# The Social Process of System Change Toward a Green Infrastructure Approach

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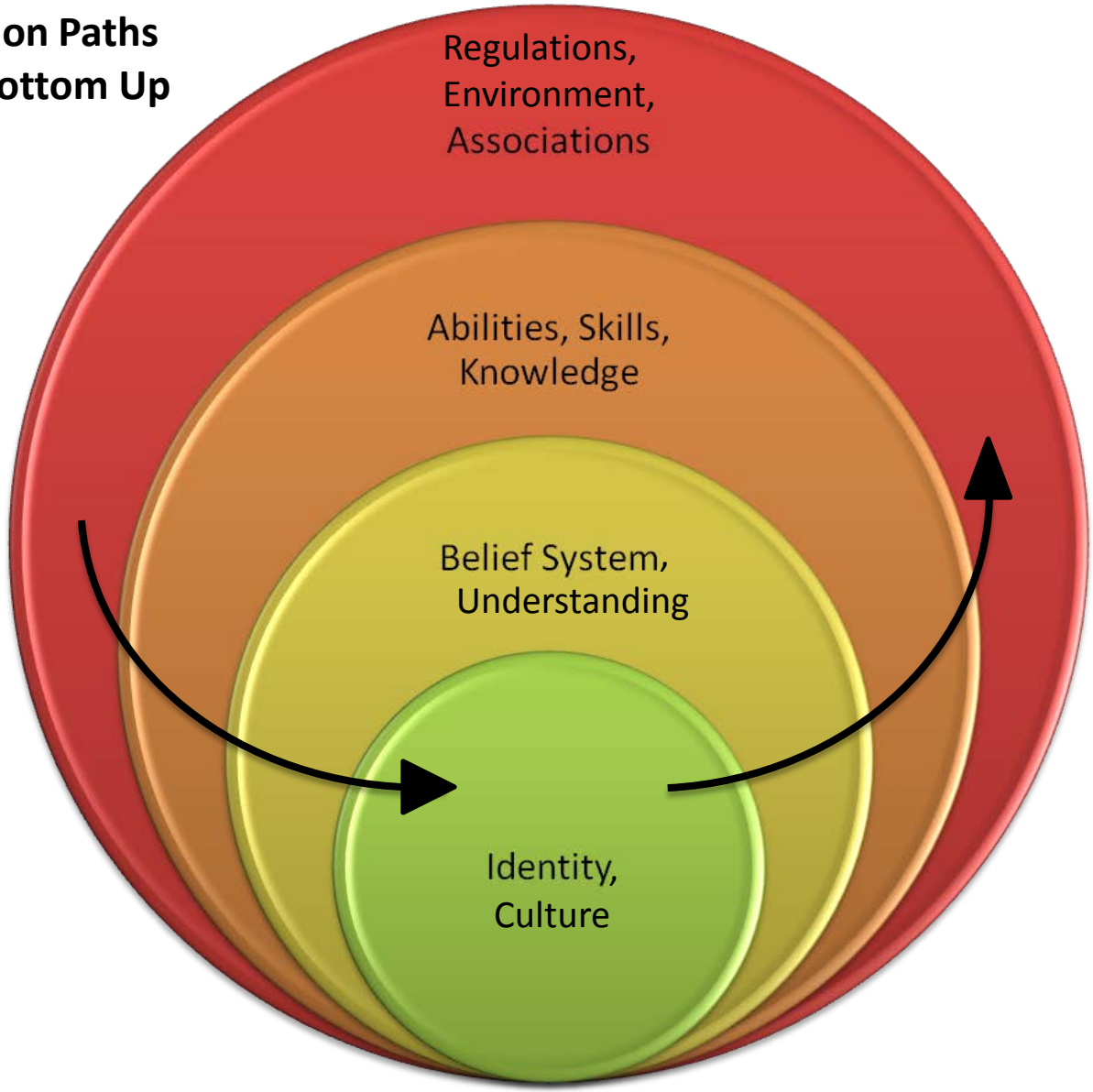
Pima Association of Governments
Tucson, AZ

Pima Association of Governments

# Bateson's Logical Levels of Change

**-Health Framework**
**-Communication Paths**
**-Top Down/ Bottom Up**

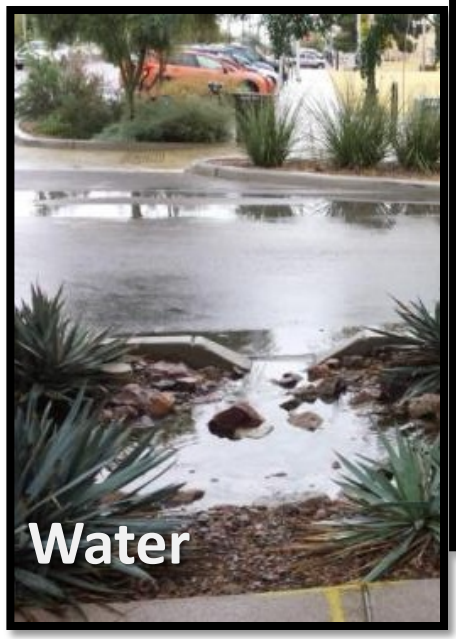


# Cross Jurisdictional, Integrated Planning

## Green Infrastructure/ Low Impact Development











A. Community Efforts
B. Municipal Staff Roles
C. Communication in General
D. Political Support

# Arid Environment is Unique

**No combined sewers**

***(No sanitary sewer overflows)***

**Not stormwater quality violations**

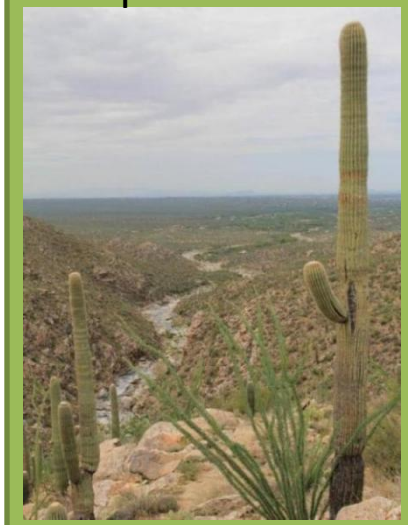
***(No Consent Decrees)***

## …Different drivers of GI/LID

**Rainwater Harvesting**

Community driven

Empowered with water security



Streets as conveyance

Watershed health

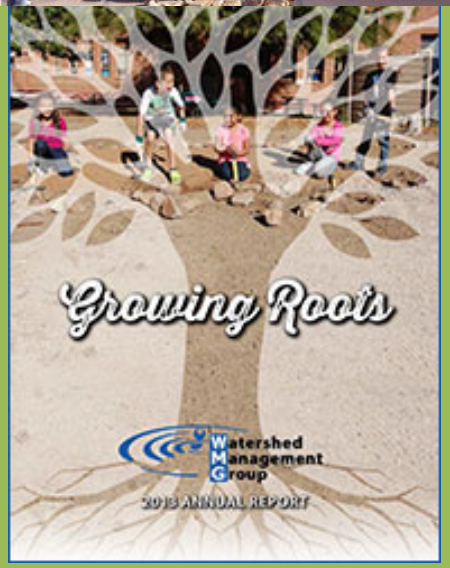
# Community Driven / Grassroots Organizing

## Assets Based

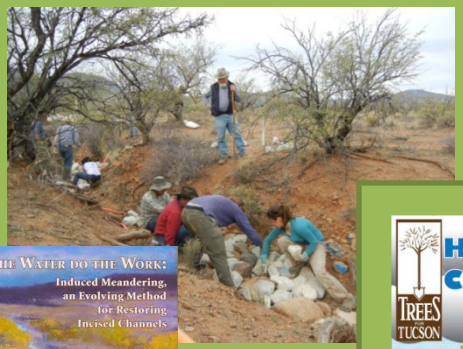
An inclusive green economy strong enough to lift people out of poverty

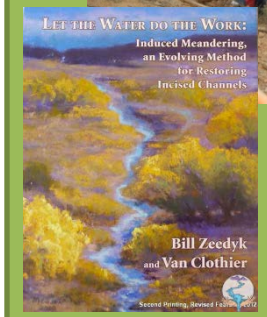


Informed by those Impacted

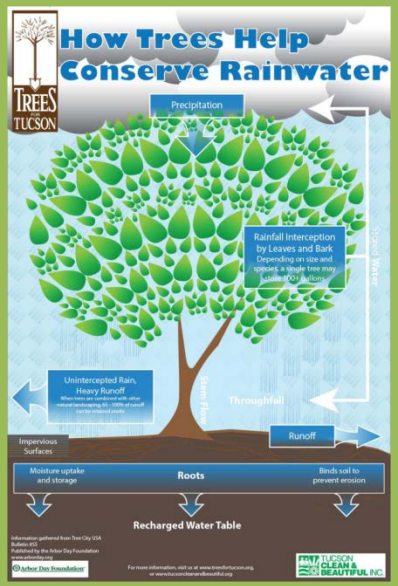




Barn Raising Model

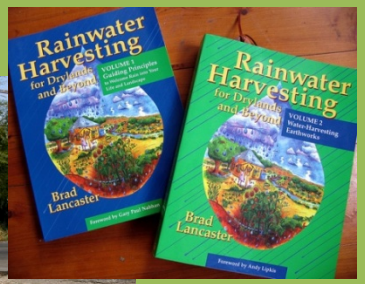





Create Local Practitioners

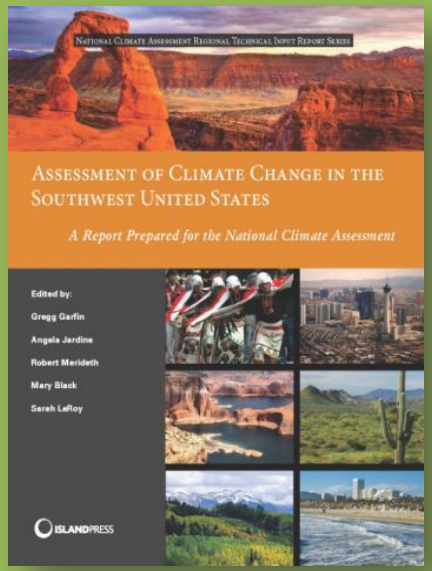



Promotoras


Waste into Resources

# Environmental Justice




2013 Institute of Environment

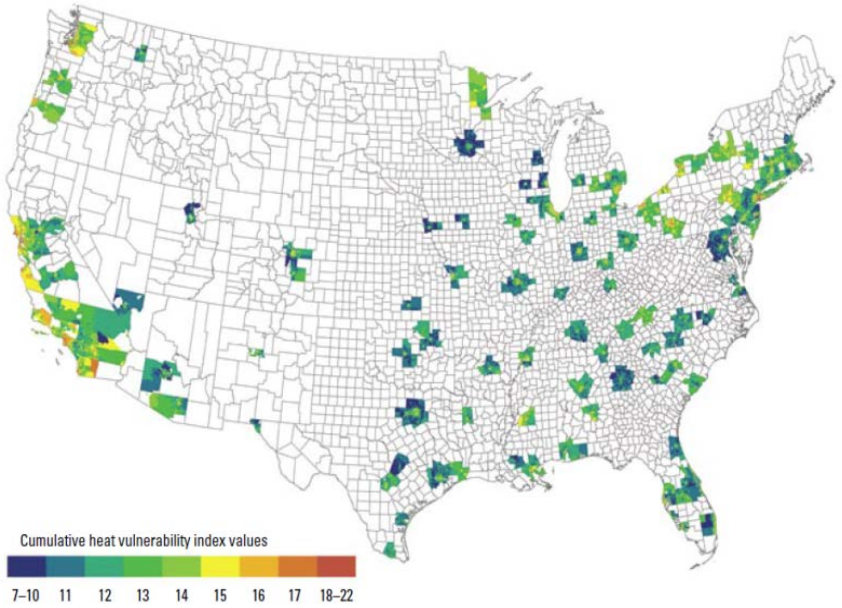



**Figure 1.** National map of cumulative heat vulnerability index by census tract ($n$ = 39,794).

- Sharon Harlan, ASU
- Az Dept of Health Services
- *U.S. Census Bureau American Community Survey (ACS)*
- *Mapping Community Determinants of Heat Vulnerability , Reid et al*

"**Heat stress**, a recurrent health problem for urban residents, has been the **leading weather-related cause of death** in the United States since 1986. . . – and the **highest rates of RESIDENTS nationally are found in Arizona.**

**Disproportionate Impact**

Physical, social, and economic factors:

- Older persons
- The **poor**
- Socially isolated, **mobility** restrictions
- Health

# Community & Municipal Planning

| Moving from a deficit approach to an asset approach | |
|---|---|
| **Where we are now - the deficit approach** | **Where an asset way of thinking takes us** |
| Start with deficiencies and needs in the community | Start with the assets in the community |
| Respond to problems | Identify opportunities and strengths |
| Provide services to users | Invest in people as citizens |
| Emphasise the role of agencies | Emphasise the role of civil society |
| Focus on individuals | Focus on communities/ neighbourhoods and the common good |
| See people as clients and consumers receiving services | See people as citizens and co-producers with something to offer |
| Treat people as passive and done-to | Help people to take control of their lives |
| 'Fix people' | Support people to develop their potential |
| Implement programmes as the answer | See people as the answer |

Photo by John Sartin

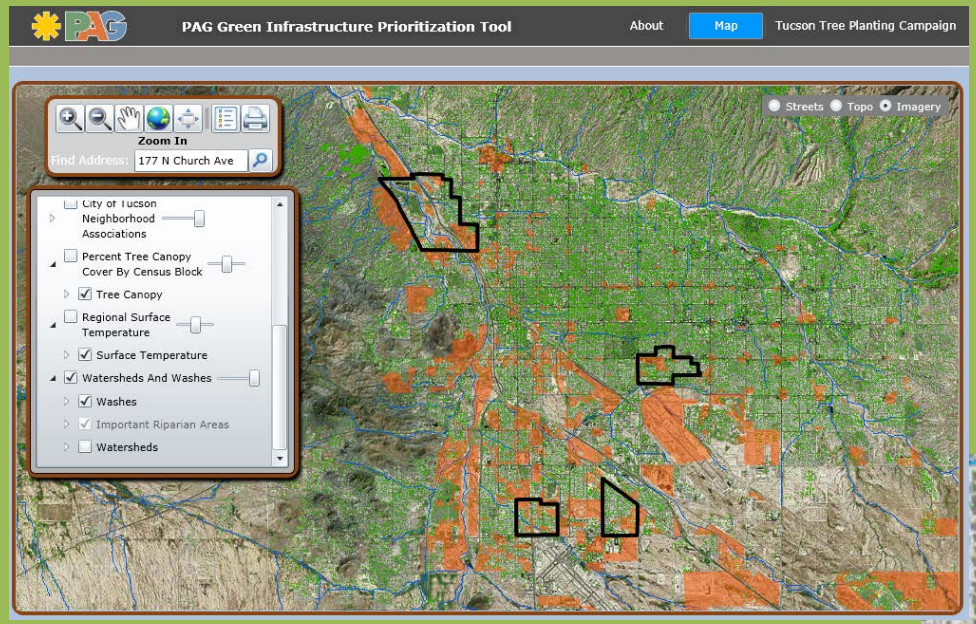
A. Community
   - ✓ Assets Approach

B. Municipal Staff / Institutions
   - Professional Tools
   - Strategic Planning
   - Collaboration
   - Demonstrations
   - Standards, Guidance

C. Communication

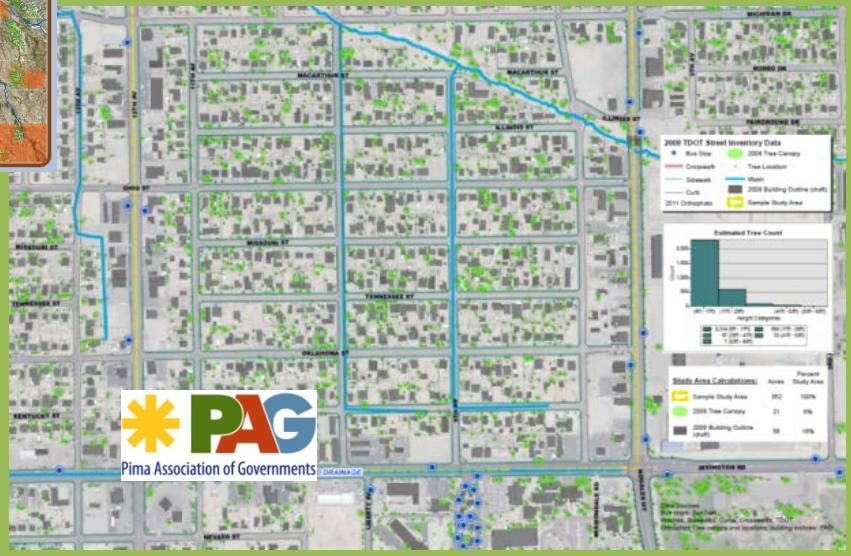
D. Political

# Municipal & Community Planning




- Green Infrastructure to Combating Heat
- Decision Support Tool
- Prioritize distribution of limited resources

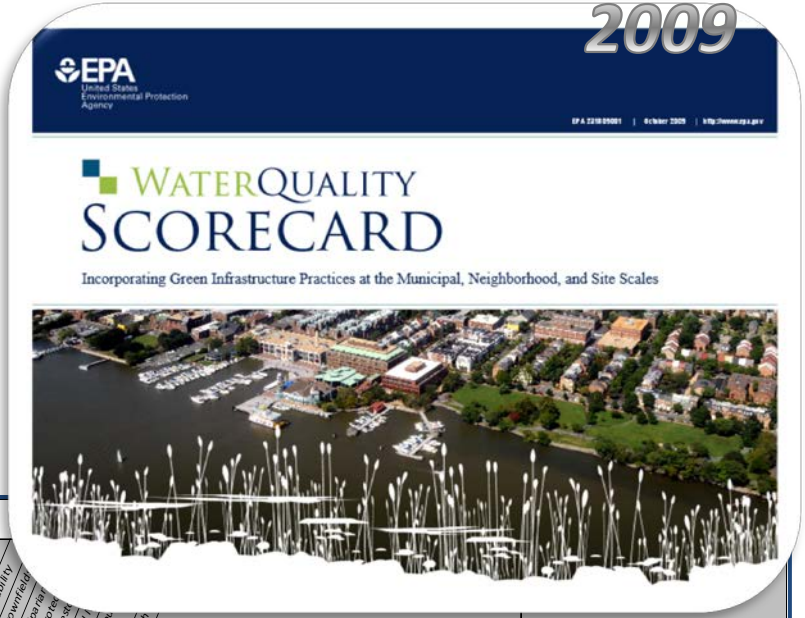
PAG's Interactive Web-Map
http://gismaps.pagnet.org/PAG-GIMap




Slide by PAG

# Municipal Progress- Inventory

- 1980 - 2012
- Analyzed 70+ policies, projects, educational; efforts, etc. around Pima County
- New: LID/GI Terminology




*e.g. curb cuts, shade trees*

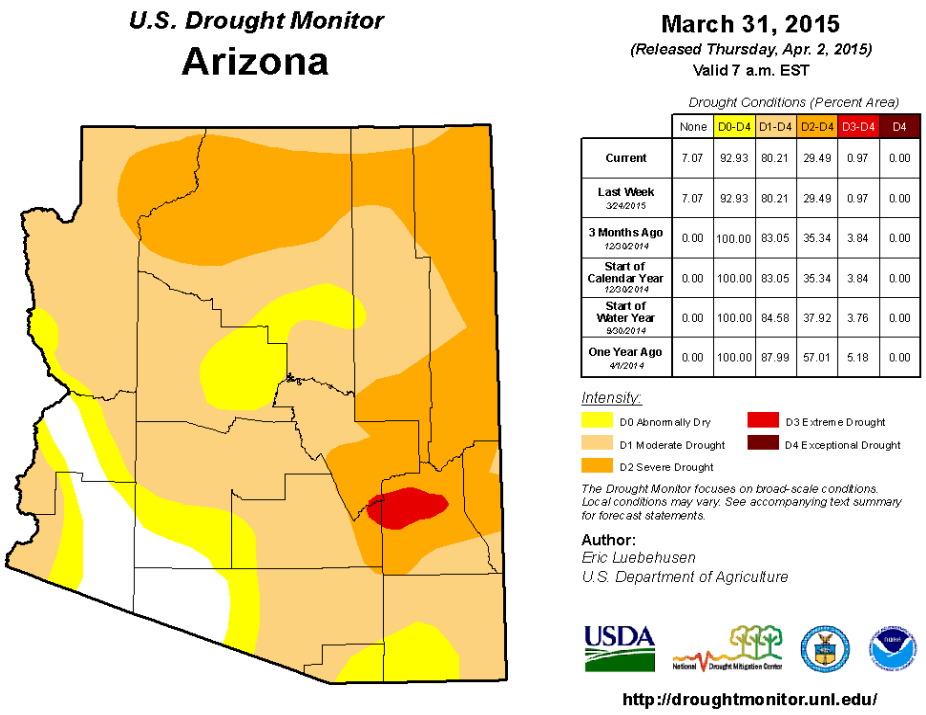
Regional Green Stormwater Infrastructure Survey (Progress Report)

Pima Association of Governments

| Sector | Type of Implementation | Specific GI/LID Effort | Date | Year | Rainwater Harvesting | Stormwater Harvesting | Graywater Harvesting | Native Plants/ Xeriscaping | Wildlife Corridors/ Habitat | Green Jobs | Shade Trees | Curb Cuts | Urban Ecosystem (Services) | Groundwater Recharge | Sustainability | Brownfield | Riparian Protec | Re-st | Urb | Pervio | Wash | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gov. and Quasi-Gov. | City of South Tucson | Education | City of South Tucson Environmental Workplace Development and Job Training Program | December, 2011 (onging) | 2011 | | x | | | x | | | | | x | x | | | | | | 7-week course of intense education to prepare participants for a position in the environmental workforce, including training in stormwater management, sustainability, and site assessment. Funded by an EPA Brownfields Job Training Grant | Derek Koller: (520) 551-7887, dkoller@allwynenvironmental.com or Joel Gastelum: JGastelum@southtucson.org |
| Gov. and Quasi-Gov. | City of South Tucson | Guideline | Growing Smarter Comprehensive Plan Update | 2002 (?) | 2002 | | | | x | | | x | | | | | | | | | | Includes objectives and strategies to convert vacant land into community gardens and encourage low-water-use tree planting | City of South Tucson Planning and Zoning (http://www.southtucson.org/government/department-and-divisions/planning-and-zoning.html) |
| Gov. and Quasi-Gov. | City of South Tucson | Guideline | City of South Tucson Comprehensive Plan | 1999 | 1999 | | | | x | | | | | | | | | | | | | Includes strategies to incorporate xeriscape landscaping into future conversion of right-of-way into linear park | City of South Tucson Planning and Zoning (http://www.southtucson.org/government/department-and-divisions/planning-and-zoning.html) |
| Gov. and Quasi-Gov. | City of Tucson | Guideline | Mayor Jonathan Rothschild's 180-day work plan | Dec-June, 2012 | 2012 | x | x | x | | | x | | | | | | | | | | | Gives priority to solar energy and water conservation, road design to minimize runoff and maximize recharge, and increasing low water use and native shade trees on city streets; goal to make Tucson an industry leader in solar power and water conservation | City of Tucson Mayor's Office (http://cms3.tucsonaz.gov/home/announcement/mayors-180-day-status-report) |
| Gov. and Quasi-Gov. | City of Tucson | Guideline | Watercourse Preservation Resolution (#15269) | April, 1990 | 1990 | | x | | x | x | | | x | | | | | x | | | | x | "The Mayor and Council find that protection and preservation of natural drainage systems should be the primary emphasis of City stormwater management efforts. Nonstructural solutions to flooding hazards shall be the preferred strategy over structural solutions." | City of Tucson Department of Transportation (http://cms3.tucsonaz.gov/transportation/watercourse-preservation) |
| Gov. and Quasi-Gov. | City of Tucson | Guideline | Landscape Advisory Committee | created in 1990 | 1990 | | | | x | | x | | x | | | | | | | | | Advises Mayor and Council on the design, management, planning, and policy of Tucson's vegetation; includes a water conservation specialist on the 11-person committee | City of Tucson Planning and Development Services (http://cms3.tucsonaz.gov/planning/news/committees/lac/index.html) |
| Gov. and Quasi-Gov. | City of Tucson | Education | Urban Heat Island Workshops | 2005 | 2005 | | x | | | | x | | | | | | | | x | | | Annual workshop to educate City staff on the urban heat island and ways to mitigate its effects | City of Tucson, Irene Ogata (Irene.Ogata@tucsonaz.gov) |
| Gov. and Quasi-Gov. | City of Tucson | Guideline (if approved) | City of Tucson General Plan update (Green Infrastructure Element) | Will be taken to voters in Nov. 2013 | 2013 | x | x | | x | x | | x | | | | | | | | | x | Contains a Green Infrastructure Element that provides a mixture of requirements and guidelines for more fully implementing GI/LID practices across the city | City of Tucson Housing and Community Development Dept. (http://cms3.tucsonaz.gov/plantucson), (http://cms3.tucsonaz.gov/sites/default/files/12minutes/green_infrastructure_final_working_document_021012.pdf) |

# Foundation - Water Resources Policies

- 1984 Tucson Water Waste Ordinance ("water cops")
- 1991 Tucson Xeriscape Landscaping Ordinance
- 2009 State Blue Ribbon Panel
- 2014 Pima County Drought Plans





*Consider Drought Stage 2- Tucson Irrigation Restrictions*

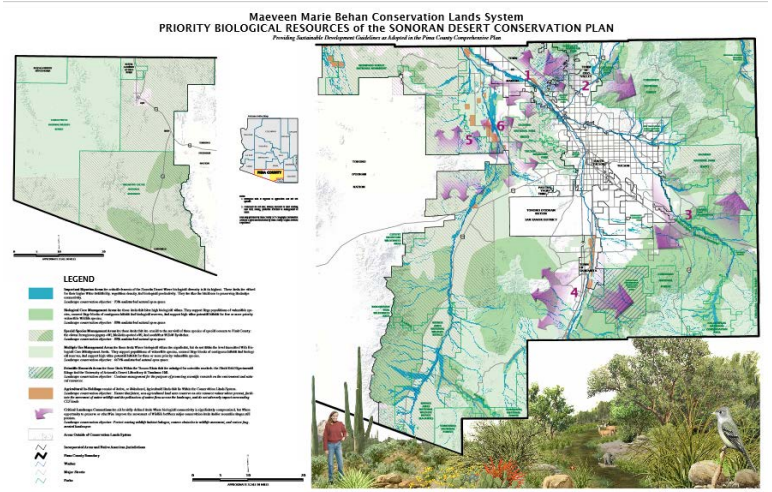
# Foundational Policies

- Large Scale GI Connectivity

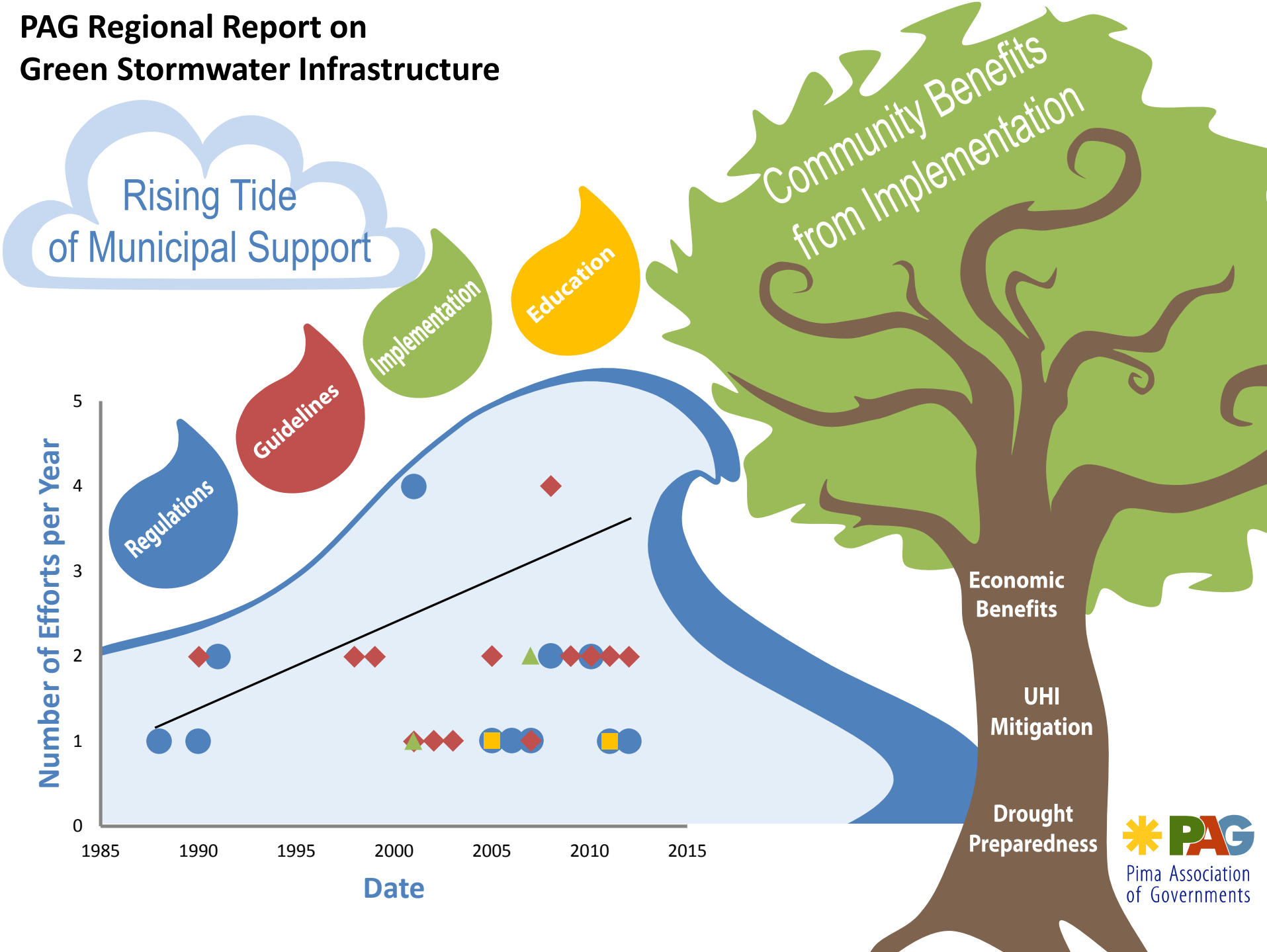
•2001 Marana Land Development Code - Protection of wildlife corridors

•2001 Pima County Sonoran Desert Conservation Plan- Conservation Lands System

•2006 Regional Transportation Authority- Funding for Wildlife Linkages

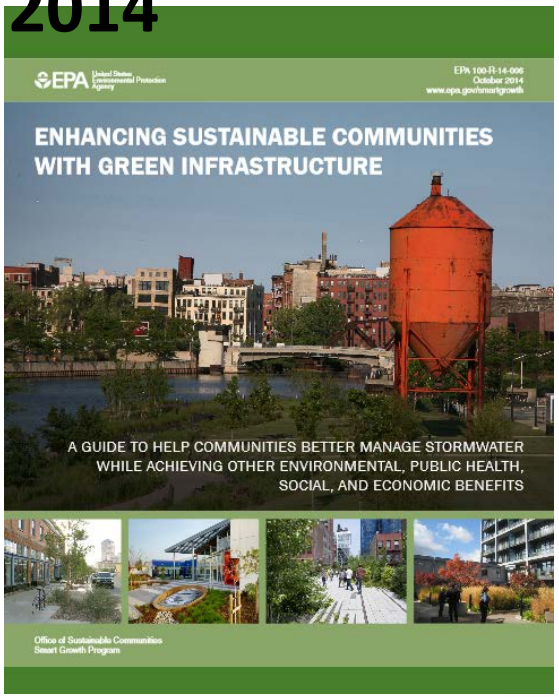


# PAG Regional Report on Green Stormwater Infrastructure



# Future Direction

**2014**





Learn more in *Enhancing Sustainable Communities With Green Infrastructure*: www.epa.gov/smartgrowth/gre[illegible]infrastructure.html

# Joint Effort: LID Working Group

## Public: Pima County

- Regional Flood Control District
- Development Services Dept.
- Dept. of. Transportation
- Dept. of. Environmental Quality

PIMA COUNTY

## Public: City of Tucson

- Office of Conservation & Sustainable Development
- Dept. of Transportation: Stormwater Division

TUCSON WATER

## Education: Univ. of Arizona

- Environmental Research Lab
- Drachman Institute
- Facilities
- Water Research Resource Center
- Biosphere 2

## Public: Other

- PAG Pima Association of Governments
- Oro Valley Arizona Founded 1974
- Marana

## Professional/Trade

- Stantec
- TETRA TECH
- WHEAT DESIGN GROUP LANDSCAPE ARCHITECTS

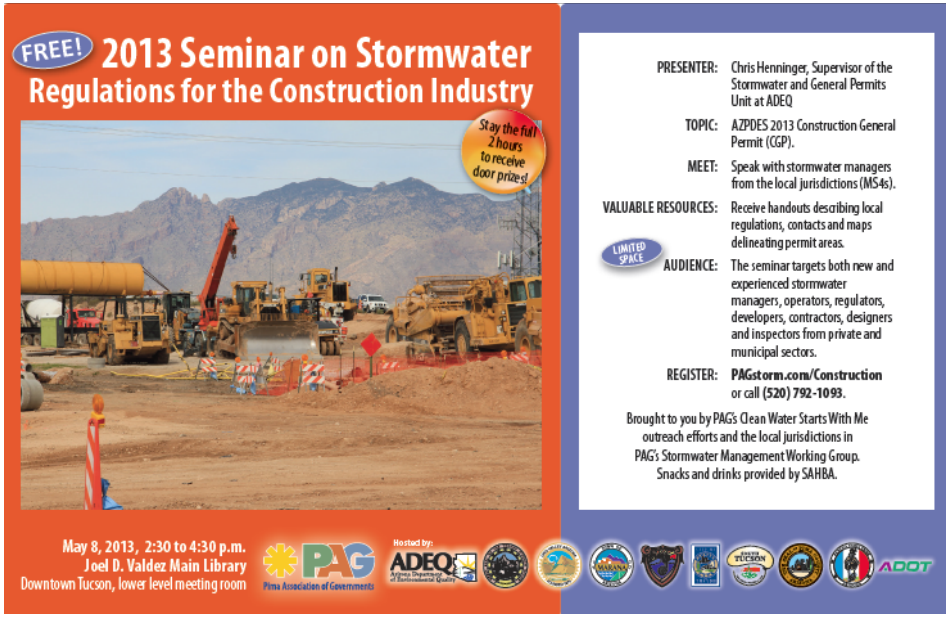
## Non-Profit

- Watershed Management Group



Slide by RFCD with Re-Arrangement by PAG

# Stormwater Quality Management




Construction Seminars
(Industry Guidance and Training)

Stormwater Management Working Group
(Staff level information sharing, Collaboration)

Preparations for Federal EPA LID Requirements
(Pro-Active, Top Down Support)

# LID Working Group, 2015 Workshop

Photos by PAG and WRRC

LOW IMPACT DEVELOPMENT/
GREEN INFRASTRUCTURE

Pima Association of Governments
City of Tucson
The University of Arizona
Pima County
Stantec
Watershed Management Group
Wheat Design Group
Landscape Architects
Town of Marana

# Case Studies

## Awards For Leaders and Demonstration Sites


PIMA COUNTY

Imagery by RFCD, Photo by PAG

# 2011 Goals: LID Working Group

PIMA COUNTY

**Develop a Vision**

**Review Regulatory Mechanisms**

**Research Effectiveness**

**Research Return on Investment**

**Educate/Train/ Coordinate**


Slide by PAG and RFCD

# Greywater Story… a familiar story

## The case for guidance

**Arizona Breaks New Ground**

•1998, Val Little of Water Conservation Alliance of Southern Arizona (Water CASA)

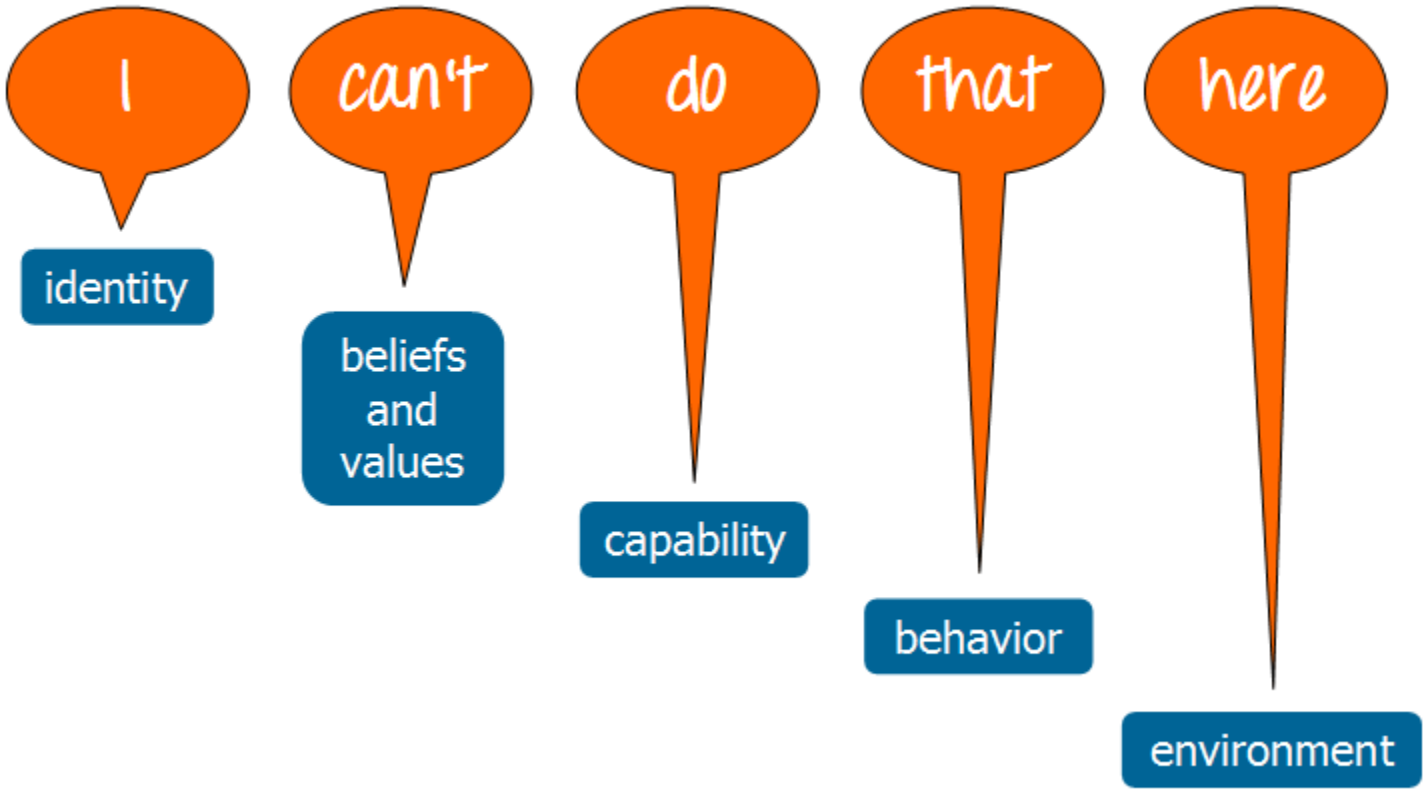
•Survey in southern AZ found 13% of residents used greywater, all illegally

•Restrictive codes prevented teaching greywater safety

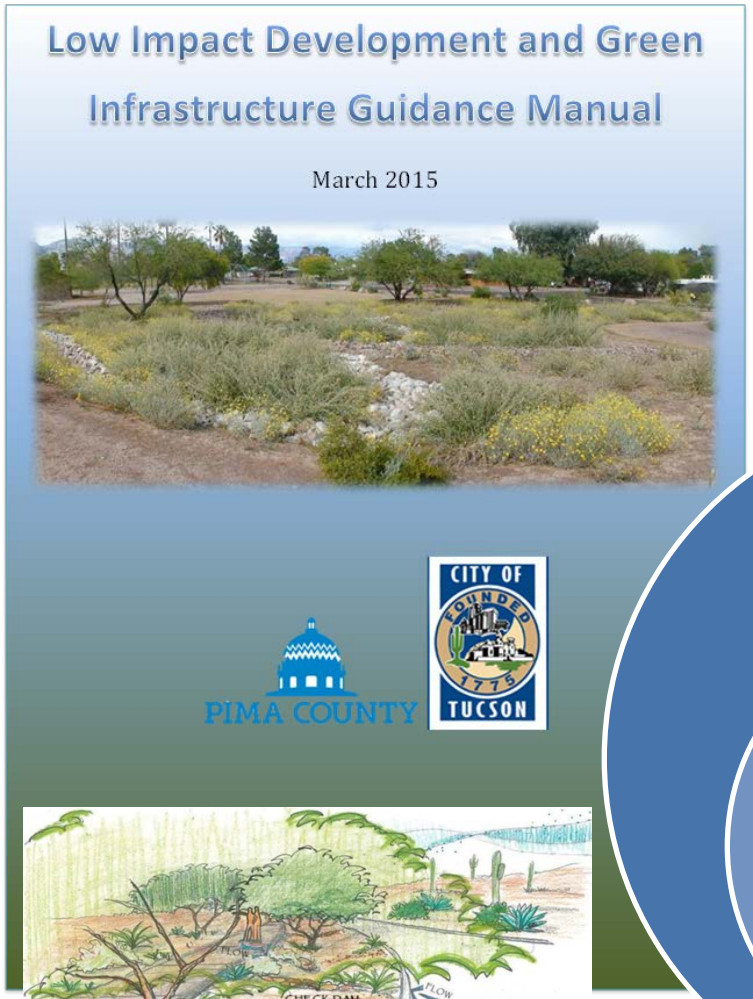
•Systems that follow the guidelines are legal — without permits, fees, or inspections

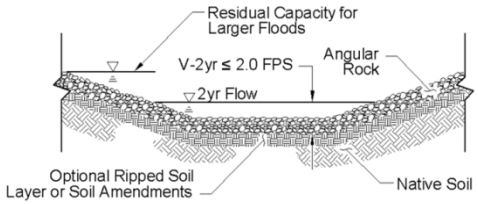


# The case for guidance…



# Guidance Manual




| | |
|---|---|
| GI/LID Strategies | •Flood Control<br>•Stormwater Management<br>•Pollution Prevention<br>•Energy Efficiency<br>•Pedestrian Friendly |
| LID Site Planning | •Natural Flow Paths Preserved<br>•Impervious Area Minimized<br>•Less Soil Compaction and Disturbance |
| Structural GI Practices | •Harvesting Rainwater and Stormwater<br>•Conveyance Features that are Naturalized |

Images by RFCD, Slide Assembled by PAG

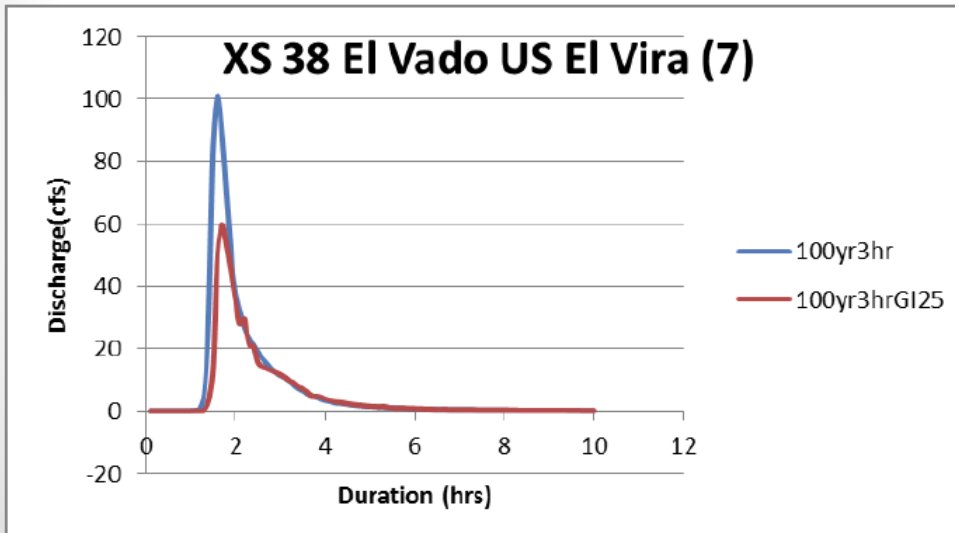
A. Community
B. Municipal Staff
   - ✓ Listen
   - ✓ Common Terms across Silos
C. Communication in the Social Process
   - Research
     - Speak Money and Required Objectives
   - Marketing
D. Political

Slide created by RFCD and WMG

# Research influences Social Process

## Flooding Issues

Drainage Area:
30 acres




## Economics

Financial Benefits

Increased Value- Pavement longevity
Property and sales

Increased Safety- Traffic accidents
Heat injury / mortality
Flooding

Reduced Costs- Irrigation
Air pollution
Energy


AutoCASE™

✓For **every $1** a community **invests** in rain gardens and green streets **over $6 of value are created** when accounting for **direct** and **indirect** economic values.

PIMA COUNTY

PAG Pima Association of Governments

CITY OF TUCSON

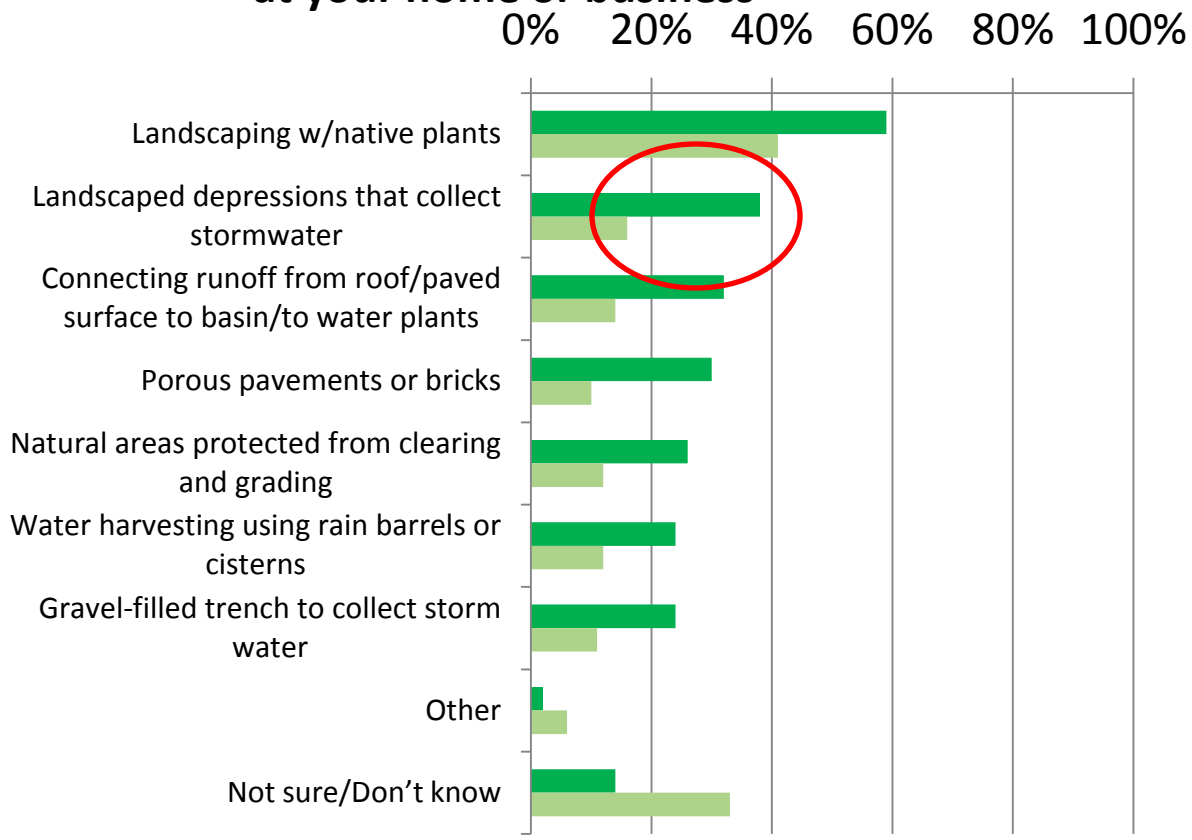
Watershed Management Group

Stantec

# Public Survey

- Stormwater Quality – Outreach is Required
- LID is a Best Management Practice (EPA/ADEQ)
- Measured Action/ Awareness of Public

**Tell me if the listed Low Impact Development practice has been implemented or installed at your home or business**



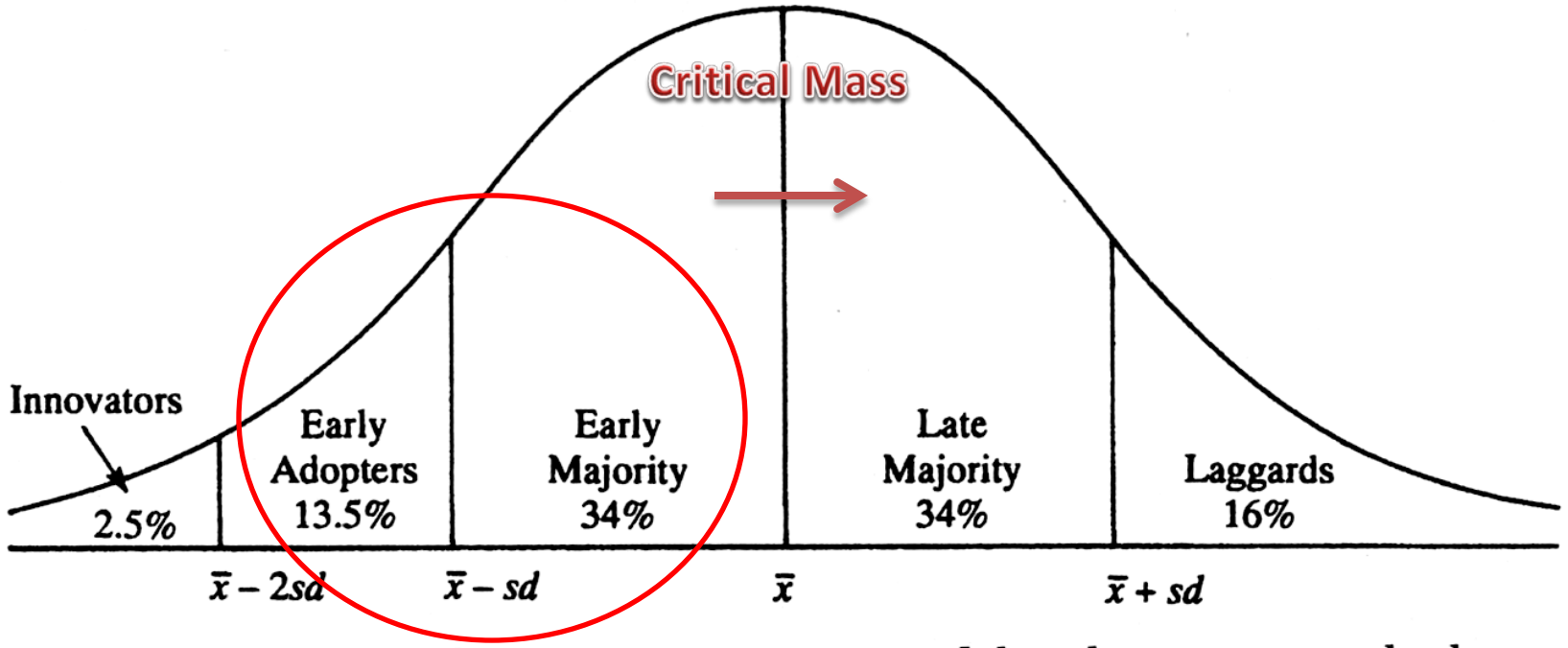

PIMA COUNTY

Photo by PAG, Graph by PDEQ

FMR, 2014, Fig. 29

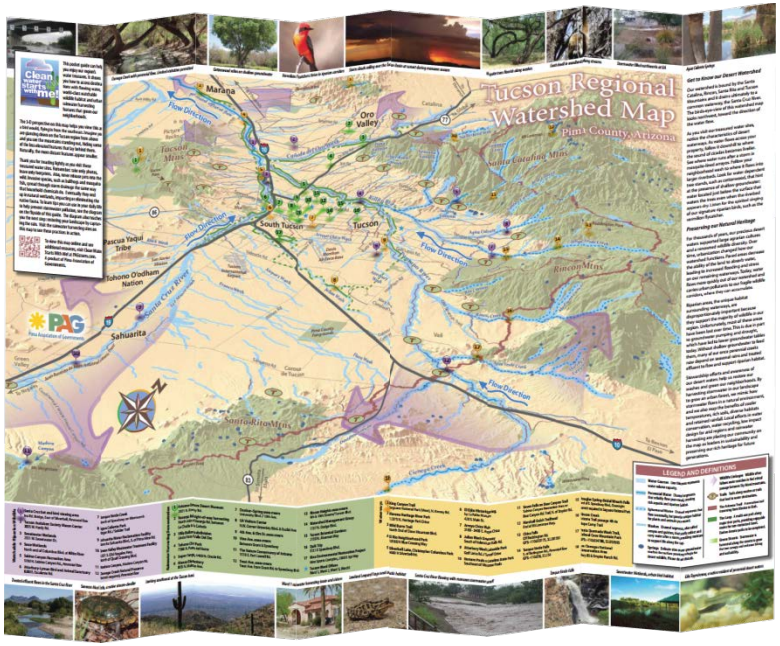
# **Public Outreach** – Social Process

**Figure 7-3.** Adopter Categorization on the Basis of Innovativeness




The innovativeness dimension, as measured by the time at which an individual adopts an innovation or innovations, is continuous. The innovativeness variable is partitioned into five adopter categories by laying off standard deviations (sd) from the average time of adoption ($\bar{x}$).

# **Public Outreach**, Engagement







- Stormwater Quality (Top Down)
- Tie to Community Momentum
- Preach a new Song to the Choir

A. Community
B. Municipal Staff
C. Communication
D. Political
   - Regulation
   - Champions
   - Recognition
   - Funding

# Top Down

- The Reasonable and Prudent Alternative (RPA) requires communities to incorporate Low Impact Development (LID) techniques as an element of their stormwater management in the Special Flood Hazard Area (SFHA).

# Local Regulations

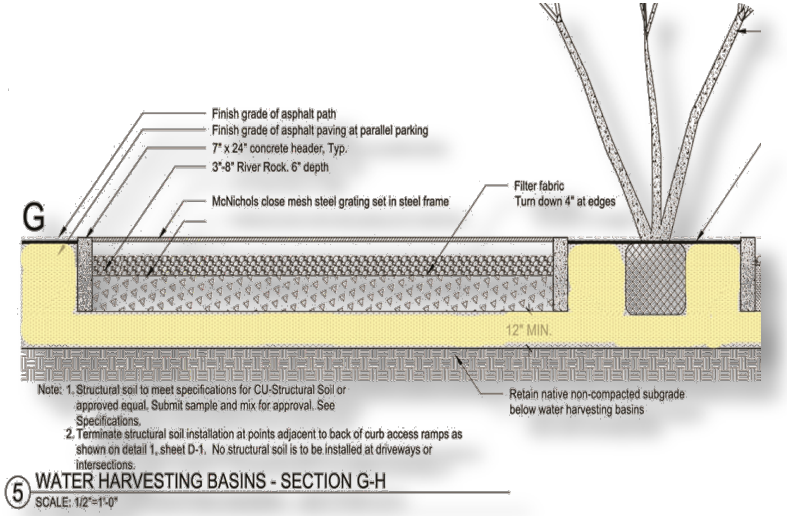
- City of Tucson Commercial Rainwater Harvesting Ordinance (CHAMPIONS!)
- TDOT Green Streets Policy (GRANTS!)

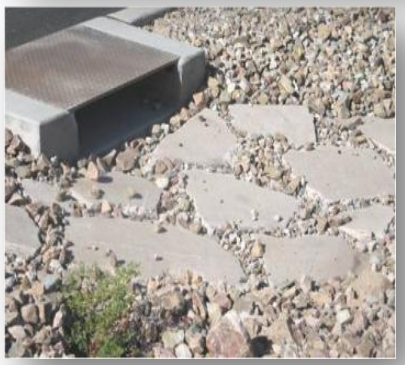
# Incentives

- Tucson Water Rebates (CARROTS!)

# Plan Tucson

- Staff Level Engagement

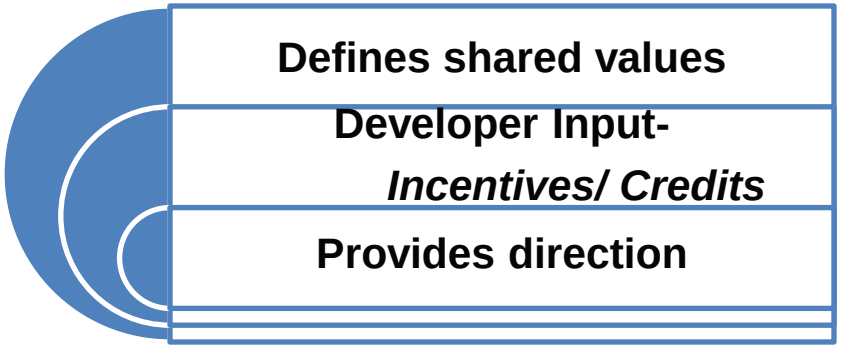


Slide content by CoT, Assembled by PAG

# Political Leadership

## Regional Council Resolutions




Pima Association of Governments

*Green Infrastructure for Regional Vibrancy*

Recognizing the value and continuing potential of Green Infrastructure and Low Impact Development to foster economic vitality, to augment the water resource portfolio and to promote human and ecosystem health,

- *Whereas*, green infrastructure (GI) utilizes stormwater flows to sustain and increase native vegetation and shade trees without increasing potable water use so that societal benefits of connecting people to natural and cultural heritage is realized in urban infill and other built environments, transportation, open space, and natural wash projects; thereby enabling sustainable stormflow irrigation that is resilient to peak drought conditions and outdoor water use restrictions; and
- *Whereas*, low impact development (LID) and the generated vegetation adds shade and beautification resulting in locally and nationally measured economic benefits such as increased home property values, commercial business success, ecotourism, health and fitness, professional expertise, energy efficiency, flood safety, irrigation efficiency, erosion prevention, pavement preservation related to shade, and reduced need for expensive flood control structures; this builds a regional "sense of place" with Sonoran desert branding to enhance investment, business success, and job growth in the region; and
- *Whereas*, trees and vegetation provide health benefits by reducing heat-related illnesses and deaths in vulnerable populations and removing particulates and other pollutants from air; these are strategies recognized by the EPA for cooling, encouraging fitness, improving job access through active and alternative modes of transportation usage, and providing environmental justice benefits to low income, elderly, isolated and minority communities; and
- *Whereas*, GI designs using context-sensitive solutions for transportation projects provide life-cycle returns on investment and safety benefits when used for roadway calming, green buffers, and other safety elements for pedestrians, cyclists, and bus riders; and
- *Whereas*, federal and state transportation funding and guidance, including the TIGER grants (Transportation Investment Generating Economic Recovery), Transportation Alternatives Program funds, ADOT's Draft Smart Transportation Guidebook, and Federal Highway Administration objectives, increasingly identify green infrastructure and beneficial use of stormwater as valued project elements.

*Now, therefore, be it recognized* that Pima Association of Governments' Regional Council (PAG) commends the region for exceeding recommendations put forth in PAG's 2012 Green Infrastructure/Low Impact Development (GI/LID) Resolution for collaborations, guidance, case studies, incentives, return on investment modeling, policy inventories, and incorporating GI/LID principles into regional planning documents. These efforts helped member jurisdictions receive grants, gain federal technical assistance and achieve top national sustainability rankings.

And may it also be recognized that PAG continues to encourage GI/LID, when feasible and affordable, as a valuable element of context-sensitive roadway design for public and private development providing multimodal benefits for all ages and abilities. PAG strongly encourages a continued emphasis on regional coordination of GI/LID planning including active engagement among departments and partner jurisdictions for development of sample guidance and policy. PAG further recommends seeking new opportunities to implement green infrastructure measuring how these projects benefit our economic vitality, energy demand, long-term water reliability, heat and drought resilience, urban biodiversity and ecosystem connectivity.

*This Resolution Made by Pima Association of Governments' Regional Council on March 26, 2015.*

PAG Pima Association of Governments

- 2009 Rainwater Harvesting – stormwater as a resource
- 2012 Low Impact Development - flooding, natural corridors
- 2015 Green Infrastructure – economic, transportation, health

# Economic Vitality – Winter 2015
## Green Infrastructure for Regional Vibrancy **Resolution**

Communicates GI relationship to **economic vitality**

- Increase home property values and commercial business success
- Attract a professional workforce and new business
- Build urban tourism and connect to ecotourism
- Save water, energy, and reduce flooding concerns

Business Vibrancy

Pedestrian and Cyclist Buffers

Sonoran Viewscapes & Branding

Mobility Safety

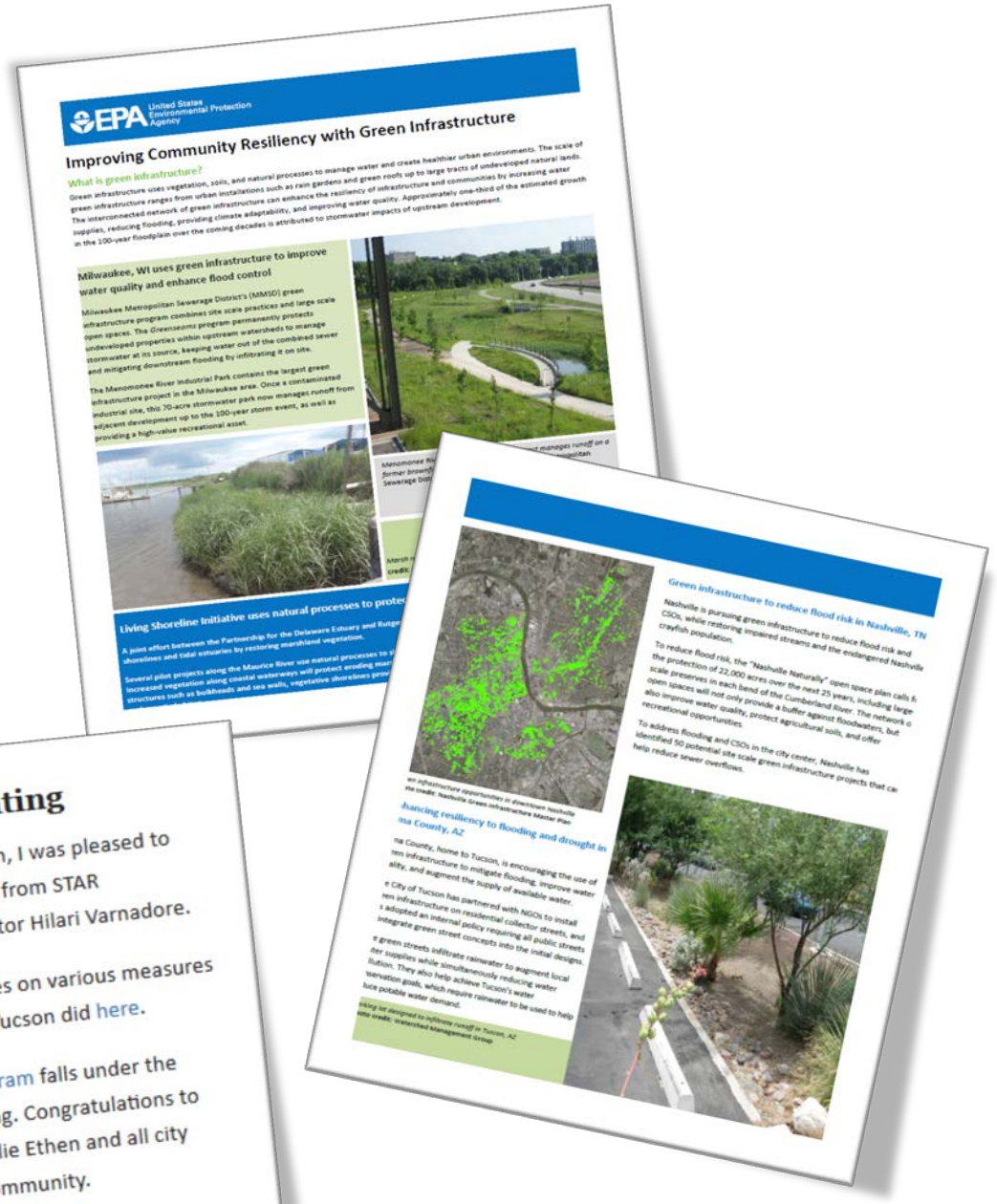
Heat Resilience Through Shading

Reduced Irrigation

*Image sources: PAG*

# Resolution aids Recognition, Awards, Grants

…In turn, recognition speaks to leaders


EPA United States Environmental Protection Agency

Improving Community Resiliency with Green Infrastructure

What is green infrastructure?

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. The scale of green infrastructure ranges from urban installations such as rain gardens and green roofs up to large tracts of undeveloped natural lands. The interconnected network of green infrastructure can enhance the resiliency of infrastructure and communities by increasing water supplies, reducing flooding, providing climate adaptability, and improving water quality. Approximately one-third of the estimated growth in the 100-year floodplain over the coming decades is attributed to stormwater impacts of upstream development.

Milwaukee, WI uses green infrastructure to improve water quality and enhance flood control

Milwaukee Metropolitan Sewerage District's (MMSD) green infrastructure program combines site scale practices and large scale open spaces. The Greenseams program permanently protects undeveloped properties within upstream watersheds to manage stormwater at its source, keeping water out of the combined sewer and mitigating downstream flooding by infiltrating it on site.

The Menomonee River Industrial Park contains the largest green infrastructure project in the Milwaukee area. Once a contaminated industrial site, this 70-acre stormwater park now manages runoff from adjacent development up to the 100-year storm event, as well as providing a high-value recreational asset.

Living Shoreline Initiative uses natural processes to prote

A joint effort between the Partnership for the Delaware Estuary and Rutge shorelines and tidal estuaries by restoring marshland vegetation.

Several pilot projects along the Maurice River use natural processes to increased vegetation along coastal waterways will protect eroding mar structures such as bulkheads and sea walls, vegetative shorelines prov

Green infrastructure to reduce flood risk in Nashville, TN

Nashville is pursuing green infrastructure to reduce flood risk and CSOs, while restoring impaired streams and the endangered Nashville crayfish population.

To reduce flood risk, the "Nashville Naturally" open space plan calls fo the protection of 22,000 acres over the next 25 years, including large scale preserves in each bend of the Cumberland River. The network o open spaces will not only provide a buffer against floodwaters, but also improve water quality, protect agricultural soils, and offer recreational opportunities.

To address flooding and CSOs in the city center, Nashville has identified 50 potential site scale green infrastructure projects that ca help reduce sewer overflows.

hancing resiliency to flooding and drought in na County, AZ

na County, home to Tucson, is encouraging the use of ren infrastructure to mitigate flooding, improve water ality, and augment the supply of available water.

e City of Tucson has partnered with NGOs to install ren infrastructure on residential collector streets, and s adopted an internal policy requiring all public streets integrate green street concepts into the initial designs.

e green streets infiltrate rainwater to augment local der supplies while simultaneously reducing water llution. They also help achieve Tucson's water servation goals, which require rainwater to be used to help uce potable water demand.

## Tucson Receives 4-STAR Sustainability Rating

*Receiving Tucson's 4-STAR rating from STAR Communities Executive Director Hilari Varnadore, with Tucson's Sustainability Manager Leslie Ethen*

On behalf of the City of Tucson, I was pleased to accept Tucson's 4-STAR rating from STAR Communities Executive Director Hilari Varnadore.

STAR Communities rates cities on various measures of sustainability. Read how Tucson did here.

Tucson's Sustainability Program falls under the Office of Integrated Planning. Congratulations to Sustainability Manager Leslie Ethen and all city staff for the work they do to make this a more livable, resilient community.

# Funding

Willingness to Pay Surveys
Public Education - Value
Feasibility Studies
Collection

General Fund/ Property Taxes
Fee for Public Service

Incentives
Credits for Pervious

Property Types
Purpose

Average quarterly $11 / household

**Strategic Planning** (Critical Mass, Loud Voices)

**Need Based** (Problem Solving)

**Asset Based** (Collaborative, Transparent, Empowered)

**Market/ Outreach** (Top Down)

**Community Driven** (Bottom Up)

# Theories of Change

| Stages of Change | Health Belief Model | Social-Cognitive Theory | Diffusion of Innovations | Social Networks |
|---|---|---|---|---|
| Precontemplation | Susceptibility | Reciprocal determinism | Relative advantage | Opinion leaders |
| Contemplation | Severity | Behavioral capability | Compatibility | Groups |
| Preparation | Threat | Expectations | Complexity | Adding or removing members |
| Action | Perceived benefits | Self-efficacy | Trialability | Bridging groups |
| Maintenance | Perceived barriers | Observational learning | Observability | Rewiring groups |
| Decision balance | Cues to action | Reinforcement | | Network weaving |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