

WESTCAS 2010 FALL CONFERENCE



A New Paradigm for Sustainable Water Infrastructure: The EPRI / WERF Report



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Background



Key WERF Efforts Related to New Water Paradigm

- *The Baltimore Charter, 2007*
- *Smart, Clean & Green - 21st Century Sustainable Water Infrastructure, 2009*
- *Case Studies on a New Water Infrastructure Paradigm, 2009*

Change is Difficult...the New Paradigm Needs Champions



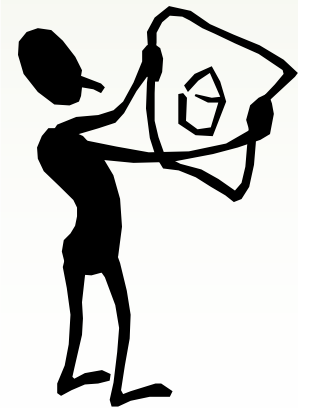
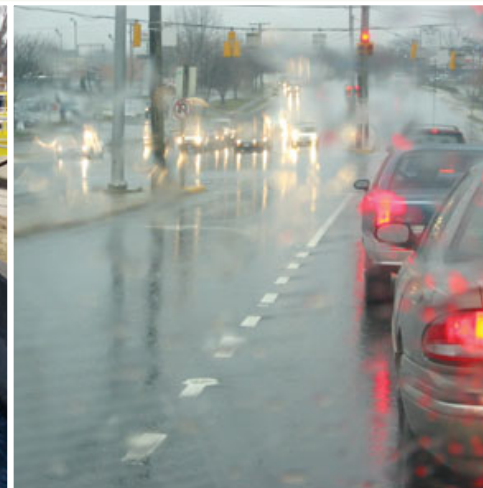
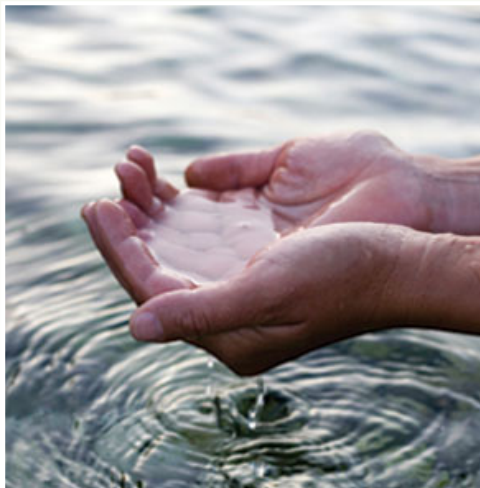
The key to accomplishment is believing that what you can do will make a difference.



Infrastructure



- Basic physical and organizational structures needed for the operation of a community or the services and facilities needed for the community to function
- **Water infrastructure** = drinking water/supply, wastewater and stormwater/flood control



Sustainability – What does it really mean?



- Bottom Line: Community development that meets the needs of the present without compromising the ability of future generations.
- Triple Bottom Line Measures:
 - Clean and healthy **environment**
 - Vibrant **economy**
 - Healthy and enjoyable **quality of living** in a just society

Current Paradigm Issues



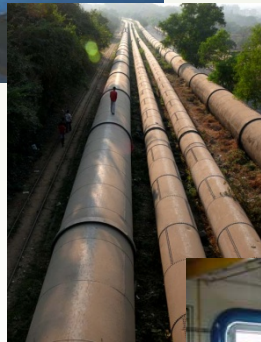
- Percent of US Waters impaired increasing
 - > 44 %
- Cost of maintaining/replacing existing aging water infrastructure increasing
 - User fees frequently not covering cost of water services
 - Gap > \$300 billion+ nationally (EPA 2010 estimate)
- Vulnerability to climate change/catastrophic events
- Water related energy use and carbon footprint is high



Reasons for Shortfalls



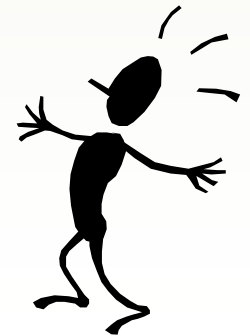
- Traditional linear approach: extract water, treat to potable standards, water typically used once, treated to high levels and then of disposed as wastewater



Reasons for Shortfalls



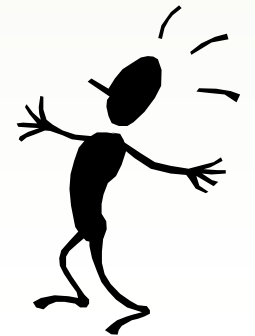
- Centralization has become the norm: wastewater is collected for a large area, conveyed to a central location often in a remote or an economically depressed area



Reasons for Shortfalls



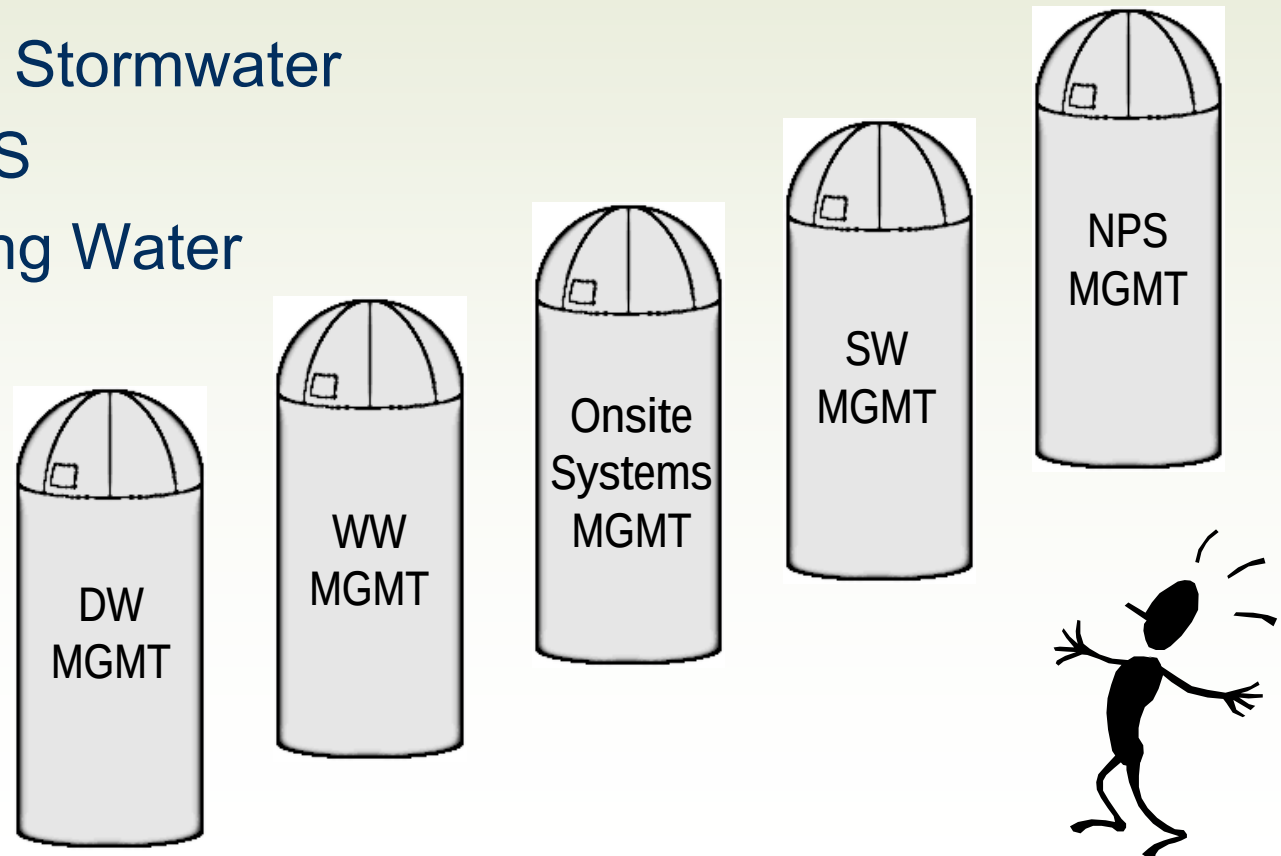
- Stormwater treated as a nuisance: largely managed for flood control through rapid conveyance and discharge



Reasons for Shortfalls



- Piecemeal management of water supply, wastewater and stormwater (“silo” programs)
 - CWA NPDES Wastewater
 - CWA NPDES Stormwater
 - CWA 319 NPS
 - SDWA Drinking Water
 - Public Health



EPRI Project No 068143: Case Studies on a New Water Infrastructure Paradigm



- 3-day retreat to define new paradigm
- Two case study communities: east & west
- 24 experts from variety of disciplines & organizations

Case Study: Tucson – Pima County AZ



- Population:
1,000,000 in Pima County
742,000 in City of Tucson
- 9,200 square miles
- Annual rainfall: 12 inches
(metro area)

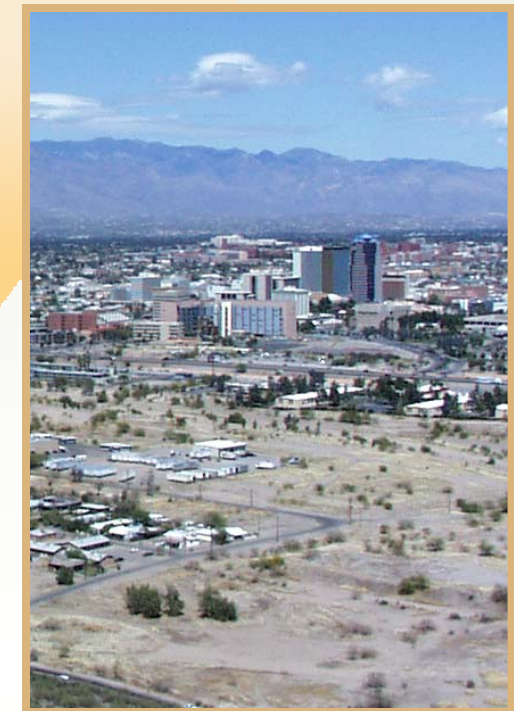
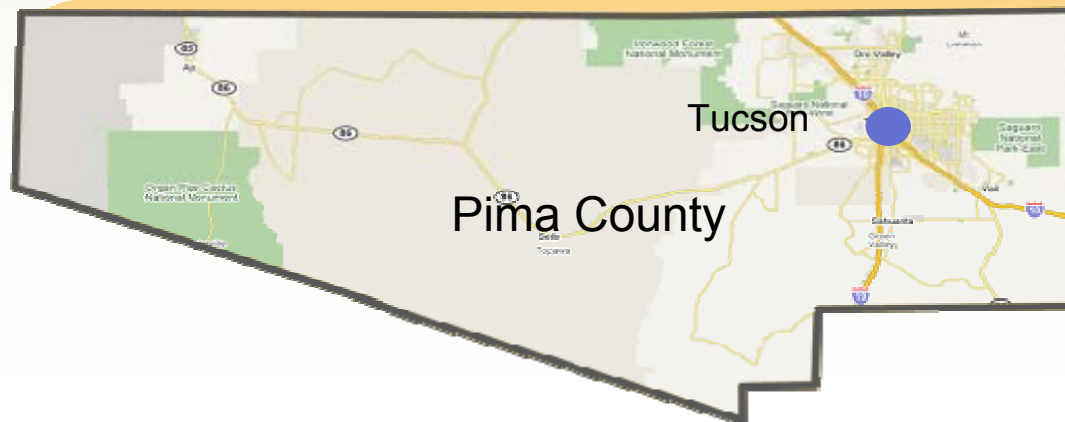
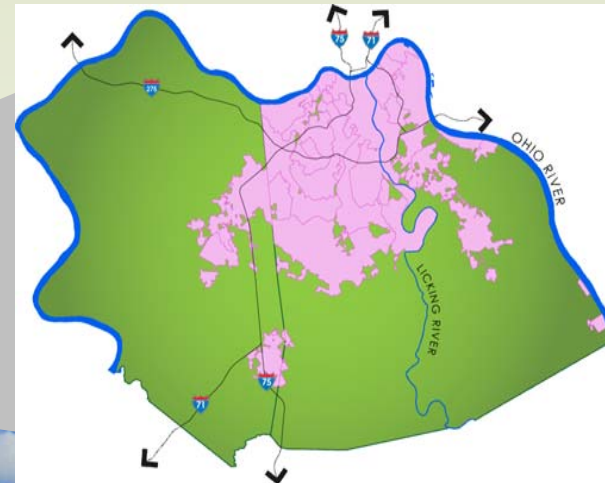
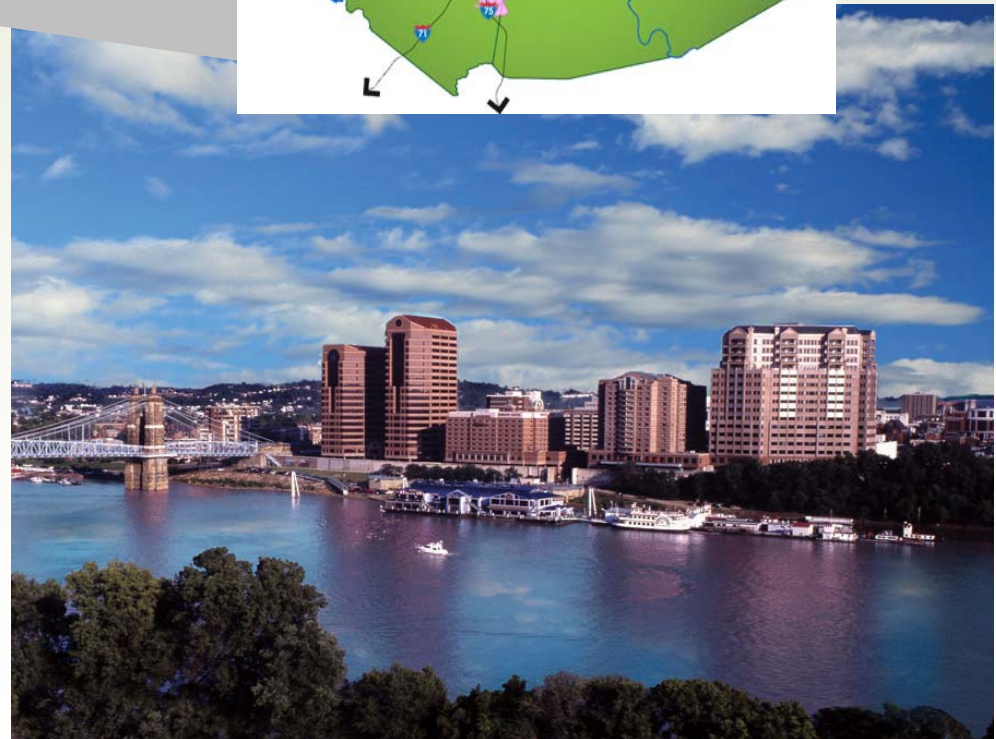


Photo by RWRD Staff

Case Study: Northern Kentucky



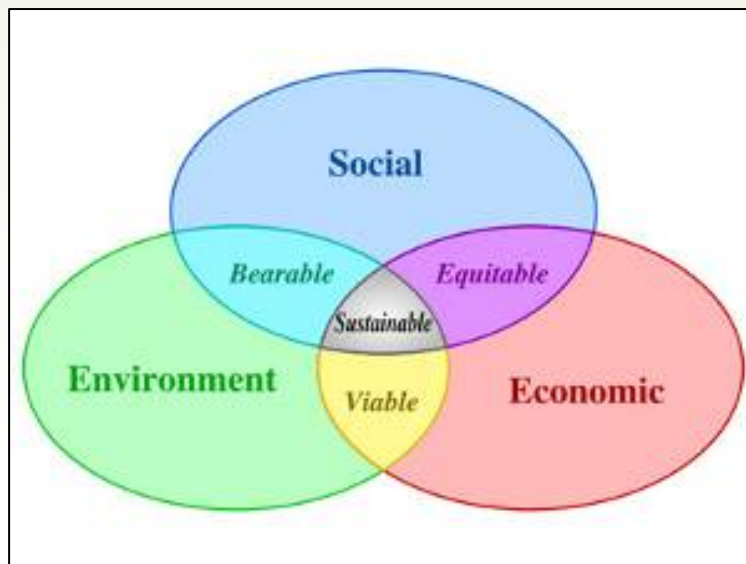
- Cincinnati metro area
- 31 cities; 3 counties
- 27% growth over 18 yrs
- Challenged by extreme wet weather flows:
 - CSOs, SSOs, stormwater



New Paradigm: Water Infrastructure is...



- Managed using a performance-based approach in a watershed context
 - More than green building
 - Apply community-based indicators and targets (e.g., pollutant loading)
 - Triple bottom line



New Paradigm: Integrated Resource Management

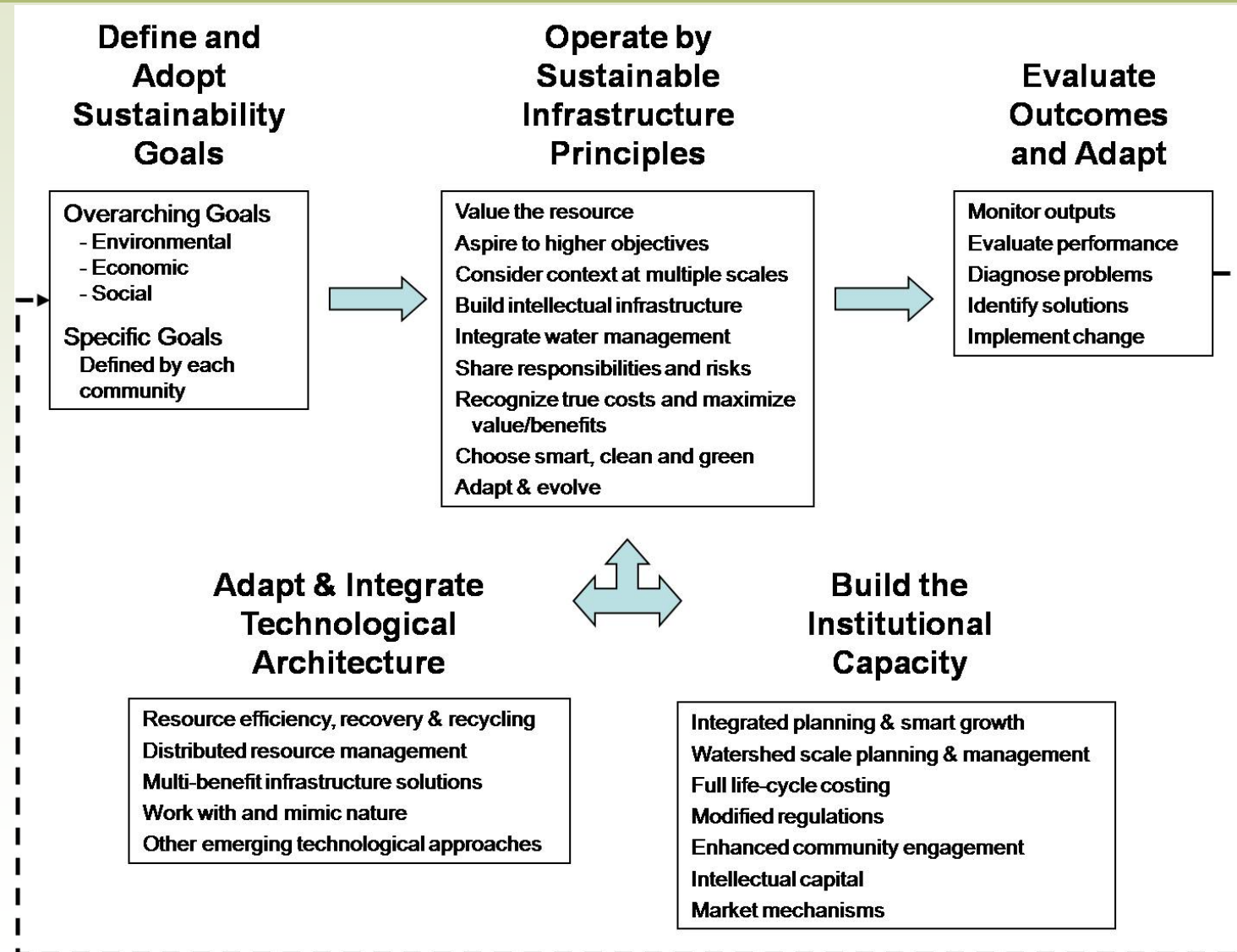


- Integrate water and land mgmt.
- Close the loop on resource cycles: water, nutrients, carbon/energy, etc.
- Augment water supplies
- Promote hydrologic and ecological restoration through land application
- Achieve multiple watershed benefits
- Generate revenue

Note: Requires agencies to rise above program silos to plan and evaluate together (including other infrastructure such as transportation and parks)



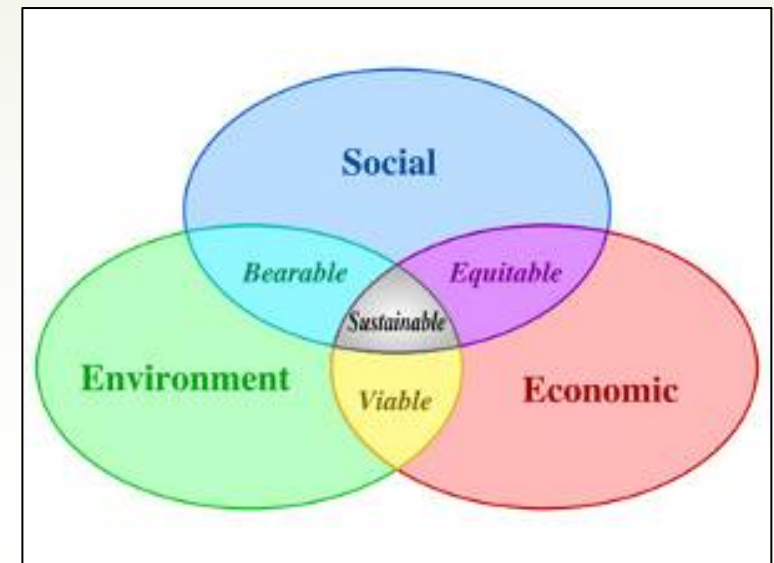
New Paradigm Key Elements



1. Overarching Sustainability Goals



- Environmental
 - Neutral impact (hydrology, nutrients, carbon, etc.)
- Economic
 - Self-supporting (not subsidized)
 - Value of services exceeds monetary cost
 - Resilient
 - Clean Technology
- Social
 - Healthy and enjoyable living
 - Connectedness
 - Environmental justice



2. Sustainable Operating Principles



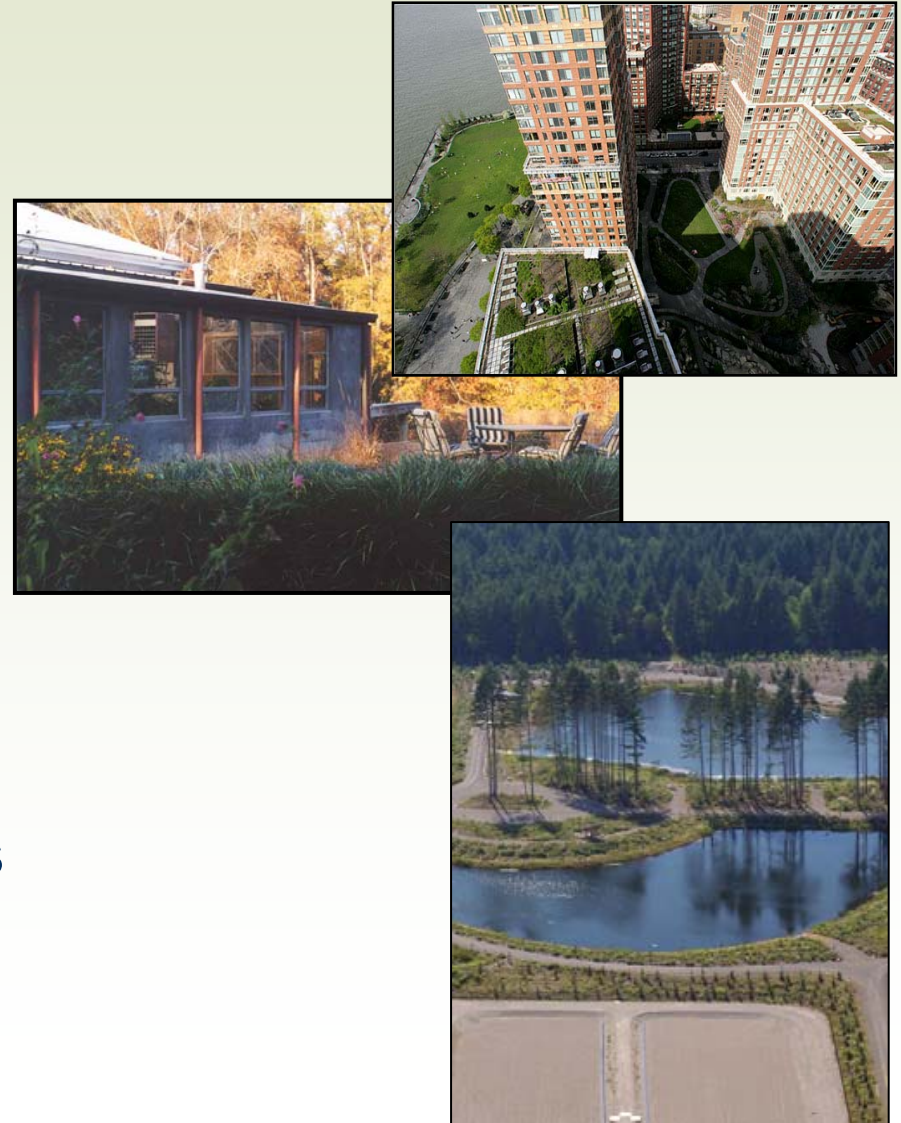
- Value the resource
- Aspire to higher objectives (that spawn better outcomes)
- Consider context at multiple scales
- Build intellectual capital
- Integrate water management
- Share responsibilities & risks
- Recognize true costs & maximize benefits
- Choose smart, clean & green
- Adapt & evolve



3. Technological Architectures



- Broader spectrum
 - Resource efficiency, recovery & recycling
 - Distributed
 - Mimic nature
 - Multi-benefit
 - Emerging
- Adapt and integrate
 - No single solution
 - Plan infrastructure systems together



4. Institutional Capacity



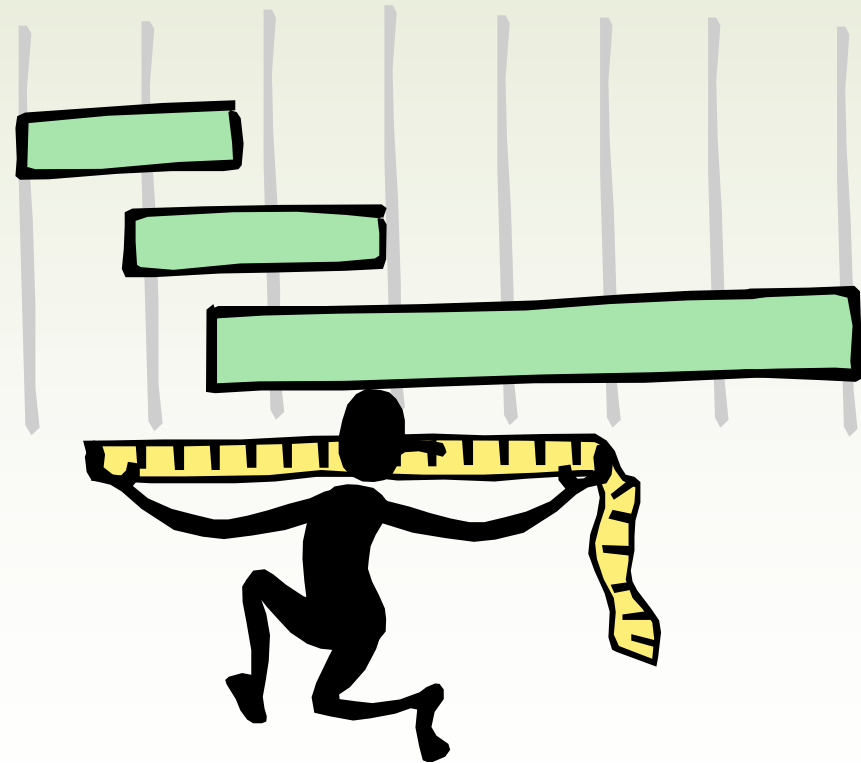
- Integrated Planning & Smart Growth
 - Multi-agency/program forums
 - Assessment tools linked to goals
 - Watershed models
 - Full life-cycle costing
- Enhanced Community Engagement
- Modified Regulations
- Intellectual Capital
- Market Mechanisms



5. Evaluation Protocol



- Monitor outputs => indicators tied to goals
- Evaluate performance
- Diagnose problems
- Identify solutions
- Implement change

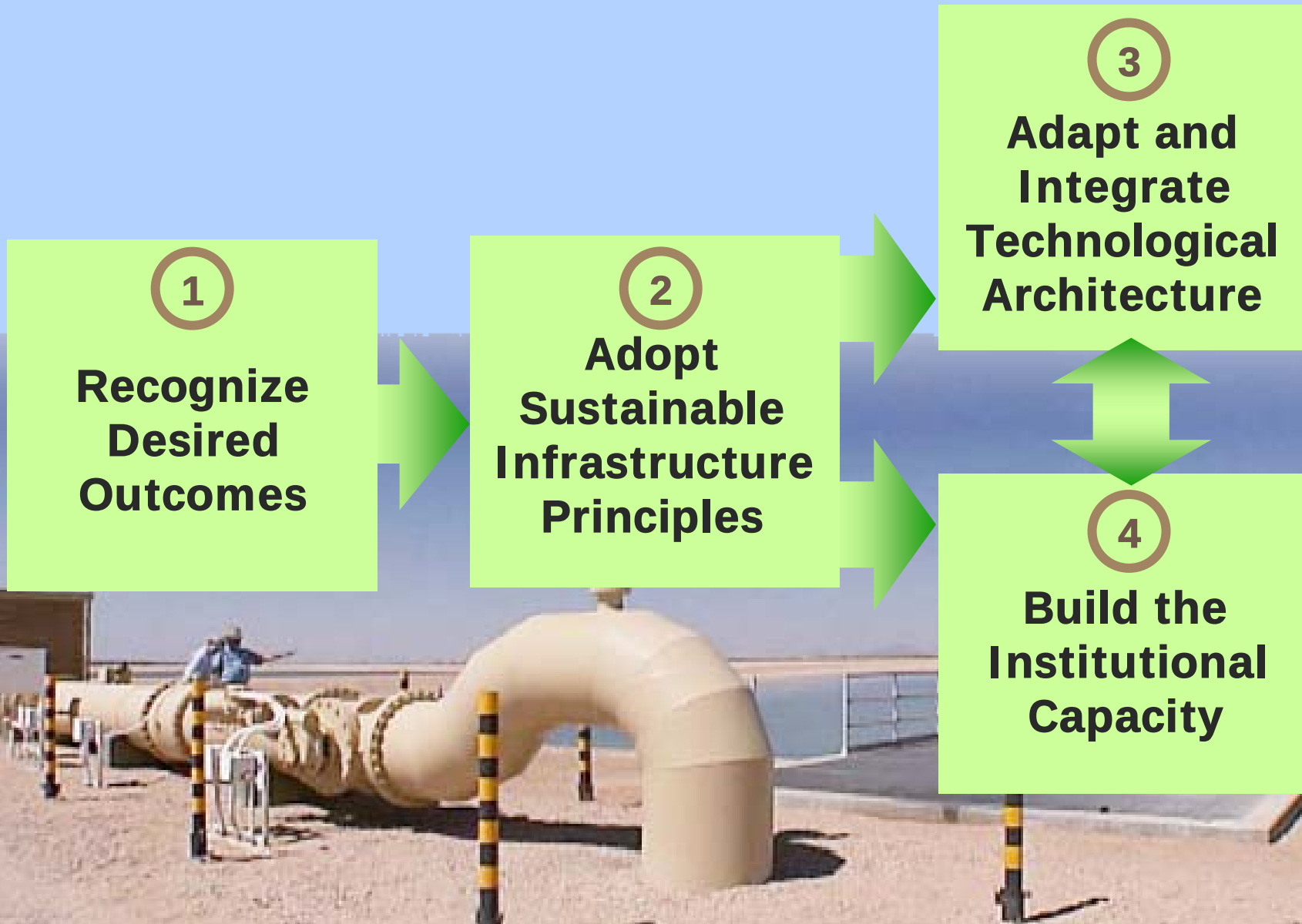


How is this different from current practices?



Topic	Current Practice	New Paradigm
Water Use	Single use before disposal	Reclaim/reuse water multiple times
Water quality supplied	Treat all water to potable standards	Level of water quality based on intended use
Waste	Dispose of	Recover resources
Stormwater	Convey offsite	Harvest onsite
Infrastructure type	Primarily gray, centralized	Integrate gray and green thru distributed approach
Infrastructure integration	Drinking water, stormwater, wastewater managed separately	Integrate as appropriate
Public Involvement	Stakeholders informed of pre-chosen solution	Stakeholders engaged in decision-making
Cost-benefit analysis	Focus on capital and recurring costs	Develop understanding of full cost and benefits

Sustainable Water Infrastructure



Arid SW: Pima Co. Water Architecture

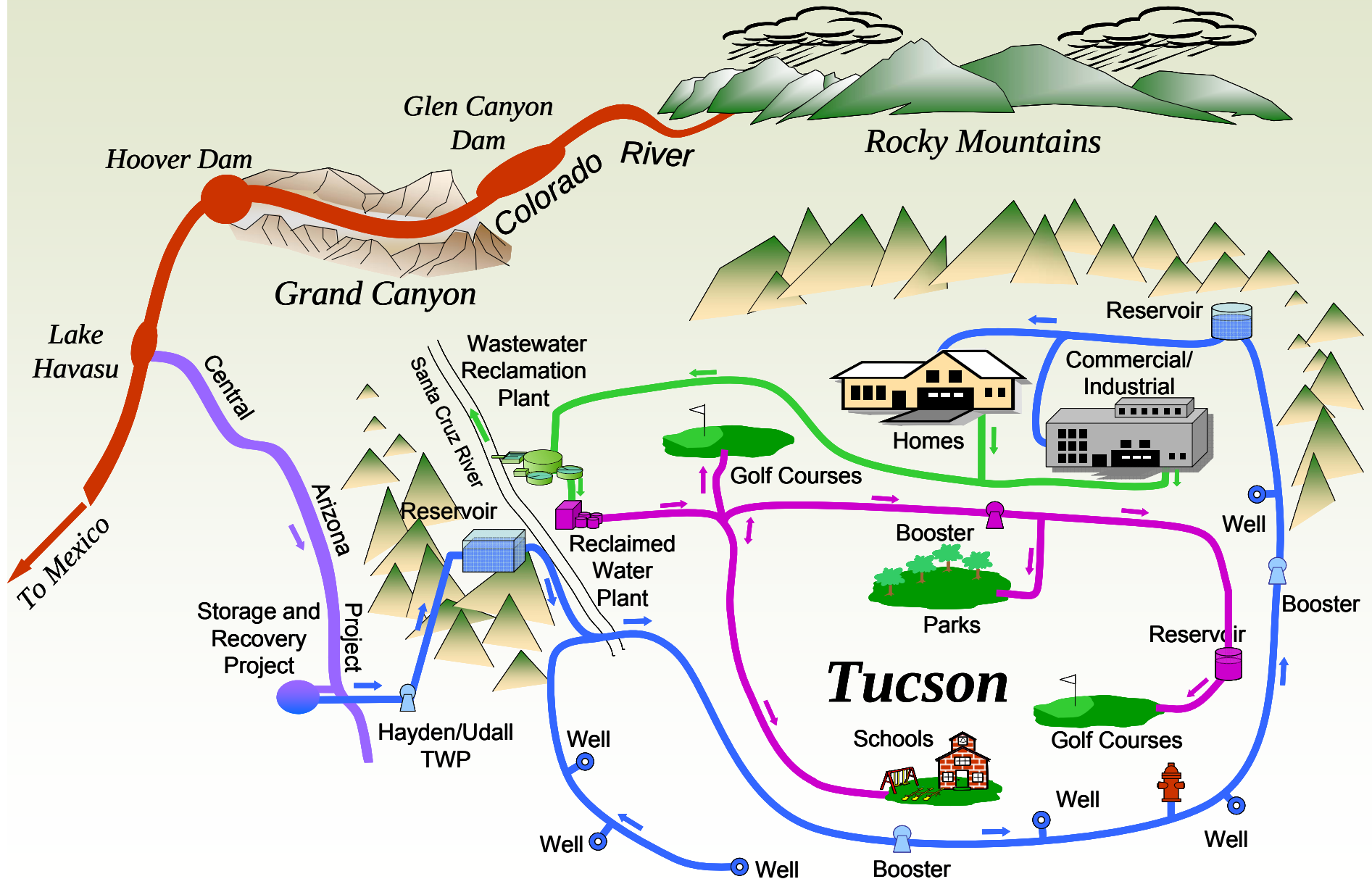


Illustration by Michael McCasland, Tucson Water

Pima Co. – Technological Approaches / Architectures



■ Goals

- Reduce reliance on Colorado River diversion
- Increase integration between built and natural environments

■ Opportunities

- Link land use planning with system architecture
- Integrate solar and co-generation with water & wastewater facilities
- Install smart systems in homes and businesses
- Public educational projects: integrate stormwater capture, wastewater reclamation, wetland restoration and natural resource amenities (e.g. Kina Environmental Restoration Project)

Cooperative Initiatives – Ecosystem Restoration

Kino Environmental Restoration Project

**Army Corps of
Engineers
Pima County
RWRD & RFCD
City of Tucson**



Before restoration



After restoration

Photos by RWRD Staff

Pima Co. – Integrated Planning



■ Goals

- Develop tools and incentives for sustainable approaches
- Increase collaboration with diverse stakeholders

■ Opportunities

- Direct growth to suitable areas for technologies through land use and capital investment planning
- Further develop use of reclaimed water, graywater and stormwater through land use planning
- Develop new platform for planning across departments and community programs
 - Develop shared water efficiency strategies at sub-regional and neighborhood scales

Pima Co. – Regulatory & Programmatic Change



■ Goals

- Research and develop standards for arid conditions
- Adopt integrated, performance-based approach
- Support innovative, adaptive approach

■ Opportunities

- Review current codes for impediments & implement model codes that support sustainable infrastructure
- Work with State agencies to overcome barriers to maximizing use of reclaimed water and dissuade use of groundwater when renewable sources are available
- Train regulatory staff in sustainable principles
- Develop faster verification measures for new technologies

Pima Co. – Enhance Community Engagement



■ Goals

- Include community members in infrastructure policy and planning decisions
- Increase community understanding of science and tools

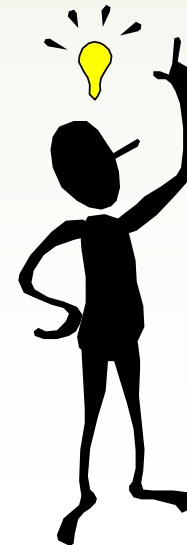
■ Opportunities

- Upcoming regional visioning process; updates to County Comprehensive Plan and Tucson General Plan
- Train community leaders to conduct round table dialogues within existing forums and organizations

Conclusions



- Current practices not capable of achieving environmental, economic and social goals
- Sustainable communities operate under a new set of principles
 - Valuing water
 - Integrating planning, design and implementation across multiple institutions and programs
 - Performance-based
 - Recognizing true cost
 - Adaptive



Conclusions: Near-Term Opportunities



- Coordinate water master planning to realize synergistic benefits
- Revise local codes to remove barriers to sustainable practices
- Build local demo projects to lead by example
- Use social marketing to increase support
- Use infrastructure grants/loans to jumpstart efforts
- Enhance training and certification to build intellectual capital



Conclusions: Long-Term Opportunities



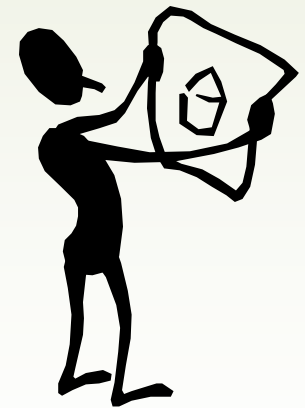
- Develop water performance standards to provide context
- Establish new ownership and maintenance models to address past shortfalls
- Develop funding and marketing mechanisms to leverage and expand capacity
- Work to adapt state and federal regulatory programs



Next Steps WERF & EPA



- **New WERF Research Program:**
“Next Generation Water”
- **EPA Strategy on Integration Under Development**



Want more details?



- Final Report Publication
 - Sustainable Water Resources Management, Volume 3: Case Studies on New Water Paradigm, EPRI, Palo Alto, CA and Tetra Tech: 2009, 1020587
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