ASIC 2016
SOUTHWEST REGIONAL CONFERENCE

April 8th, 2016

Prescott, Arizona

ASIC 2016 REGIONAL CONFERENCES

Southeast, Southwest, Northeast, & California

American Society of Irrigation Consultants

Jeffrey Bruce

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The Future of Green

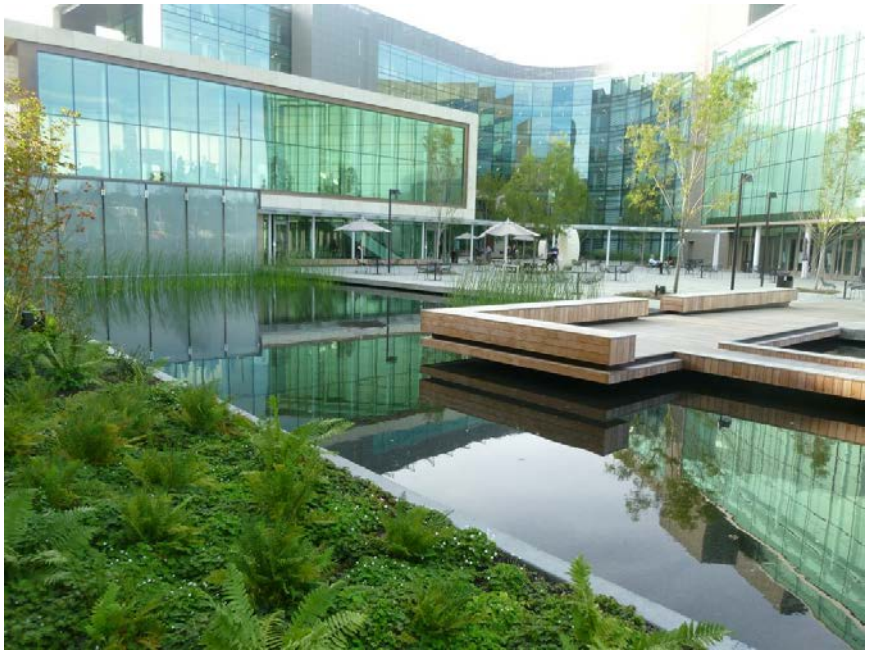
Jeffrey L. Bruce, FASLA, LEED, ASIC, GRP

ASIC Southwest Conference

JBC 30

What is a Green Roof?

A green roof is a green space created by adding layers of growing medium and plants on top of a traditional roofing system.



Hanging Towers of Babylon (450 BC)

Green Roofs are as old as America

1981 Green Roof

INDUSTRY GROWTH

"Green roofs and green walls is expected to surge to $7.7 billion by 2017. Installations of green roofs will rise 70% by then, to 79.76 square miles." Lux Research, 2012

Source: ASLA

MARKET DRIVERS

“Unlike other “green” sectors adoption is not driven by national-level policy measures, but entirely by city-level hyperlocal priorities.

- Building code requirements and mandates.
- Financial incentives.

MARKET DRIVERS

Value Proposition against Competing Technologies is a Major Barrier for Adoption.

Four Seasons Hotel, Boston

COMPETITION

Value Proposition against Competing Technologies is a Major Barrier for Adoption.

Source: Tremco

MARKET TRENDS

Significant challenges remain in performance measurements and estimating payback periods, and clients should expect to see the following trends emerge.

- Financial concerns will dictate choice of vegetation.
- Building materials companies will develop special waterproof membranes and geosynthetic fabrics.
- Payback periods become an important metric.
- Technologies increasingly integrate with other innovative building materials.

Singapore

ASIC Southwest Regional Conference

W A T E R at the F O R E F R O N T

"*There is no shortage of water in the desert unless you try to establish a city where no city should be.*"

Edward Abbey, "Desert Solitaire," 1968

ALTERATION of NATURE

"*An animal exhibit is an intensive care hospital with a pretty frame for interpretation*."

John Coe

ALTERATION of NATURE

Water as Fuel

We can’t build greener cities simply by wasting less energy and water. The idea of net zero water is that we can actually **harness the power of nature** to restore our rainwater, air, and ground water.

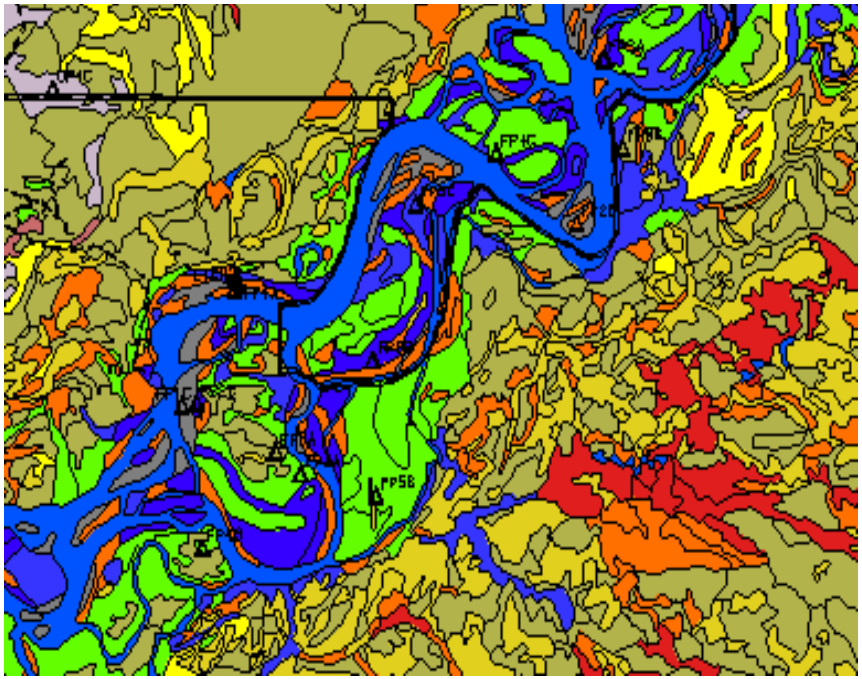
Aesthetic vs. Function

Horticulture

Ecology

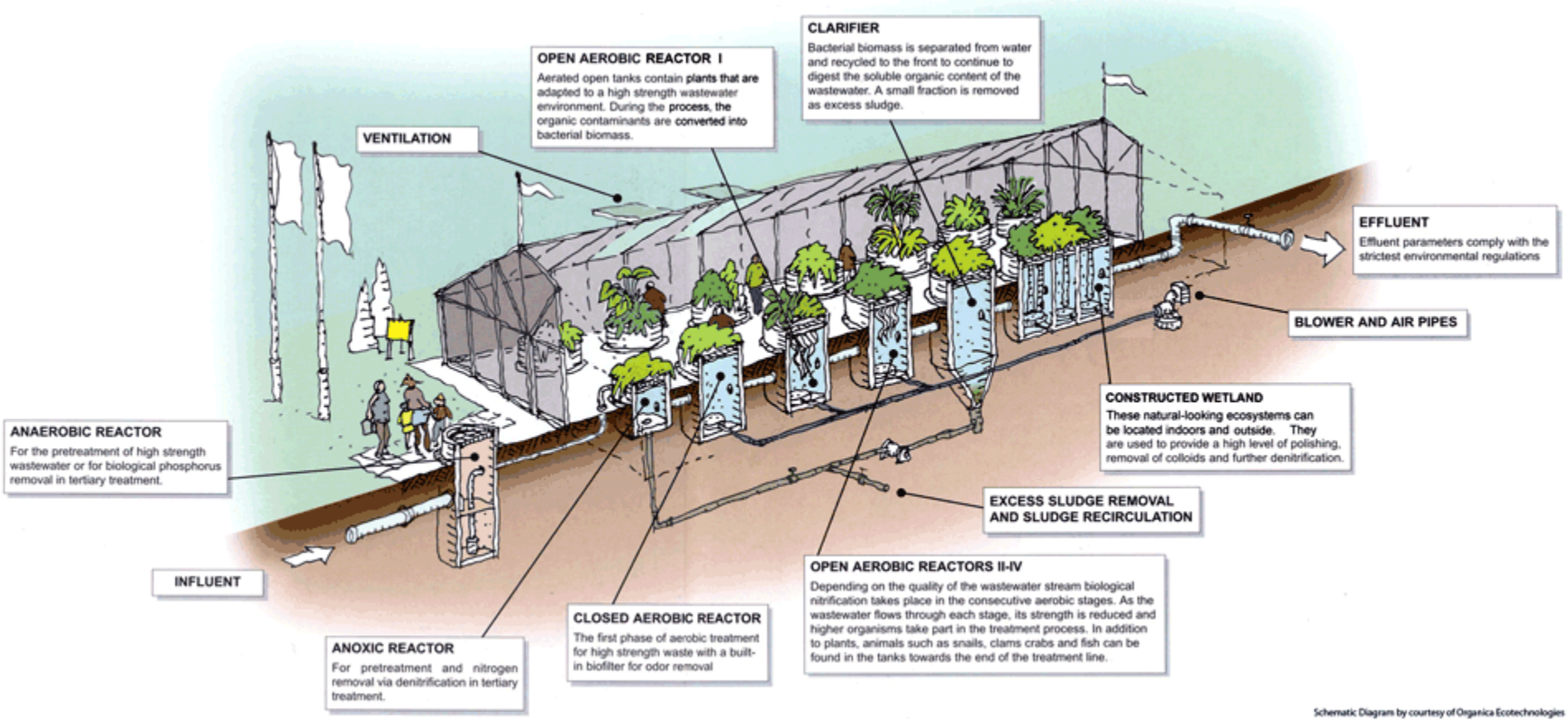
Consumptive vs. Restorative

Horticulture



Ecology

Landscapes as Living Machines



Schematic Diagram by courtesy of Organica Ecotechnologies

If We Were To Dream?

If We Were To Dream?

Green Roofs

Green Roofs

Thermal Village Blumau

Green Roofs

“Waldspirale" Darmstadt, Germ

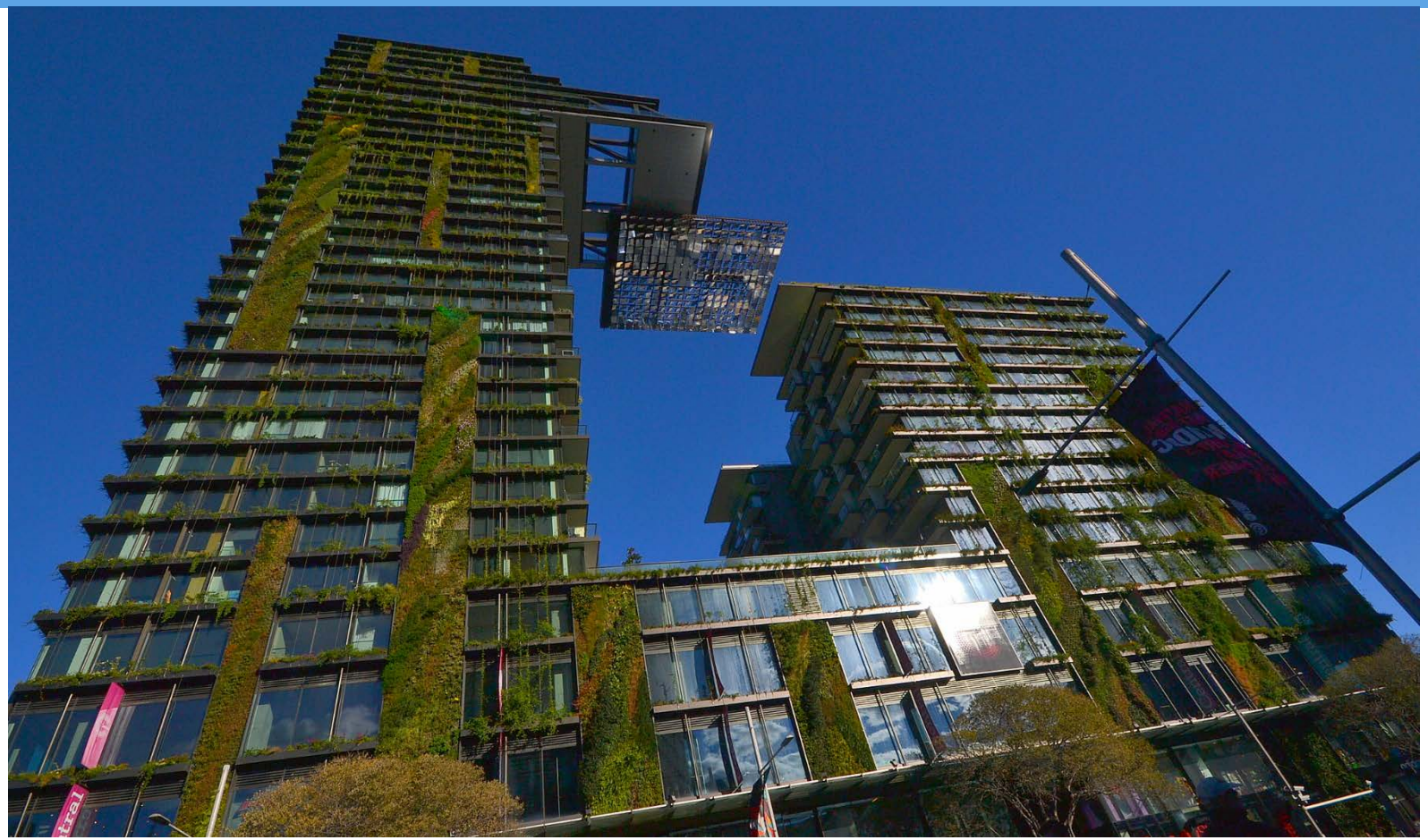
Green Roofs

RCCL Solstice Lawn Club

Rooftop Urban Agriculture

Brooklyn Grange, New York City

Green Walls



One Park Central, Sidney

Bio-Lungs

Siam Paragon Center, Bangkok Thailand

Vertical Forests

Bosco Verticale, Milan

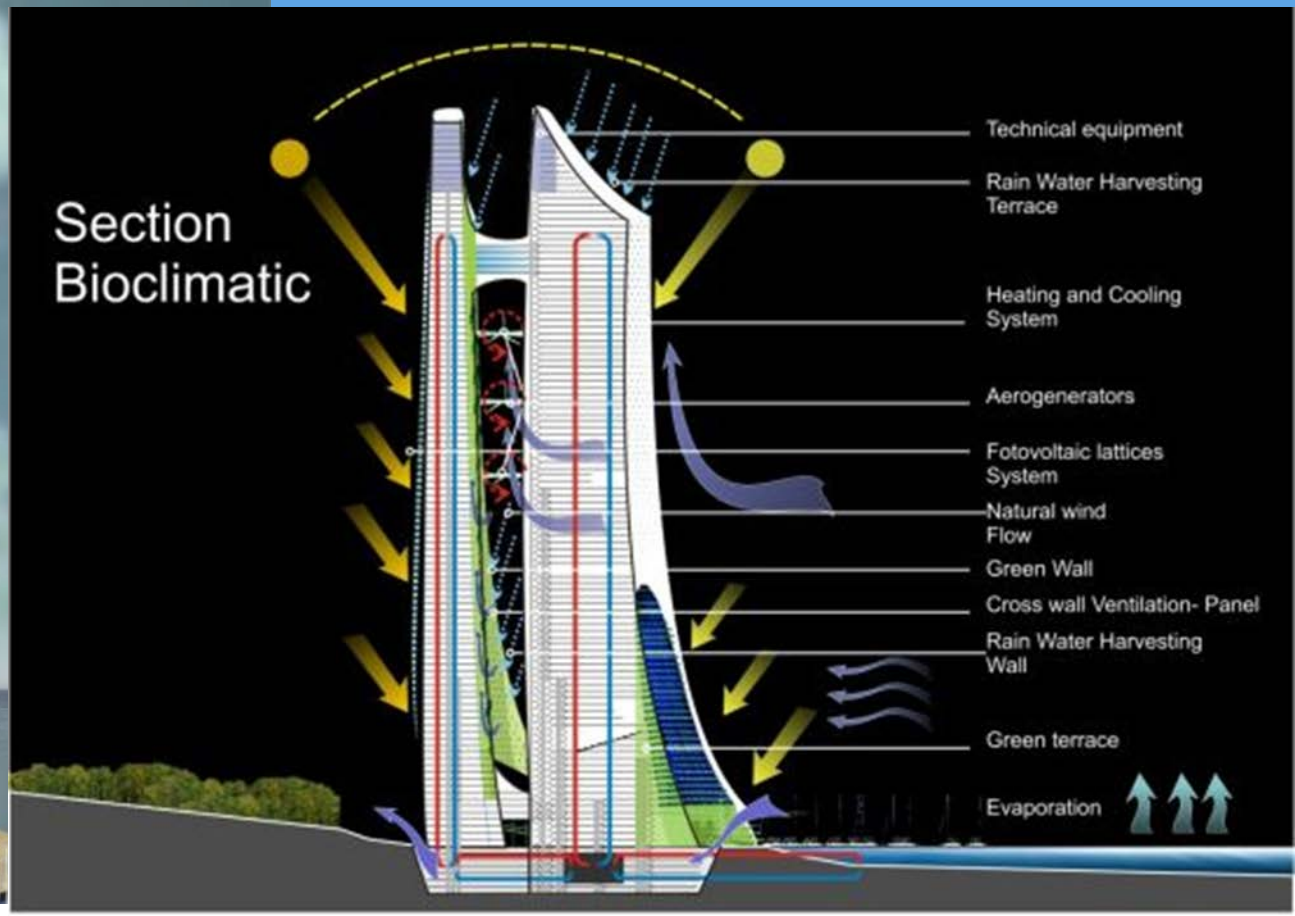
Vertical Greenhouses

EDDIT Tower Singapore

Vertical Farming

Sky Green Vertical Farms

Bio-Climatic Buildings



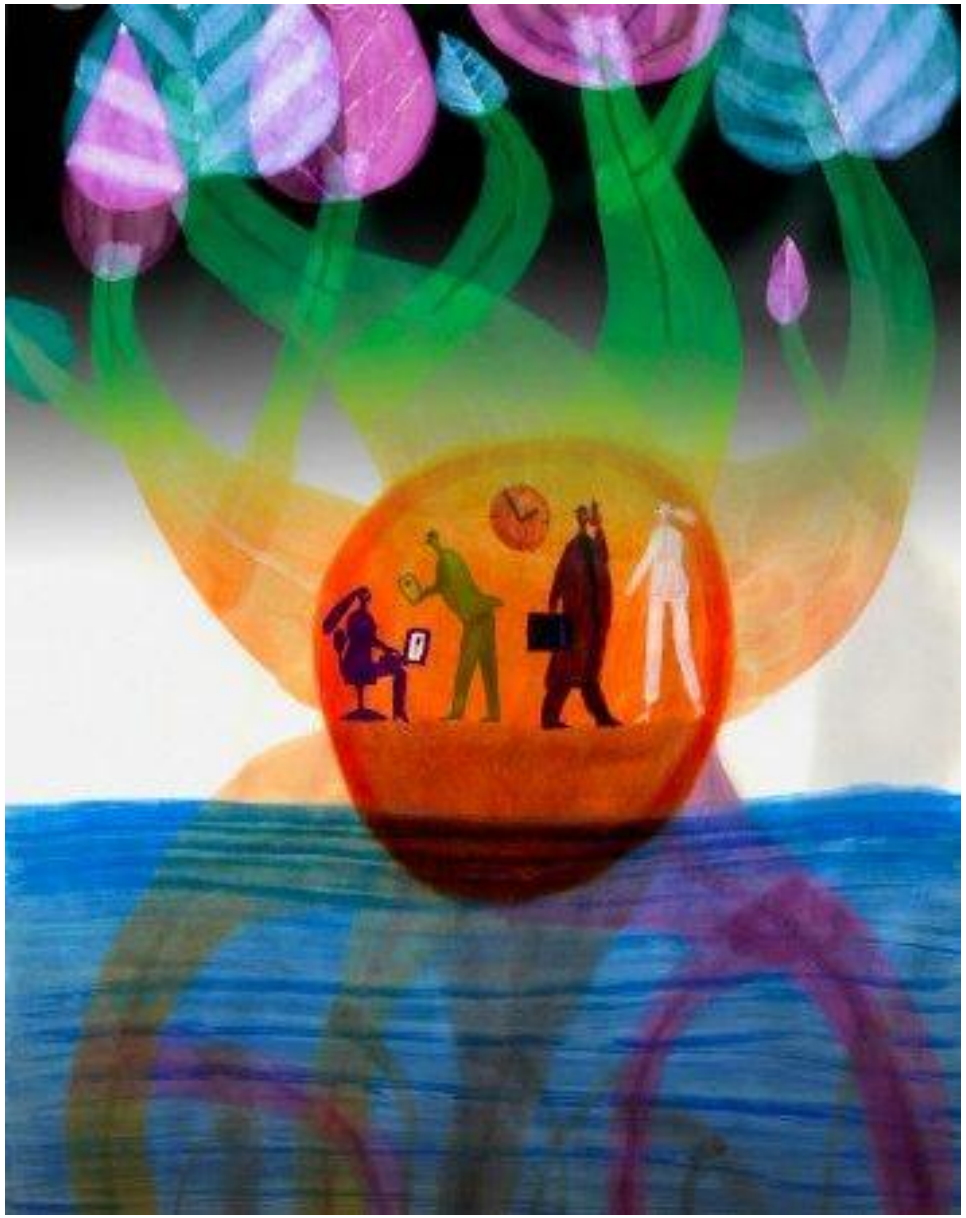
Eco-Cybernetic City

Bio-Climatic Buildings

Fog Tower, Chile

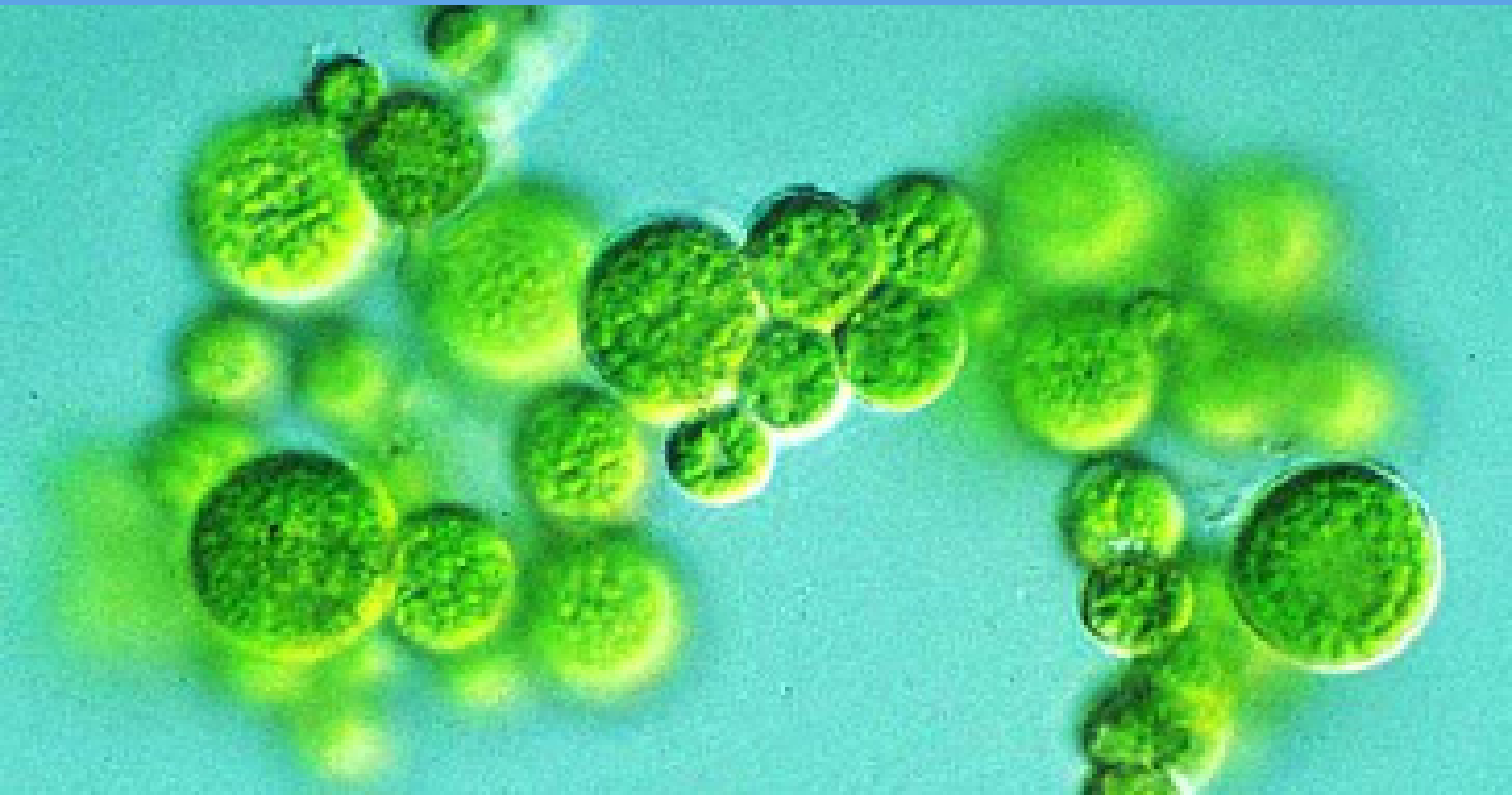
Building Integrated Vegetation

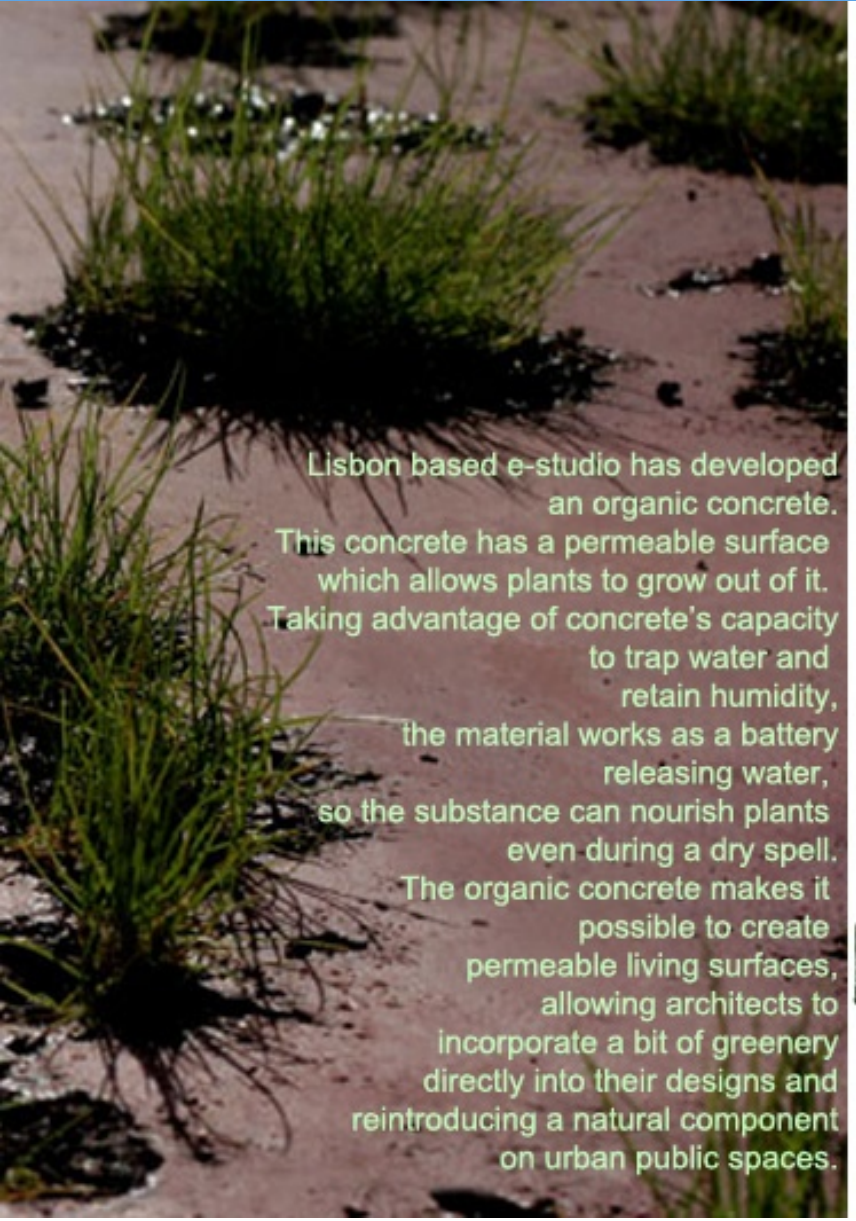
Hundertwasser House, Austria



Convergence of Technologies

Self Healing Materials





Organic Concrete

bonds both vegetal and inorganic in one element

Biological Concrete

Water Harvesting & Treatment Facades

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Will bioluminescent trees replace streetlights?

Robotic Bees to Pollinate Monsanto Crops

Digital Data Successfully Merged With Biological DNA

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Algae Bioreactor

El Paso, Texas

Cities of the Future: Built By Drones and Bacteria

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Nature is Not Waiting for Us

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Architecture's Search for this Aesthetic

Restorative Urban Environments

The Living Bridges of Cherrapunji

“The battle for life on earth will be won or lost in cities.”

United Nations 2008

A New Paradigm Shift

A Better Paradigm Shift

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Prepare for a Radical Paradigm Shift

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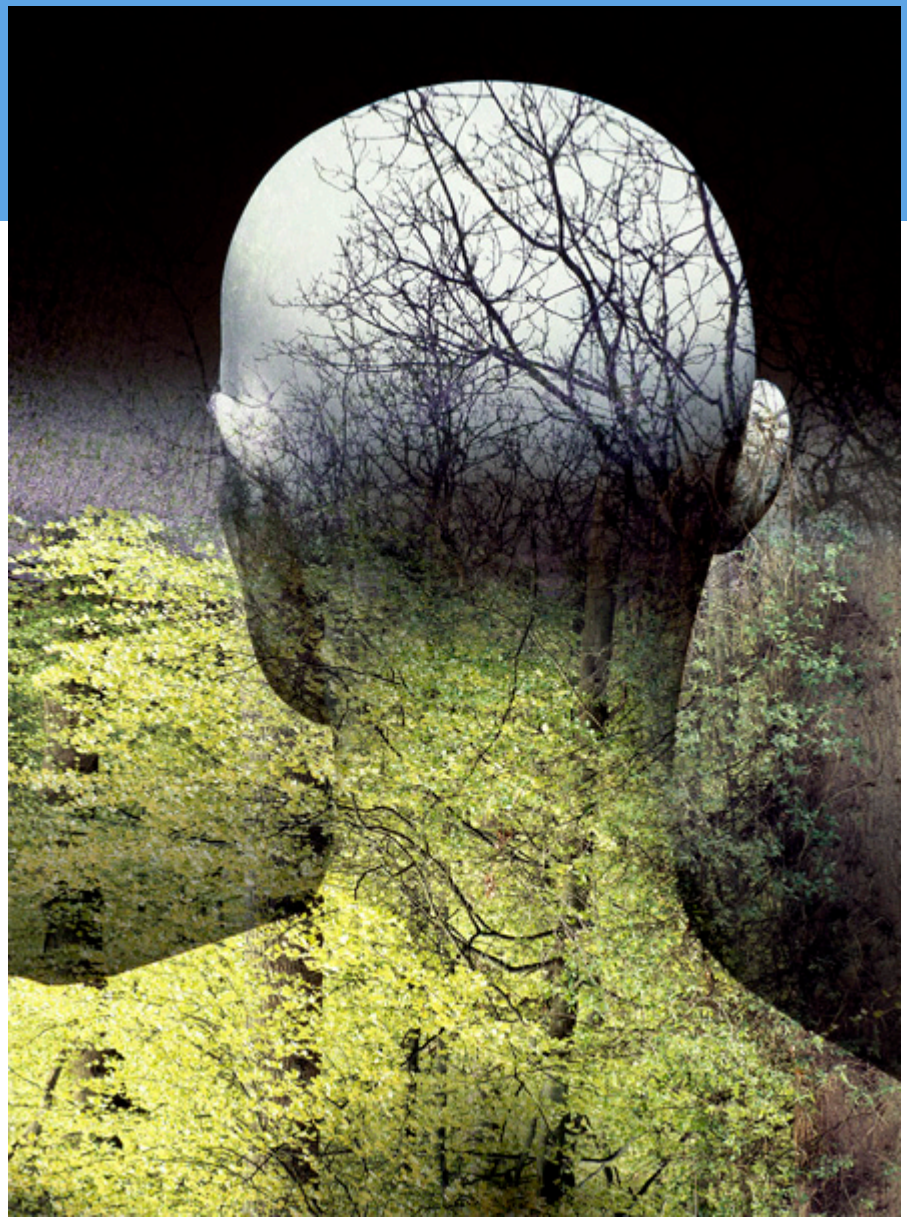
What's Next

"Design is the most under-utilized resource for solving environmental problems."



Ann Audrey

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Designing Water Harvesting to Augment Irrigation in the Arid Southwest

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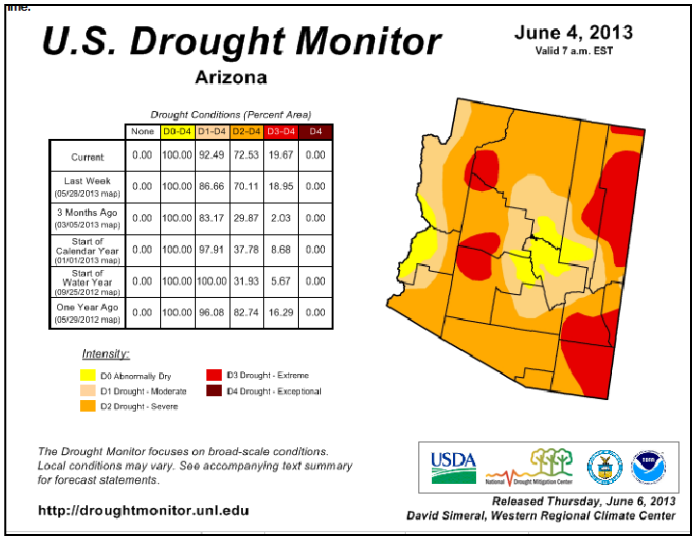
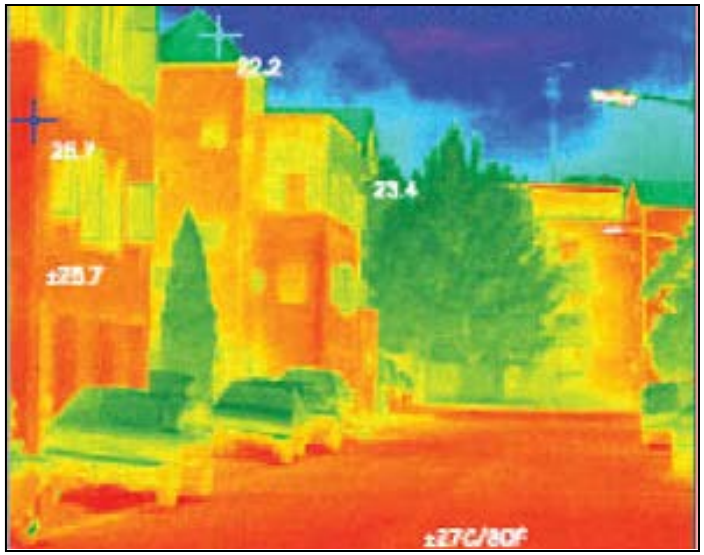
Southwest Water problems….

- **Drought**
- **Groundwater depletion**
- **Flashy flood peaks**
- **Need to deflect stormwater**
- **Urban heat island effect**

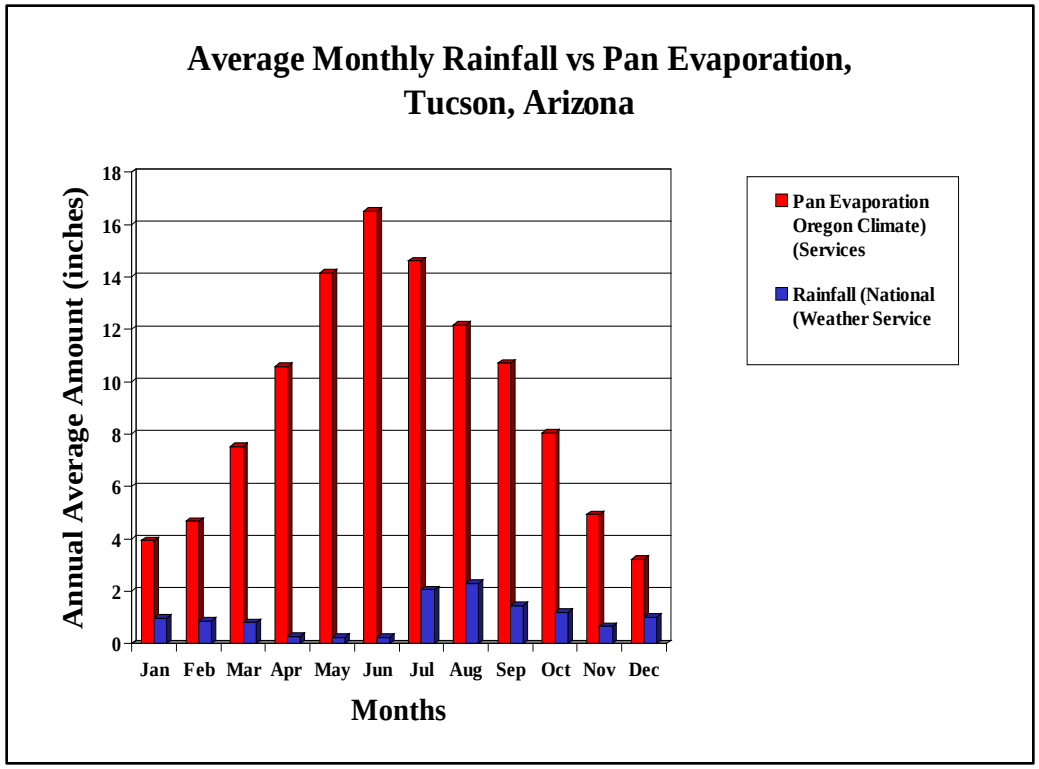




http://www.urban-climate-energy.com/urbanHeatIsland.htm

Irrigation & landscape issues….

- **High evaporation rates – need on-going irrigation**
- **Erosion in big storms**
- **Soils salt up**
- **Many landscapes deflect water**



The Solution…

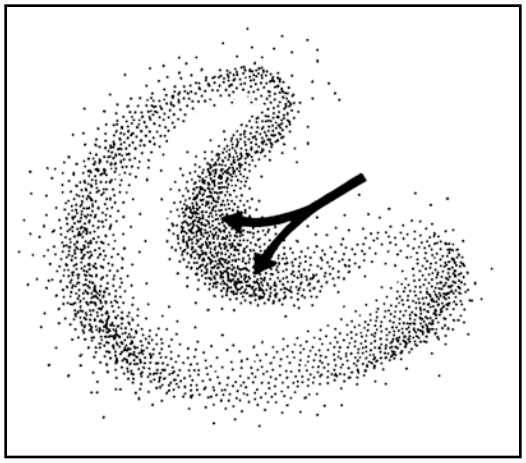
Capture rainfall
Use is beneficially

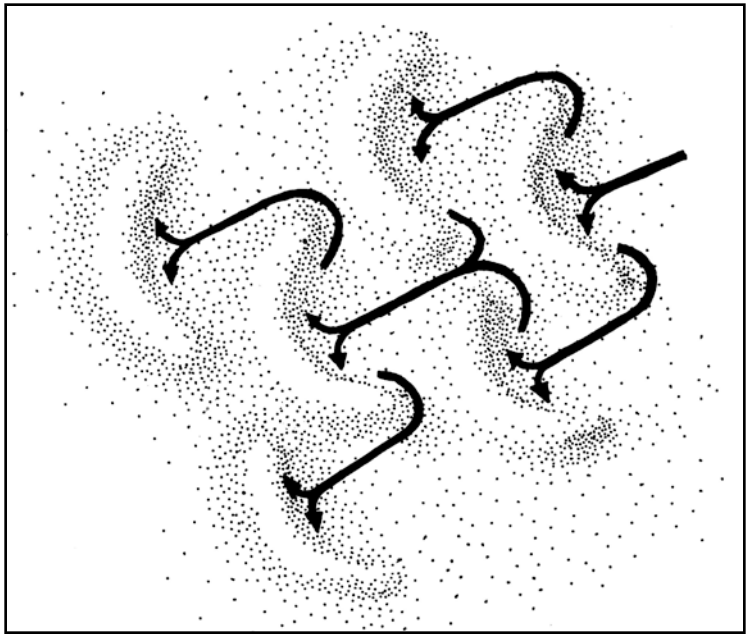
1. There's lots of it in urban areas
2. It falls where you need it
3. Plants like low salt and high nitrogen
4. Save $$$ getting rid of stormwater
5. Save $$$ over-irrigating (use Smart Controllers)
6. **Its FREE**

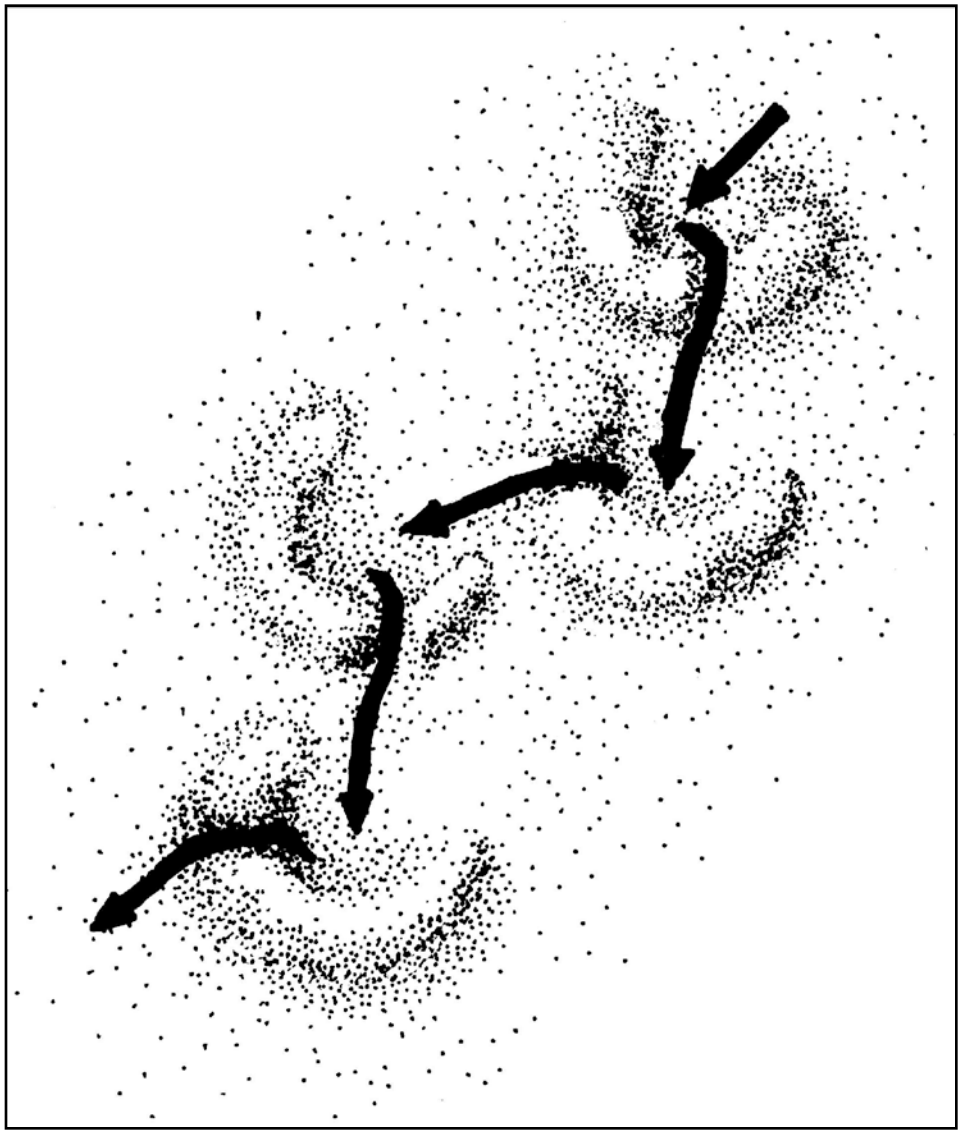
PASSIVE rainwater harvesting
(its not just about tanks...)

Shape the earth to
collect and store water in the soil

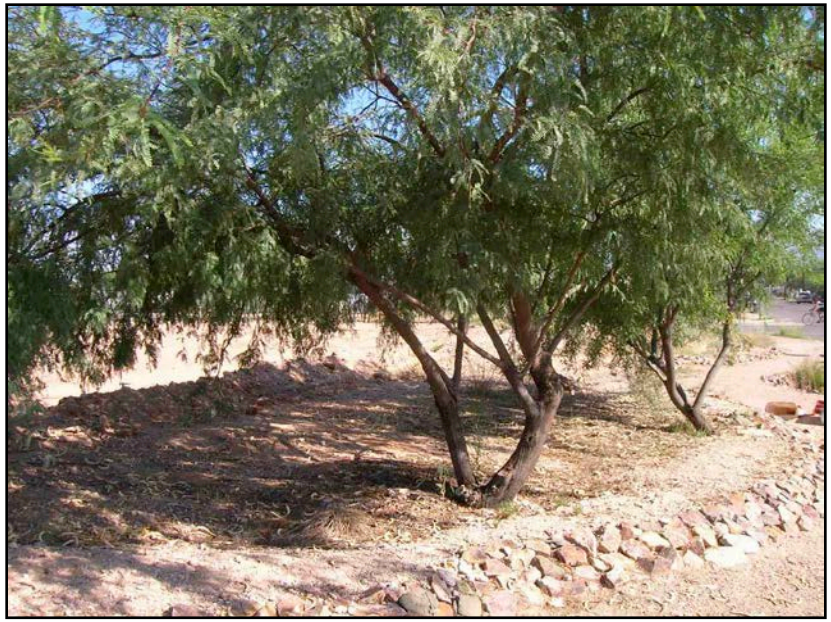
Basins

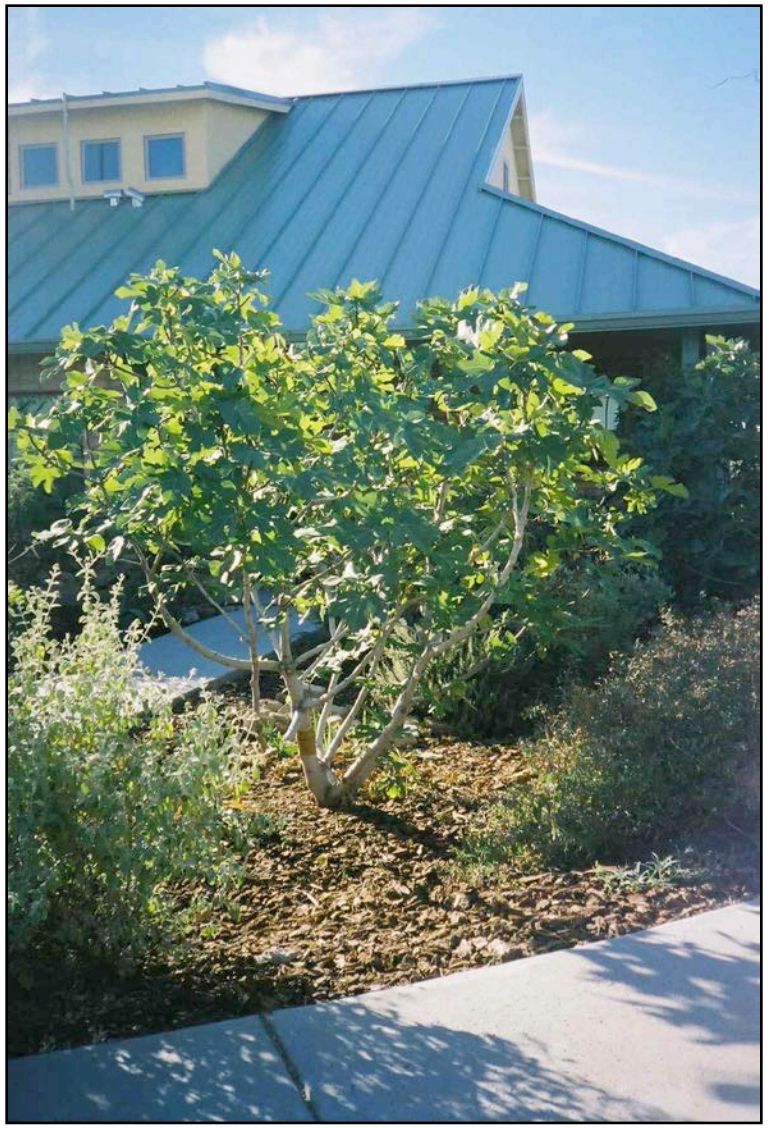




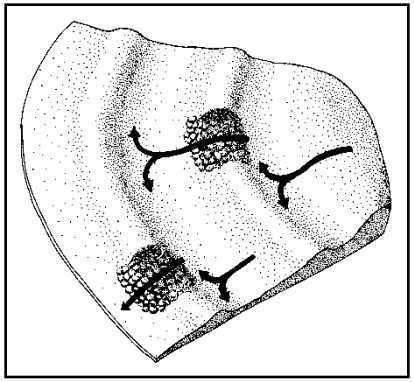


Basins

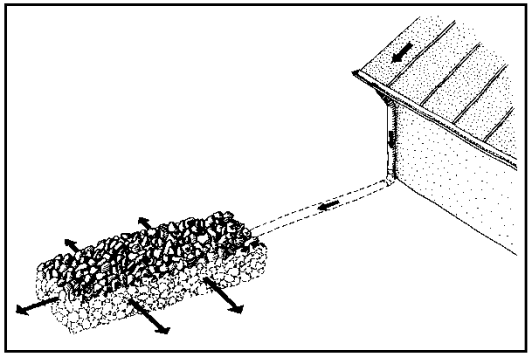


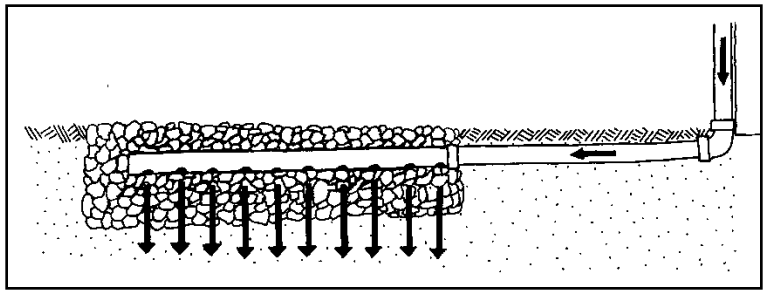


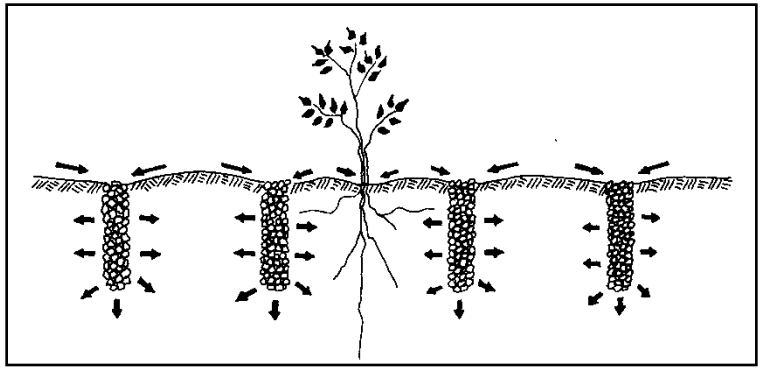
Swales

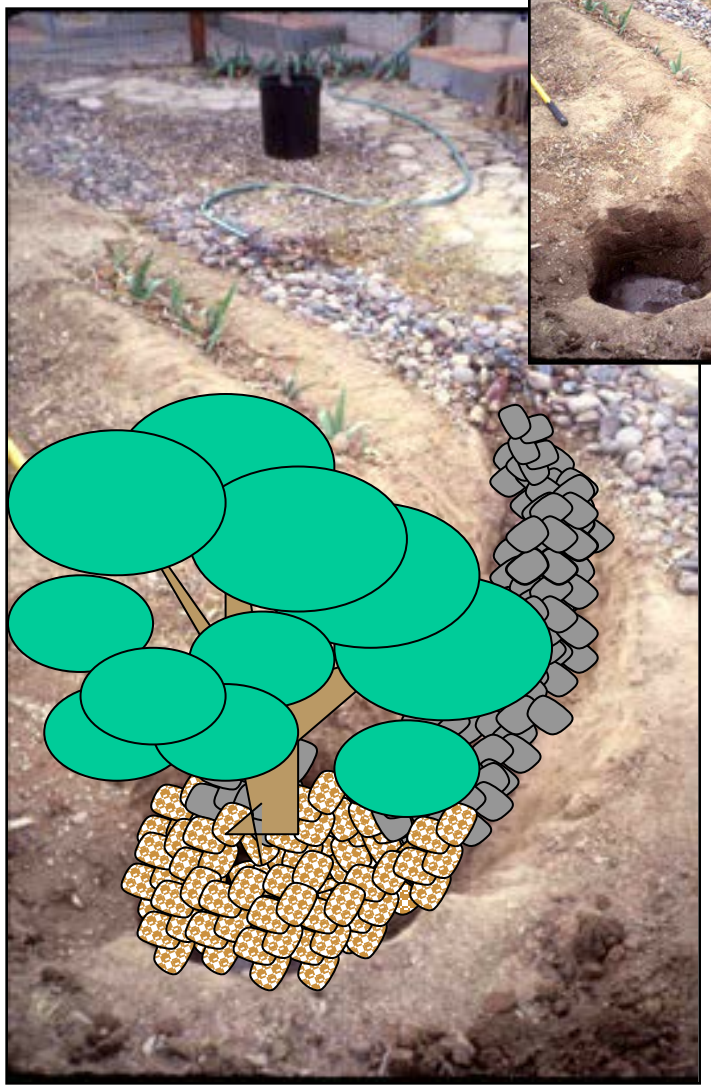


Gravel-filled drains

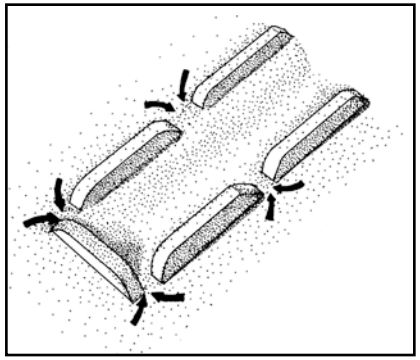


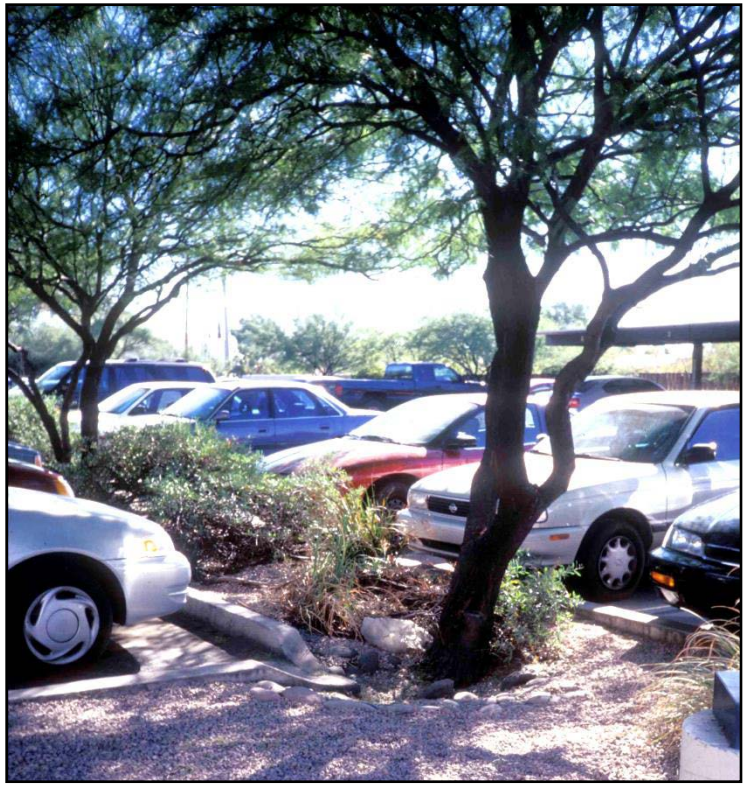






Curb cuts





Weirs/Grade control structures

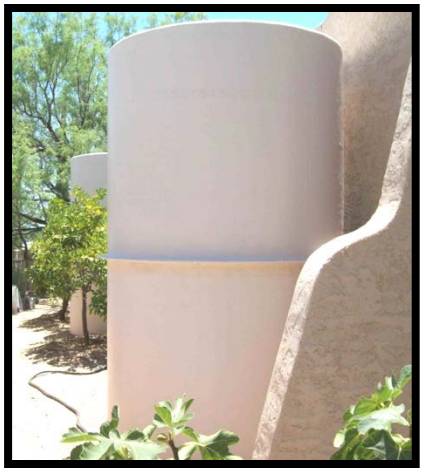
Porous pavement

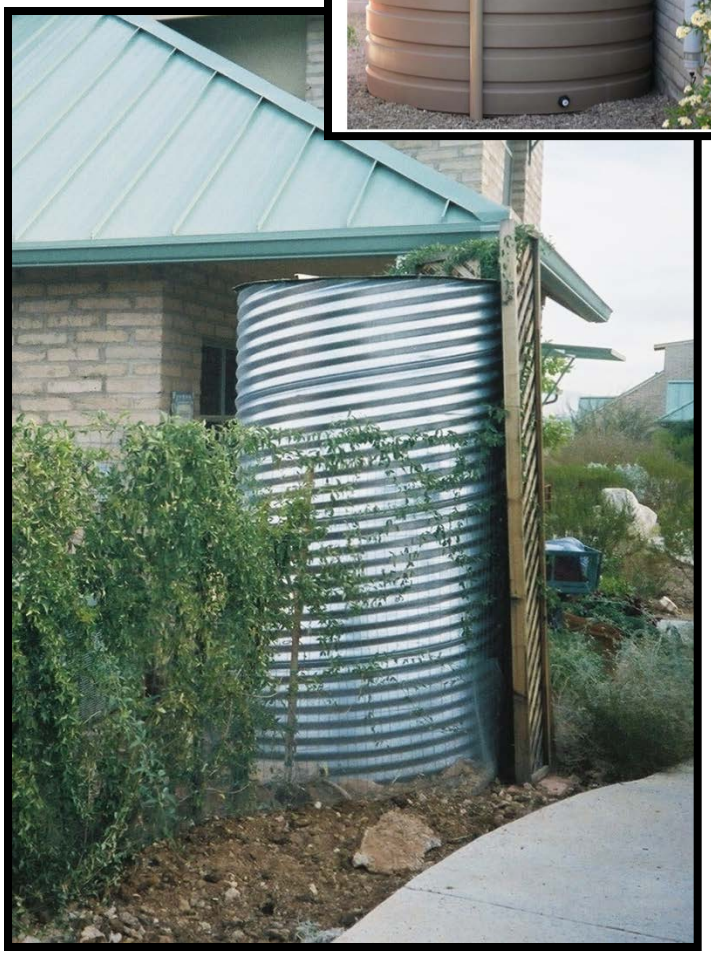
Infiltration Basins, LID & GI projects

ACTIVE rainwater harvesting

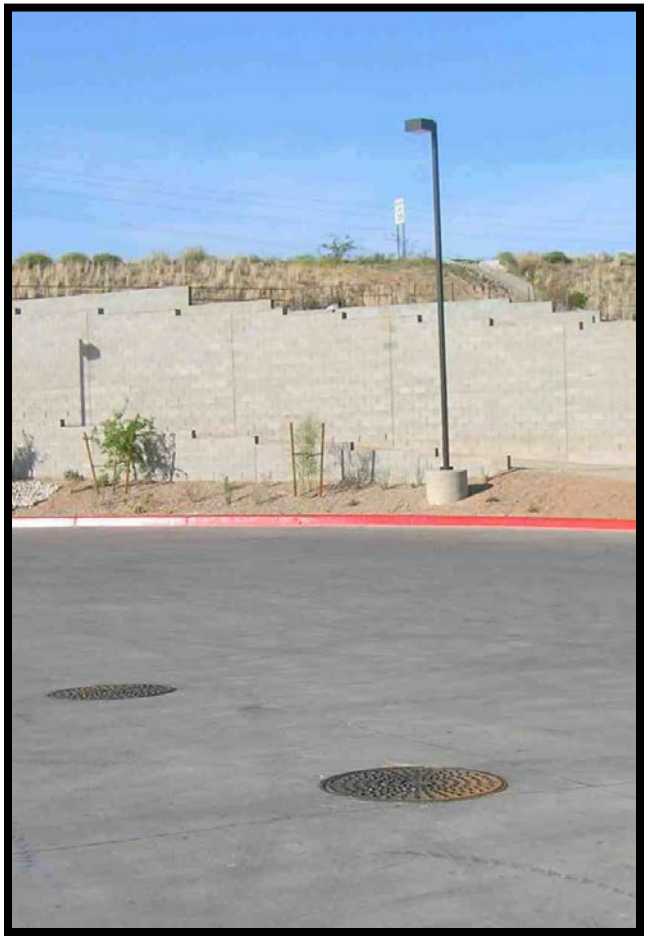
Capture rainwater in a tank
Store it for later beneficial use

Above-ground tanks





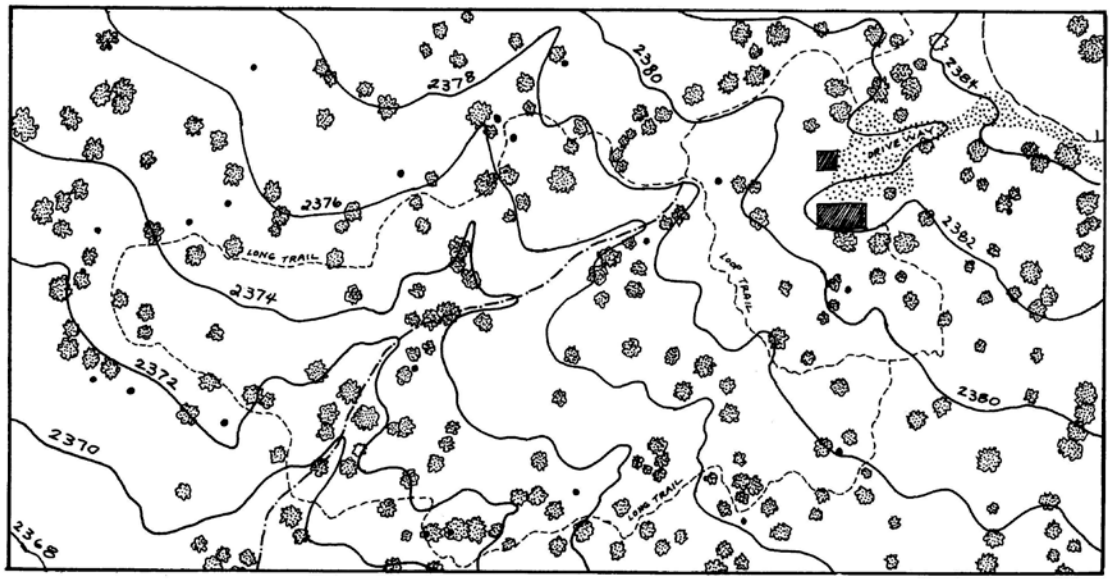
Below-ground tanks

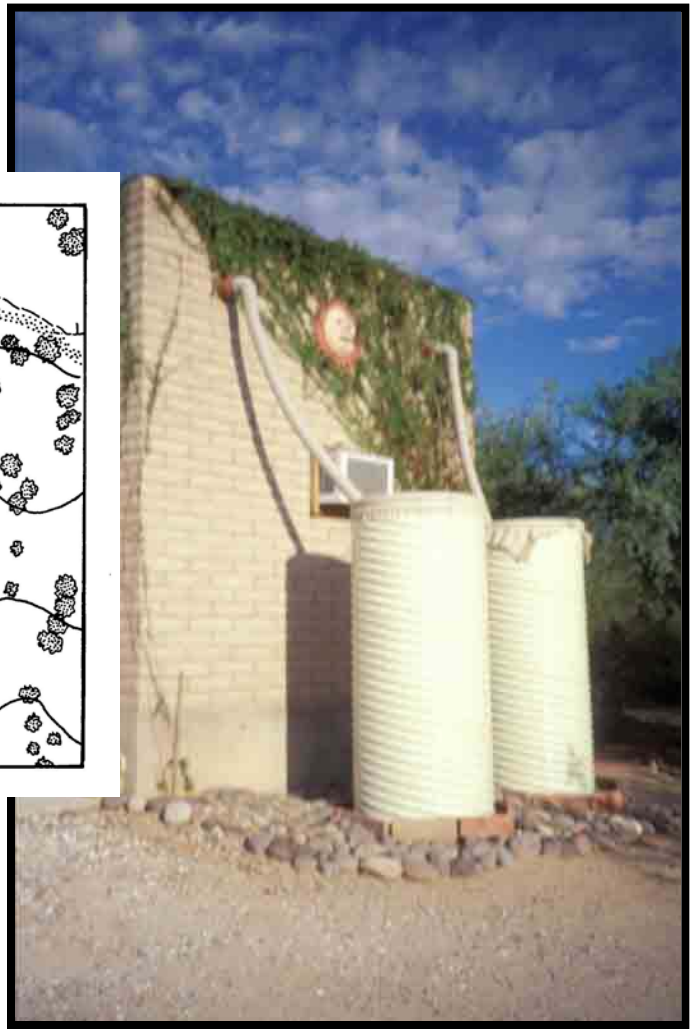


How do you design it?

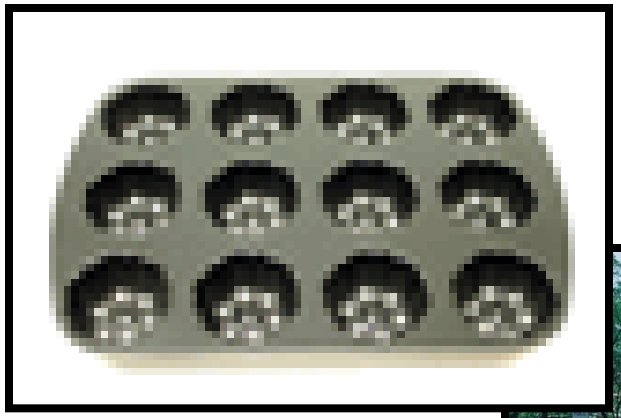
Principles used in
Rainwater harvesting design

Start harvesting at the top of the watershed





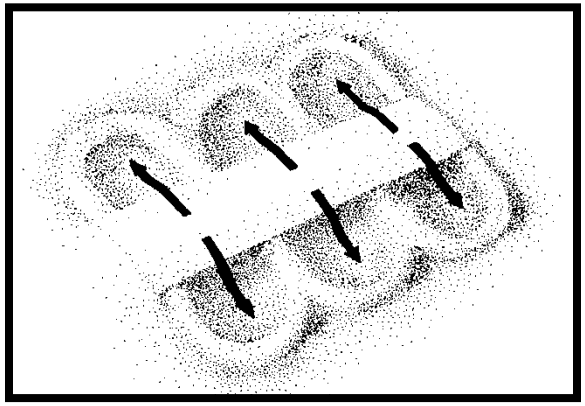
Capture water in multiple small catchments throughout the watershed



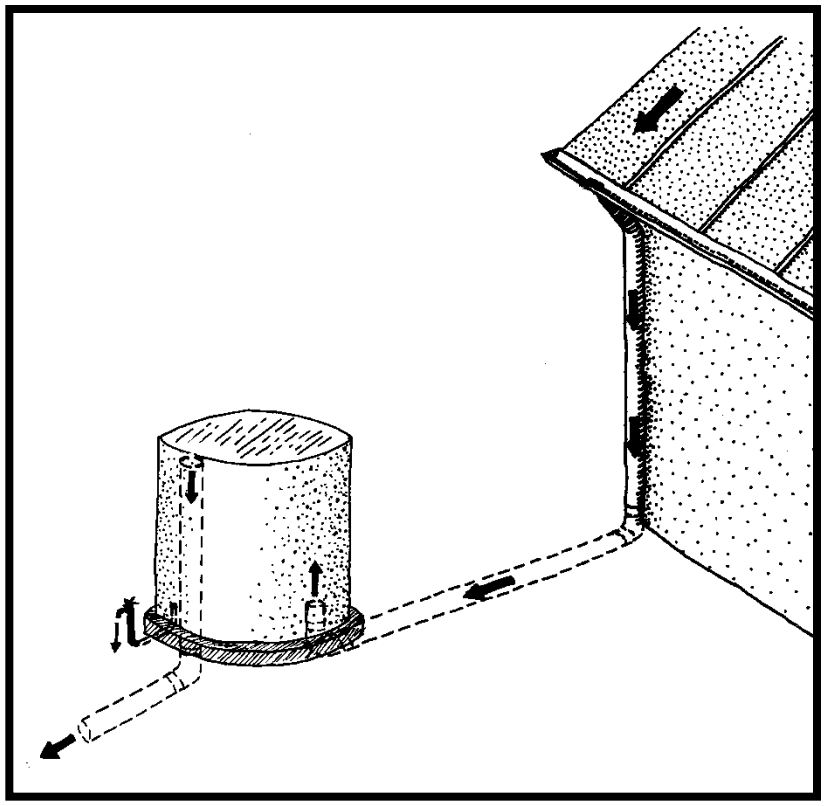
Collect, slow and infiltrate the water

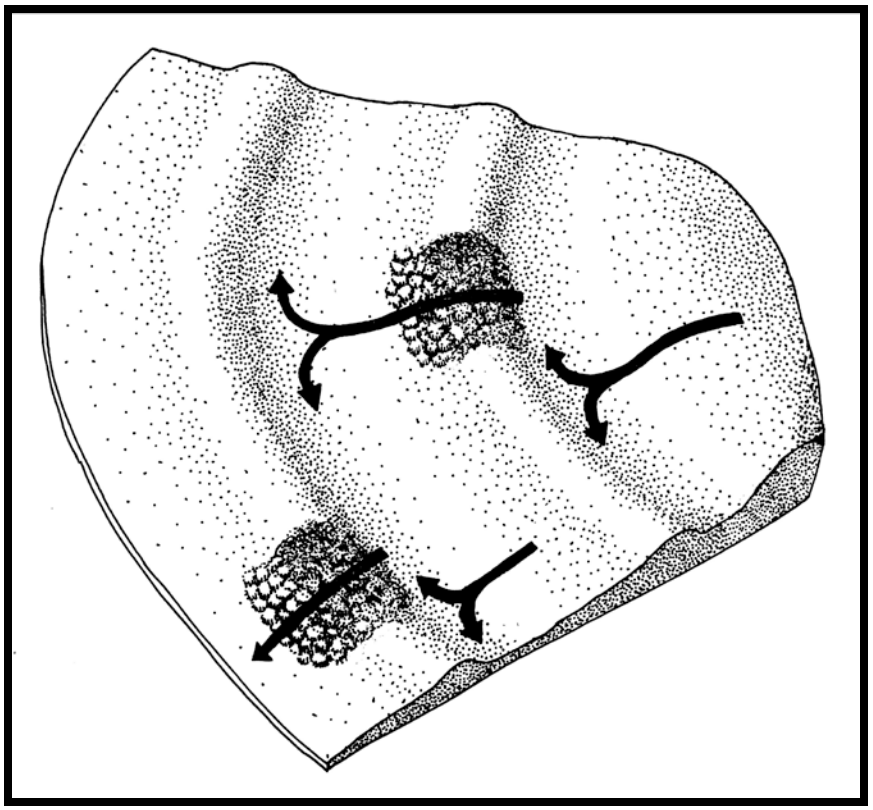
Poinciana Road, Tucson, photo by Akhila Graham

Raise roads, sidewalks and paths; lower adjacent planting areas

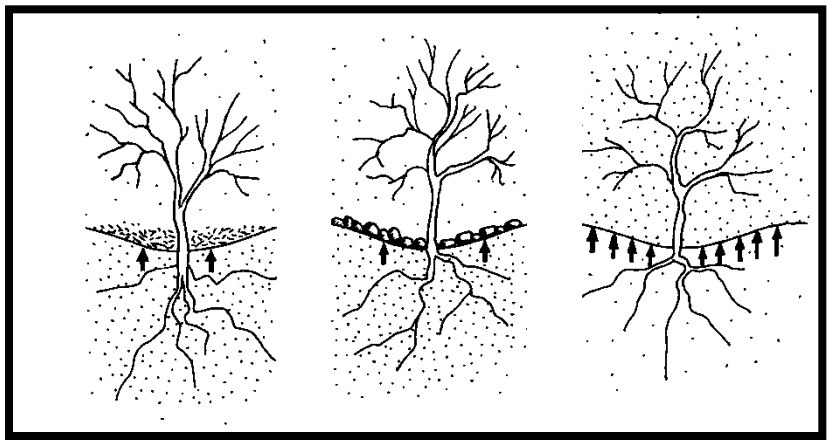


Prepare for overflow

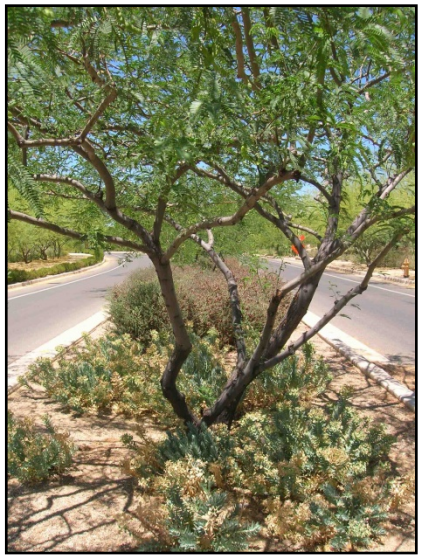




Mulch to reduce evaporation



Plant appropriate vegetation



Design for many functions: shade, clean stormwater, reduce runoff

How much water can you harvest?

The catchment-canopy-area ratio approach

Example: Use of catchment-to-canopy-area ratios

From: Guide to Assessing Rainwater and Stormwater Harvesting Potential to Meet Multiple Challenges and Provide Multiple Benefits

A project funded by U.S. Bureau of Reclamation
Landscape Conservation Cooperative
WaterSMART Program

Conducted by University of Arizona Water Resources Research Center, with input from Technical Advisory Committee, Water Harvesting and Landscape Consultants, and Regional Water Providers

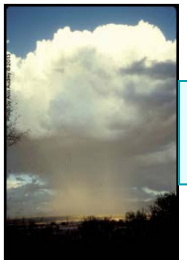
U.S. Department of the Interior Bureau of Reclamation

Desert Landscape Conservation Cooperative

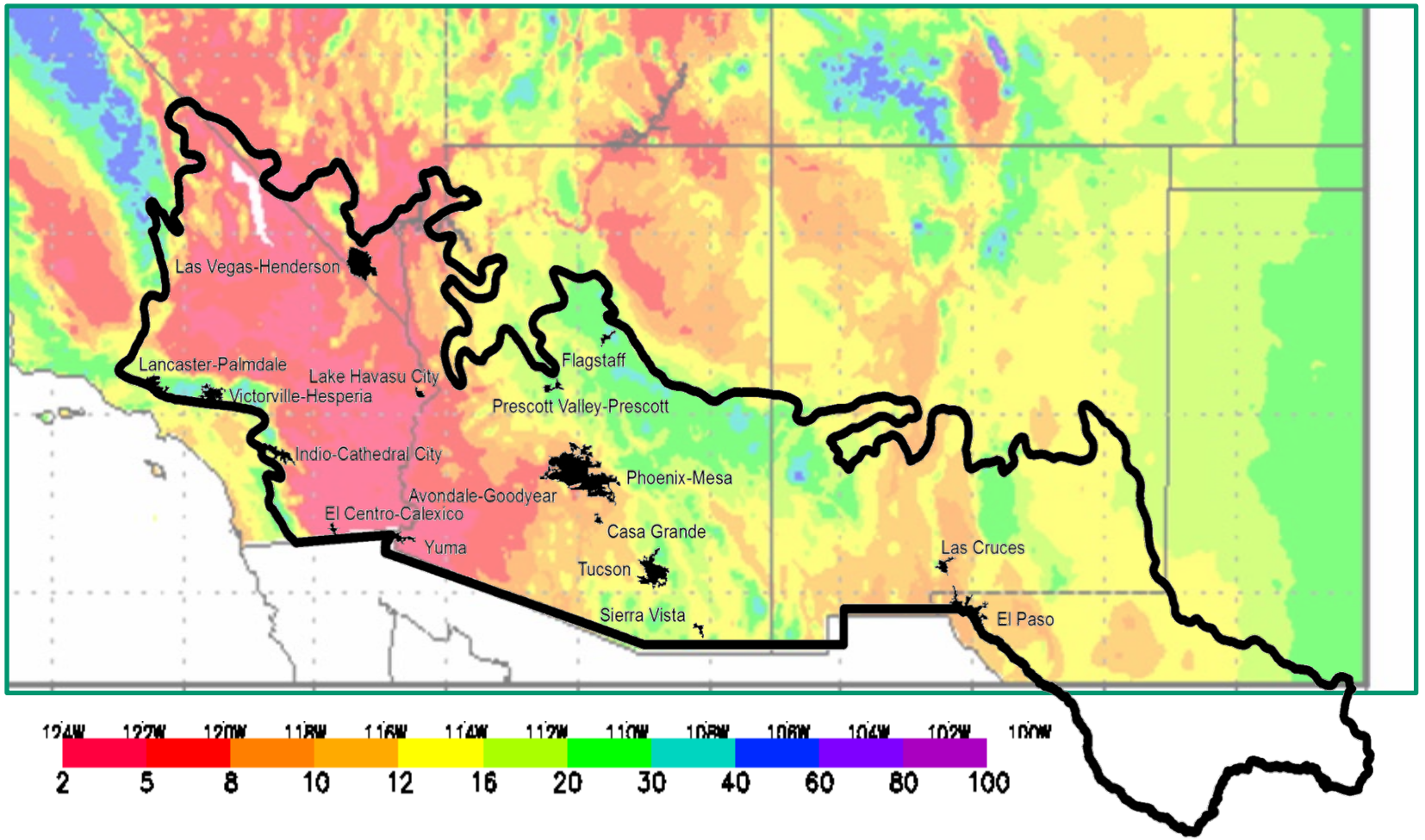
WRRC Water Resources Research Center

The University of Arizona College of Agriculture & Life Sciences

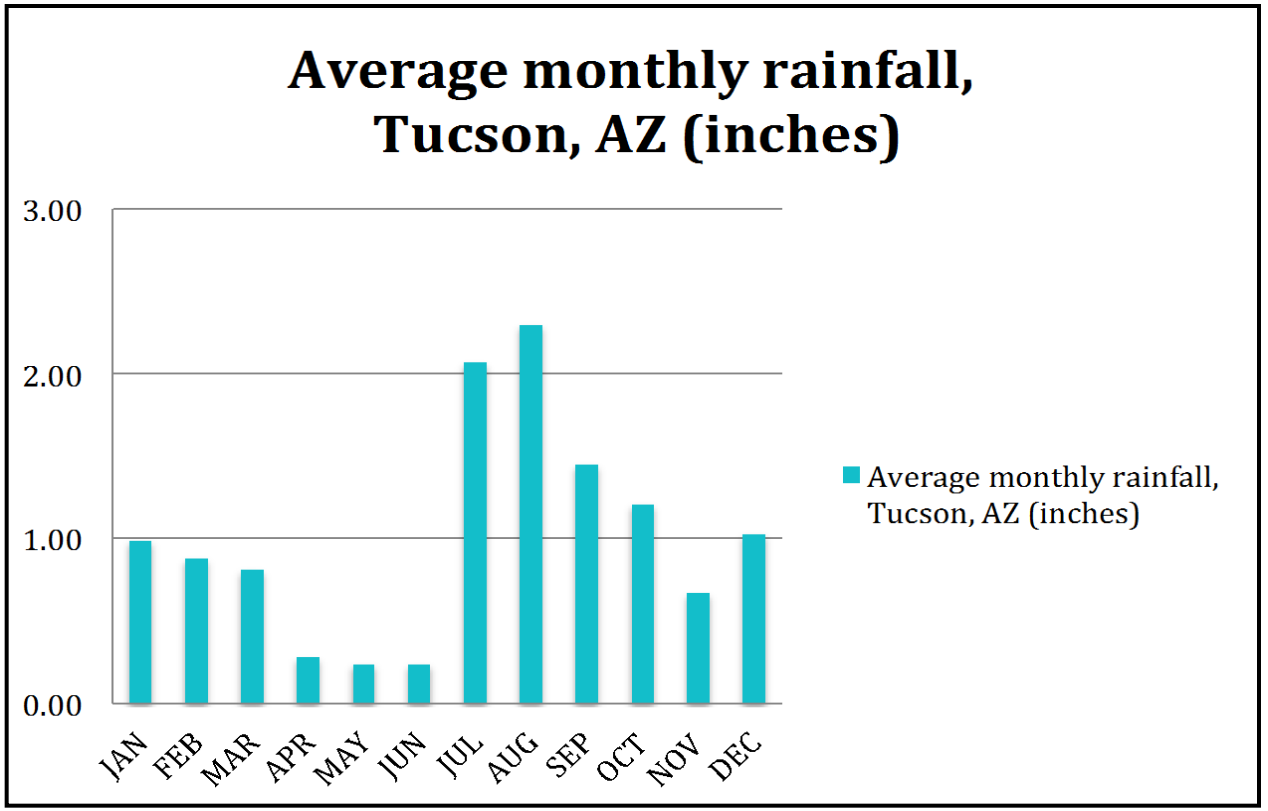
Desert Water Harvesting Initiative



SW desert average annual rainfall



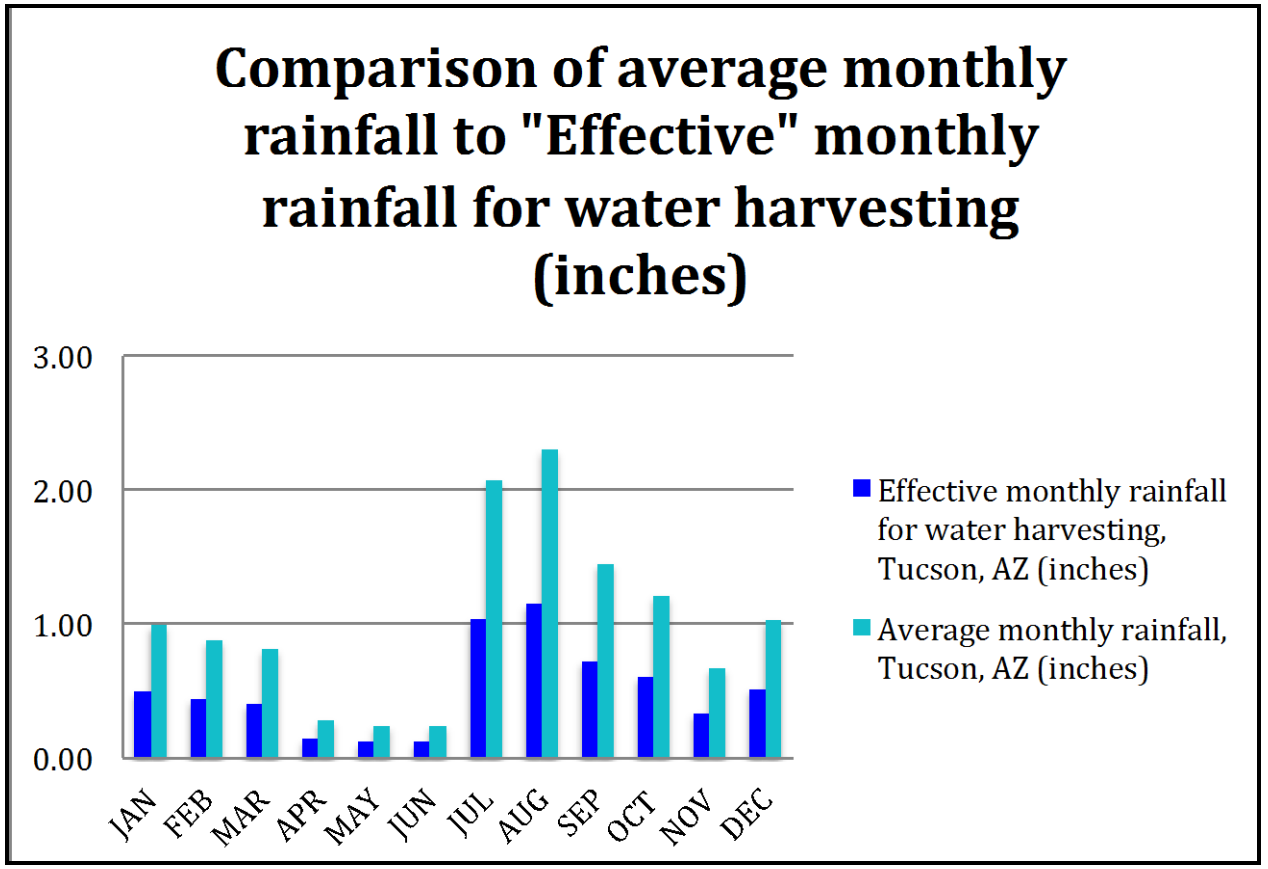
Step 1. Graph average monthly rainfall



EXAMPLE: Tucson, Arizona

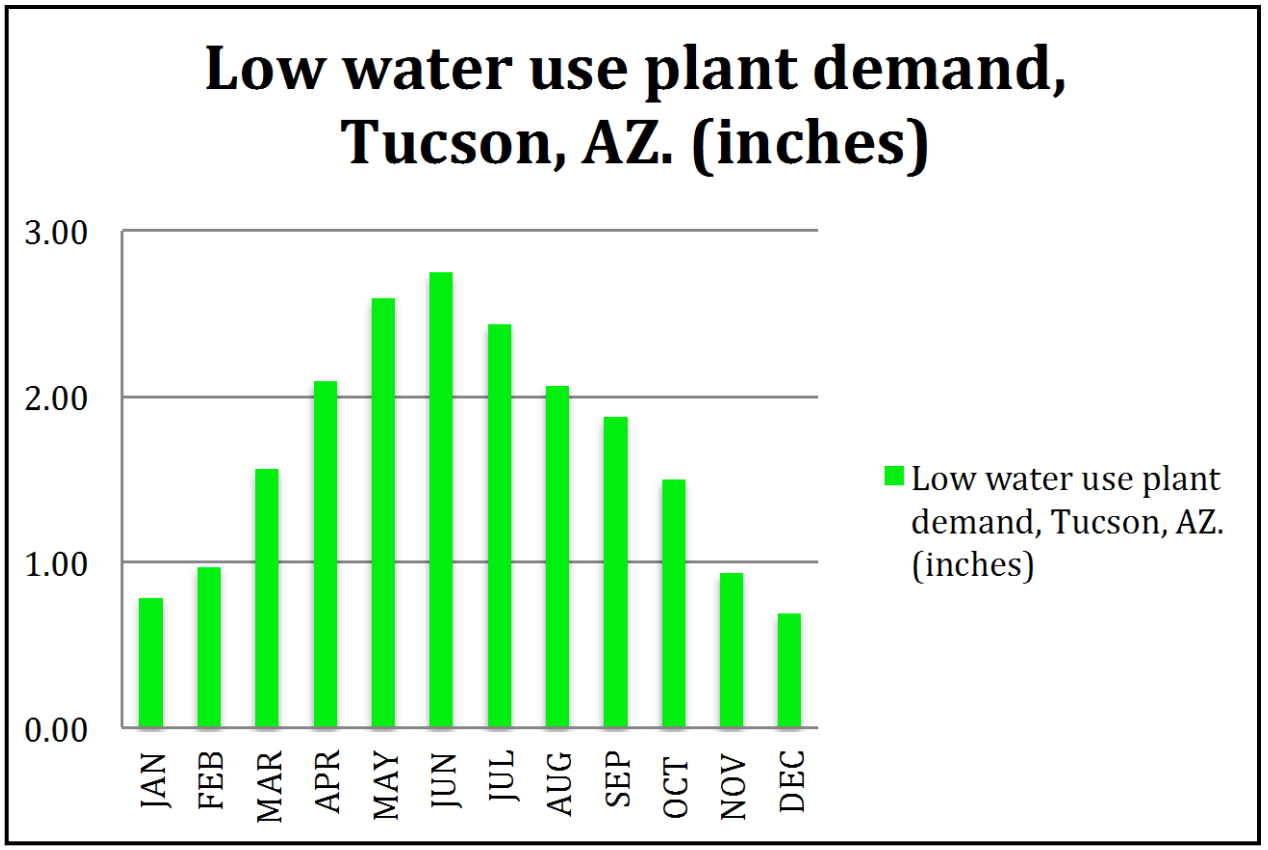
Annual average rainfall: 12 inches/year

Step 2. Graph 50% less rain/month to take into account variability & high/low rain events



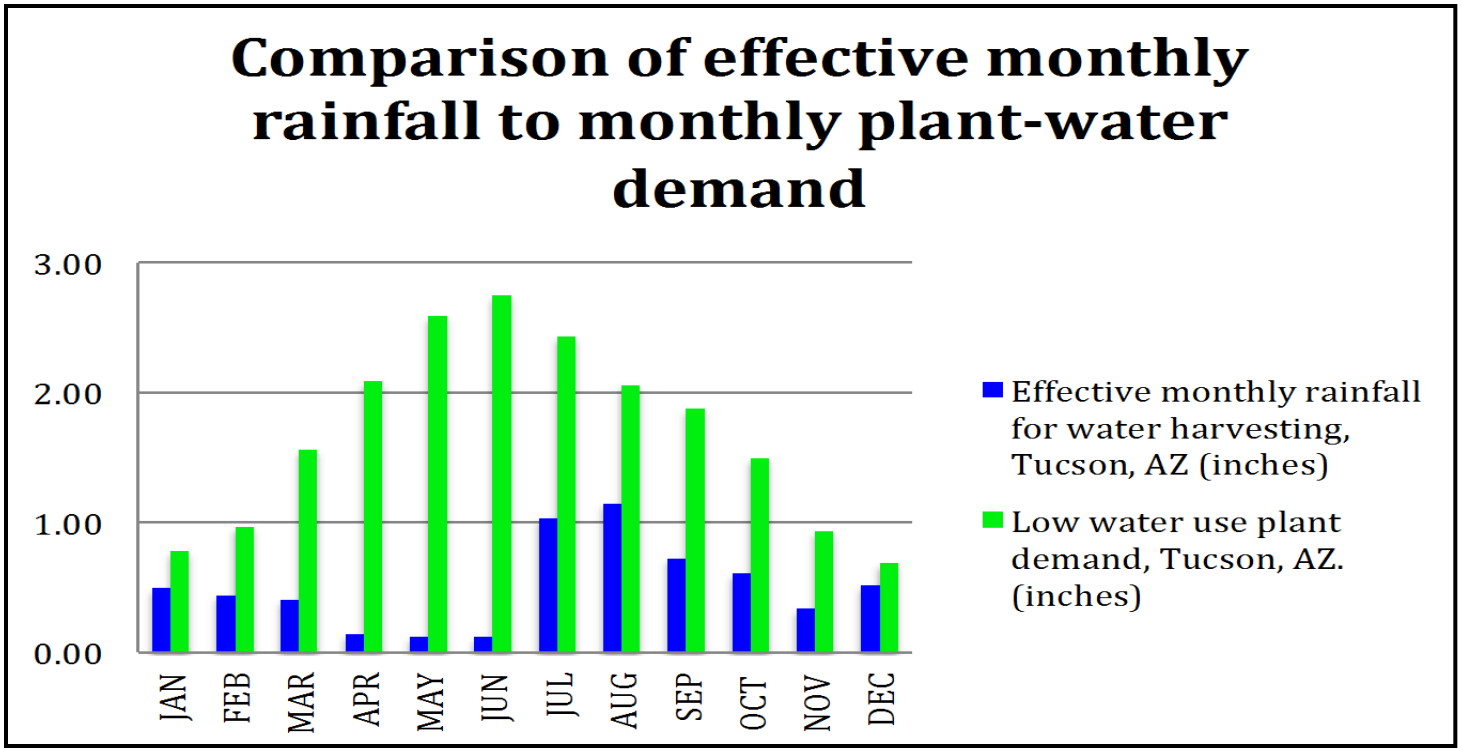
Tucson, AZ: Effective rainfall = 6 inches/year

Step 3. Graph low-water-use plant water demand



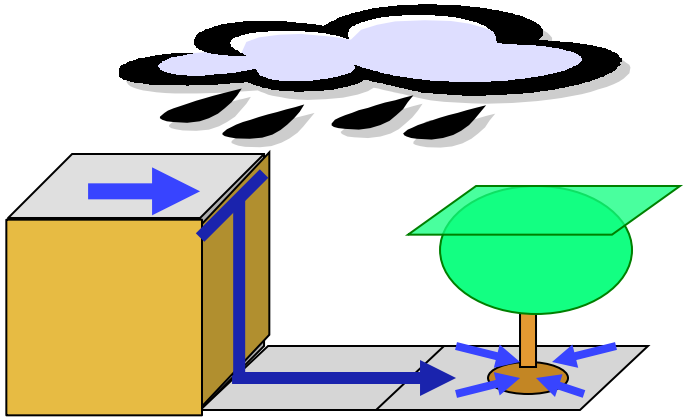
Tucson, AZ, Low-water-use plant demand = 20 inches/year

Step 4. Compare low-water-use plant water demand to effective rainfall

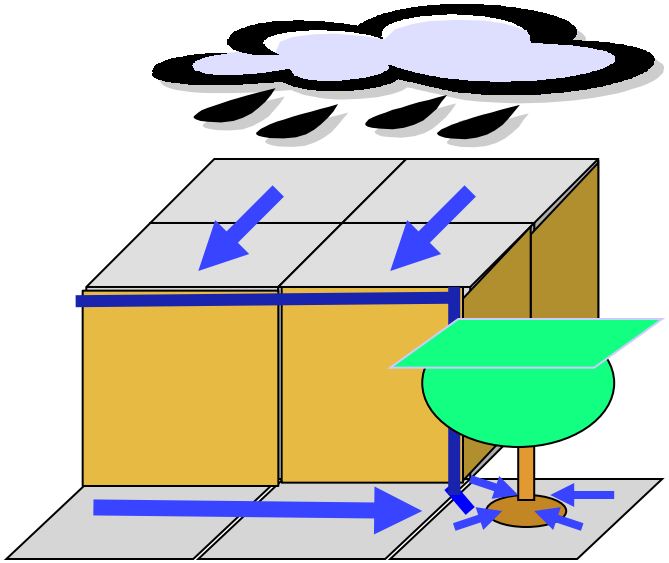


Tucson, AZ, Low-water-use plant demand = 20 inches/year; Effective rainfall = 6 inches/year

Example catchment-to-canopy-area ratios



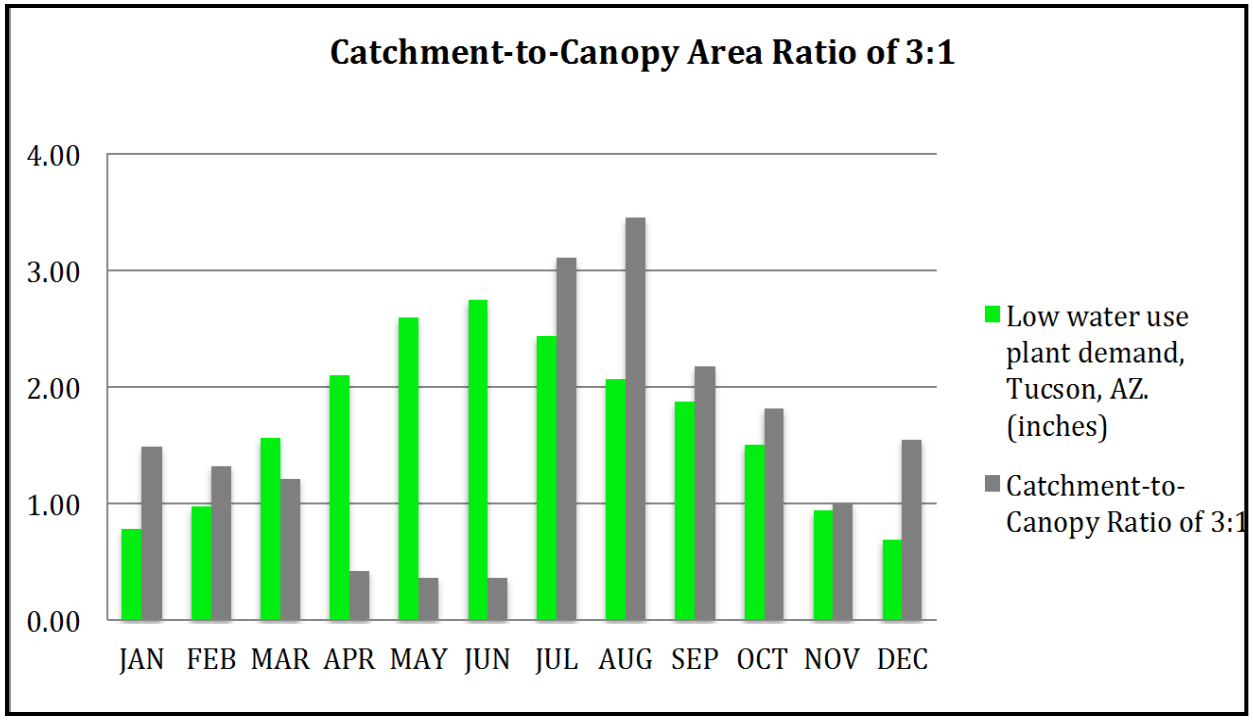
3:1 ratio of catchment-area (gray) to tree canopy-area (green)



7:1 ratio of catchment-area (gray) to tree canopy-area (green)

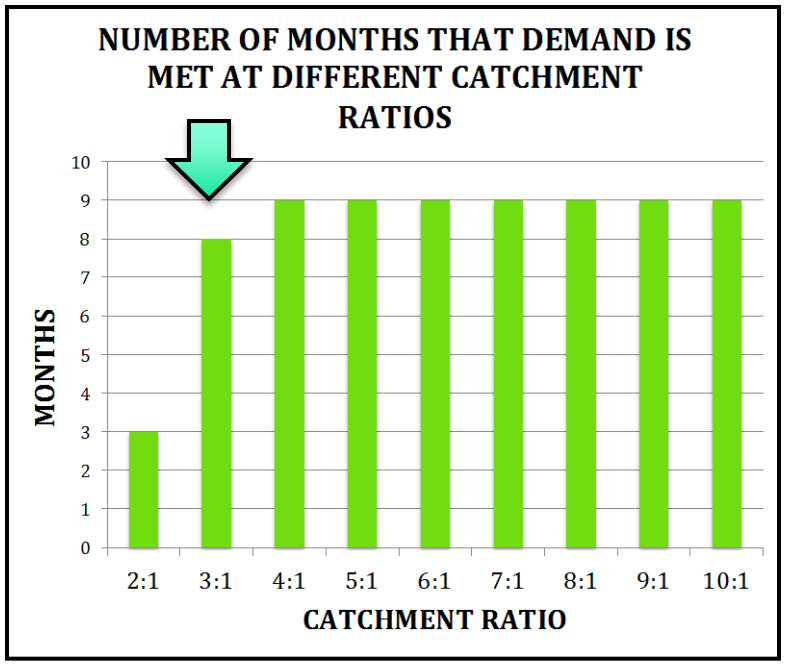
NOTE: For typical urban sites, catchment areas include roofs, sidewalks, parking lots, patios, driveways, etc. plus rain falling on the land under the plant canopy

Step 5. Select effective catchment-to-canopy area ratio for the site

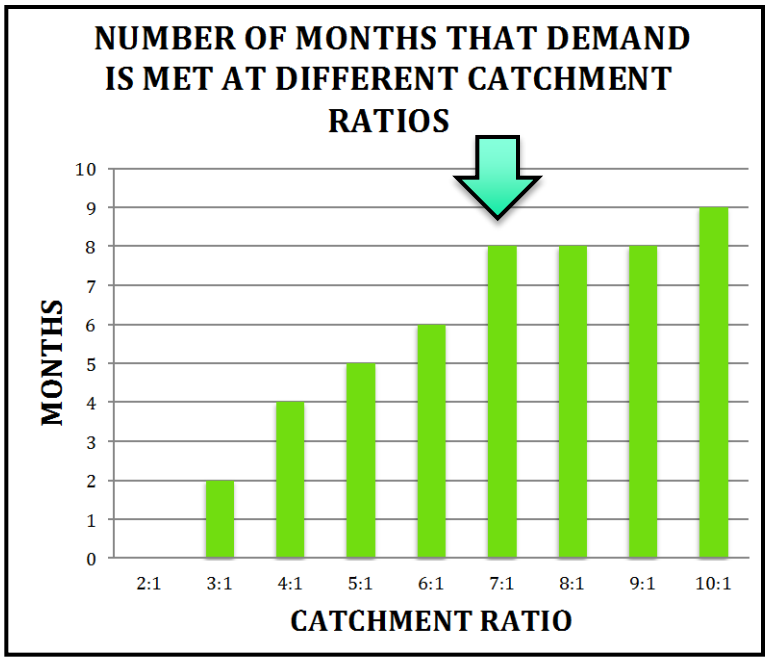


Tucson, AZ, Catchment-to-canopy-area ratio of 3:1 meets plant water demand 8 months/year

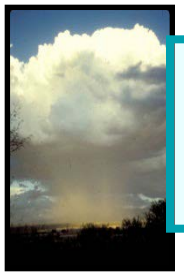
Example: How to select effective catchment-to-canopy-area ratios



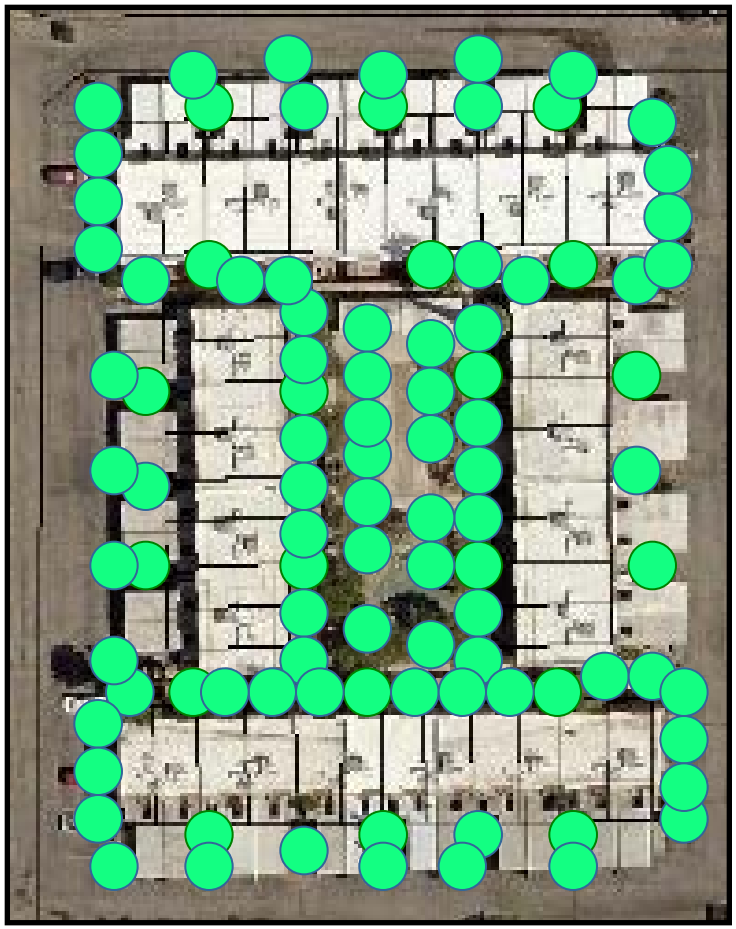
EXAMPLE:
SEMI-ARID AREA >10" PPT/YR,
3:1 RATIO MEETS PLANT
DEMAND 8 MONTHS/YR



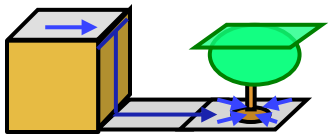
EXAMPLE:
ARID AREA <10" PPT/YR,
7:1 RATIO MEETS PLANT
DEMAND 8 MONTHS/YR



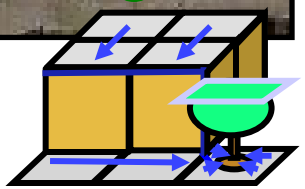
Example: Catchment-to-canopy area ratios at multifamily residential sites



3:1 catchment ratio



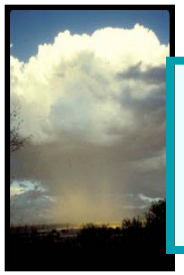
7:1 catchment



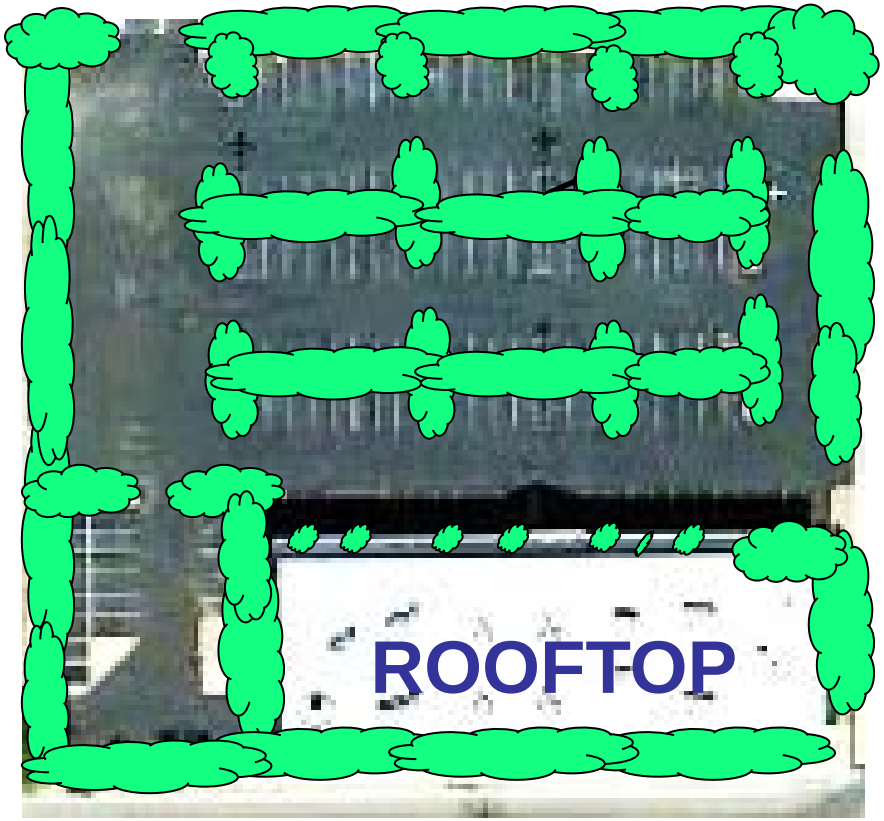
Multifamily Sites

Water harvesting-based landscape at multifamily site, Tucson, AZ

Standard landscape at adjacent multifamily site, Tucson, AZ



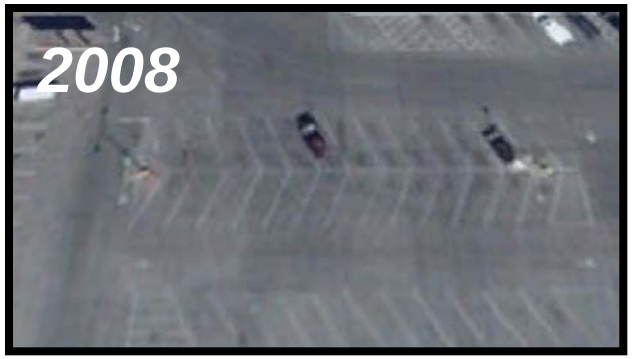
Example: Catchment-to-canopy area ratios for commercial sector



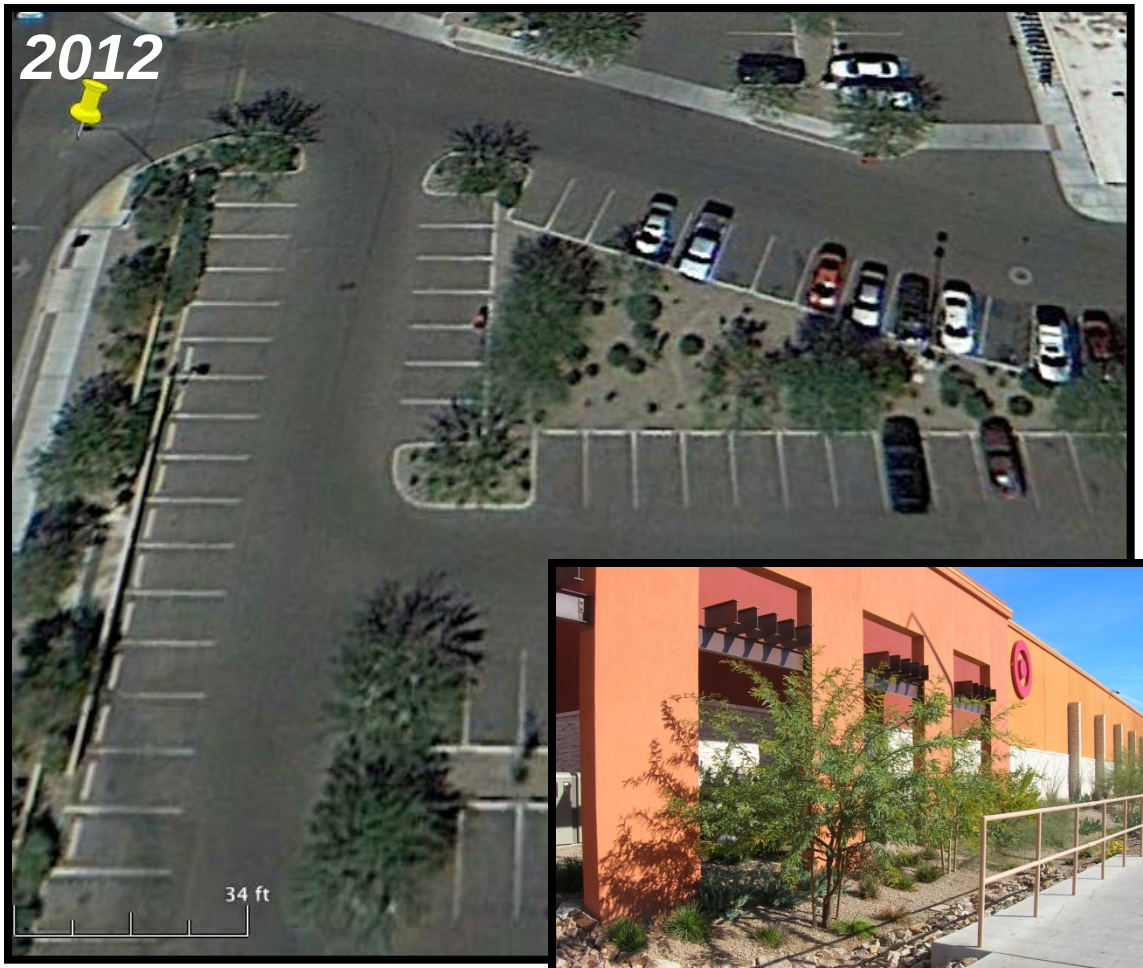
3:1 CATCHMENT RATIO

7:1 CATCHMENT RATIO

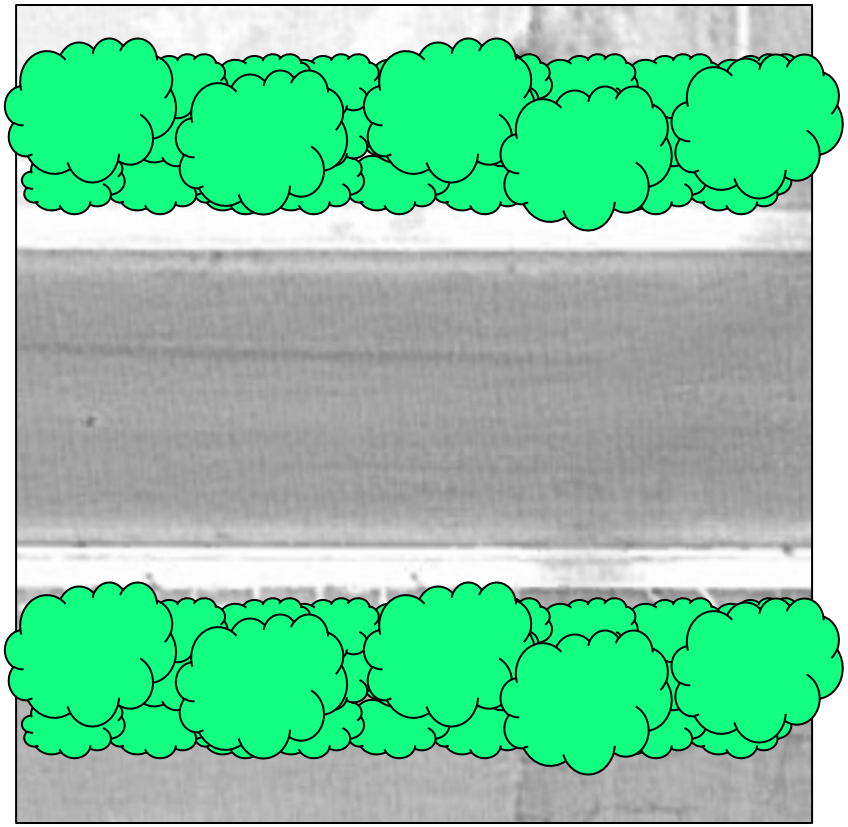
Commercial site



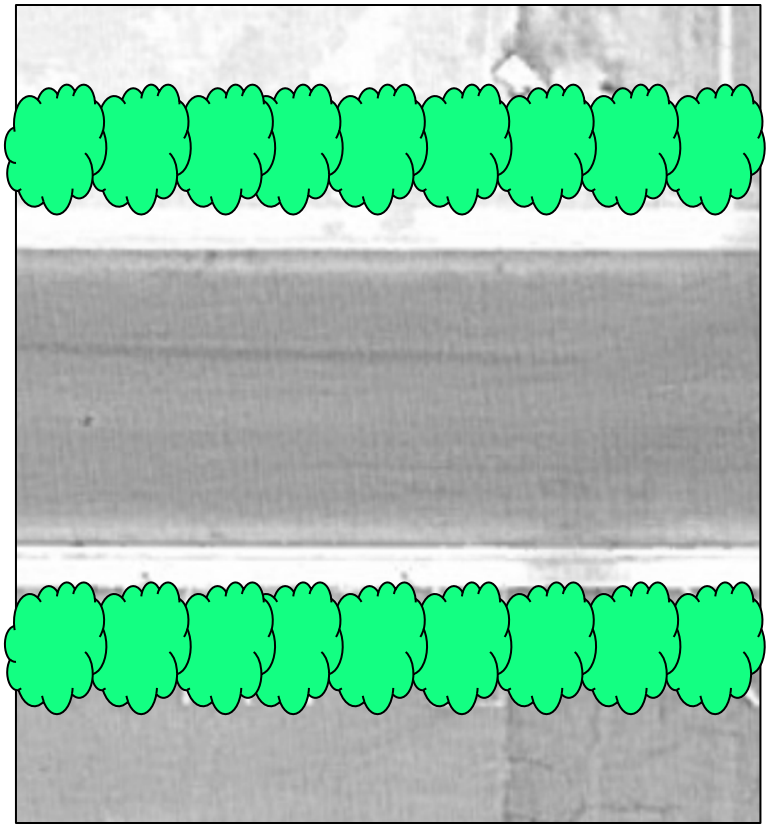
Commercial parking lot redesigned and re-graded to harvest water, Tucson, AZ.



Example: Catchment-to-canopy area ratios for street rights-of-way

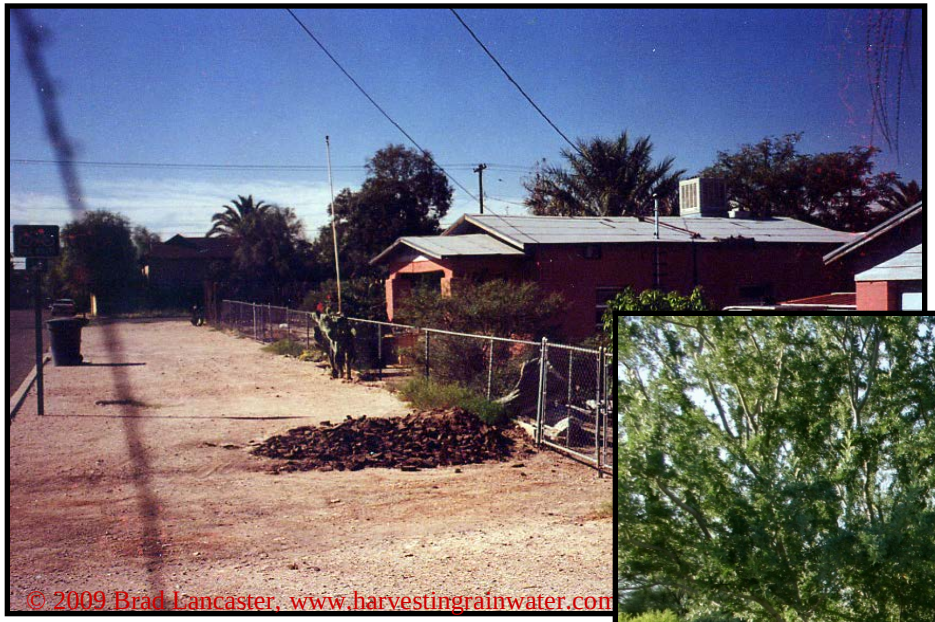


3:1 CATCHMENT RATIO



7:1 CATCHMENT RATIO

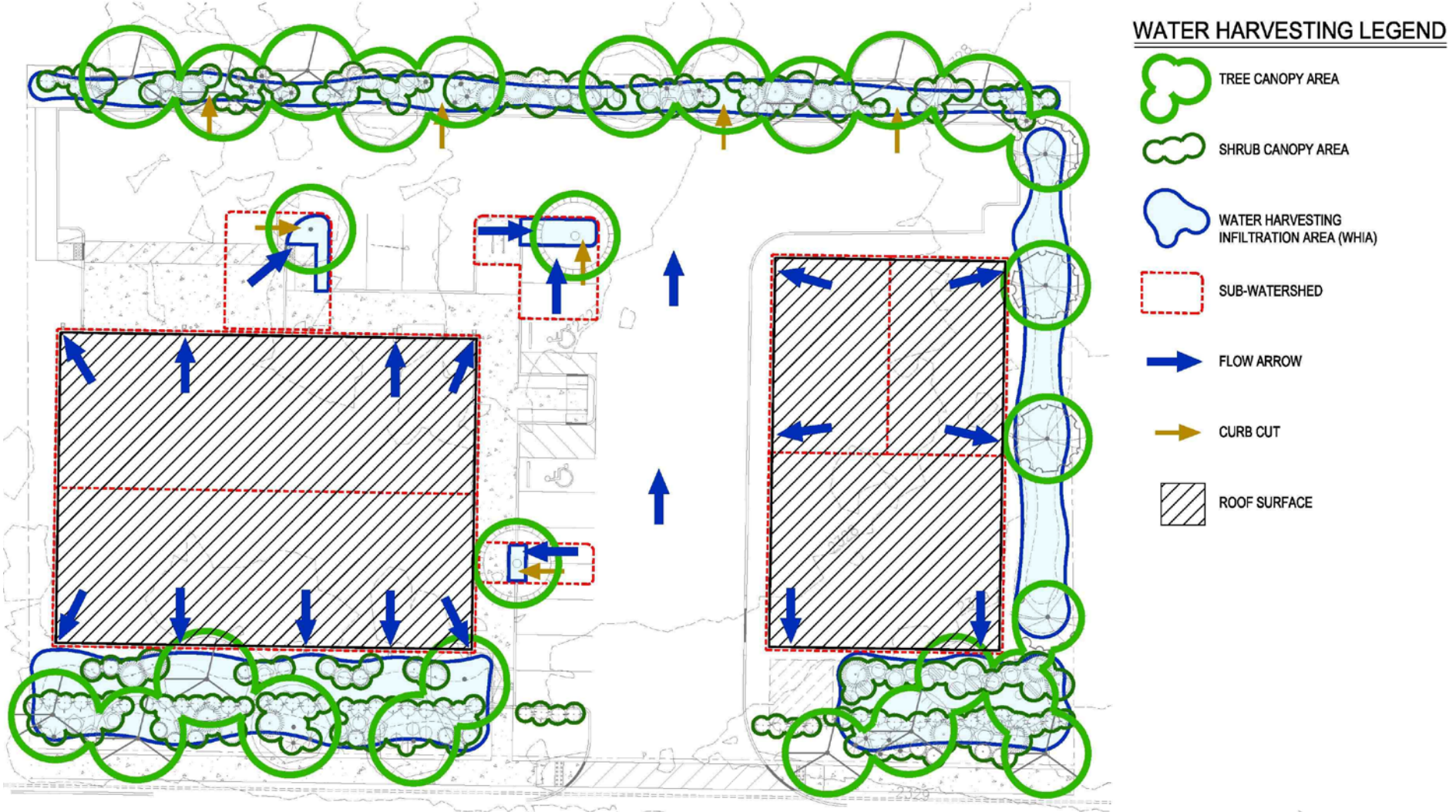
Public right-of-way



Lancaster Residence
public right-of-way
Tucson, Arizona

Basic components of Water Harvesting Plans

Who should be involved in planning?



RAINWATER HARVESTING PLAN ELEMENTS

GRS
LANDSCAPE ARCHITECTS, INC.

Design and implementation team
Coordination is key

- ☑ Developer
- ☑ Building architect
- ☑ Drainage/stormwater engineer
- ☑ Landscape architect
- ☑ Construction manager
- ☑ Grader operators
- ☑ Landscape installers
- ☑ Irrigation installers
- ☑ OTHERS?

Creative Water Harvesting

Richard Restuccia

ASIC 2016 REGIONAL CONFERENCES

Southeast, Southwest, Northeast, & California

American Society of Irrigation Consultants

BUILDING YOUR BRAND USING DIGITAL MEDIA

Presented by Richard Restuccia V.P. Jain Irrigation

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AGENDA

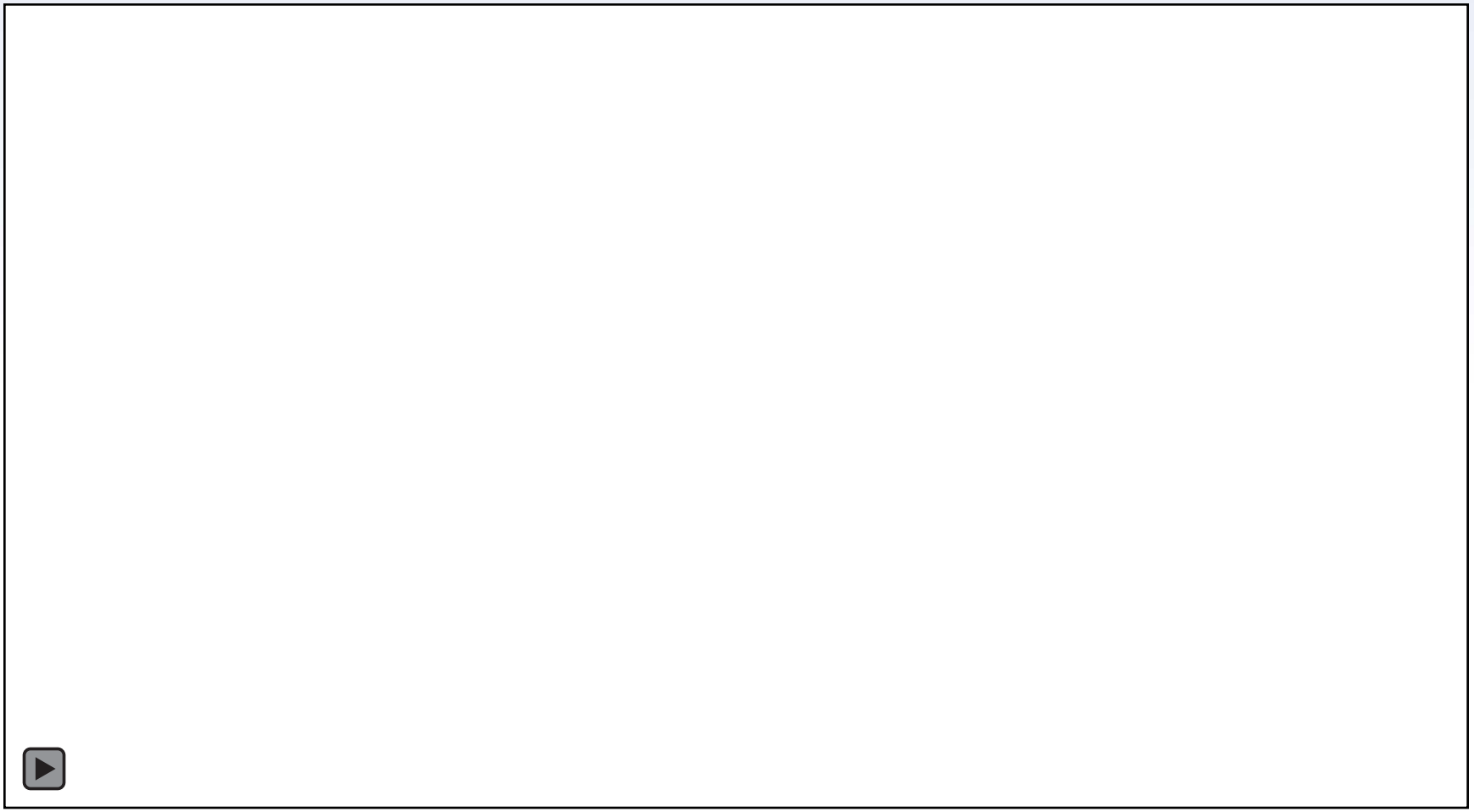
WHY DIGITAL NOW

OVERALL STRATEGY

AWESOME PLACES TO START

A FEW EXAMPLES

"67% of marketers think marketing has changed more in the past two years than the previous fifty, and less than half of digital marketers feel highly proficient in their field." - Adobe Systems 2013



Abe Hagenston, 42, is a homeless man living in Detroit who accepts donations via credit card. He also has a website where people can hire him for odd jobs. (Photo courtesy of WDIV-TV)

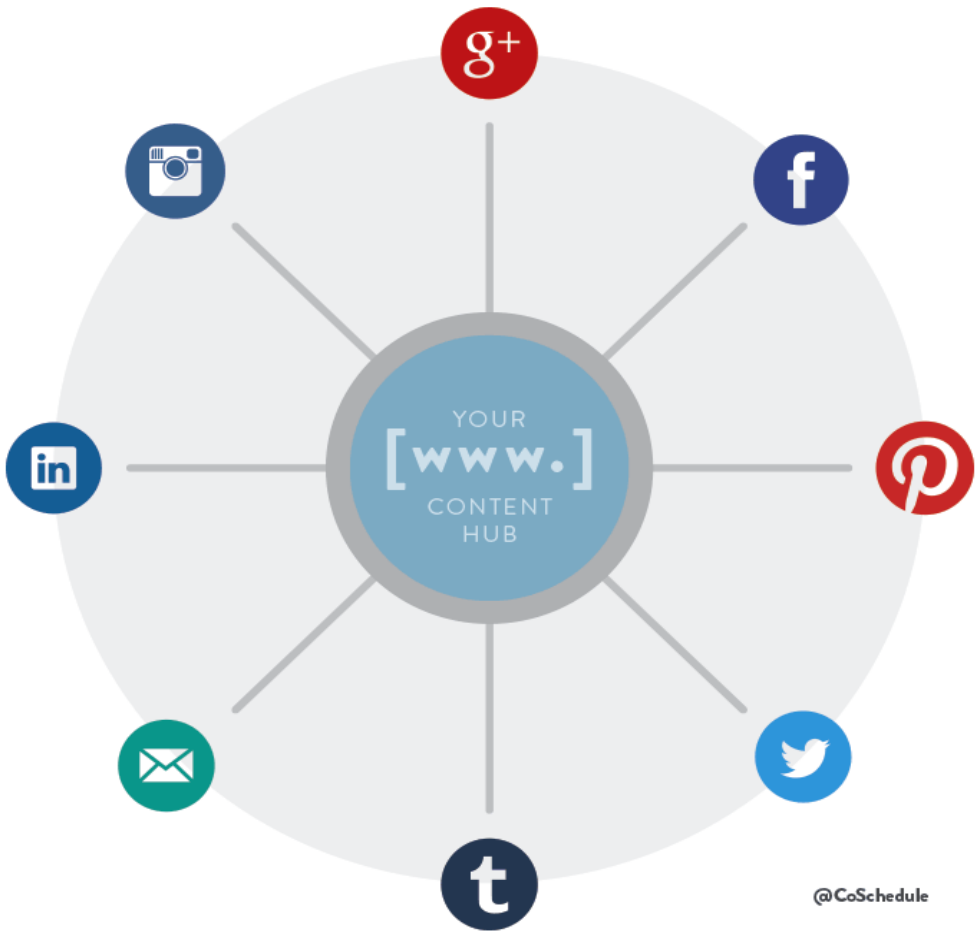

Joe: 203-892-6217
Gill's Landscaping
Fall leaf clean-up and gutter cleaning
Shrub Planting and Lawn Repair
Billy Inward
Lic #HIC.0631507


Broadcast Yourself™
Nikon
Google
facebook
adidas
Unilever
SAMSUNG
Coca-Cola
MasterCard

WHAT ARE YOUR DIGITAL MEDIA GOALS?

- Company/Agency Branding (Marketing)
- Information/Content
  - Distribution (Creation)
  - Education (Gathering/Sharing)
- Recruitment (to find or to be found)
- Sales/Lead Generation
- Other Goals

SIMPLE PLAN



SOCIAL MEDIA Marketing Plan

Choose your networks

Fill out your profiles

Find your voice & tone

Pick a posting strategy

Analyze and test

Automate and engage

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- **What is LinkedIn?**
- World's largest professional network with over ~~161 238 345~~ **400 million members** and growing rapidly.
- 2 billion member updates each week
- LinkedIn connects you to your trusted contacts and helps you exchange knowledge, ideas, and opportunities with a broader network of irrigation professionals.

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- **Why Use LinkedIn?**
- LinkedIn helps locate and foster professional relationships with landscape professionals.
- Since over 400 million businesspeople use LinkedIn, having a presence, a good reputation, and easy accessibility will attract and inform followers.
- LinkedIn is where the largest audience of influential irrigation professionals virtually congregate. When you **engage** this social media site you will improve:
- **Professional Visibility, Connectability and Credibility**

- Never miss a chance to connect
  - 1700 1st connections
  - 768,000 2nd connections
- Never make a cold call again
- Get past the gate keeper with InMail
  - Paid accounts
  - 50 for Bus plan
  - Other than 1st connections
  - Roll-over

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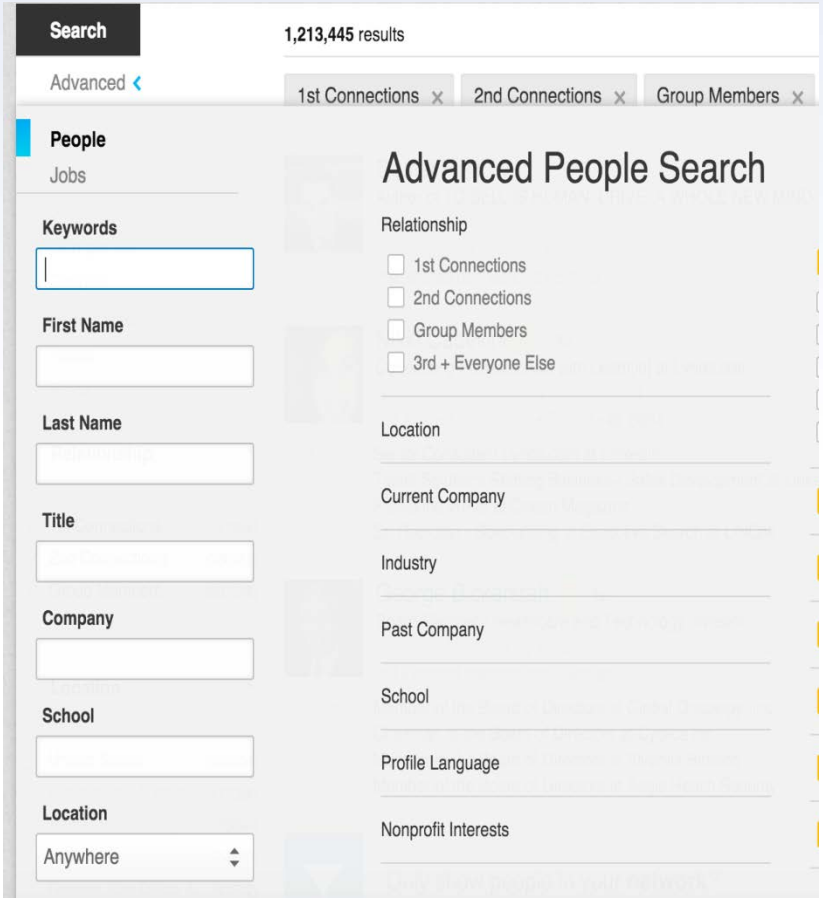
LinkedIn

- A smarter way to search
- Find people by company, location, key word
- Save your search and get weekly report



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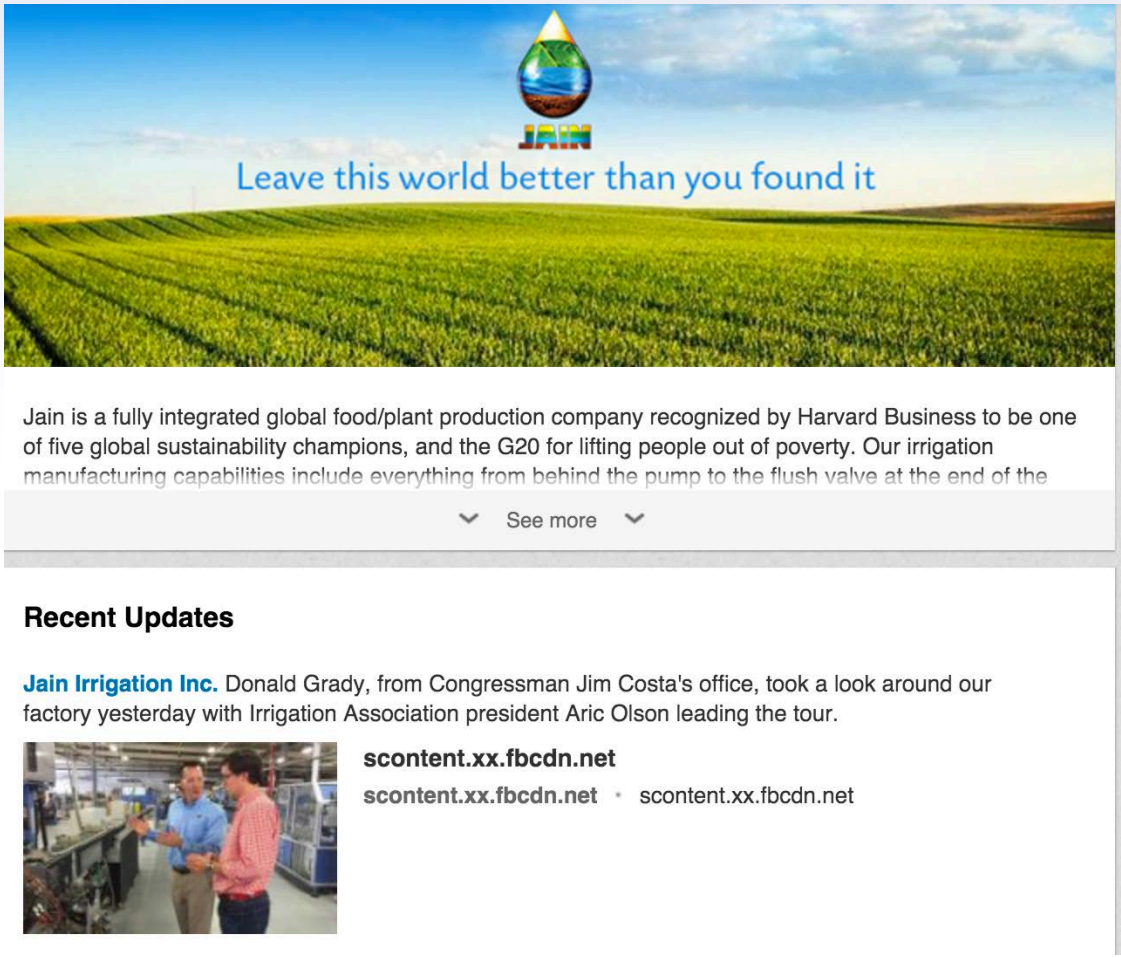
LinkedIn

- Learn what is happening in your prospects companies
- Follow companies LinkedIn Page



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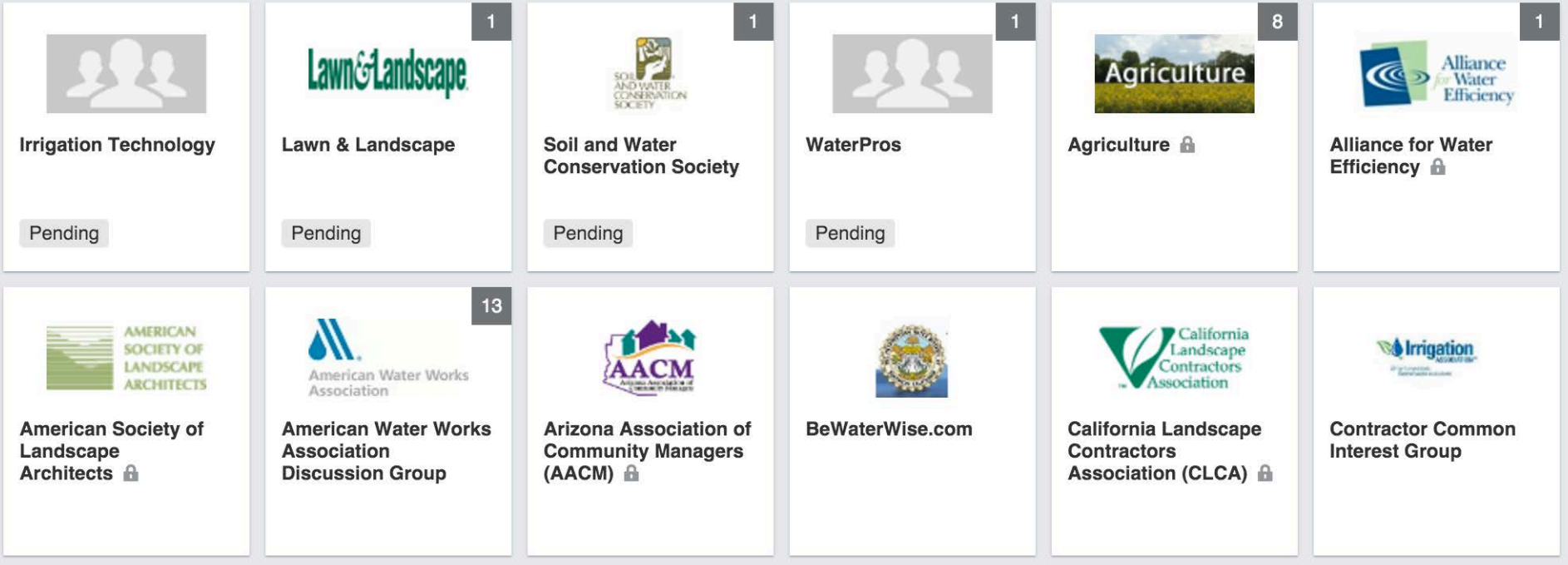
LinkedIn

- Groups
- The number one reason to use LinkedIn
  - Learn about the irrigation industry
  - Opportunity to see more about prospect
  - Post and comment



- ASLA – 24K members
- Irrigation Association – 9K members
- CA Landscape Contractors – 4K members
- American Water Works – 37K members
- Landscape – 17K members

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LinkedIn

- Photo *(helps people know which 1 of 246 Russell Clarks)*
- Headline *(what do you do…not your title)*
- Summary *(why do you do what you do w/ personal touch)*
- Projects & Publications
- Experience (summary statement or 3 accomplishments)
- Education
- Websites

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LinkedIn

First Impression – Headline, Pic & Summary

Alan Harris

Water Scribe, Landscape Architect and Director of Sales Operations

Greater Atlanta Area | Facilities Services

Current	ValleyCrest Companies
Previous	ValleyCrest Companies, TruGreen LandCare, Lifescapes
Education	The University of Georgia

Improve your profile | Edit

500+ connections

www.linkedin.com/in/alanharris/

Contact Info

ASIC

LinkedIn

Sara (Hartmann) Castle

1st

Developing professional relationships while driving property value through landscape solutions

Washington D.C. Metro Area | Commercial Real Estate

Current	ValleyCrest Companies
Previous	Teach for America, University of Florida
Education	University of Florida

Send a message

500+ connections

Summary: Unique, Personal & Call to Action

Summary

With over 30 years in the Green Industry I bring a diverse understanding of Design, Installation and Sustainable Solutions in Maintenance to the ValleyCrest teams and customers with whom I work. I enjoy sharing my knowledge and experience to drive successful solutions and help others solve problems.

Working at ValleyCrest enables me to work with a great local teams and be a one-stop solution for our customers' landscape needs. I enjoy working with a wide range of customers—from resorts and retail centers to corporate campuses, public spaces and homeowners associations. ValleyCrest has a vision for great landscapes, a passion for outstanding customer service and the expertise to offer the most comprehensive services from turf to trees and from irrigation to seasonal color displays.

To learn more how we can help you with custom landscape and irrigation management solutions contact me at aharris@ValleyCrest.com or facebook.com/waterbloggers. On the weekends you can find me on the tennis court when not recovering from knee surgeries or sprained ankles.

Specialties: Expertise in Leadership, Water Management, Landscape Architecture, Social Media, Sales Management, Business Development, Sales Operations and Client Services

TWITTER

- Twitter connects users to the latest stories, ideas, opinions and news about what they find interesting.
- Completely customized news source with all the headlines you care about from "reporters" you trust.
- To your customers and followers, ***you*** **are that reporter**. You tell them what's important.

TRIVIA QUESTION #1

How many Twitter users are there in the U.S. today?

- A: **65 Million**

TWITTER

- Twitter connects businesses to customers in real time
  - quickly share information
  - gather market intelligence and feedback
  - build relationships with customers, partners and influencers
- The fastest, simplest way to stay close to everything you care about.

TRIVIA QUESTION #1

What is the percentage of verified Twitter accounts that are journalists?

- A: **25%**

Michelle Russ @greenthumbqueen · Mar 24

Teach a man to fish.. What a great trip! Crazy to think "Drip irrigation" can change lives. #DripIrrigation #Charity

Jain Irrigation USA @JainsUSA

Our water charity trip to the Bateyes of the Dominican Republic jainsusa.com/water+charity

4 1

WHAT MAKES A GREAT TWEET

- Have a personality
- Keep content interesting, frequent, and relevant
- Its hrd 2 undstd abbrv>keep it smpl & brf
- Create solutions
- Ask questions
- Use photos

TWITTER BEST PRACTICES

- Be part of the conversation
- Promote other users
- Keep up with it
- Create a tweet bank

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- Thank you and questions
- Richard Restuccia
- 858 952-6038
- Rrestuccia@jainsusa.com

Carol Ward-Morris

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Ongoing Drought & Looming Colorado River Shortage: Managing to Avoid Crisis

Carol M. Ward-Morris, Assistant Director
Arizona Municipal Water Users Association

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Colorado River Basin

What Severe Drought in the Co. River Basin Looks Like

Washington Post, March 30, 2015

"More area in the West has persistently been in drought during the past 15 years than in any other 15-year period since the 1150s and 1160s." -- bioclimatologist Park Williams

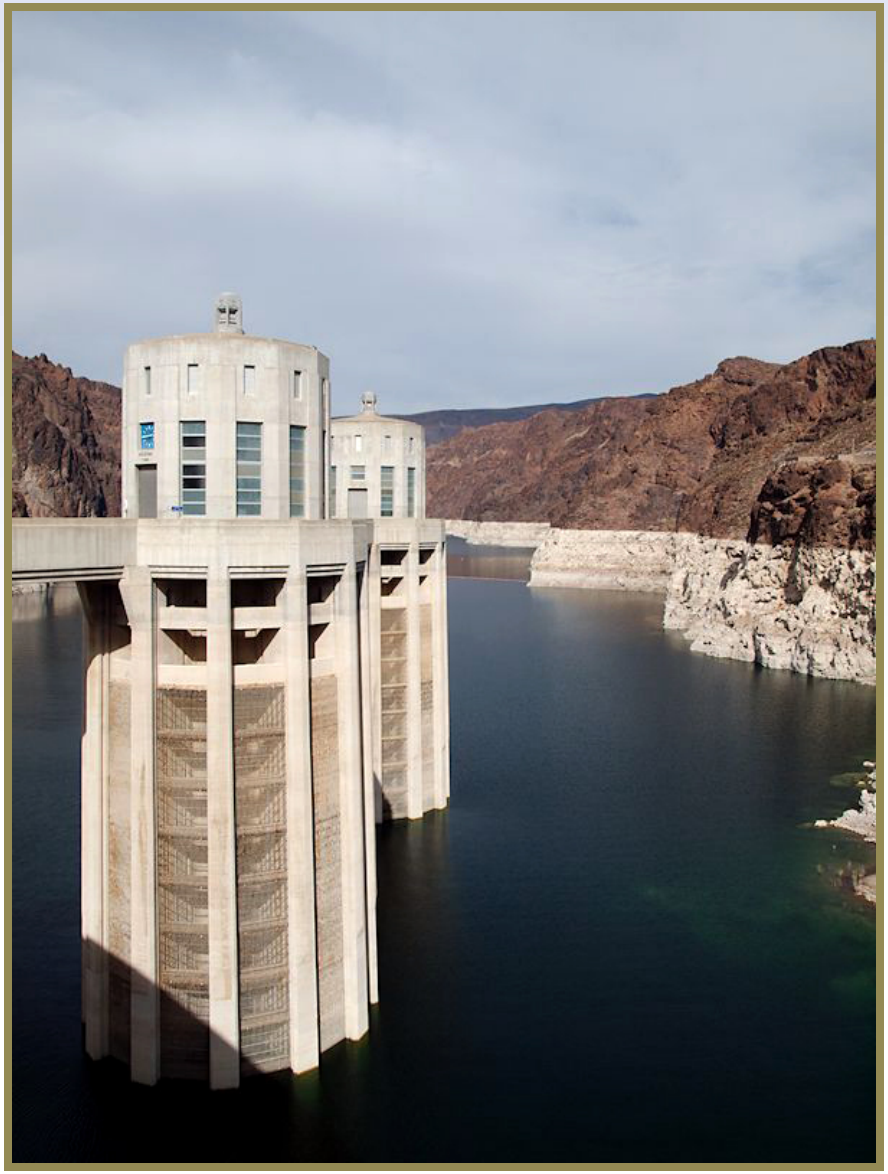


photo: Jeff Lee

As Lake Mead Levels Drop, The West Braces For Bigger Drought Impact

NPR, April 17, 2015

"Just to see the rings around it,
it's just…
kind of scary, you know."

Lake Mead sinks to record low, risking water shortage

AZ Republic, June 24, 2015

"This is the check engine light."

photo: Mark Henle, AZ Republic

‘Historically dry’ February could lead to first-ever shortage declaration at Lake Mead

Las Vegas Review-Journal, March 14, 2016

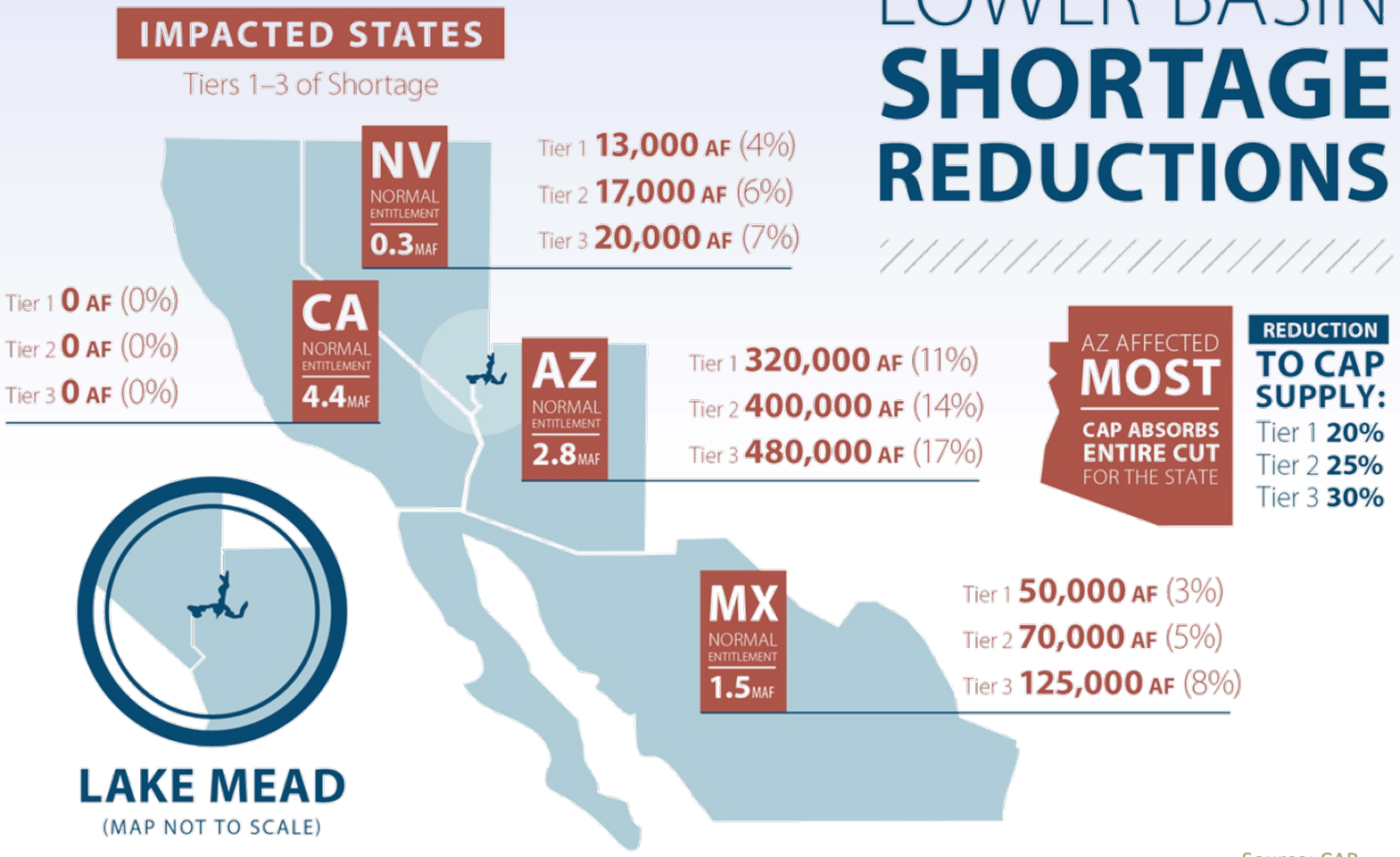
photo: David Becker, Las Vegas Review-Journal

Probability of Colorado River Shortage

	2016	2017	2018	2019	2020
Probability of any level of shortage (Mead ≤ 1,075 ft.)	**0**	**37**	**59**	**60**	**59**
1st level shortage (Mead ≤ 1,075 and ≥1,050 ft)	0	37	49	41	35
2nd level shortage (Mead <1,050 and ≥1,025 ft)	0	0	10	16	18
3rd level shortage (Mead <1,025)	0	0	0	3	6

Source: US Bureau of Reclamation CRSS Model Run – January 2016

LOWER BASIN SHORTAGE REDUCTIONS

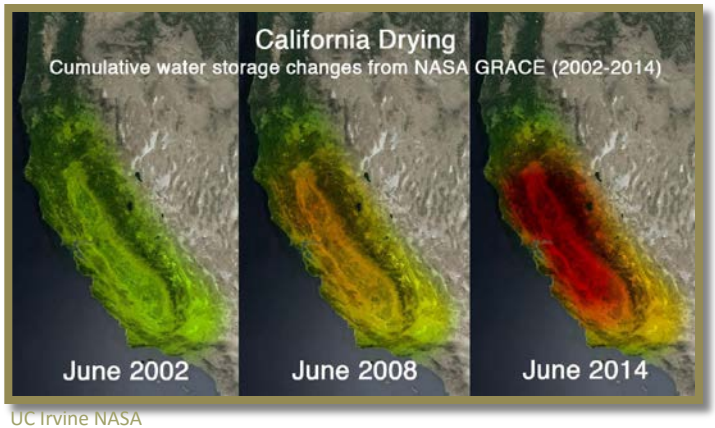


Source: CAP

Water, 2015, California: The no-good, very bad year – now, 'pray for rain'

Los Angeles Times, Sept. 29, 2015

Almaden Reservoir, Feb. 2014
Photo: Marcio Jose Sanchez, Associated Press



UC Irvine NASA

Governor Brown, April 1, 2015
Photo: Max Whittaker, Getty Images

Unyielding California drought continues, despite “miracle March” deluge

Washington Post, March 11, 2016

Almaden Reservoir, Mar. 2016
Photo: Marcio Jose Sanchez, Associated Press

Snow Survey, Mar. 2016
Photo: Rich Pedroncelli, AP

x
x

Golden Gate Bridge, Mar. 2016
Photo: Eric Risberg, AP

Arizona stuck in prolonged drought but sees no California-style restrictions

Associated Press, June 7, 2015

photo: C. Ward-Morris

Top 10 Extreme Environments
#1: Tucson, Arizona

NationalGeographic.com

stormchase.net

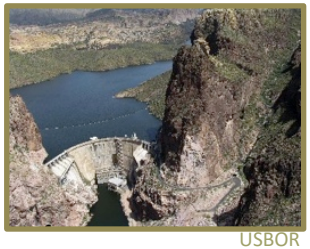
Mike Crimmins, UA

CBS15

The SRP System

photo: J. Stewart

USBOR



USBOR

USBOR

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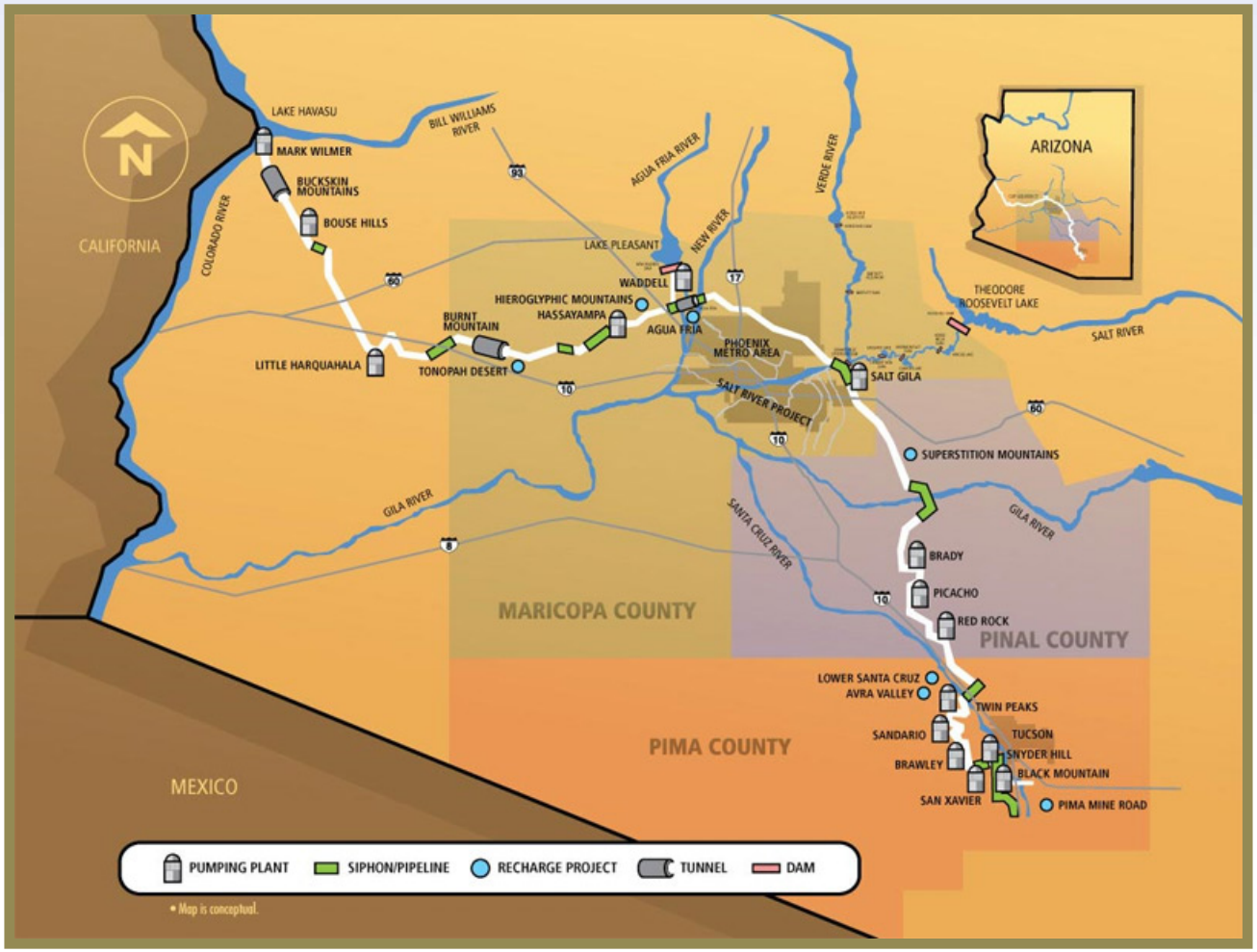
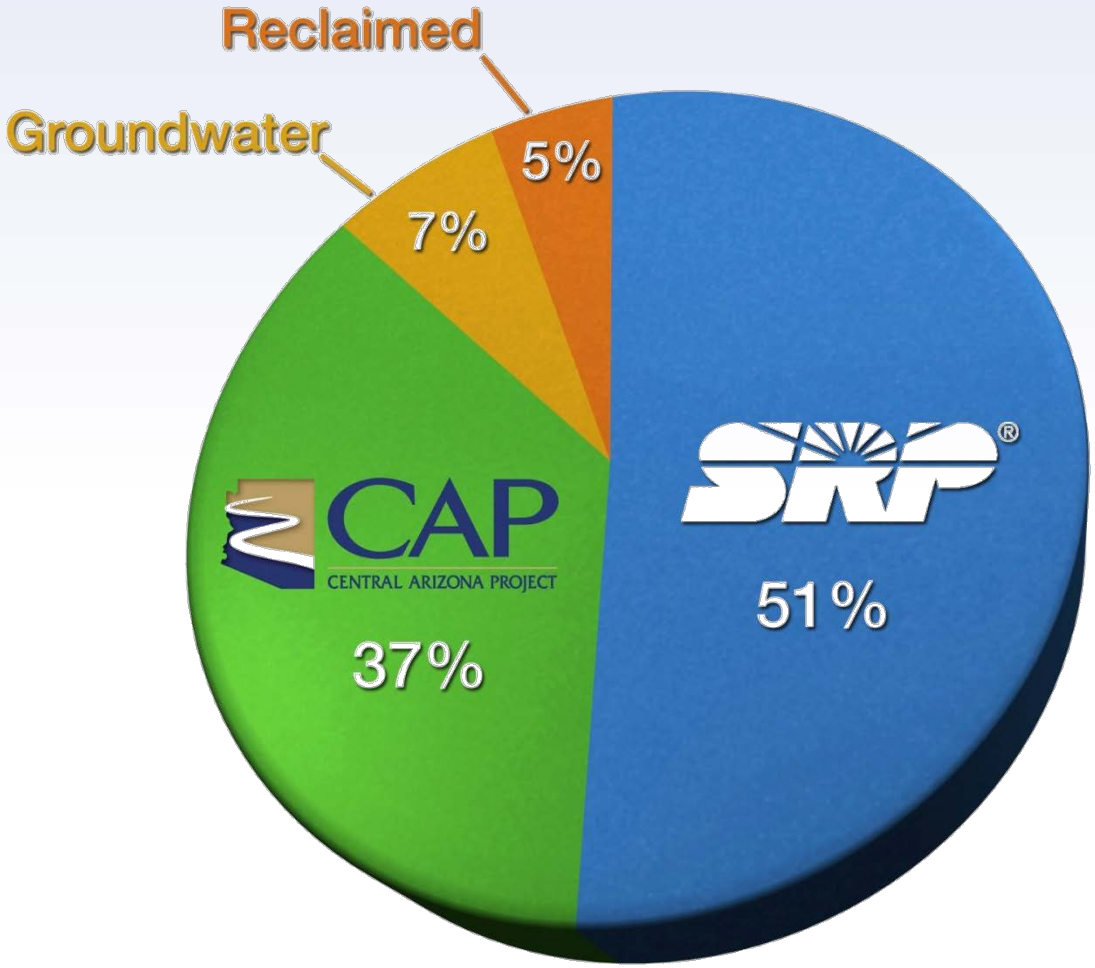
The CAP System



Source: CAP

AMWUA Member Supply Portfolio



Source: AMWUA

1980 Groundwater Management Act

Photo: AMWUA files

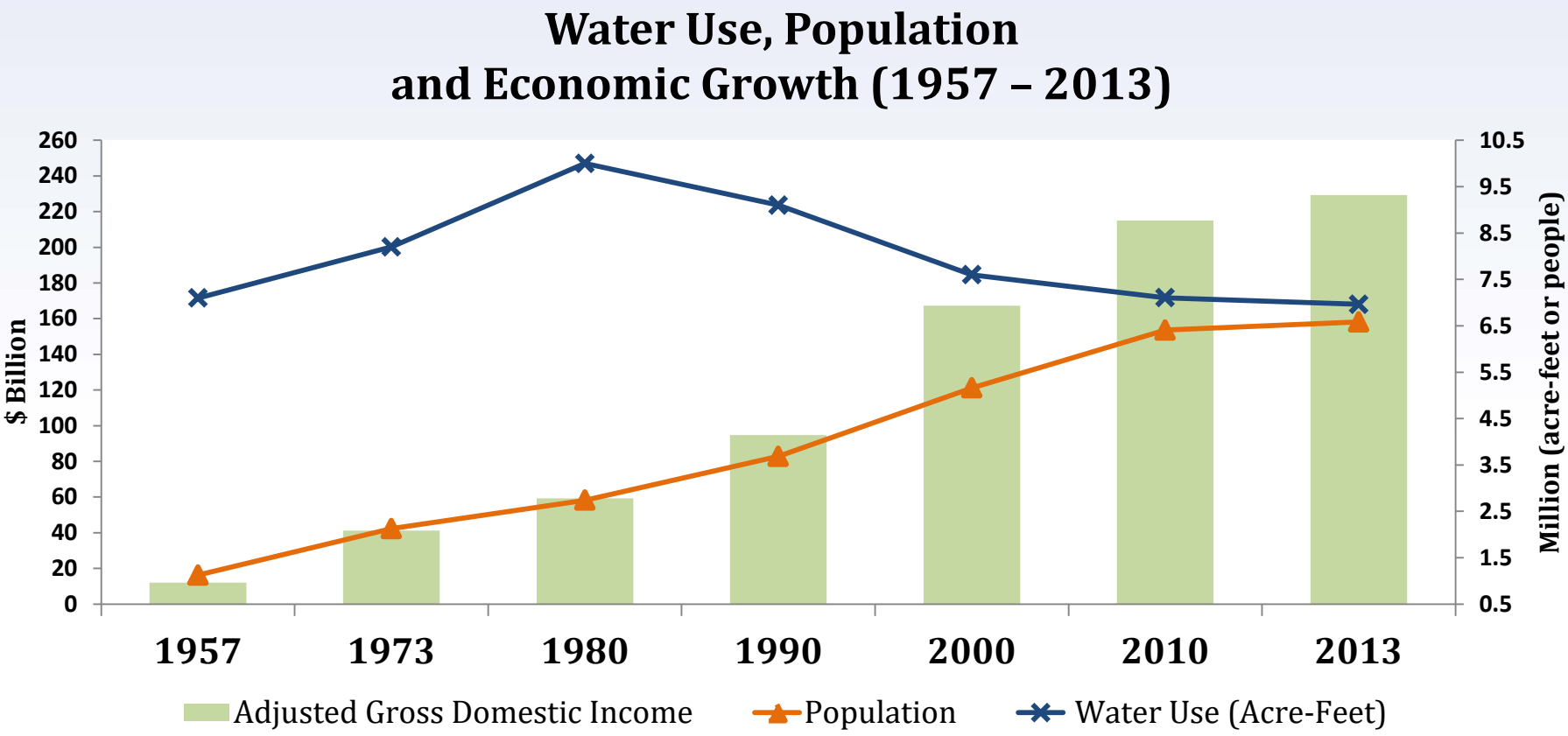
Conservation Requirements

Photo: City of Tempe

from the publication *Landscaping with Style*


photo: Donna DiFrancesco

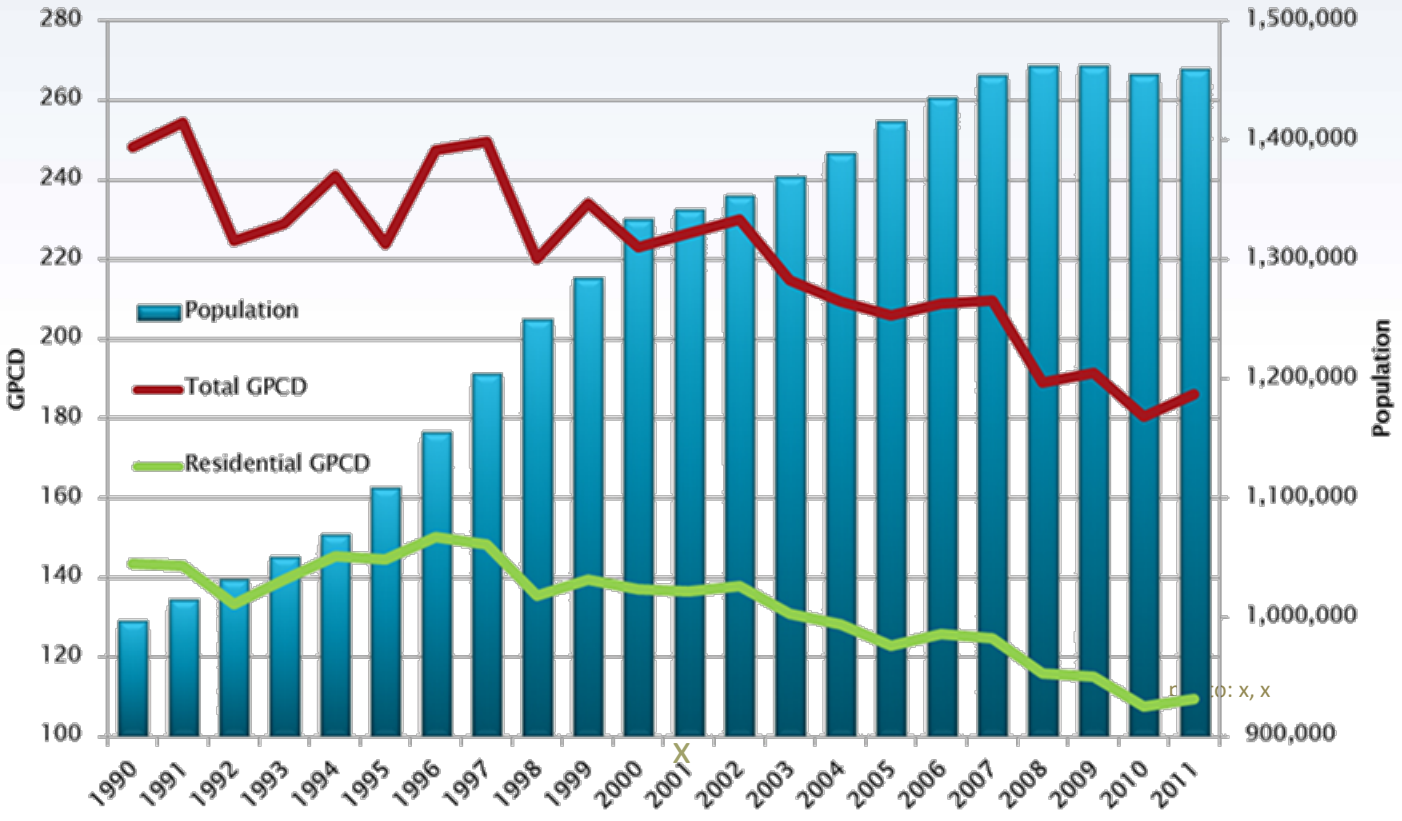
Arizona



Source: ADWR

City of Phoenix

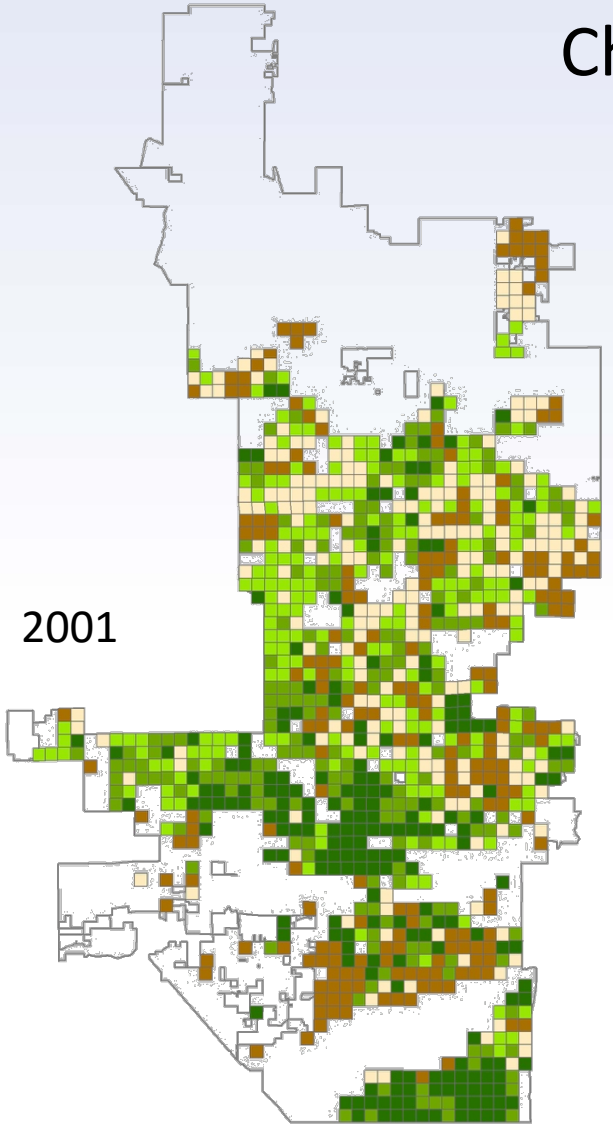
Gallons per Capita per Day (GPCD)



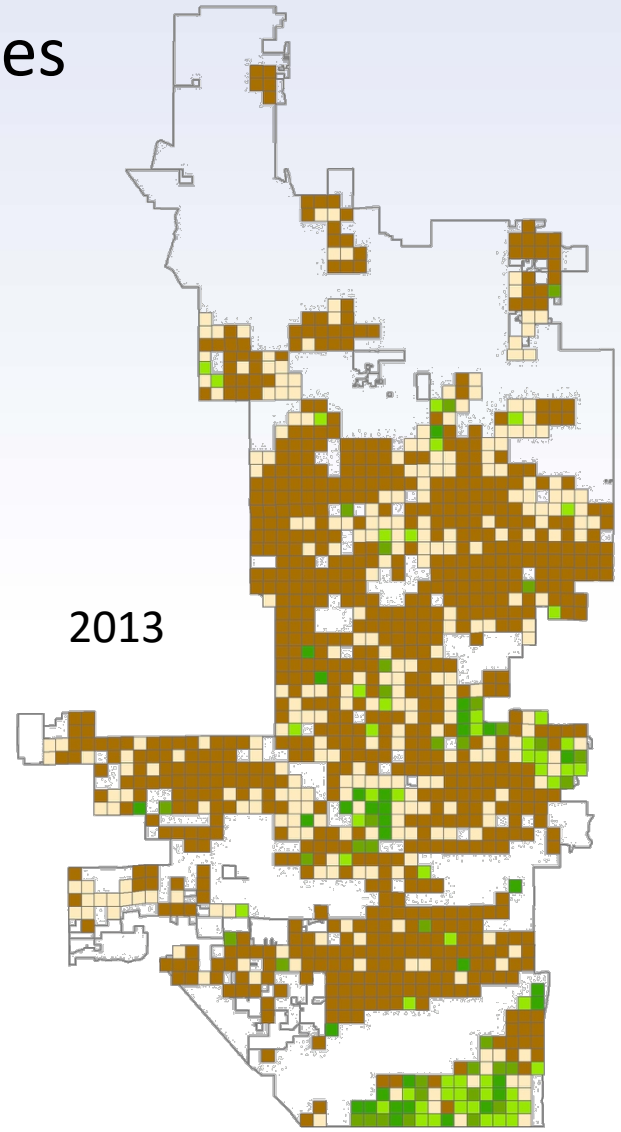
Changing Landscapes

City of Phoenix Relative Water Use by Quarter Section

2001



2013

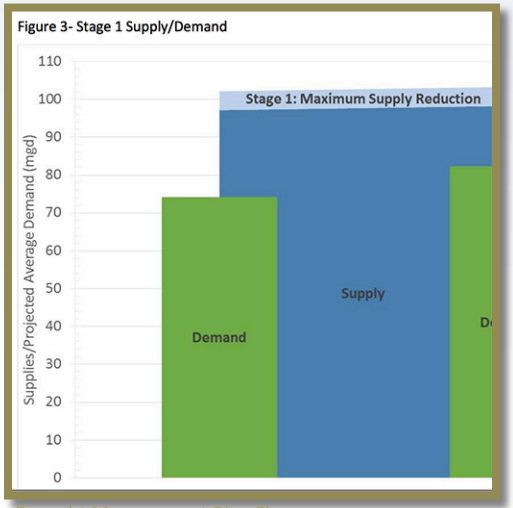


Source: City of Phoenix

Recycling, Underground Storage, Drought Plans

Palo Verde Nuclear Generating Station
Photo: APS

Tonopah Desert Recharge Project
Photo: City of Glendale

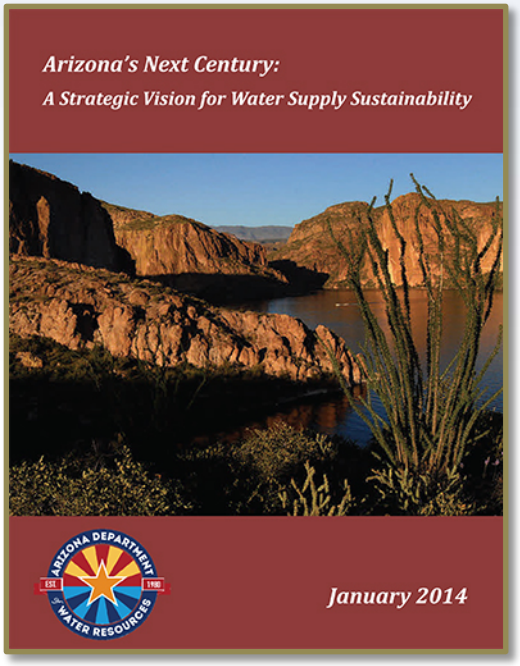


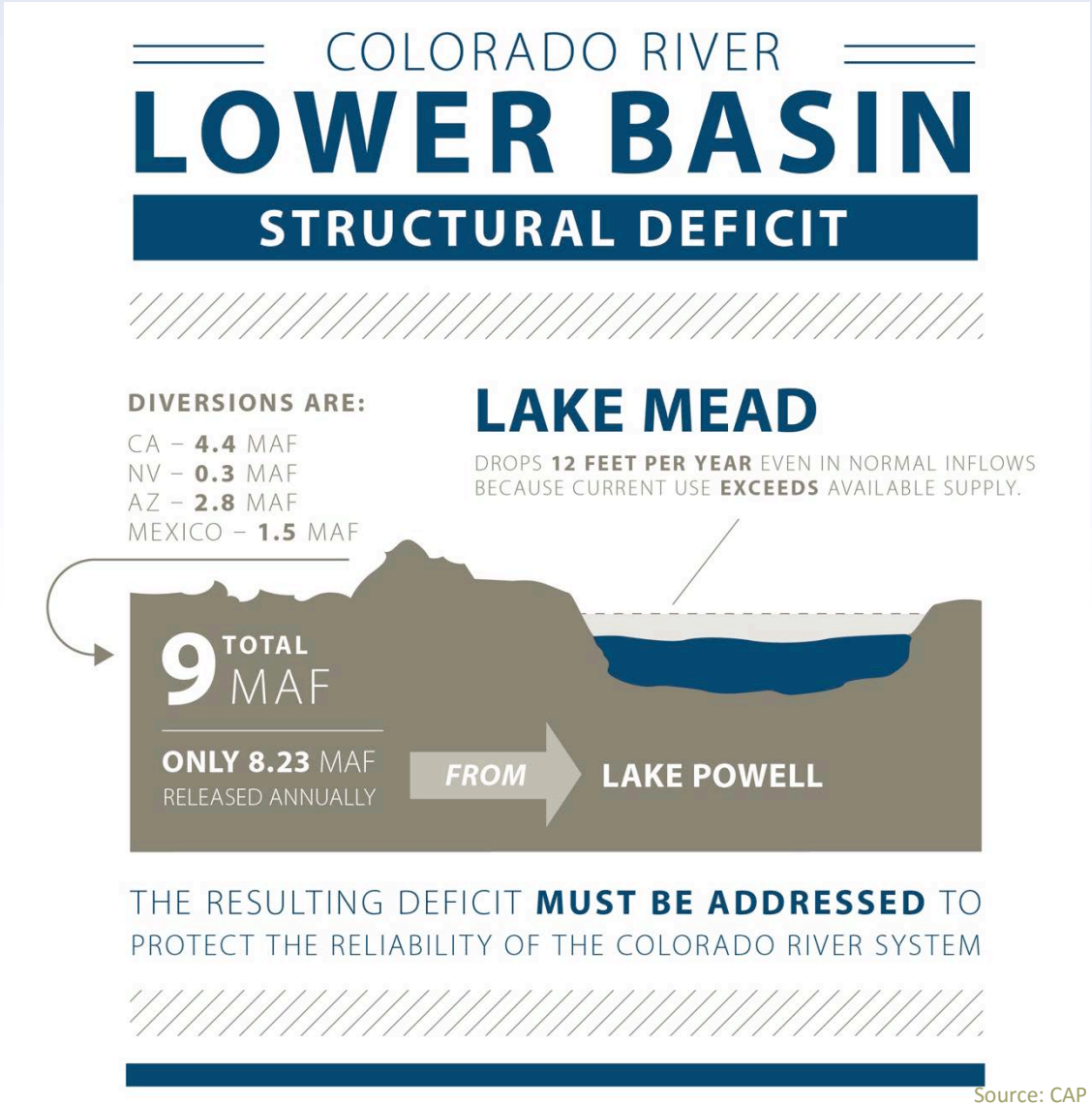
Drought Management Plan Figure
City of Scottsdale

Drought Management

photo: Kenne Turner, kenneturner.com

Arizona's Water Supply Sustainability




COLORADO RIVER
LOWER BASIN
STRUCTURAL DEFICIT
DIVERSIONS ARE:
CA – 4.4 MAF
NV – 0.3 MAF
AZ – 2.8 MAF
MEXICO – 1.5 MAF
LAKE MEAD
DROPS 12 FEET PER YEAR EVEN IN NORMAL INFLOWS
BECAUSE CURRENT USE EXCEEDS AVAILABLE SUPPLY.
9 TOTAL MAF
ONLY 8.23 MAF
RELEASED ANNUALLY
FROM
LAKE POWELL
THE RESULTING DEFICIT MUST BE ADDRESSED TO
PROTECT THE RELIABILITY OF THE COLORADO RIVER SYSTEM

Source: CAP

ASIC

Addressing the Challenges on the Colorado River

Photo: Jeff Lee

ASIC

photo: C. Ward-Morris

ASIC

Carol Ward-Morris
Assistant Director, AMWUA
cwardmorris@amwua.org | 602.248.8482

Water Reliability for A Desert Community

Fernando Molina
Tucson Water
April 8, 2016

TUCSON WATER

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Water**Reliability**

A Series of Investments to Ensure Tucson's Water Future

The Five Elements of Water Reliability

Water Supply

- Develop new supplies to accommodate growth
- 50 Year Water Plan
- Limit the use of non-renewable resources
- Focus on use of renewable water supplies

Central Avra Valley Recharge and Recovery Program

City of Tucson

Tucson Water

Southern Avra Valley Recharge and Recovery Program

City of Tucson

Tucson Water

The Five Elements of Water Reliability

Water Quality

- Water quality must match the use

- Meet or exceed water quality standards

The Five Elements of Water Reliability

Maintenance and Infrastructure

- 4700 miles of pipe
- 60 Reservoirs
- 85,000 Valves
- 20,000+ Fire Hydrants
- 244,000 Services

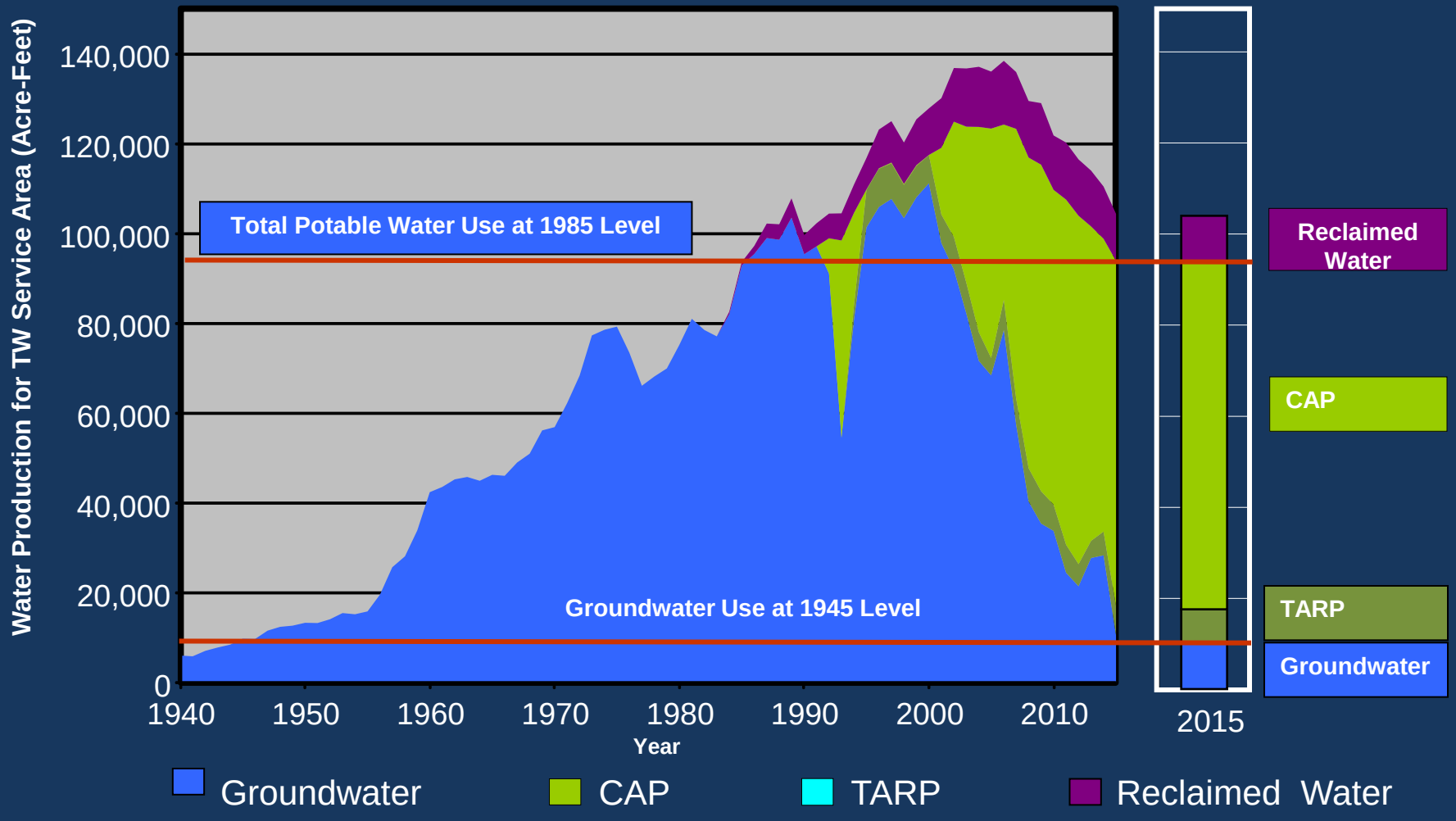
Infrastructure

The Five Elements of Water Reliability

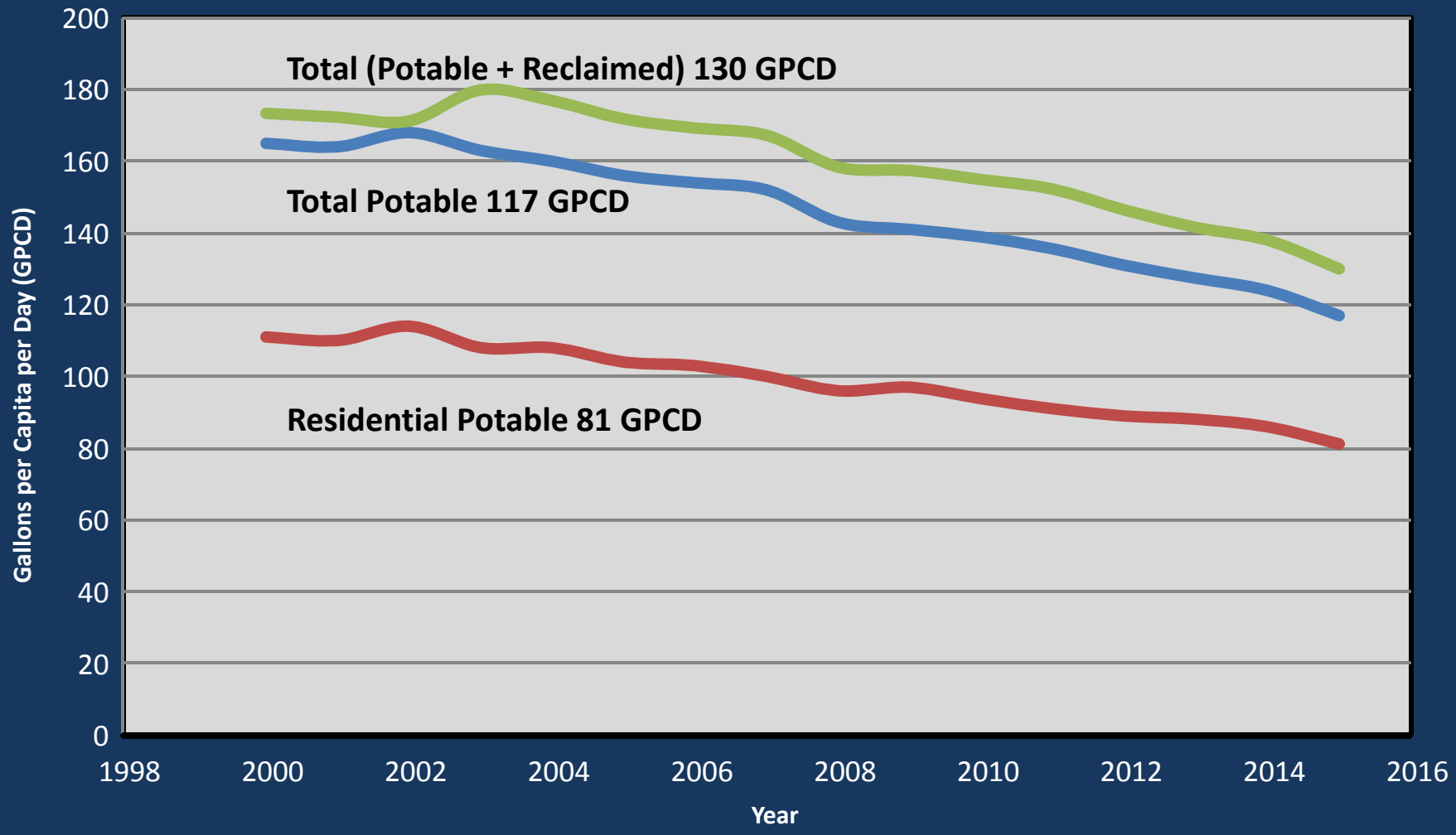
Efficiency and Sustainability

- Water Use Efficiency
- Sustainability
- Organizational Efficiency

Transition to Renewable Water Supplies

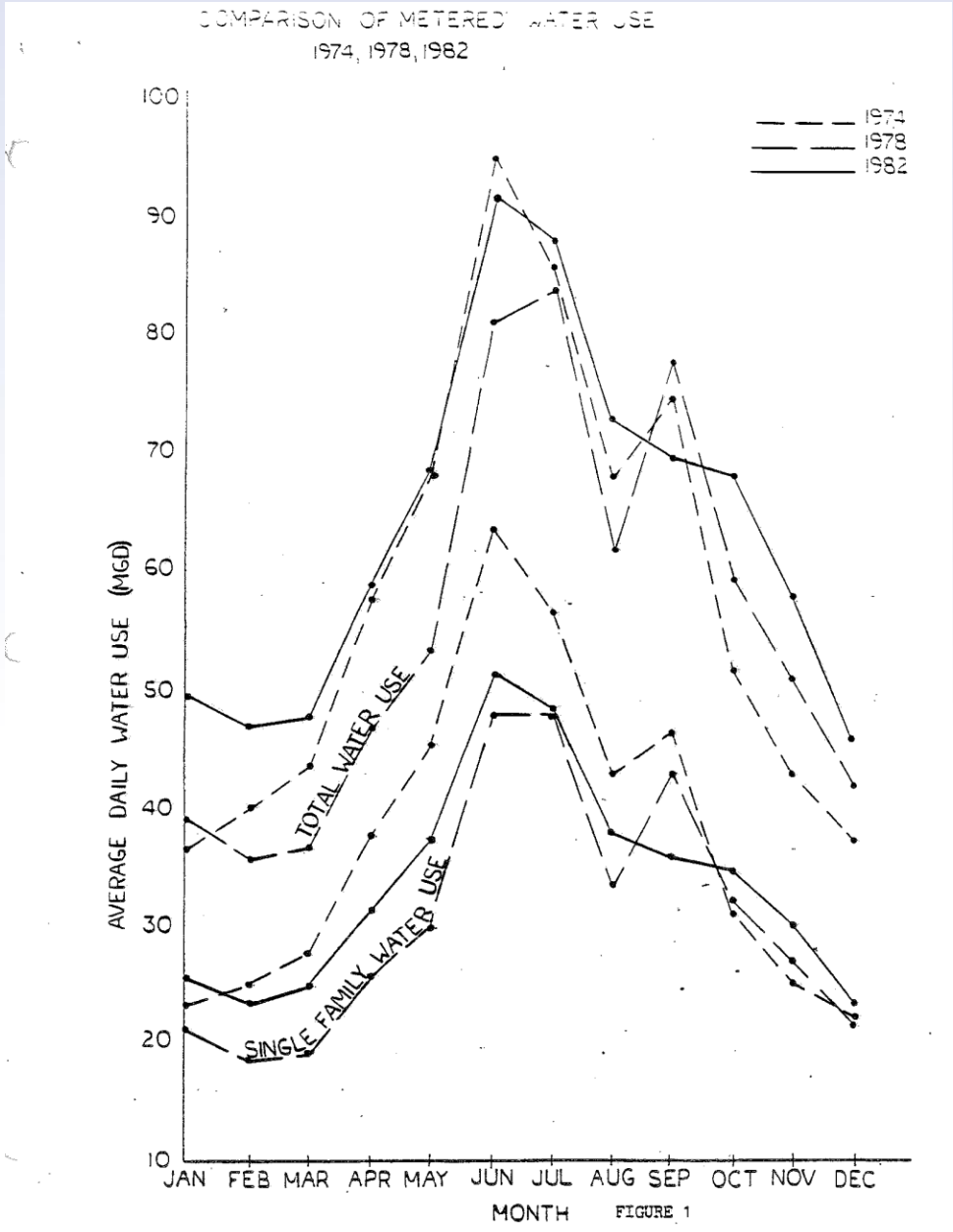


Tucson Water Service Area GPCD Trends 2000-2015



1970s Water Crisis

- Growth in 1940s – 1970's outstripped infrastructure investment
- Unable to meet demands during peak use periods
- Voluntary conservation, rate structure changes, political fallout
- Establishment of Beat the Peak Program



1970's Tucson Landscapes

1970's Tucson Landscapes

Beat the Peak Conservation Program

- Initiated in 1977

- Community Education

- Promotion of Desert Landscaping and “Trickle Irrigation”

1980's / Groundwater Management Act

- Conservation requirements on users
- Tucson requirement calculation included reductions achieved in 1970's.
- Still a groundwater system
- Beat the Peak continues

1990's

- Development of Reclaimed Water System
- Initial attempt of CAP use
- Rates, Education & Ordinances to achieve conservation
- Xeriscape Ordinance for new Commercial Construction
- Establishment of Water Waste Ordinance

Irrigation Management Program

- Established LOW4 Program to conduct water audits at Commercial sites

- Contacted 300 sites
- Heard back from 150
- Scheduled with 75
- Pre-visit culled down to 35 – 40 audits
- Average DU approx. 27%

Lessons Learned

- Low DU's & lack of groundskeeper/maintenance staff knowledge
- Transition to Education Program
- ADWR Grant / TUSD
- Follow up Audits /Decrease in DU
- ET-Based irrigation strategy connected to irrigation system efficiency

2000's

- Re-Introduction of CAP water
- Water use patterns continue to change
- Peaking no longer an issue
- Transition from ***Beat the Peak*** to ***Be Water Smart***
- Efficiency Rebates (2011)

Irrigation Efficiency Program

Procedures / Findings

- Pre & Post Audits Required

- 45% avg DU Pre-Inspection
  64% avg DU Post-Inspection

- 39% EU Pre-Inspection
  82% EU Post-Inspection

- Contractors did not understand DU and how to improve

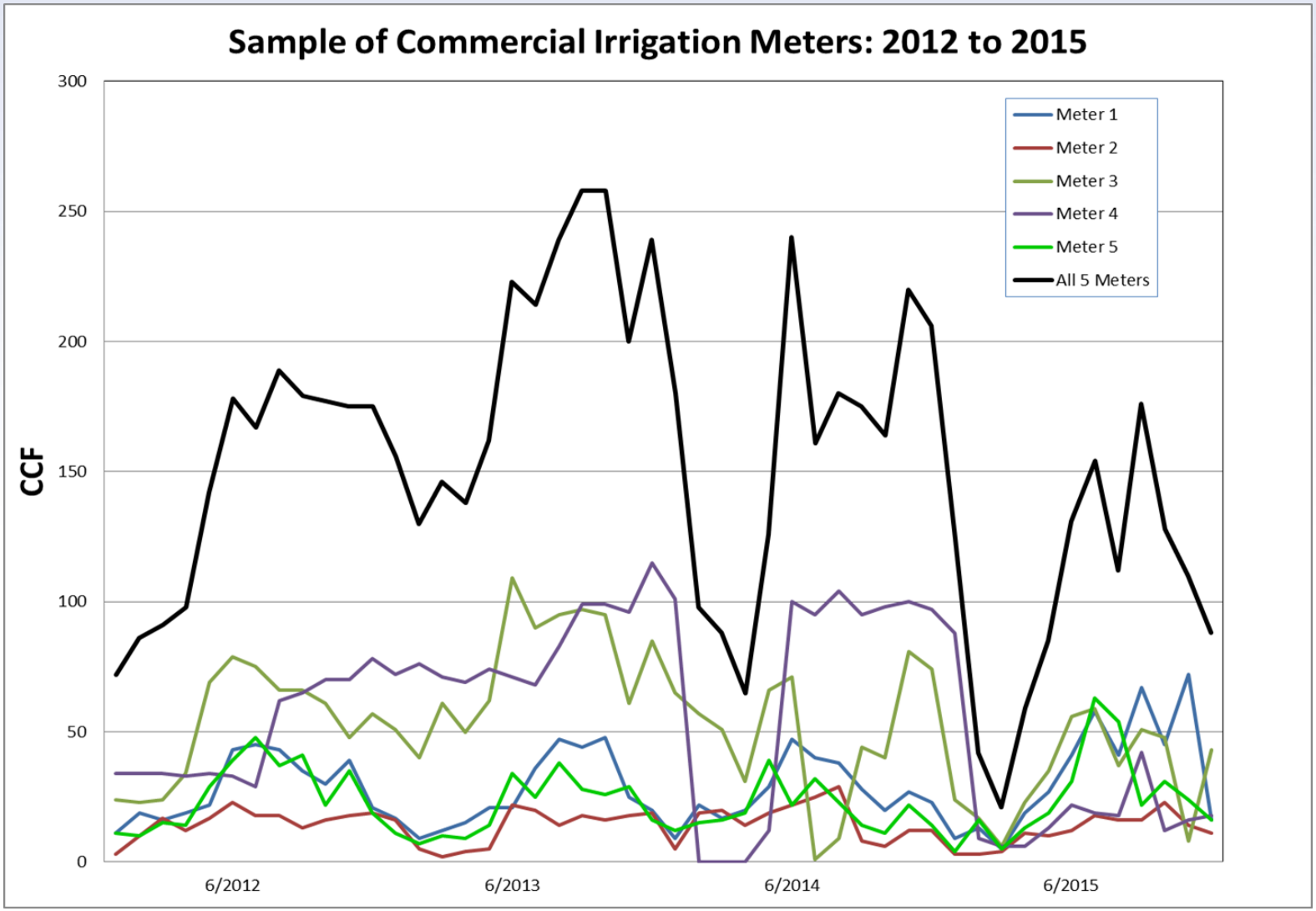
Irrigation Efficiency Program Revisions

- Payout Capped at $10,000
  - Initially 1/3 cost of materials
  - Revised to ½ cost materials &labor

- Continue with Pre and Post Audit Requirement

- More prescriptive recommendations

- Rebate based on completed upgrades:
  - Sprinkler head adjustments
  - Move/add heads
  - Correct nozzles
  - Rain/soil moisture sensors
  - Weather based controller
  - Dedicated irrigation meter
  - Training


Sample of Commercial Irrigation Meters: 2012 to 2015
CCF
300
250
200
150
100
50
0
6/2012
6/2013
6/2014
6/2015
Meter 1
Meter 2
Meter 3
Meter 4
Meter 5
All 5 Meters

Greywater and Rainwater (RWH) Harvesting

2008

- Commercial RWH Ordinance
- Residential Greywater Ordinance

2011

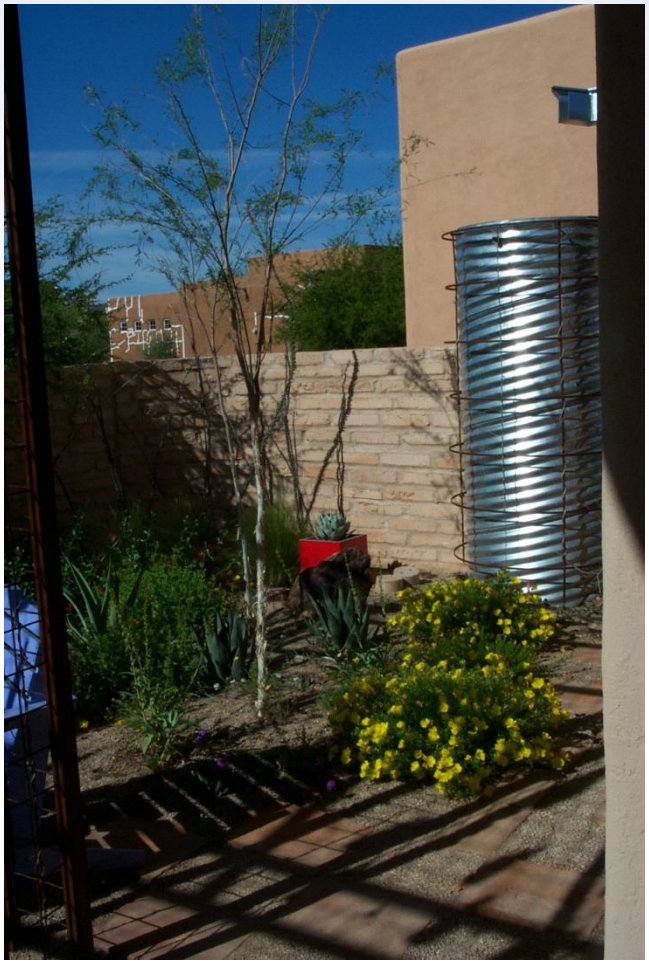
Residential Greywater Program

-Up to $1000 Rebate

2012

Residential Rainwater Harvesting Rebate

- Up to $2000 Rebate

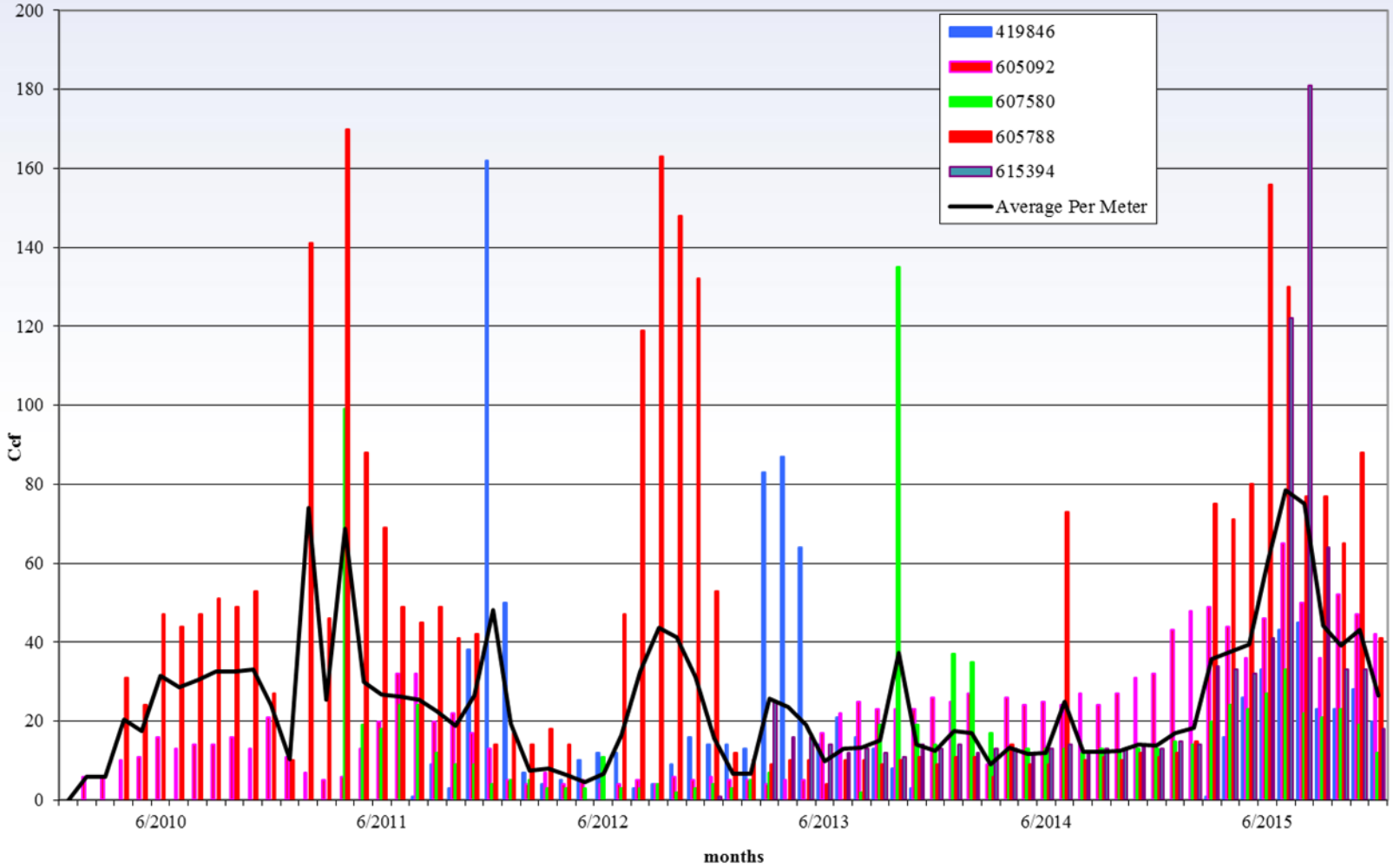


Commercial Rainwater Harvesting Ordinance

Ordinance Requirements:

- 50% of Landscape Water Requirement met through RWH practices
- Develop a landscape water budget
- Best available Practices/Technologies
- Monitoring and Reporting requirements
- Demonstration Projects


OPEN
IN 6
DAYS


Quik Trip Irrigation Meters: 2010 to 2015
200
180
160
140
120
100
80
60
40
20
0
Ccf
419846
605092
607580
605788
615394
Average Per Meter
6/2010
6/2011
6/2012
6/2013
6/2014
6/2015
months

Residential Rainwater Harvesting Rebate Program

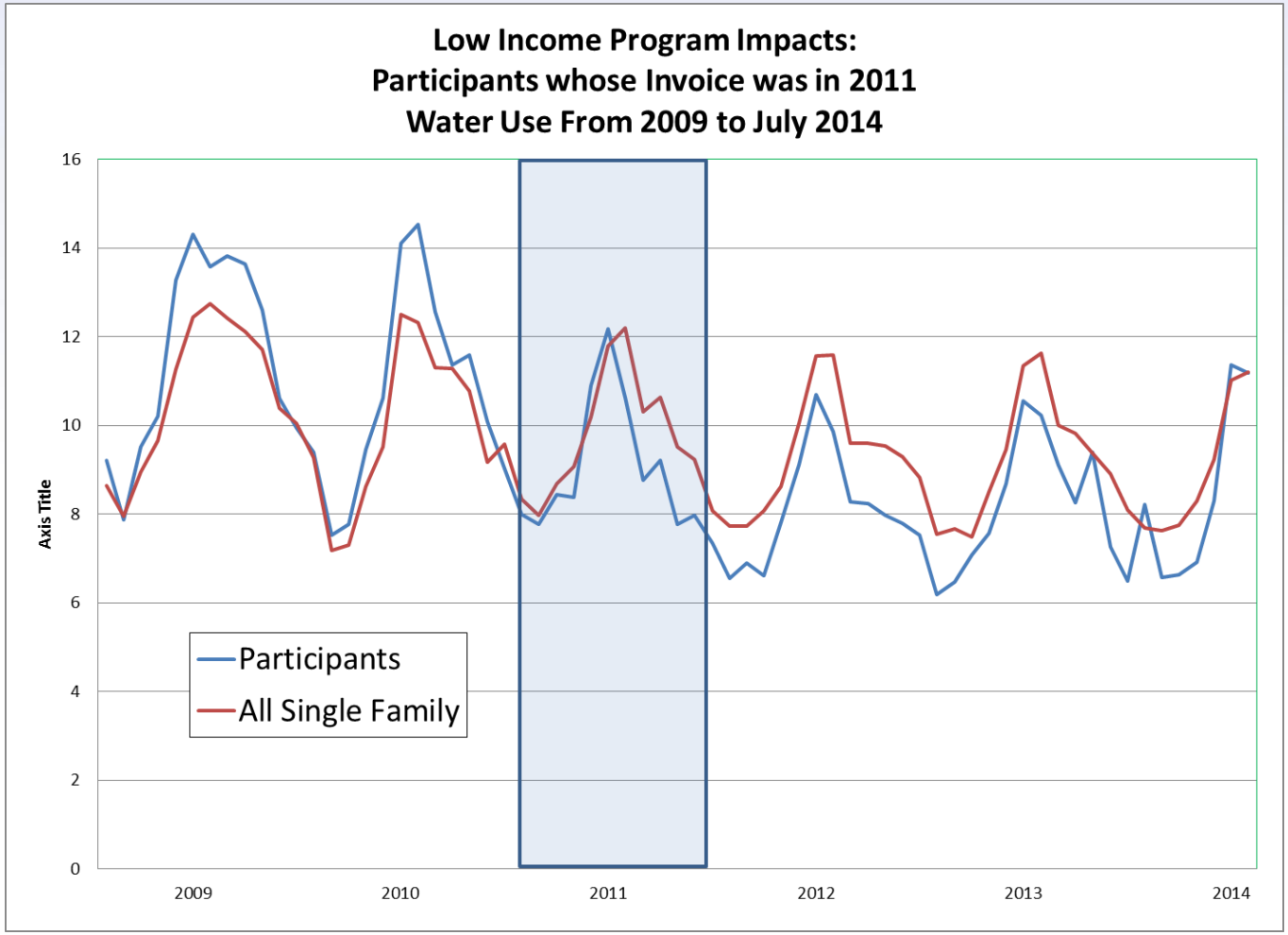
-Two levels of Participation:

Passive: Up to $500

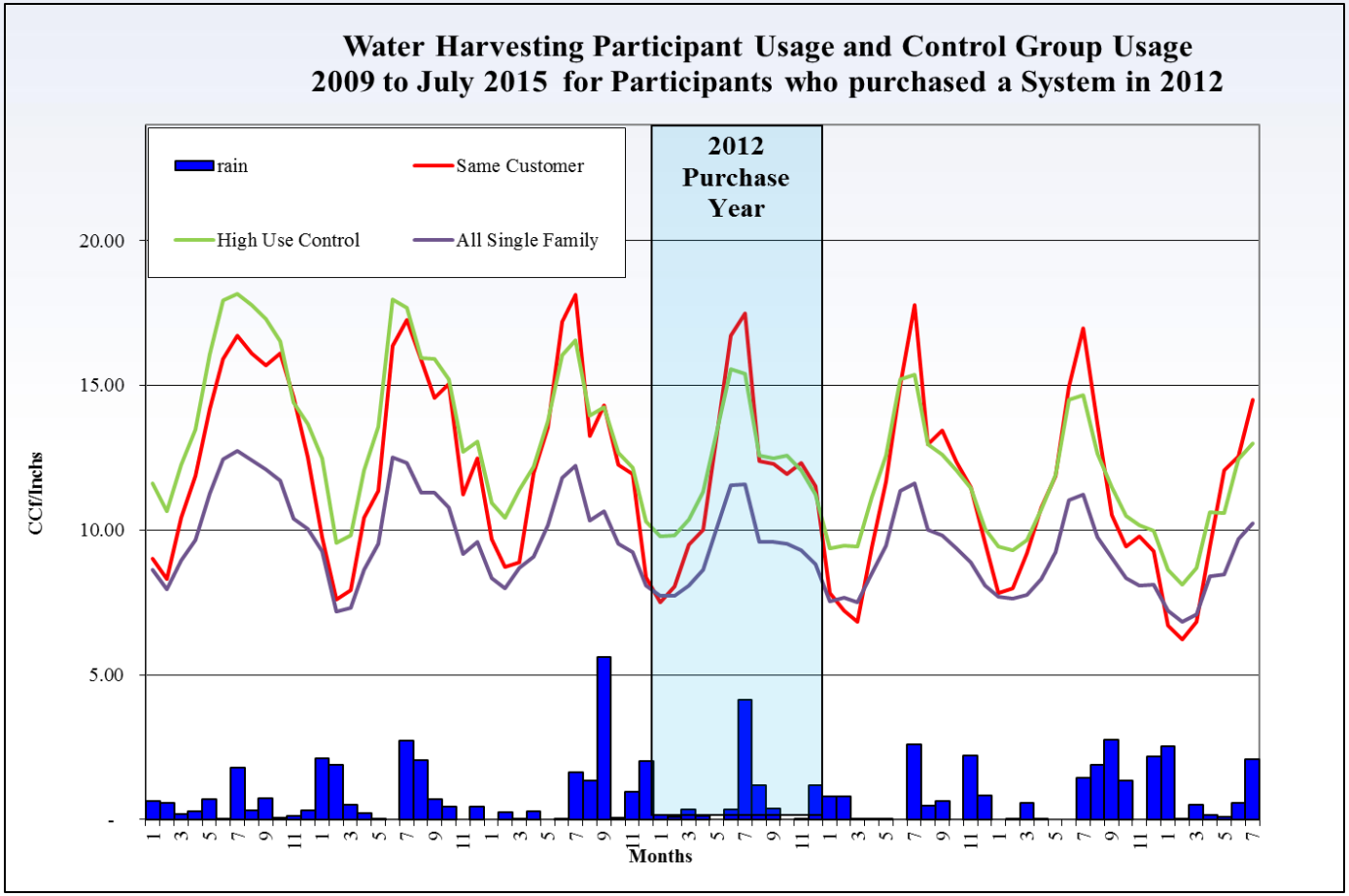
Active: Up to $2000

- Must attend workshop
- Modified in 2015 to include Small Commercial Customers and Curb Cuts
- Approximately 900 rebates issued

Successful HET Program



2012 Participant Analysis



Drought and Tucson Water

- Currently storing almost 50% more then we use annually *(144,000 af CAP allocation; use ~100,000af)*
- Demand is down & continues to fall
  - 25% decrease since 2000
  - In 2014: 124 total gpcd and 88 residential gpcd
- ***Tucson has a Drought Preparedness & Response Plan***

Stages of Drought Awareness

- **Stage One: Awareness**
  - Observed since 2007
  - City of Tucson Facility Audits required
  - Modifications & audits (facility, voluntary)

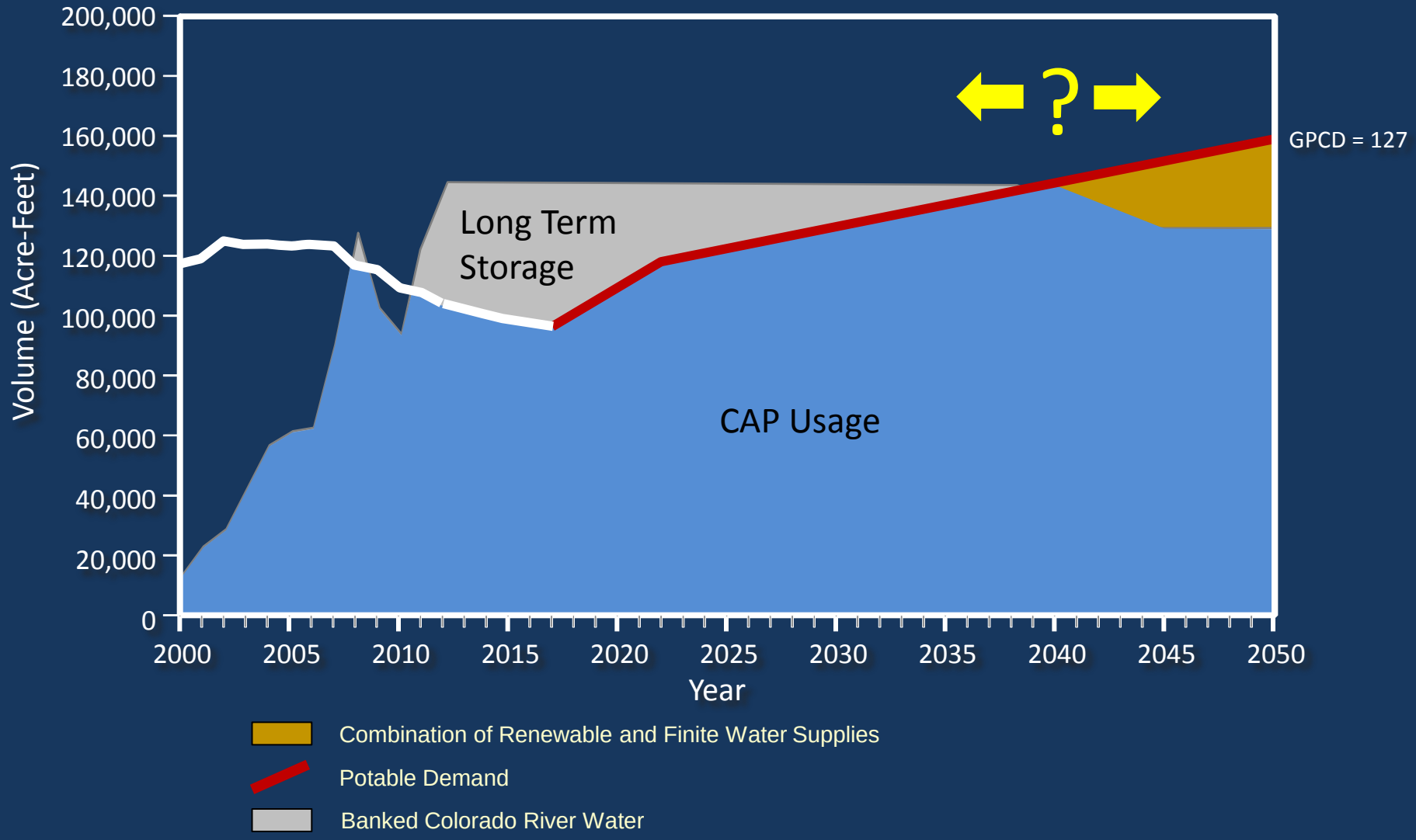
- **Stage Two: Shortage on the River**
  - Mandatory audits at facilities using more than 320ccf/month
  - *May* implement irrigation restrictions
  - Request conservation, self-audits, address non-essential uses

Stages of Drought Awareness

- **Stage Three: CAP Reduction**
  - Continue Stage One & Two
  - No operations of fountains at CII, multi-family sites
  - Restrictions on irrigation & washing paved areas
  - Interior efficiency retrofit requirements

- **Stage Four: Severe Cutbacks**
  - Implement City Emergency Water Conservation Ordinance
  - Restriction of non-essential outdoor water use, public misting systems
  - Water upon request
  - No filling of swimming pools, other exterior water features
  - Cars washed at recycle water facilities only—except emergency vehicles

Potable Water Use - Projection to 2050 with Shortage

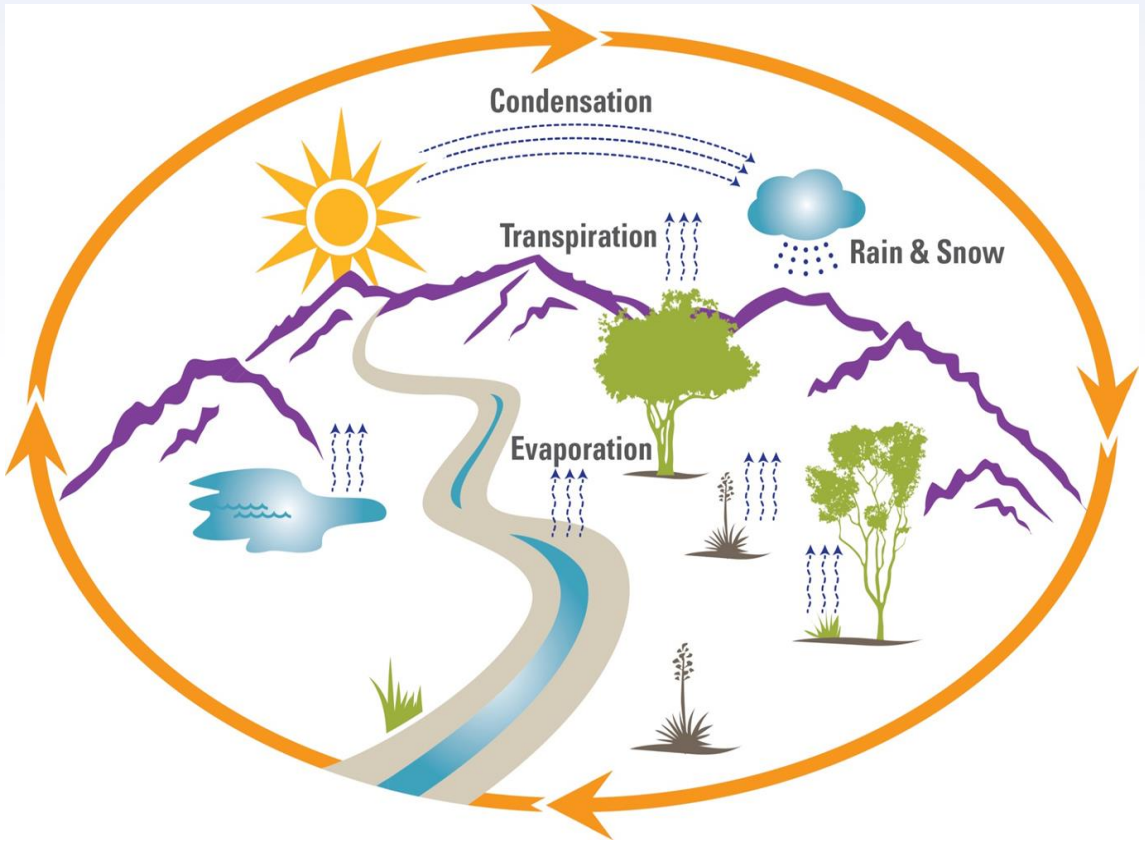


Ensuring Our Water Future: Indirect Potable Reuse

- Unused Reclaimed Water added to the drinking water supply
- Technology can create the highest quality water
- Sustainable – Supply renews and grows

Benefits of Using Recycled Water

- Local Control
- Significant investments in water and infrastructure
- Maximize use of existing infrastructure
- Buffers community from drought
- Supports economic development
- Reflects community stewardship of water resources



Conclusions

- Water will only become more expensive over time
- Rainwater harvesting does not appear to impact demands; equity issues need to be addressed
- Green infrastructure is critical to a sustainability effort
- Irrigation management requires on-going educational effort

Don't let the Water Waste Monster Bite You!

ASIC

Questions or Comments?

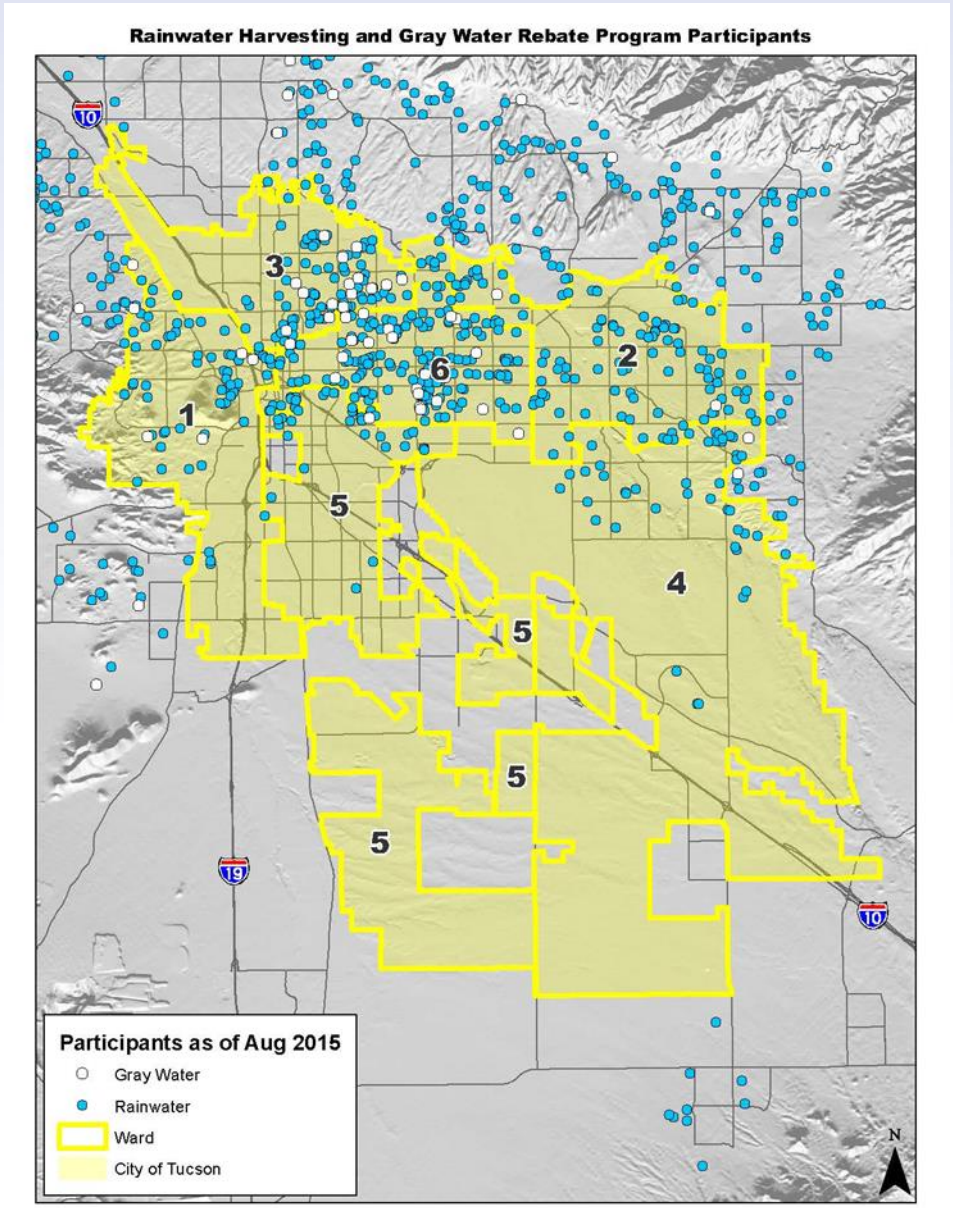
Rainwater Harvesting Rebate Program

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

- imported soil to create passive rain garden practices
- purchase and delivery of gravel or decomposed granite (also known as DG or 1/4 minus)
- purchase or installation of pumps or associated controls, irrigation systems, or backflow prevention devices
- 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.
- labor completed by owner, neighbor, friend, or handyman

Simple Payback: Active Rainwater Harvesting

- Payback assuming water collected was a new source:
  - One 50 gallon rain barrel filled five times collects 250 gallons annually – resulting in a **$1.24** value based on current water rates
  - One 865 gallon cistern filled five times collects 4,325 gallons annually – resulting in a **$21.45** value based on current water rates
  - One 2,825 gallon cistern filled five times collects 14,125 gallons annually – resulting in a **$70.06** value based on current water rates
- 60+ year payback?


Rainwater Harvesting and Gray Water Rebate Program Participants
10
19
1
2
3
4
5
6
Participants as of Aug 2015
Gray Water
Rainwater
Ward
City of Tucson
N

2013-2014: Cost per CCF

	Expenditure	Saved Water (Ccf)	Cost per Ccf
Single-Family HET	$202,160	24,938	$8.11
Multi-Family HET	$490,506	49,076	$9.99
Commercial HET	$28,886	4,932	$5.86
Low-Income HET	$313,116	9,988	$31.34
High-Efficiency Urinal	$52,400	2,582	$20.29
Gray Water	$4,678	174	$26.89
Rainwater Harvesting	$354,538	0	$354,538.00
Irrigation Upgrade	$83,676	3,074	$27.22

Steve Hohl

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Southeast, Southwest, Northeast, & California

American Society of Irrigation Consultants

Drought Management in the West

Issues Facing California Consultants from Drought Legislation

Steve Hohl, ASIC

WATER CONCERN LTD.
Landscape Irrigation /Consulting

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American Society of Irrigation Consultants

GOAL

…To explain how legislation and codes have changed in California to improve water use efficiency in the irrigation industry…

…To promote a call to action for our profession to get involved to make viable solutions…

CURRENT STATUS

- EO B-29-15
  - Restriction of water allotment to new landscapes
  - Mandatory 25% reduction of water use with higher values based on per capita use
  - 50 M sq. ft. turf replacement
  - Prohibit irrigation of turf medians with potable water
  - Requirement of new landscapes to comply with CAL-GREEN
  - Update the MWELO to increase water efficiency standards through more efficient irrigation, greywater usage, onsite storm water capture and limiting turf use

HISTORY OF MWELO

- 2004
  - AB2717 passed requesting California Urban Water Conservation Council (CUWCC) to start a task force of public and private agencies to evaluate proposals to improve water use efficiency in new and existing urban landscapes. Updates to 1990 Model Water Efficient Landscape Ordinance (MWELO)

History of MWELO

- 2006 Water Conservation in Landscaping Act
  - AB1881
  - Required update to MWELO to take effect in 2010
  - Local agencies must update ‘at least as effective’ or adopt State model
  - Requires adoption of performance standards, labeling requirements for irrigation equipment to reduce wasteful consumption of energy or water
    - Controllers
    - Moisture sensors
    - Emission devices
    - Valves

MWELO

- 2010 – All agencies in California adopt local ‘at least as effective’ MWELO
- 2015 – Executive Order B-29-15 in April required an update to the MWELO by January 2016

Photo Credit: AGWEB, www.agweb.com

THOUGHTS

Lack of professionalism in design, install and maintenance

Photo Credit: Rodrigo Pena, OC Register
www.ocregister.com/articles/water-679689-percent-orange.html

Photo Credit: City of Cypress
www.ci.cypress.ca.us/public_works/overspray.htm

Photo Credit: Adrien Flickr CC By-NC-SA 2.0
http://articles.extension.org/pages/62183/irrigating-the-parking-strip

THOUGHTS

Some would ban irrigation if permitted

Public perception magnified due to drought

Photo Credit: Thomas Boyd
http://quietmike.org/2015/04/11/ways-to-tackle-the-extreme-california-drought/

MWELO 2015

Applicability

- 500 sq. ft. (2,500 prior) for public and private development
- 500 sq. ft. (5,000 prior) for residential projects
- 2,500 sq. ft. for rehabilitated landscapes
- Requiring a permit

Meeting the applicability requires submission of Landscape Document Package

MWELO 2015

Landscape Document Package

- Water Efficient Landscape Worksheet
  - Maximum Applied Water Allowance
  - Estimated Total Water Use
- Soil Management Report
- Landscape Design Plan
- Irrigation Plan
- Grading Design Plan
- Certificate of Completion
- Scheduling
- Maintenance Schedule
- Irrigation Audit
- Minimum Irrigation Efficiency

Photo Credit: Austin Pond Doctor

MWELO 2015

Maximum Available Water Allotment (MAWA)

$$MAWA = (ETo\ x\ .62)\ [(ETAF\ x\ LA) + (1 - ETAF)\ x\ SLA]$$

Whereas:

Eto =	Reference ET (inches per year)
0.62 =	Conversion factor to gallons
ETAF =	ET adjustment Factor (0.45 for Commercial, 0.55 for Residential
LA =	Landscape Area (Sq. ft.)
SLA =	Special Landscape Area (Recycled water, Recreational area, Edible gardens)

"Recreational area" means areas designated for active play, recreation or public assembly in parks, sports fields, picnic grounds, amphitheaters or golf course tees, fairways, roughs, surrounds and greens.

MWELO 2015

Estimated Total Water Allotment (ETWU)

$$ETWU = (ETo\ x\ 0.62) \sum \frac{LA(h)\ x\ PF(h)}{IE(h)} + SLA$$

Whereas:

Eto =	Reference ET (inches per year)
0.62 =	Conversion factor to gallons
LA(h) =	Hydrozone Landscape Area (Sq. ft.)
PF(h) =	Hydrozone Plant Factor based on WUCOLS or other source
IE(h) =	Hydrozone Irrigation Efficiency
SLA =	Special Landscape Area*

*All SLA areas automatically designate an ETAF of 1.0

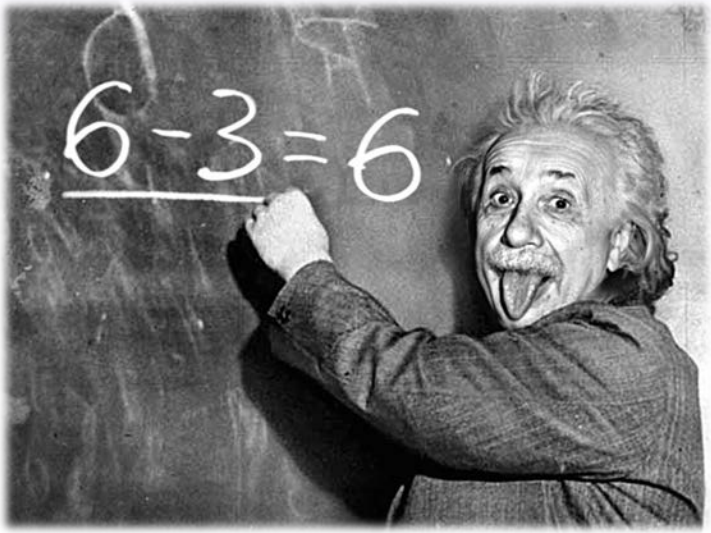


Photo Credit: Donna Williams Blog, www.donnawilliams.net

MWELO 2015

Increased Irrigation Efficiency based on DUlh and Irrigation Management Efficiency (IME) of 0.90

- Overhead spray = 0.83 x .90 = 0.75
- Drip = 0.90 x 0.90 = 0.81

ETAF (PF / IE)= .45 for commercial

- 70% low with drip / 30% moderate planting with drip
- 85% low with drip / 15% warm season turf with HE spray
- 90% low with drip / 10% cool season turf with HE spray

ETAF (PF / IE)= .55 for residential

- 30% low with drip / 70% moderate planting with drip
- 65% low with drip / 35% warm season turf with HE spray
- 80% low with drip / 20% cool season turf with HE spray

MWELO WATER USAGE WORKSHEET

WATER METER 1 / CONTROLLER A

CITY OR ZONE ANAHEIM
REFERENCE EVAPOTRASPIRATION (ETo) 49.20
LANDSCAPE TYPE NON-RESIDENTIAL

REGULAR LANDSCAPE AREAS

HYDROZONE NO.	LANDSCAPE AREA (SQ. FT.)	PLANT TYPE	PLANT FACTOR (PF)	IRRIGATION TYPE	IRRIGATION EFFICIENCY (IE)	ET ADJUSTMENT FACTOR (ETAF)	ESTIMATED WATER USE (GALLONS)
1	1,500	SHRUB - LOW WATER USE	0.2	INLINE DRIP	81%	0.25	11,298
2	252	TURF - WARM SEASON	0.6	HE SPRAY	73%	0.82	6,318
3	4,523	SHRUB - LOW WATER USE	0.2	MSMT ROTARY	76%	0.26	36,308
4	211	SHRUB - MOD WATER USE	0.5	INLINE DRIP	81%	0.62	3,973
5		---		---			-
6		---		---			-
7		---		---			-
8		---		---			-
9		---		---			-
10		---		---			-
11		---		---			-
12		---		---			-
13		---		---			-
14		---		---			-

TOTAL (SQ. FT.) 6,486

ESTIMATED TOTAL WATER USE (GALLONS) 57,897

SPECIAL LANDSCAPE AREAS

TYPE	LANDSCAPE AREA (SQ. FT.)	PLANT TYPE	PLANT FACTOR (PF)	IRRIGATION TYPE	IRRIGATION EFFICIENCY (IE)	ET ADJUSTMENT FACTOR (ETAF)	ESTIMATED WATER USE (GALLONS)
RECYCLED WATER	-						-
ACTIVE PLAY	43,560					1.00	1,328,754
EDIBLE GARDEN	-						-
URBAN FOREST	-						-

TOTAL (SQ. FT.) 43,560

TOTAL AREA (SQ. FT.) 50,046

SLA ESTIMATED TOTAL WATER USE (GALLONS) 1,328,754
SITEWIDE ESTIMATED TOTAL WATER USE (GALLONS) 1,386,651

MAXIMUM APPLIED WATER ALLOWANCE (GALLONS) 1,417,786

ETWU < MAWA YES

SPECIAL LANDSCAPE AREAS - ACTUAL WATER USE

HYDROZONE NO.	LANDSCAPE AREA (SQ. FT.)	PLANT TYPE	PLANT FACTOR (PF)	IRRIGATION TYPE	IRRIGATION EFFICIENCY (IE)	ACTUAL ET ADJUSTMENT FACTOR (ETAF)	ACTUAL ESTIMATED WATER USE (GALLONS)	SPECIAL LANDSCAPE AREA TYPE
1	-	SELECT		SELECT			-	RECYCLED WATER
2		---		---			-	RECYCLED WATER
3		---		---			-	RECYCLED WATER
4		---		---			-	RECYCLED WATER
5	43,560	TURF - WARM SEASON	0.6	ROTOR	73%	0.82	1,092,127	ACTIVE PLAY
6		---		---			-	RECYCLED WATER
7		---		---			-	RECYCLED WATER
8		---		---			-	RECYCLED WATER
9		---		---			-	RECYCLED WATER
10		---		---			-	RECYCLED WATER
11		---		---			-	RECYCLED WATER
12		---		---			-	RECYCLED WATER
13		---		---			-	RECYCLED WATER
14		---		---			-	RECYCLED WATER
		---		---			-	ACTIVE PLAY
		---		---			-	EDIBLE GARDEN
		---		---			-	URBAN FOREST

TOTAL SLA AREA (SQ. FT.) 43,560
TOTAL STANDARD AREA (SQ. FT.) 6,486
TOTAL LANDSCAPE AREA (SQ. FT.) 50,046

SITEWIDE EFFICIENCY 74%
SITEWIDE ETAF 0.75

SLA TOTAL WATER USE (GALLONS) 1,092,127
STANDARD LANDSCAPE WATER USE (GALLONS) 57,897
ACTUAL TOTAL WATER USE (GALLONS) 1,150,023
ACTUAL TOTAL WATER USE (HCF) 1,537
ACTUAL TOTAL WATER USE (ACRE FEET) 3.530

MAXIMUM ALLOWABLE WATER ALLOTMENT (GALLONS) 1,417,786

MWELO 2015

Landscape Design Plan

- Turf not permitted on slopes > 25%
- High water use plants not permitted in medians
- Water features considered as high water use hydrozone and included in ETWU
- Compost integrated at 4CY / 1,000 sq. ft. 6” deep
- Minimum 3” mulch
- Delineate all hydrozones
- Identify water use classification of plant palette
- Permeable non irrigated areas not considered in Landscape Area

MWELO 2015

Irrigation Design Plan

- Water meters for non-residential landscapes > 1,000 sq. ft.
- Water meters for residential landscapes > 5,000 sq. ft.
- ET or soil moisture based controllers
- Pressure regulator if static pressure > required dynamic
- Rain sensor
- Flow sensor on all non-residential systems and on residential systems > 5,000 sq. ft.
- Master valve on all projects
- Minimum DULQ > 0.65 or using protocol in ASABE/ICC 802-2014

MWELO 2015

Irrigation Design Plan

- In mulched areas, the use of low volume irrigation is required to maximize water infiltration into the root zone*
- Swing joints required
- Check valves
- Areas < 10 feet in any direction require subsurface irrigation or other means that produces no runoff or overspray
- Overhead irrigation not permitted within 24 inches of non-permeable surface
- Slopes > 25% limited to application rate < 0.75 inches per hour
- Trees shall be placed on separate valves – where feasible
- Identify the hydrozone and application rate on each valve
- “I have complied with the criteria of the ordinance and applied them accordingly for the efficient use of water in the irrigation design plan”

MWELO 2015

Certification of Completion

- As-built plan
- Hydrozone plan kept with controller
- Irrigation Schedule
- Maintenance Schedule
- Audit Report
  - Conducted by local agency or third party certified auditor.
  - Cannot be conducted by person who designed or installed landscape
  - 1 in 7 or 15% of Lots in large development

LOCAL VARIANCES

At Least as Effective

Variances include:

- Prohibit overhead spray on slopes
- No designation of recycled water as a SLA
- Setback distance from non-permeable landscape areas
- Timing charts (Peak ET schedule, monthly, volume per valve per month)
- Hydrozone charts in addition to schedules
- Definition of “Low Volume Irrigation”
- Irrigation Efficiencies

Many agencies lack staff and funding to implement and enforce new MWELO requirements

Confusion on plan review implementation due to subjective interpretation and lack of irrigation knowledge

Photo Credit: www.agindiscodiva.blogspot.com/2008_05_01_archive

WE ARE HERE…

- More creative use of planting
- Public acceptance will take time
- Creative search for water resource development
- Accountability of the installer and maintenance entity
- Tiered rate structures
- Penalties for over-use
- Public education
- Agency reporting

WE ARE HERE…

Photo Credit: The Metropolitan Water District of Southern California
http://bewaterwise.com/gardenspot.html

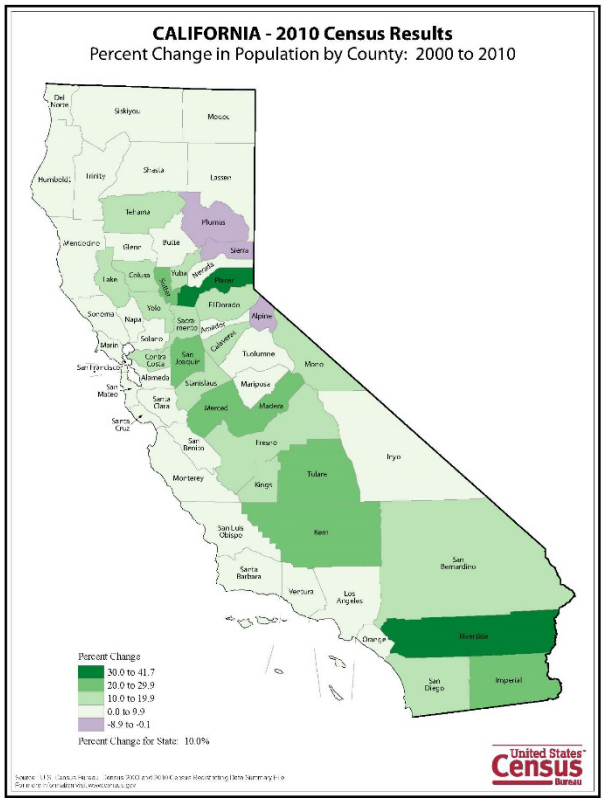
THE FUTURE

Population increase and limited water resource development require further tightening of potable water use in the landscape…

Projected California Population Growth

2015	2020	2025	2030	2035
38,896,969	40,619,346	42,373,301	44,085,600	45,747,645

Source: California Department of Finance, Table P-1, Last accessed: January 28, 2016.[29]



THE FUTURE?

- Decrease potable water use by 50%
- Further turf reduction
- Home inspection reports to include irrigation system
- Expansion of MWELO to existing landscape
- Water budget .80 ETAF with 55 GPD / Person
- Applicability
- Change the SLA to 0.80 ETAF
- All landscapes require a permit

THE FUTURE?

ASIC worked with ASLA, BIA, IA and other organizations to collaborate our stakeholder responses to DWR.

Our goals to improve outdoor water use efficiency are in common, including the viable solutions offered to DWR.

We have a call to action to continue to keep the solutions at mid ground.

We need to have an active presence with policy makers.

THE FUTURE?

Photo Credit: AP Photo/Rich Pendroncelli

CALIFORNIA DEPARTMENT OF WATER RESOURCES

NEWS FOR IMMEDIATE RELEASE

March 30, 2016

Contacts:
Doug Carlson, Information Officer – (916) 653-5114
Doug.Carlson@water.ca.gov
Ted Thomas, Information Officer – (916) 653-9712
Ted.Thomas@water.ca.gov
Elizabeth Scott, Information Officer – (916) 712-3904 (mobile at survey site)
Elizabeth.Scott@water.ca.gov

Sierra Nevada Snowpack Grew During First Half of March, But Dry Spell Leaves Water Content Still below Average

SACRAMENTO – California's statewide snowpack usually reaches its peak depth and water content each year around the first of April, after which the snow begins to melt as the sun's path across the sky moves a little further north each day. Therefore, conditions today were just about as good as they're going to get this year when the Department of Water Resources (DWR) conducted its media-oriented snow survey at Phillips Station in the Sierra Nevada east of Sacramento.

The same is true for the statewide snowpack, which some had expected to benefit more than it has from El Niño conditions. Statewide, water content of the mountain snowpack today is only 87 percent of the March 30 historical average.

ASIC

QUESTIONS?

Brent Mecham

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American Society of Irrigation Consultants

Another Way to Characterize Sprinkler Performance

Brent Mecham, Ed Norum

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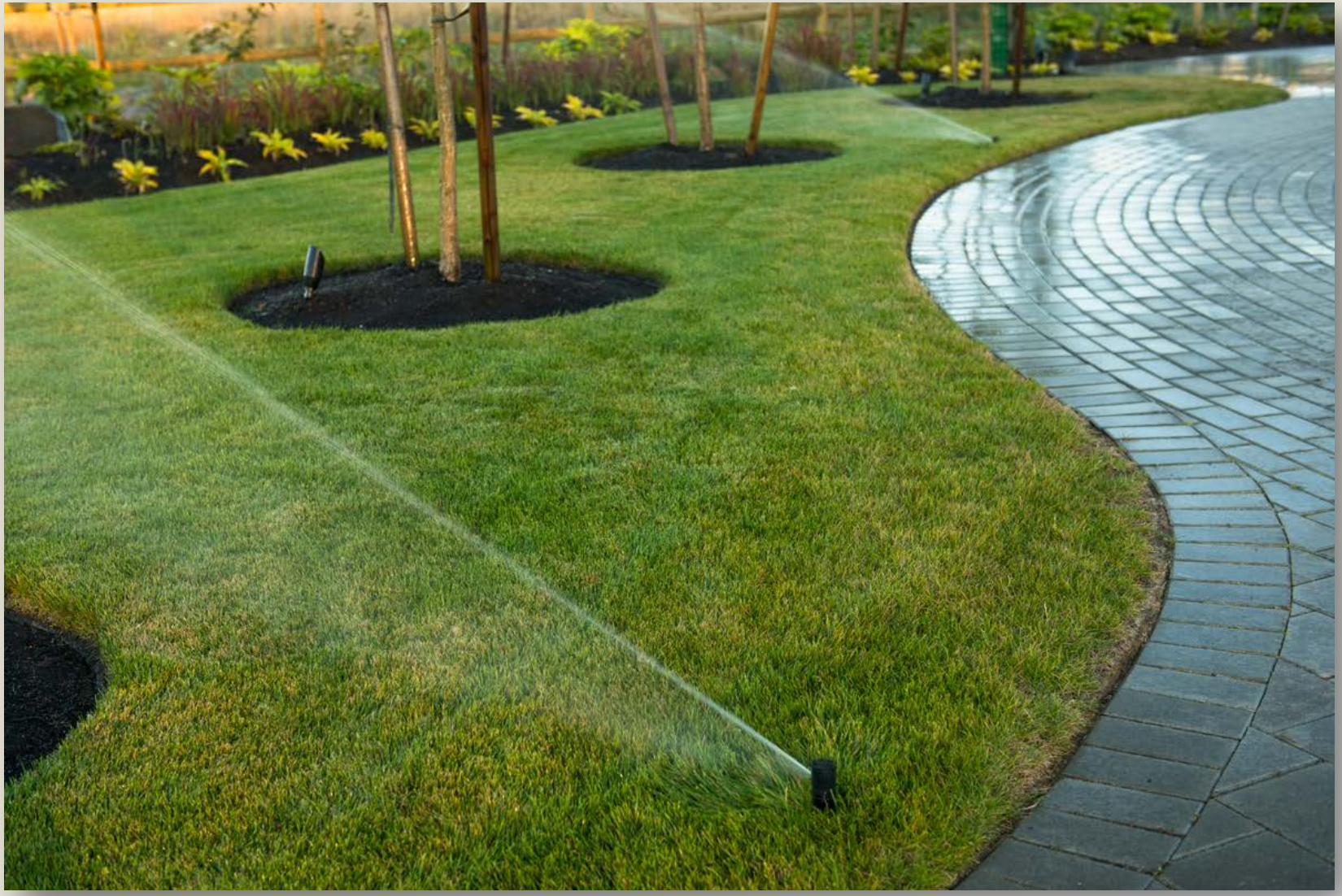
American Society of Irrigation Consultants

Simple irrigation

Challenging



Complex

Sprinkler interaction

Nozzle choices

Study at Cal Poly-Pomona

Distribution Uniformity of Multi-Stream-Rotating Nozzles Spaced Below Recommended Distance

Kumar, Green, Vis

Study: RMSMT nozzles

- Maximum spacing HTH
- Spacing reduced 10%, nozzle unadjusted
- Spacing reduced 25%, nozzle unadjusted
- Spacing reduced 10%, nozzle adjusted
- Spacing reduced 25%, nozzle adjusted

10% = common design practice

25% = common maximum radius adjust

Study Results--DU_{lq}

Treatment	Nozzle A	Nozzle B	Nozzle C	Overall
Max HTH	0.58	0.58	0.45	0.54
-10% unadj.	0.64	0.65	0.57	0.62
-25% unadj.	0.59	0.78	0.62	0.66
-10% adjust.	0.81	0.76	0.52	0.70
-25% adjust.	0.75	0.74	0.67	0.72
Overall	0.68	0.71	0.56	0.65

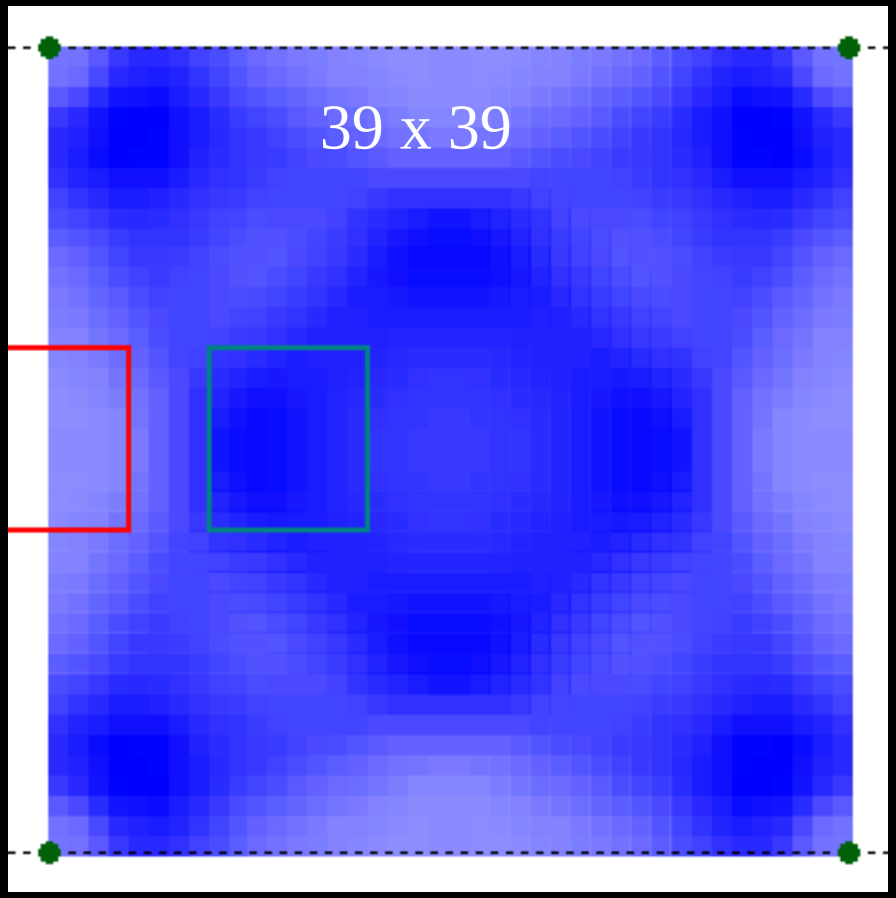
Average of four replications

Unadjusted = over spraying target area

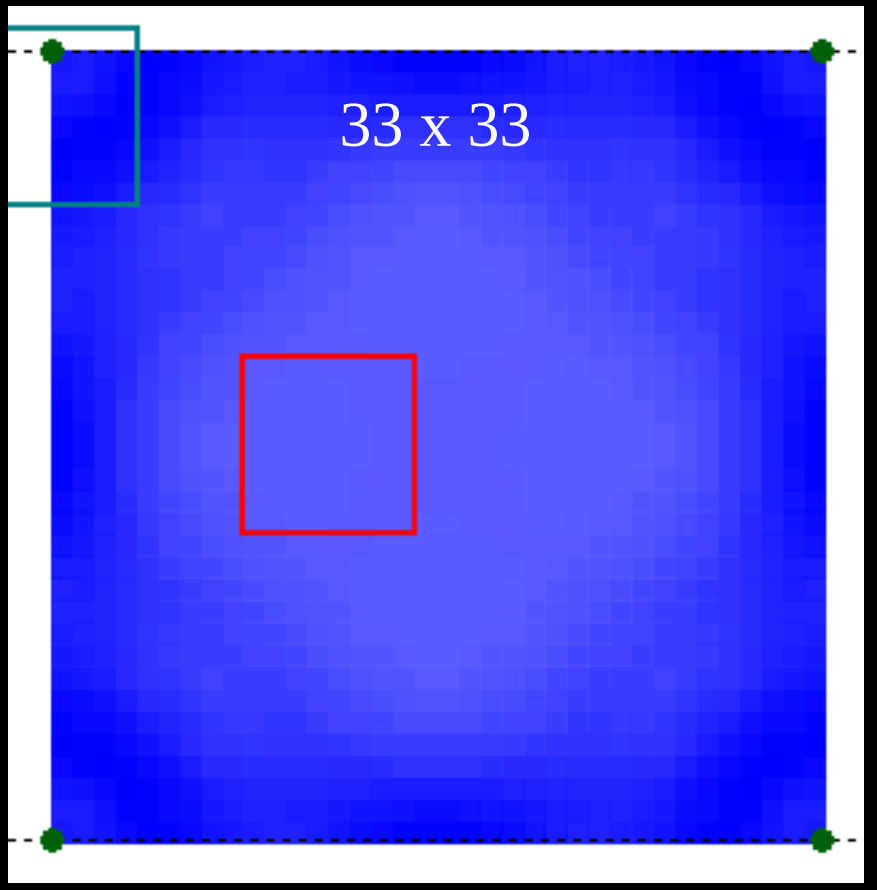
Densograms

- Visual graphic showing water application
- Based on a single sprinkler profile
- Spacing arrangements
- Does not explain off-target application
- Does not explain jet interference
- Calculated potential DU_{lq}, SC, CU

7 nozzle 40 psi Square Spacing

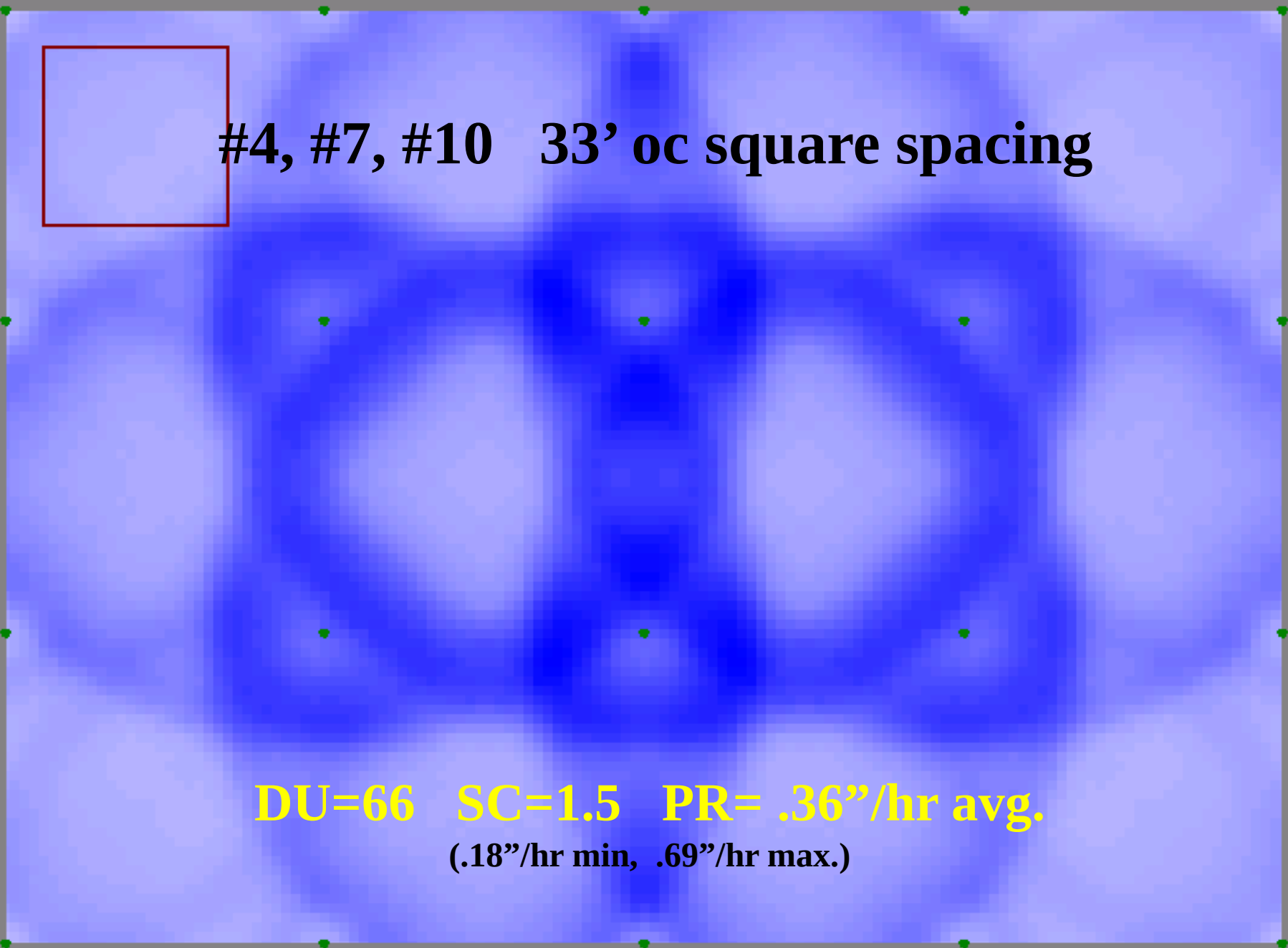


DU= .73 SC=1.6



DU= .82 SC=1.2

#4, #7, #10 33’ oc square spacing



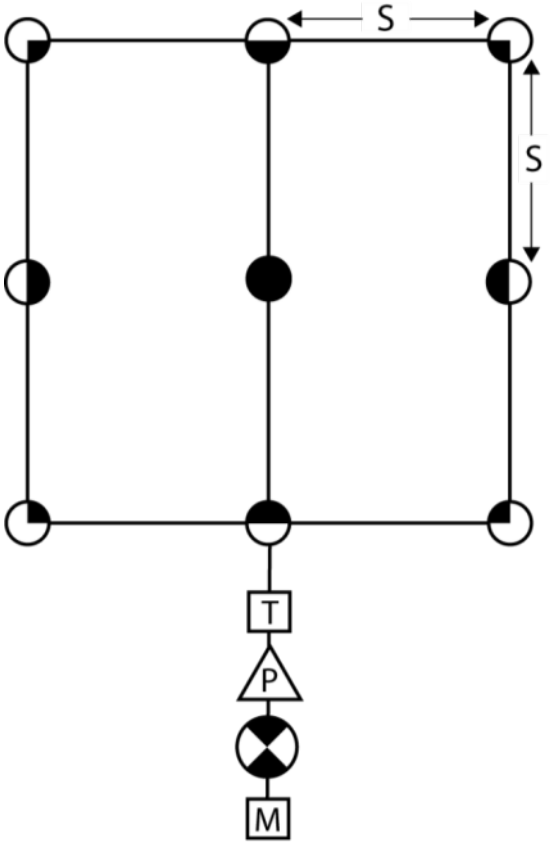
DU=66 SC=1.5 PR= .36”/hr avg.

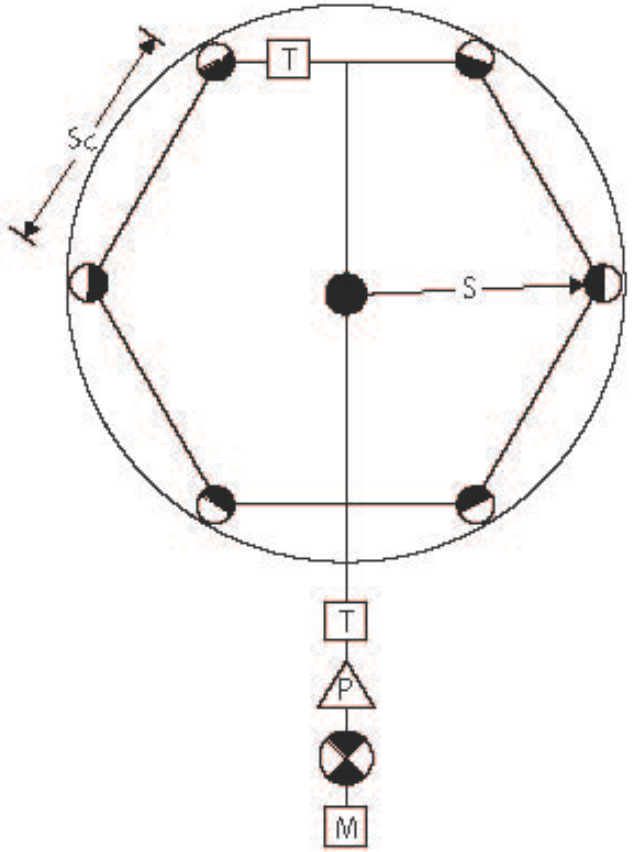
(.18”/hr min, .69”/hr max.)

SWAT Testing Protocol

- Spray Head Nozzles Performance Characteristics 3.2
  - Individual nozzles and groups of nozzles
  - Spacing configurations
  - Operating pressures
  - Repeatability
  - Sprinkler operational efficiency
  - DU_{lq}
- Finalized April, 2015—ready for testing

Testing configurations



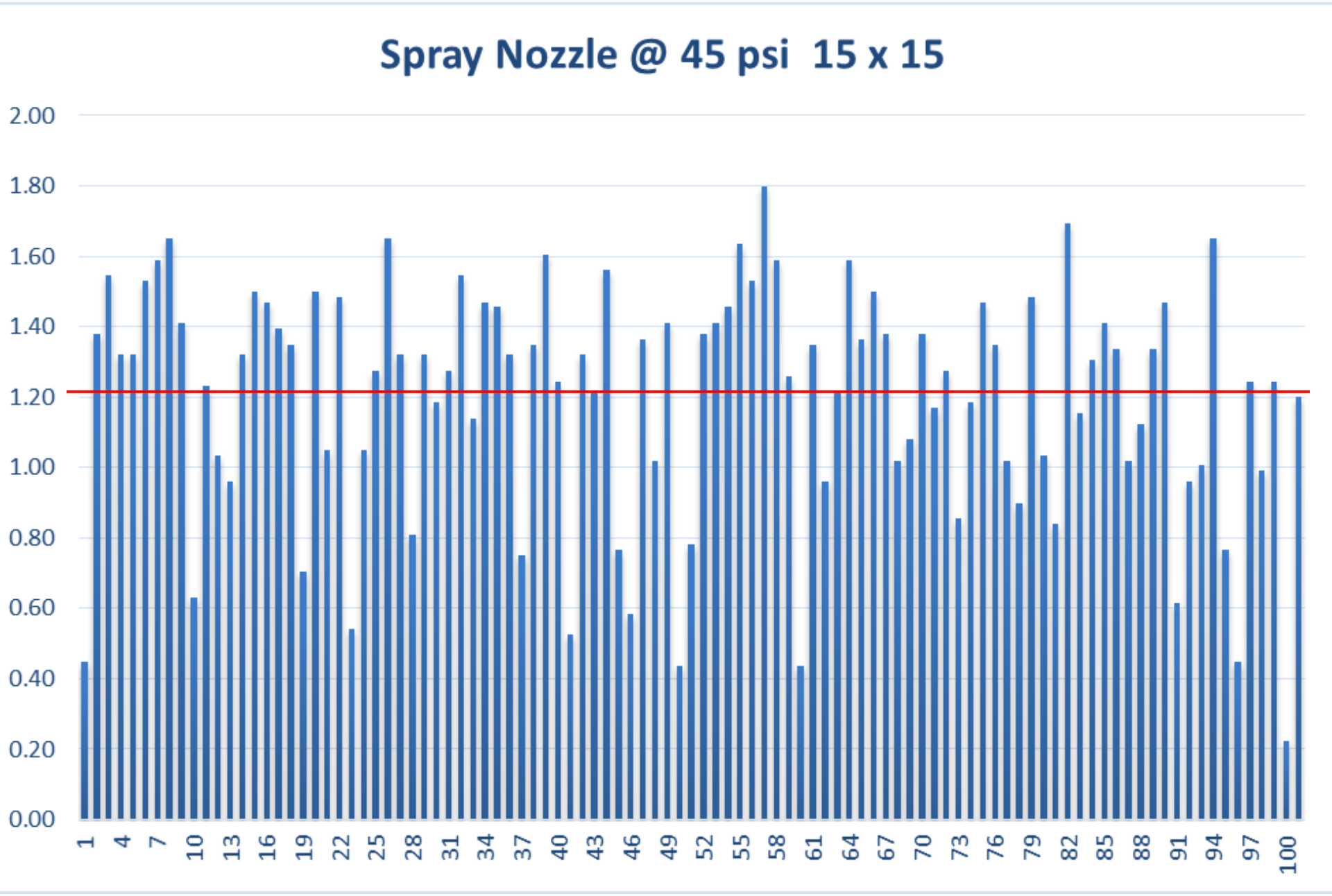


Controlled operating pressure

Catchment devices
measure to 0.01 inches

Testing

- Consider:
  - Operating pressure
  - Overspray
  - Percolation (excess)
  - Median and Effective application rate
  - Sprinkler Operating Efficiency
  - Du_{lq} for comparison


Spray Nozzle @ 45 psi 15 x 15
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
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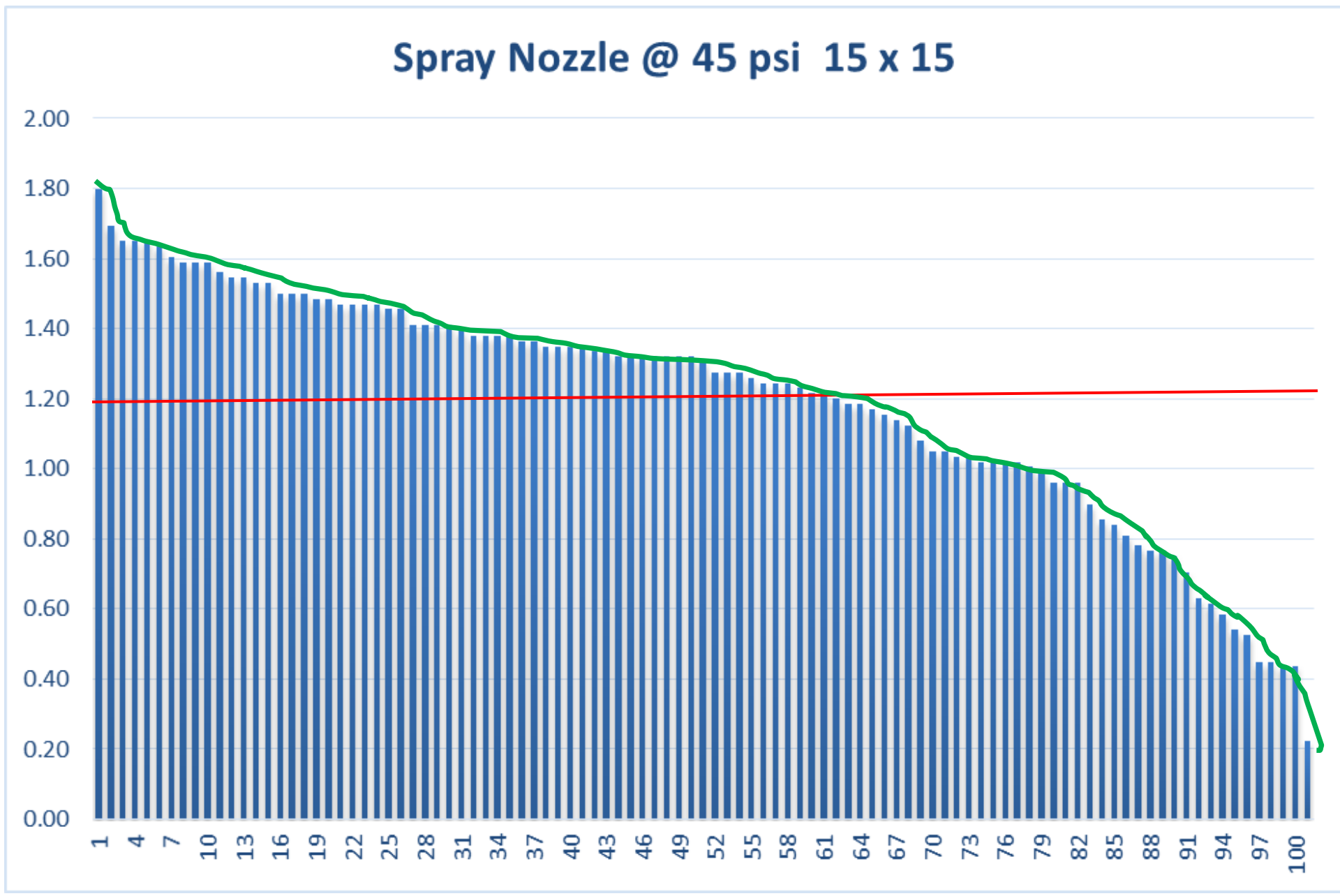
73
76
79
82
85
88
91
94
97
100


Spray Nozzle @ 45 psi 15 x 15
2.00
1.80
1.60
1.40
1.20
1.00
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0.40
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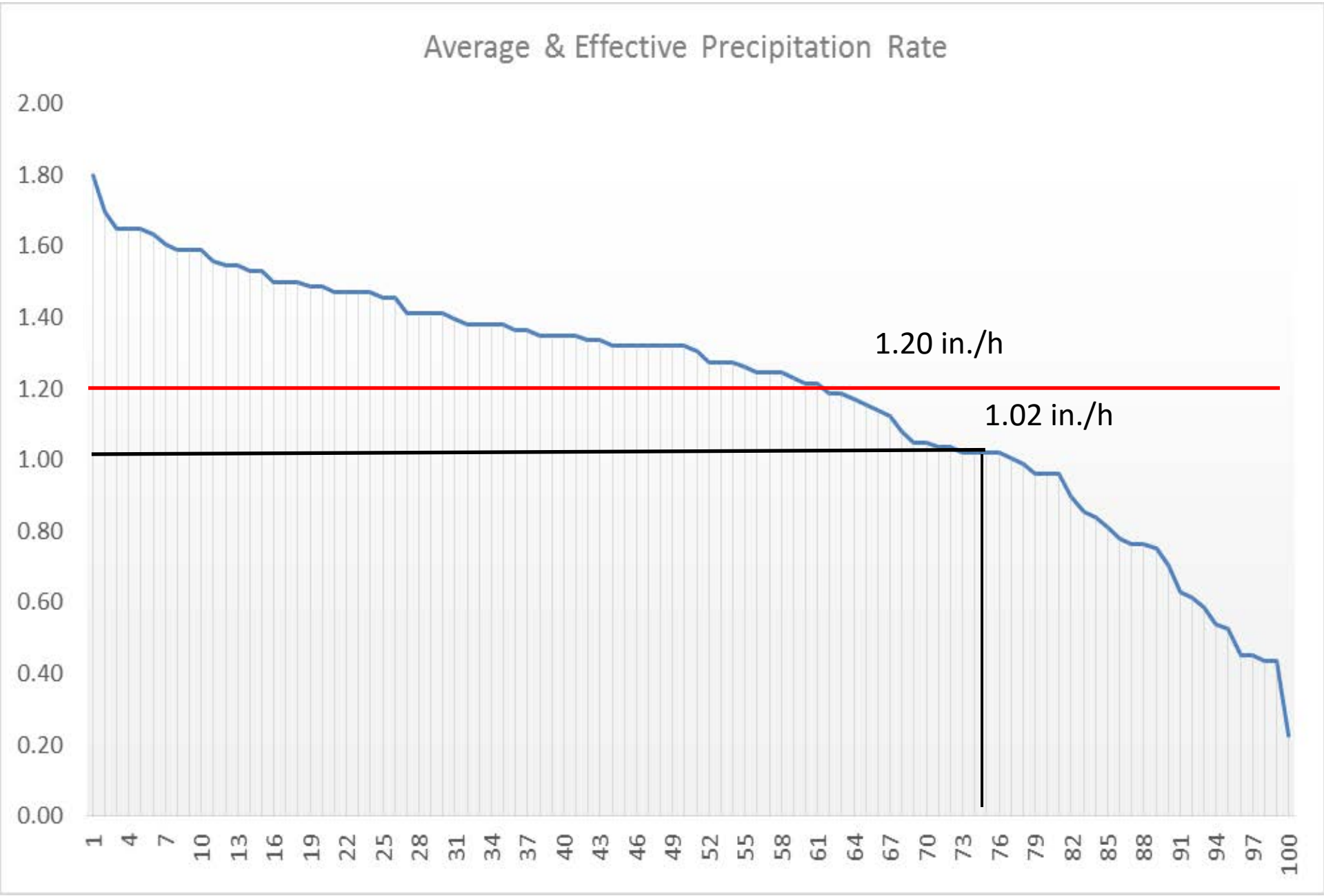
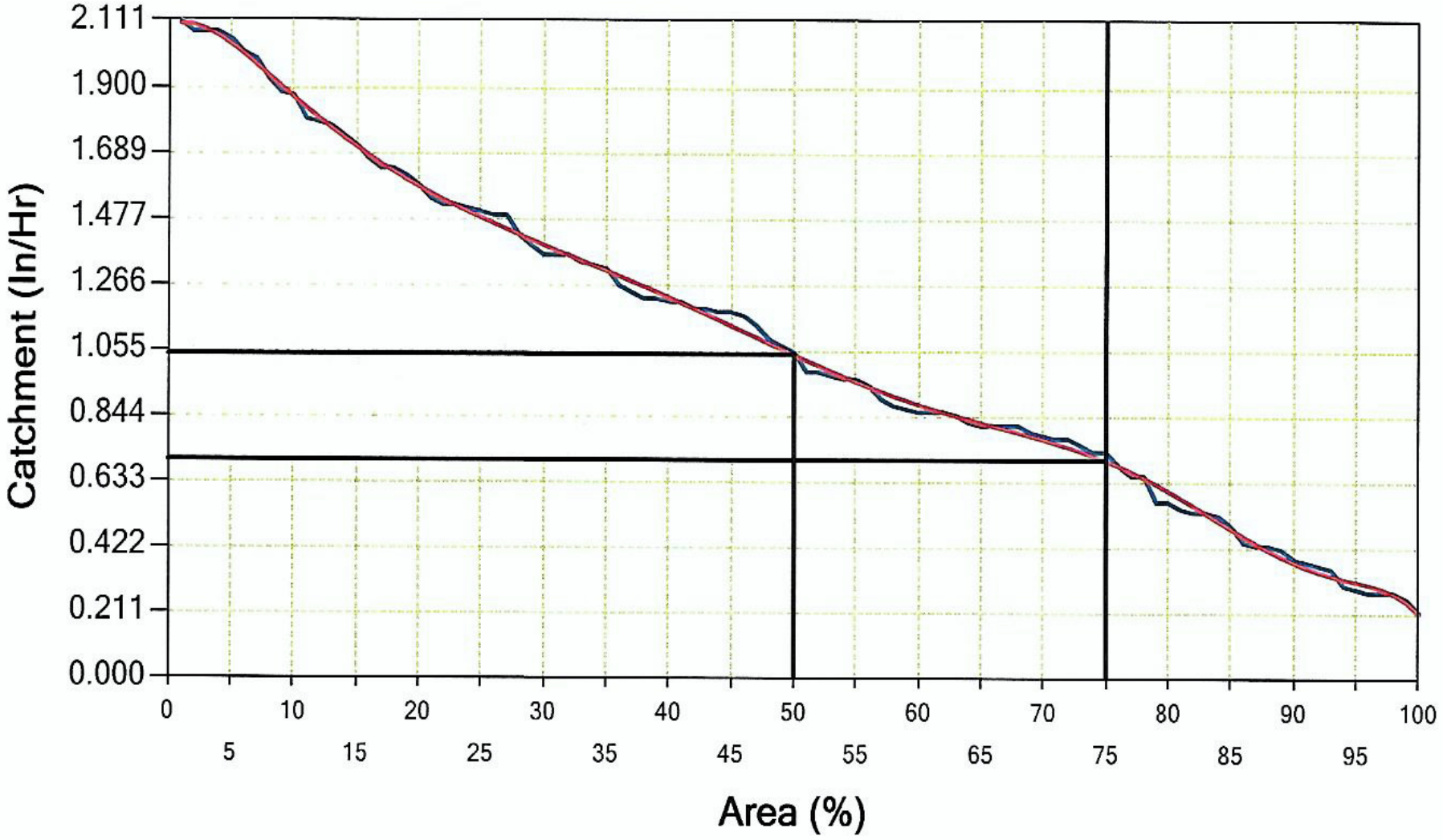
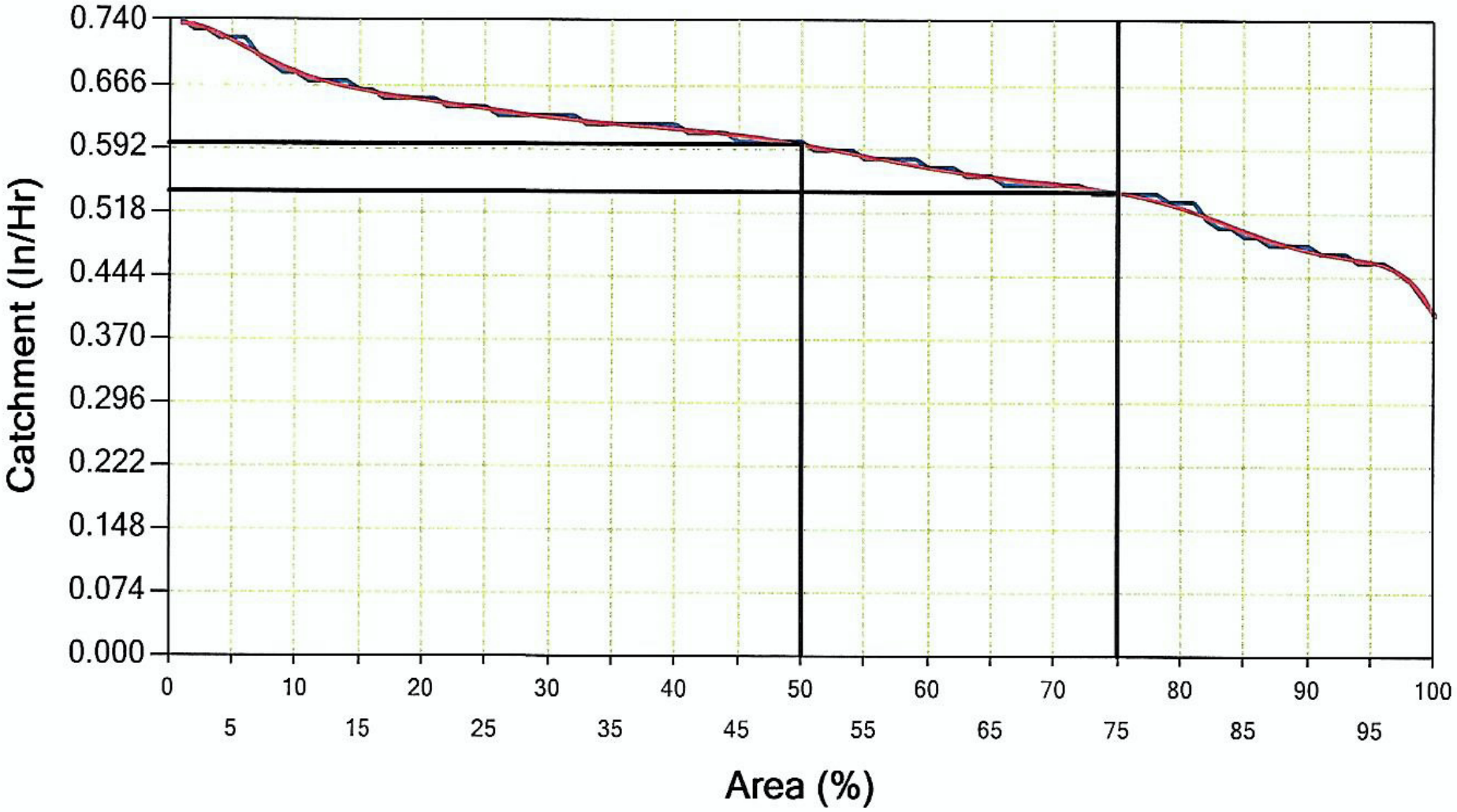
97
100


Average & Effective Precipitation Rate
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1.20 in./h
1.02 in./h
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
49
52
55
58
61
64
67
70
73
76
79
82
85
88
91
94
97
100

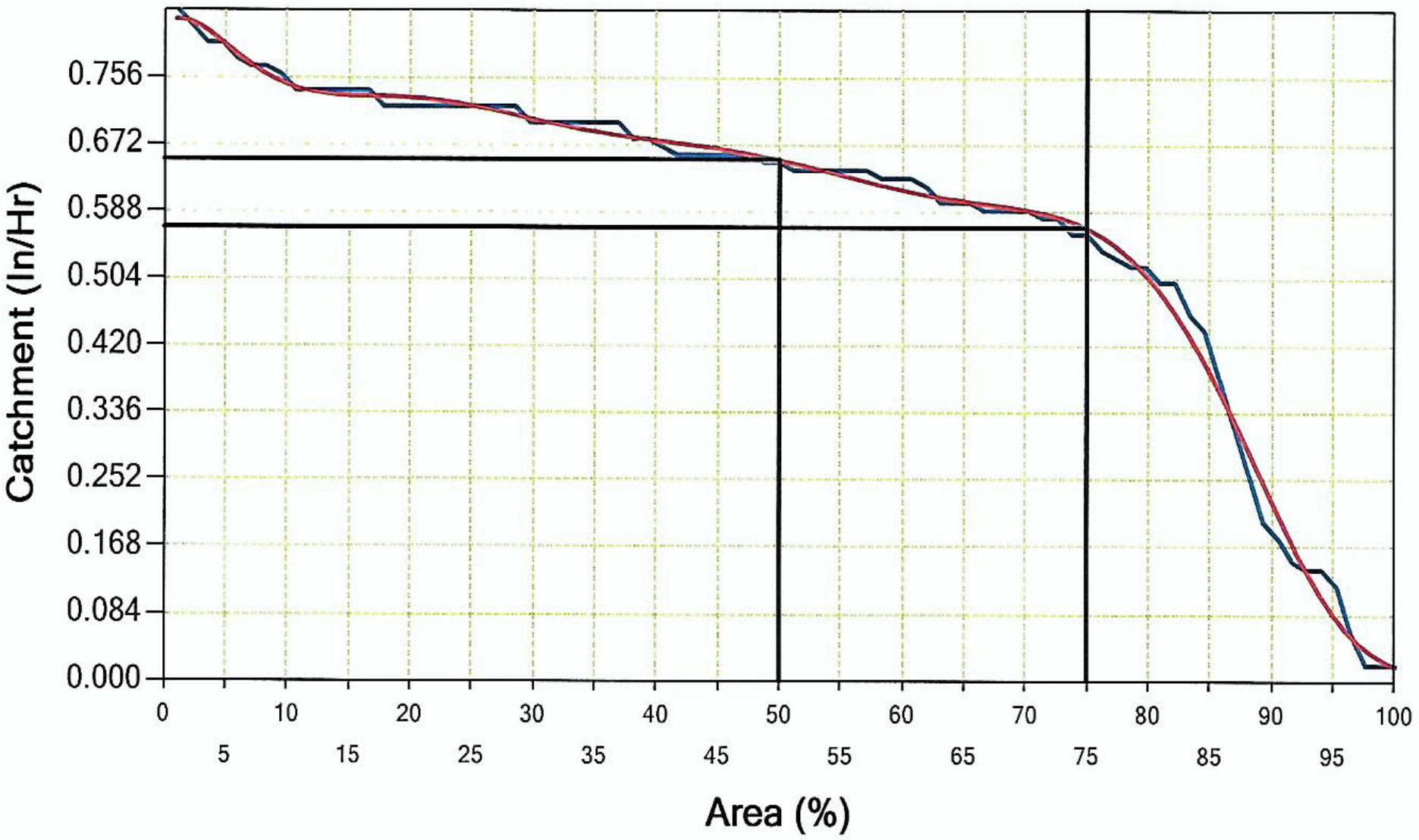
OS=0.1% PL=42.7% OE_S= 57.2% DU_{lq}=0.40



OS=1.5% PL=10.4% OE_S= 88.3% DU_{lq}=.83



OS=6.8% PL=15.3% OE_S= 78.9% DU_{lq}=0.49



Sprinkler Operational Efficiency

$$OS = \frac{\sum OS}{N\left(\overline{x}\right) + \sum OS}$$

$$PL = 1 - \left(\frac{\sum_{1st}^{75th} \left(n_1 + n_2 + n_3 \ldots\ldots n_i \right)}{n\left(\overline{x}\right)} \right)$$

$$OE_S = \left(1.0 - PL\right)\left(1.0 - OS\right)100$$

Results-Spray Nozzle

Nozzle	Shape	psi	PR_{avg}	PR_{effect}	OS %	PL %	OE_S%	DU_{lq}
S		20	0.82	0.63	3.6	26.9	70.5	0.62
S		**30**	**0.94**	**0.79**	**3.8**	**18.7**	**78.2**	**0.71**
S		45	1.31	1.02	2.1	22.4	76.0	0.60
S		20	0.85	0.63	8.6	30.4	63.6	0.64
S		**30**	**1.03**	**0.76**	**8.4**	**27.4**	**66.5**	**0.68**
S		45	1.24	0.98	8.6	23.5	69.9	0.71

Same nozzle and spacing, different operating pressures

Results-MS Rotating Nozzle

Nozzle	Shape	psi	PR_{avg}	PR_{effect}	OS %	PL %	OE_S%	DU_{lq}
R-1		40	0.46	0.39	1.1	19.1	**80.0**	0.66
R-2		40	0.60	0.54	1.5	10.4	**88.3**	0.83
R-3		45	1.04	0.70	0.1	57.4	**42.5**	0.40
R-1		40	0.48	0.37	1.8	27.0	**71.7**	0.51
R-2		40	0.65	0.57	6.8	15.3	**78.9**	0.49
R-3		45	1.35	0.88	6.0	36.6	**59.6**	0.53

3 different MS-rotating nozzles

In 2014 CIT was asked to develop a protocol useful in administering sprinkler rebate programs

- The protocol would be administered by third-party testing agencies to:
  - Pre-qualify turf sprinklers for rebate programs
  - Establish current “state-of-the-art”
  - Provide incentives for ongoing improvements
  - ***Unfortunately no test protocol existed that calculated sprinkler operational efficiency***

Current sprinkler test method:

- NOT consistent with operational conditions
- Single head tested
- Computer simulation using multiple heads
- Makes no allowances for jet mechanical interference

Multiple sprinkler performance

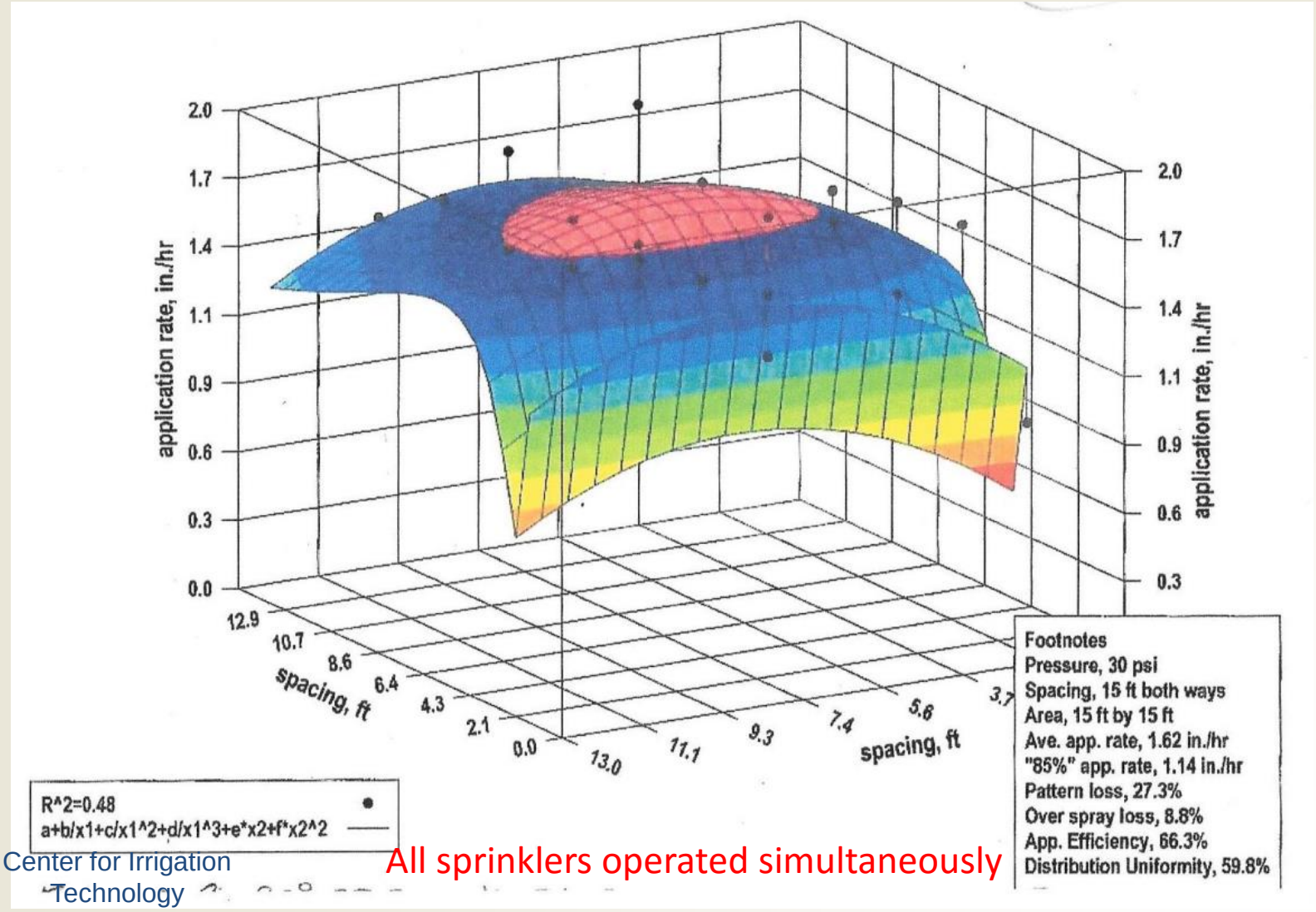
Multiple sprinkler performance

Full scale irrigation set-up in CIT

- Sprinkler heads operated simultaneously
- Sprinkler heads operated individually
- Operational Efficiency calculated for each

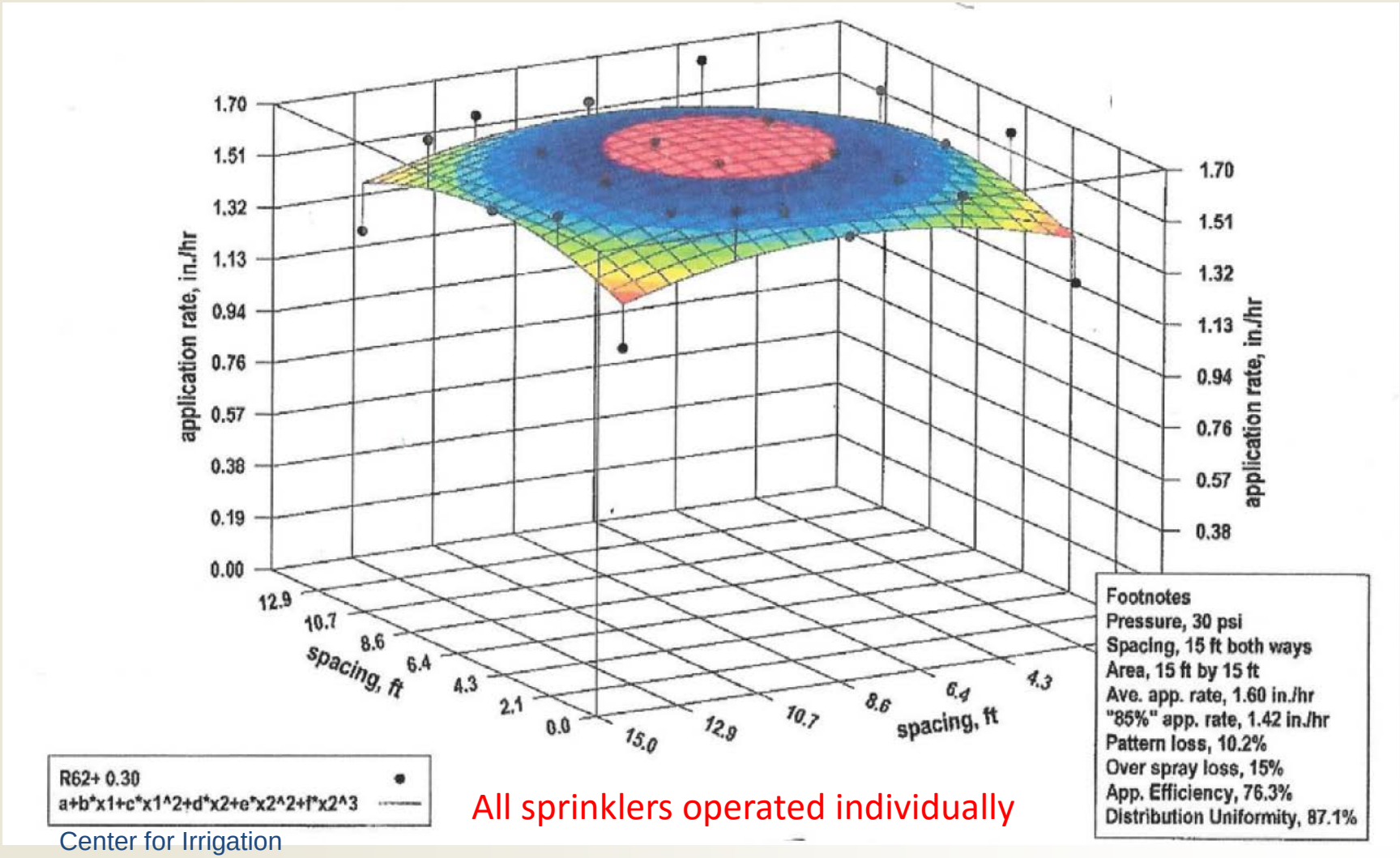
Sprinkler Operation Test Setup

Phenomena of Jet Interference = DU= 0.598



All sprinklers operated simultaneously

Non Interference = DU: 0.871

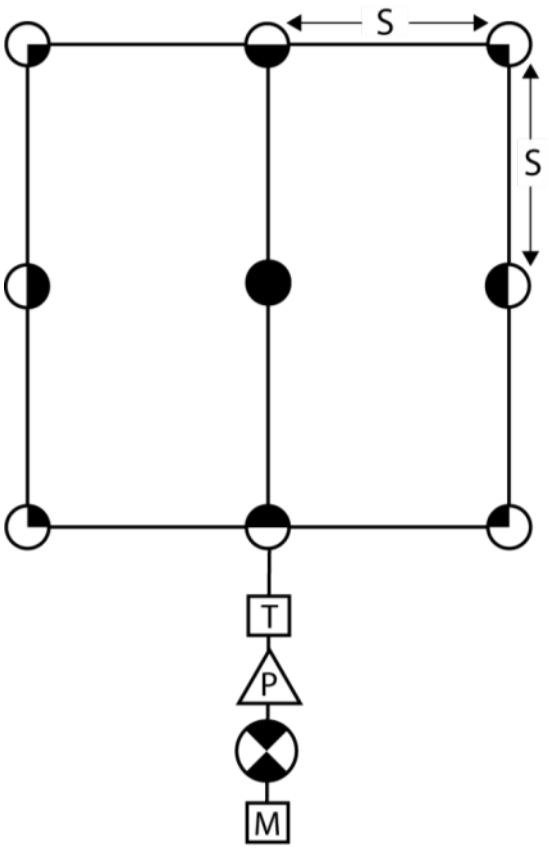


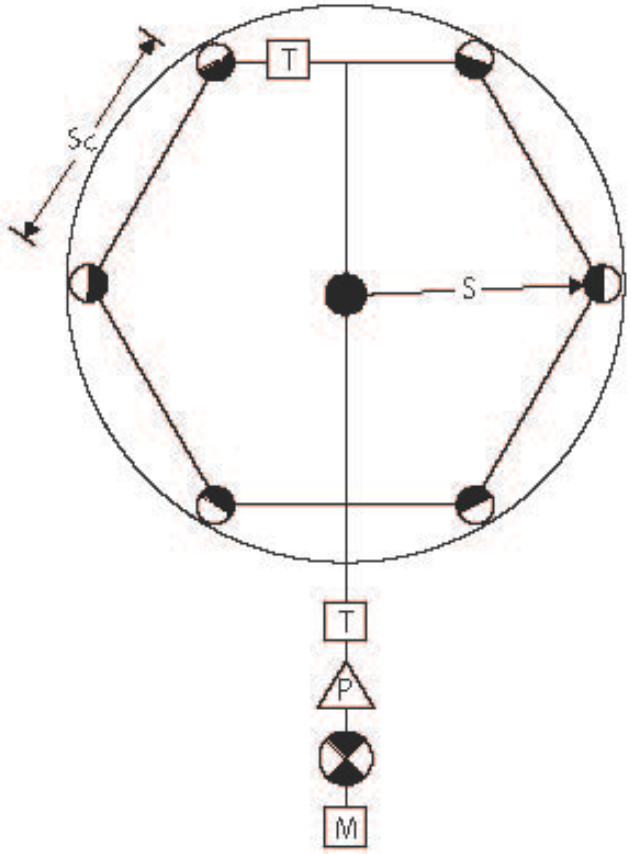
All sprinklers operated individually

Test

- Tests conducted by CIT
- Defined shape and spacing
- Manufacturers supply the nozzle best suited to the situation.

Testing configurations





Results—Square

Nozzle	Shape	psi	PR_{avg}	PR_{effect}	OS %	PL %	OE_S%	DU_{lq}
#1		30	1.62	1.38	1.0	20.1	**79.1**	0.74
#2		30	1.61	1.40	0.1	19.3	**80.6**	0.74
#3		40	0.61	0.56	6.2	12.7	**81.9**	0.79
#4		30	1.63	1.28	2.0	25.4	**73.1**	0.63
#5		30	1.25	1.09	0.9	21.2	**78.1**	0.65
Avg			**1.34**	**1.14**	**2.0**	**19.7**	**78.6**	**0.71**

Manufacturers recommended and supplied the nozzle to irrigate a square shape that is 30 ft. x 30 ft. in size.

Results—Circular

Nozzle	Shape	psi	PR_{avg}	PR_{effect}	OS %	PL %	OE_s %	DU_{lq}
#1		30	1.75	1.47	7.0	24.2	**70.5**	.63
#2		30	1.86	1.40	0.2	33.6	**66.3**	.29
#3		40	0.64	0.49	6.0	27.6	**67.9**	.41
#4		30	0.90	0.73	1.1	30.8	**68.4**	.55
#5		30	1.82	1.45	10.0	23.6	**68.7**	.64
Avg			**1.39**	**1.11**	**4.9**	**28.0**	**68.4**	**.50**

Manufacturers recommended and supplied the nozzle to irrigate a circular shape that is 30 feet in diameter.

Comparison—same nozzle

Nozzle	Shape	psi	PR_{avg}	PR_{effect}	OS %	PL %	OE_S %	DU_{lq}
#1-a		30	1.62	1.38	1.0	20.1	**79.1**	0.74
#1-b		30	1.75	1.47	7.0	24.2	**70.5**	0.63
#1-c		30	1.86	1.40	0.2	33.6	**66.3**	0.29

Same nozzle. Test #1-c is “fine-tuning” after test #1-b

What does this mean?

- Landscapes are irrigated by areas.
- Need to consider how zoning and piping can improve sprinkler performance.

Conclusions

- Curvilinear shapes are more difficult to irrigate efficiently.
- DU is one metric—
- Sprinkler operation efficiency (OE_S) considers where is the water going.
- MS rotating nozzles create less interference of pattern.
- Keep water on target.
- Cycle & Soak is effective to deal with wind.

Comparison

Test #	Sprinkler ID	Shape	Pressure psi	PR avg. in./h	PR effective (75%)	DU_{lq}	SM	Effective PR PRavg/SM	Over spray Losses %	Deep Perc Losses %	Sprinkler Oper'l Efficiency %
1	A	SQ	20	0.818	0.63	0.62	1.30	0.630	3.6	26.9	70.5
2	A	Circle	20	0.849	0.631	0.64	1.28	0.664	8.6	30.4	63.6
3	A	SQ	30	0.944	0.793	0.71	1.21	0.778	3.8	18.7	78.2
4	A	Circle	30	1.026	0.76	0.68	1.24	0.828	8.4	27.4	66.5
5	A	SQ	45	1.312	1.015	0.60	1.32	0.997	2.1	22.4	76.0
6	A	Circle	45	1.244	0.981	0.71	1.21	1.028	8.6	23.5	69.9
7	B	SQ	30	1.676	1.298	0.60	1.32	1.274	1.3	27.0	72.1
8	B	Circle	30	1.635	1.343	0.60	1.32	1.243	10.8	27.5	64.7
9	C	SQ	40	0.458	0.391	0.66	1.26	0.365	1.1	19.1	80.0
10	C	Circle	40	0.481	0.368	0.51	1.42	0.340	1.8	27.0	71.7
11	D	SQ	40	0.597	0.541	0.83	1.11	0.536	1.5	10.4	88.3
12	D	Circle	40	0.653	0.568	0.49	1.44	0.453	6.8	15.3	78.9
13	E	SQ	45	1.041	0.7	0.40	1.56	0.666	0.1	42.7	57.2
14	E	Circle	45	1.347	0.884	0.53	1.39	0.967	6.0	36.6	59.6

Minutes to apply 1" of water			
PR_{avg} Ideal	PR effective	SM upper boundry	PRavg/SOE
73.3	95.2	95.3	104.1
70.7	95.1	90.3	111.1
63.6	75.7	77.1	81.3
58.5	78.9	72.4	87.9
45.7	59.1	60.2	60.2
48.2	61.2	58.4	69.0
35.8	46.2	47.1	49.7
36.7	44.7	48.3	56.7
131.0	153.5	164.6	163.7
124.7	163.0	176.7	174.0
100.5	110.9	111.9	113.9
91.9	105.6	132.4	116.4
57.6	85.7	90.1	100.7
44.5	67.9	62.0	74.7

Thoughts

Questions

Douglas Macdonald

ASIC 2016 REGIONAL CONFERENCES

Southeast, Southwest, Northeast, & California

American Society of Irrigation Consultants

Certification Update

ASIC 2016 REGIONAL CONFERENCES

Southeast, Southwest, Northeast, & California

American Society of Irrigation Consultants

ASIC Strategic Plan – Adopted 4/26/10

Vision Statement

ASIC strives to represent the most experienced and responsible irrigation professionals in the world. Its members facilitate successful water resource management through design expertise, client advocacy, public service, education, *accreditation*, and the promotion of allied green industry partnerships.

ASIC Strategic Plan

Objective #1

Position/Brand ASIC as *the top-tier body* representing water resource development, design and management professionals with a commitment to environmental stewardship and the responsible use of water.

ASIC Strategic Plan

Tactic #3

Adopt an *optional certification program* that demonstrates stringent professional standards and expectations to the marketplace. The certification process will entail clear, unambiguous requirements.

- Time Frame: Immediate
- Resources: Board of Directors subcommittee and Staff

Recent History

- Discussions with membership - no progress...
- Board realization that we can't do this on our own
  - Third-party assistance
  - Experienced entity – Irrigation Association
    - Proposal submitted to ASIC at BOD Meeting November 2014

2015 Proposal Background

Certification Program requires process

Design & implementation requires:

- Strong organizational commitment
- Financial investment to launch and maintain the program
- Expertise of many experienced professionals to help develop program

2015 Proposal Background

- Certification provides proof that an individual has mastered knowledge, skills and abilities to perform a specific job and requires:
  - Establishment of clear goals up-front
  - Market research and analysis
  - Determine mission, goals and objectives for the program.

Three phases in developing a *legally defensible* certification:

- Phase 1: Defining Need
- Phase 2: Development
- Phase 3: Evaluate, Monitor and Maintain

ASIC Sub-committee:

- Co-chairs:
  - Carey June, Doug Macdonald
- Committee Members:
  - Jim Barrett
  - Tom Shannon
  - Jim Laiche

Phase 1 – Defining Need

- Identify need for certification (Strategic Plan)
- Determine financial resources (Board of Directors) – collaboration with Irrigation Association was approved

Phase 2 - Development:

- Step 1 - Job Analysis First (most important) aspect and key to *legally defensible* certification
  - Objective; determine key aspects of job and related knowledge, skills & abilities to be measured by testing.
    - Focus group and/or survey to ensure broad review and participation by all stakeholders.

Job Analysis Goals

- Regardless of moving forward with certification or not, this process will provide benefits for the organization and members:
  - Help Create Awareness of ASIC and our profession
  - Establish key service areas that differentiate us from others (marketing)

Job Analysis Process

- Utilize 3rd Party with Job Analysis experience to direct process and ensure end results meet our organization's goals
  - Psychometrician ensures that Job Analysis process provides measurable and definable content outline at the conclusion of the process
  - Psychometrics = Mental Measurement (testing of intelligence, not really psychology)

Job Analysis Process

- IA / ASIC Collaboration for Job Analysis
  - Leon Gross (Psychometrician) - PhD in statistics, 30 years experience, NCCA Commission for Accreditation
  - IA - Clover Belluz (Professional Development Director) & Deborah Hamlin (Executive Director) & multiple IA member representatives
  - ASIC “Blue Ribbon Panel” – Eight Professional Members
- Meeting conducted Jan 13-15, 2016 in Dallas to develop survey

Job Analysis Process

- On-line Survey submitted to IA and ASIC members in March 2016
- Survey results and demographics currently being compiled
- Meeting/presentation scheduled for July 11-13, 2016 in Orlando to review results

Phase 2 - Development:

- **Step 1: Job Analysis**

BOD will determine whether to proceed beyond this point based on results

- Step 2: Item Writing
- Step 3: Beta Testing and Item Performance Analysis
- Step 4: Exam Delivery and Maintenance

ASIC

QUESTIONS AND COMMENTS?