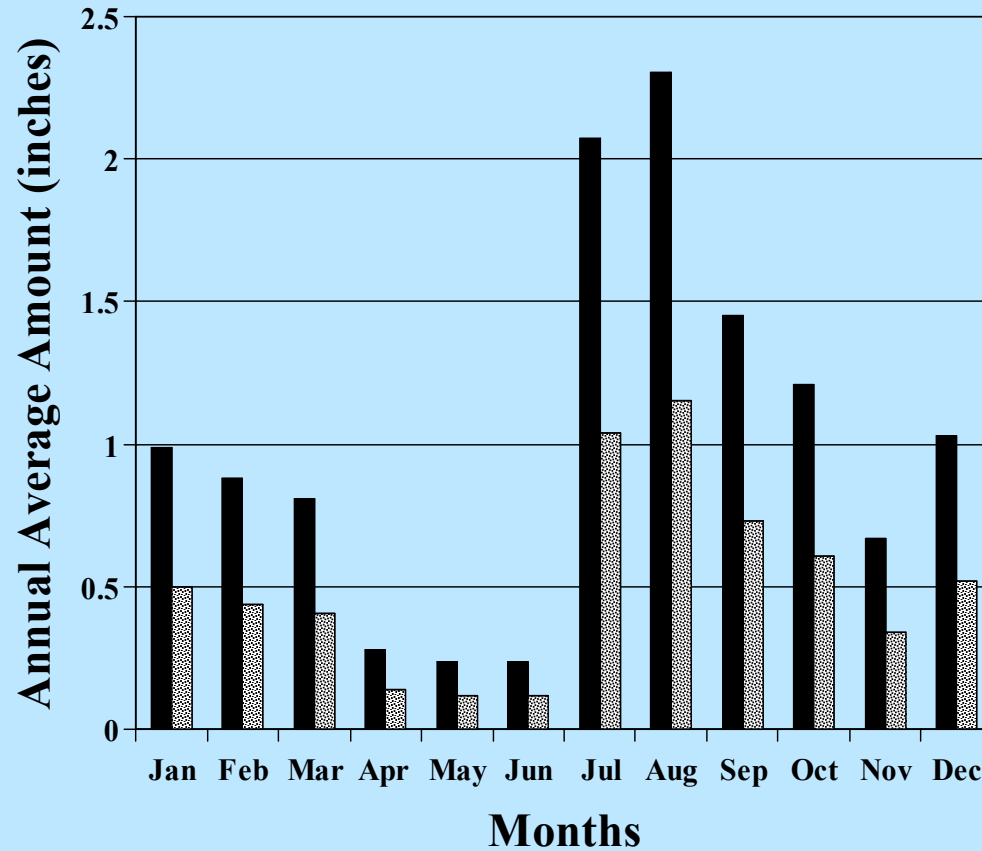
Monthly Low-Water-Use Landscape Plant Demand vs Monthly Rainfall, Tucson, Arizona



Design implications

Demand exceeds rainfall 8 months in normal year. April, May, June equal 36 % of annual demand.

Average Monthly Rainfall vs Adjusted Monthly Rainfall - Tucson, Arizona



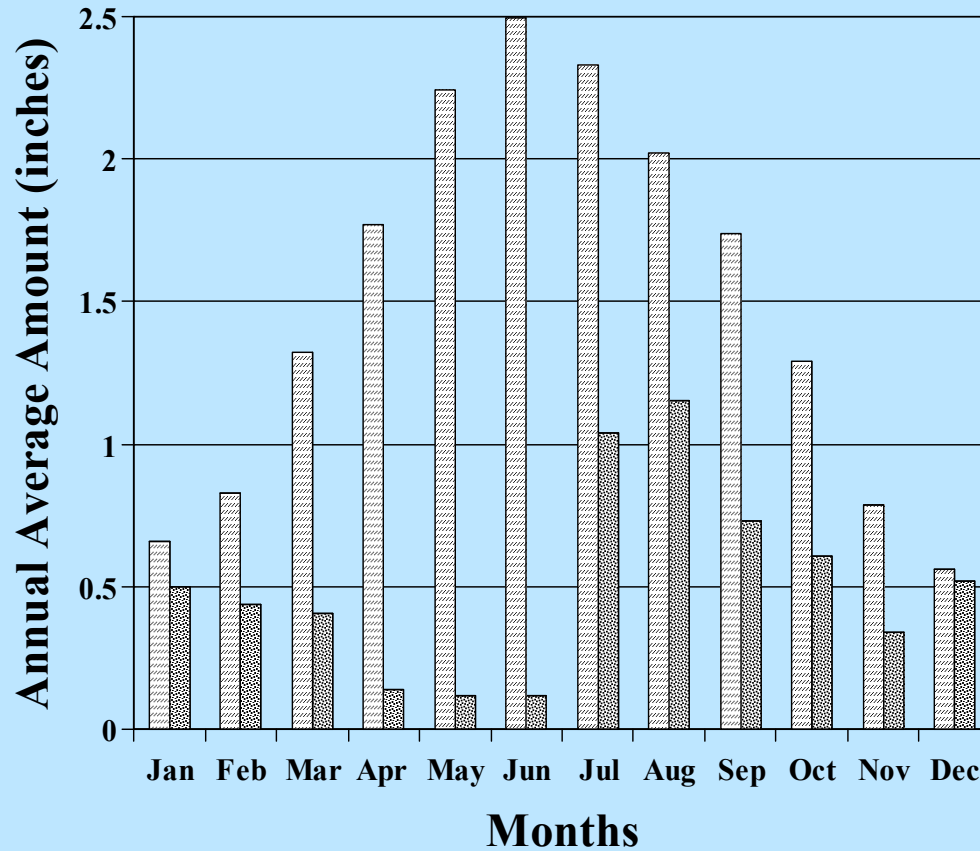
■ Rainfall (National Weather Service)

▨ Adjusted Rainfall (average rainfall less 25% for local variability, less 25% for high and low magnitude events)

Design implications

Maximize water harvesting to prepare for low rainfall years and climate change

Monthly Low-Water-Use Plant Demand vs Adjusted Rainfall, Tucson, Arizona



▨ Plant Water Demand
(Arizona Department
of Water Resources)

▨ Effective Average
Annual Rainfall
(calculated)

Design implications
***Determine ratio of
water harvesting
catchment area to plant
canopy area that is
needed to meet plant
water demand***

Design factors

GOAL: Water supply = 50% rainwater plus 50% potable

April, May, June = 36% annual plant water demand

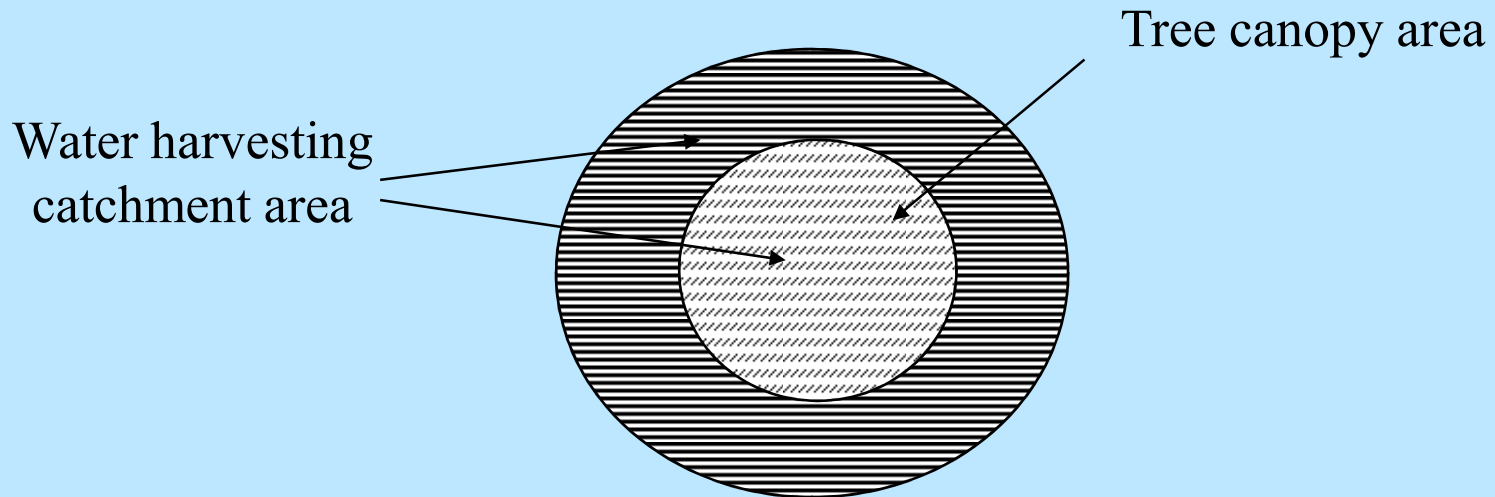
March is the next limiting month for plant water demand

Plant canopy area drives needed water harvesting catchment area

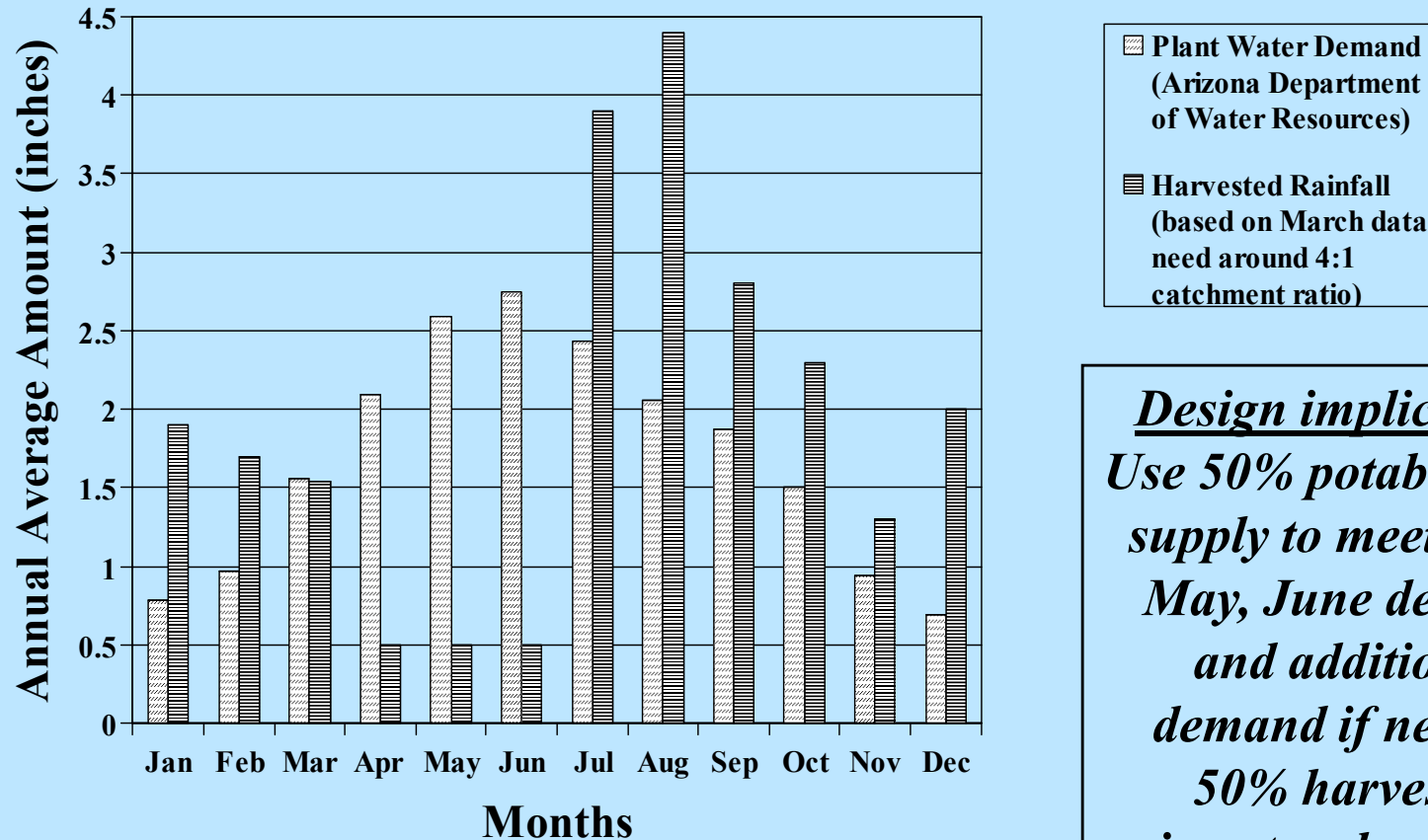
Design water harvesting area to meet March plant water demand

$$\frac{1.56 \text{ inches March water demand per sq ft of canopy}}{0.41 \text{ inches adjusted March rainfall per sq ft of canopy}} = 3.8$$

Therefore, harvest rain from around 4 times the canopy area to meet March demand



Monthly Low-Water-Use Plant Demand vs Harvested rainfall, Tucson, Arizona



Design implications
Use 50% potable water supply to meet April, May, June demand and additional demand if needed. 50% harvested rainwater should meet or exceed the rest of demand.

Tucson's newly adopted Gray Water Ordinance

Title: Residential Gray Water Ordinance
(Ordinance No. 10579)

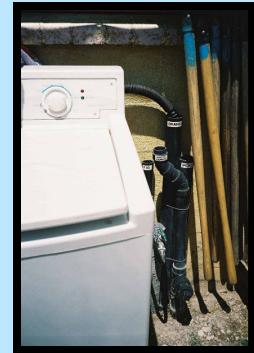
Adopted: September 23, 2008

Effective: June 1, 2010

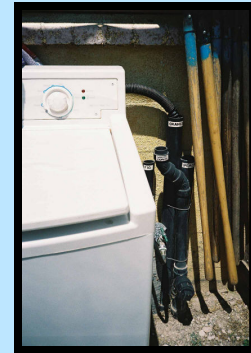
Applies to:

New single family and duplex residential units

Primary requirement: Installation of segregated drains for graywater and blackwater plumbing fixtures to allow future gray water distribution systems



Major Elements of New Greywater Ordinance



Detailed Requirements:

- Graywater drains stub out three feet from building foundation
- Gravity-fed drain for washing machines
- All gray water systems must comply with ADEQ codes for residential gray water use

Allows:

- Installation of graywater distribution system is not included in the requirements