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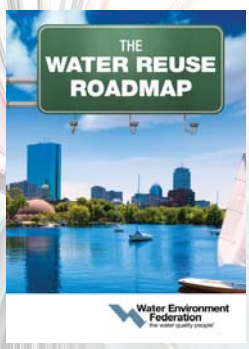

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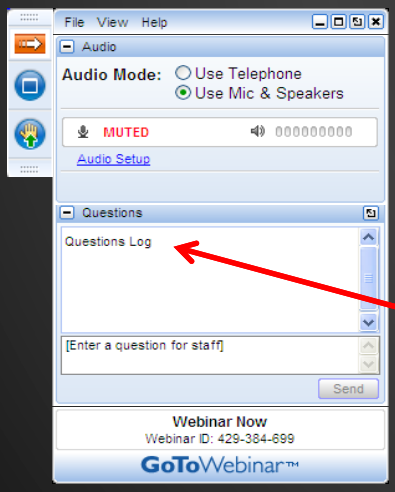
Water Environment Federation

How to Participate Today



- **Audio Modes**
  - Listen using Mic & Speakers
  - Or, select "Use Telephone" and dial the conference (please remember long distance phone charges apply).
- **Submit your questions using the Questions pane.**
- **A recording will be available for replay shortly after this webcast.**

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Drive On: Exploring the Highlights of the Reuse Roadmap

Thursday, March 8, 2018
1:00 – 3:00 pm ET

Thank you to today's webcast sponsor, Newterra!

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Today's Moderator

Phill Yi

Associate

Hazen

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Today's Speakers and Topics

- Kati Bell
  - *Water Reuse Roadmap* Primer
- Vijay Sundaram
  - *Roadmap* Overview
- Allegra da Silva
  - Strategic Planning (*Roadmap* ch. 3)
- Patricia Tennyson
  - Communication & Outreach (*Roadmap* ch. 6)

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Our Next Speaker

Kati Bell, PhD, PE, BCEE

Global Practice Leader,
Water Reuse

Stantec

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Water Reuse Roadmap
A Primer: Drivers and Purpose

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Presentation outline

- Motivation
- Process of development
- Themes and best practices matrix
- The framework

Motivation

Two of the Water Environment Federation's (WEF) critical objectives are to:

- "generate an increased public awareness of the value of water leading to increased funding to protect water quality through appropriate levels of infrastructure, management approaches, and services"
- "establish the conditions that promote accelerated development and implementation of innovative technologies and approaches in the water sector."

Framework for the Roadmap

- February 2016; >3 dozen diverse "experts"
  - Water utilities
  - Regulatory agencies
  - Academia
  - Consultants
  - Associations
  - Non-governmental organizations (NGO)
- Framework was based on aspirational goal:

"Water reuse is an element of a diverse and resilient water management strategy."

Goal of the Reuse Roadmap

Develop a high-level approach for utility and industry decision-makers in considering water reuse

- Brief, and high-level document accessible to all types of stakeholders, including public officials, utility managers, operators, engineers, and regulators
- Do not "reinvent the wheel," there are great technical resources; focus on helping decision-makers to quickly understand strategic issues inherent in a water reuse effort

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Agenda, day 1…

Monday, February 22, 2016

Time	Task
12:00 - 1:00pm	Lunch
1:00 - 1:30	Welcome, Ground rules, Introductions, Facilitator overview of meeting - Warner, Spangler, Stacklin
1:30 - 2:00	Existing Tools (SGMM, Energy Roadmap, Nutrient Roadmap) - Liner may also consider discussion of aspirational goal for sector
2:00 - 3:30	Success Stories (Brief Vignettes + Q&A) • West Basin Designer Water • Tres Rios Wetlands • Industrial/Power Plant • IPR/DPR • Irrigation • International
3:30 - 3:45	Break
3:45 - 4:45	Plenary Discussion: Common themes from successes and how those apply to into Key Operating Domains (Feedback from pre-meeting survey) Defining Key Operating Domains (Breakouts for 15 min first then plenary?)
4:45 - 5:00	Wrap-up of day, Overview of next day
5:00 - 6:30	Break (Planning with Table Captains for a couple of min)

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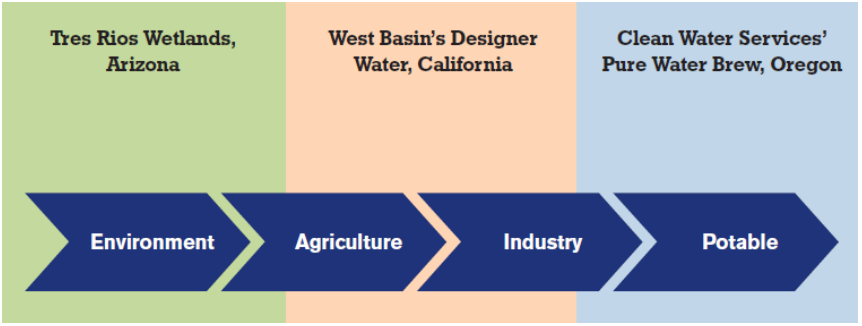
Major Themes

While a number of topics were discussed, two *themes* were prevalent:

Fit for Purpose and **Legitimacy**

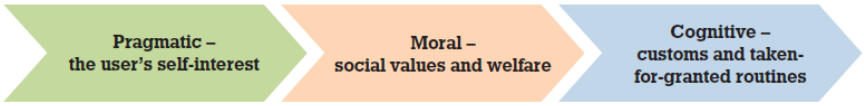
Fit for Purpose



Matching water of a specific quality to a use appropriate for that quality

Legitimacy

Three Levels of Legitimacy



- Pragmatic – How do I benefit? How am I involved in decision-making?
- Moral – How are safety and quality guaranteed? How has the organization performed in the past?
- Cognitive – How essential is the technology, given any alternatives? How does the technology fit with my daily life?

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Best practices compiled into 12 focus areas, under 3 topics

Product Focus

- Product Development
- Implementing Treatment Technologies
- Monitoring and Control
- Implementing Innovation

External Communications

- Message Development
- Communication & Outreach
- Risk Management & Communication
- Regulatory Environment

Management and Organizational

- Local Issues
- Strategic Management
- Financial Sustainability
- Resiliency

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Matrices

2: IMPLEMENTING TREATMENT TECHNOLOGIES

	PLAN	PREPARE & IMPLEMENT	EVALUATE & IMPROVE

Technology Evaluation	*Identify Treatment Levels*
	• Determine level of treatment available
	• Determine level of treatment required or desired
	• Define operational/process changes required to provide water quality
	• Identify available technologies to provide appropriate multi-barrier protection.
	  • Where used/experience with technology
	  • Maturity of technology
	  • Alternative analysis
	  • Waste stream (brine, other) implications
	  • Regulatory issues
		Identify Opportunities
		• Ensure adequate treatment vs. overtreating to meet regulatory requirements with minimum concentrate generation
		• Consider storage
		  • Emergency
		  • Process upsets
		  • Demand variability
		  • Equalization
		  • Monitoring
		  • Attenuation
		• Identify additional opportunities requiring more time or capital to implement, and develop a plan to finance/implement
		• Assess liquid vs. solid recovery (water reuse vs. land application/struvite recovery)
			Evaluate and Implement
			• Multi-barrier approach using cost-effective and low carbon footprint technology to provide right quality reuse
			• Unintended consequences are evaluated through scenario planning or other means, such as
			  • No return flows
			  • Collection system issues from scalping
			  • Aggressive water
			• Identify research and development needs to drive innovations
			• Identify water quality trading and greenhouse gas offset credit opportunities

Treatment Management	*Plan for the Future*
	• Identify unit operations/basins for use in future iterations of designer water production
	• Long-term planning such as leaving space in the facility hydraulic profile to accommodate future processes
	• Develop scenario analysis in master planning
	  • Future regulations
	  • Water supply/demand
	  • Treatment resiliency and tailsate planning
		Mitigate Risks
		• Design for current requirements with an eye toward future requirements
		• Validate technologies
		  • Reliability
		  • Long-term prospects
		  • Path dependency
		  • Public support
		  • Intellectual property issues
		  • Operational efficiency
		  • Scalability
		  • Monitoring requirements
		  • Byproducts and coproducts
			Manage Tradeoffs
			• Understand tradeoffs
			  • Reliability vs. advanced technology
			  • Regulatory requirements vs. business needs
			  • Resource recovery vs. treatment

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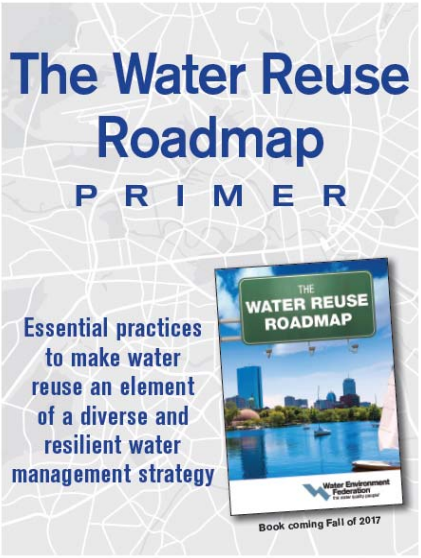
Next steps

Create a framework for reuse that overlays other existing technical documents



Contact information

Kati Bell, PhD, PE, BCEE
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Our Next Speaker

Vijay Sundaram, PE

Regional Practice Leader,
Water Sustainability

WEF Task Force Chair,
Water Reuse Roadmap

Stantec

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The Water Reuse Roadmap Overview

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The Roadmap provides water managers with the following:

- An overview of virtually all water reuse opportunities and issues faced by water reuse projects;
- An understanding of the elements of a water reuse project—their importance, attributes, and integration to the community, resulting in a successful water reuse program; and
- Assistance with implementing or expanding a water reuse program.

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Roadmap Chapters

Chapter 1: Introduction

Chapter 2: Development of Purpose and Needs Statement

Chapter 3: Strategic Planning and Concept Development

Chapter 4: Regulations and Risk

Chapter 5: Financial Sustainability

Chapter 6: Communications and Outreach

Chapter 7: Implementation: Treatment Technologies and Other Project Elements

Chapter 8: Monitoring and Control

Chapter 9: Ongoing Maintenance and Monitoring Progress

Thank You Reuse Roadmap Authors!

Chapter 1
Vijay Sundaram and Jim Crook

Chapter 2
Marie Burbano, Tyler Hadacek, Sheryl Smith, and Hardeep Anand

Chapter 3
Allegra da Silva, Mia Smith, Emery Myers, Emily Stahl, Tom Watson, Kim Jusek, Joe Griffey, Chris Hill, and Michael Adelman

Chapter 4
Caroline Russell, Eva Steinle-Darling, Daniela Castañeda, Craig Riley, and Bob Hultquist

Chapter 5
Thierry Boveri, Nick Smith, and Robert Ori

Chapter 6
Patsy Tennyson and A. Brooke Wright

Chapter 7
Larry Schimmoller, Jason Assouline, and Tyler Nading

Chapter 8
Ben Stanford, Stephanie Ishii, Paul Biscardi, Phill Yi, Bryce Danker, and Wendell Khunjar

Chapter 9
Chris Stacklin and Bruce Cooley

WEF Team:
Barry Liner, Lorna Ernst, David Plank, Morgan Brown, and the WEF Publications Group.

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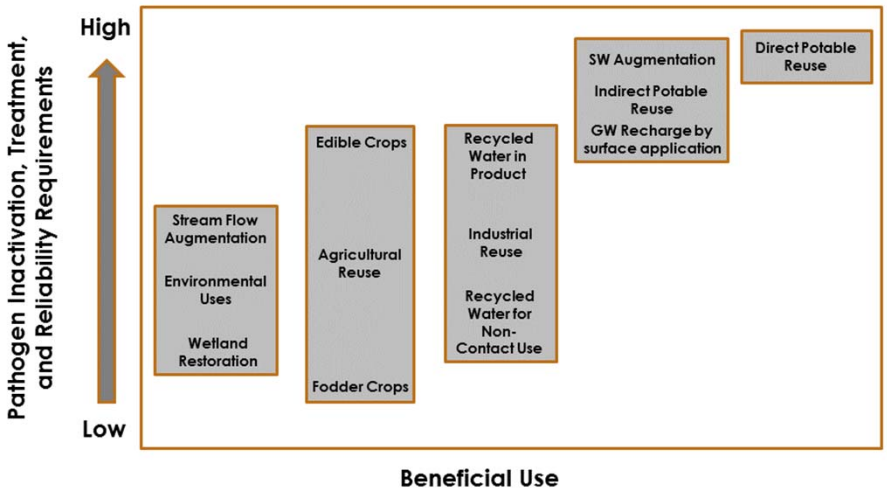
The Water Reuse Spectrum (Ch. 1)



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Drivers for Water Reuse (Ch. 2)

Driver	Description
Economic development and urbanization	Recycled water can be a best-value proposition for providing a lower-cost water than alternatives
Water scarcity	Use wastewater as a valuable resource to be conserved and reused
Resiliency and climate change	An additional source of water to alleviate pressure on existing drinking water systems
Regulatory requirements	Meet rules and regulations from federal, state, or local governments
Diversification of water sources	Provide multiple sources of water in case of degradation or damage to a single source
Reduced dependency on external sources	Reduce the need for imported water or make sources available to environmental restoration
Need for financial resiliency	Limited funding and a growing financial need

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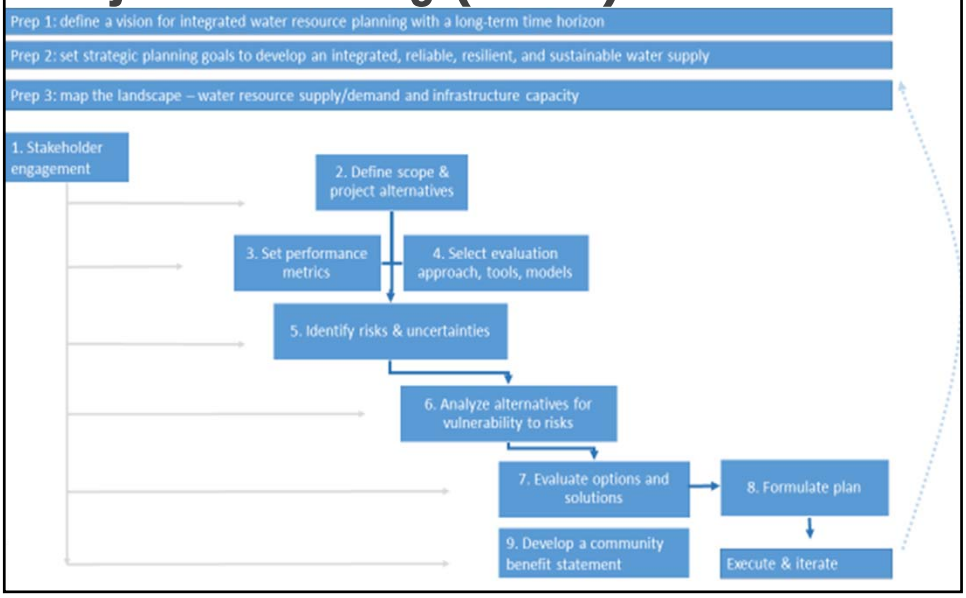
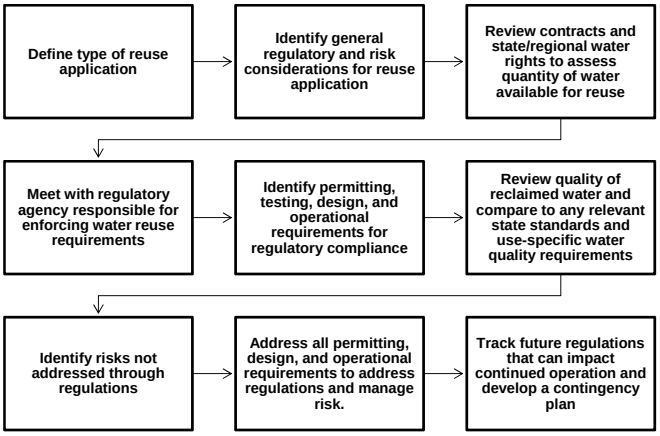
Conceptual Elements of Reuse Project Planning (Ch. 3)



Approach for Addressing Regulatory Requirements (Ch. 4)



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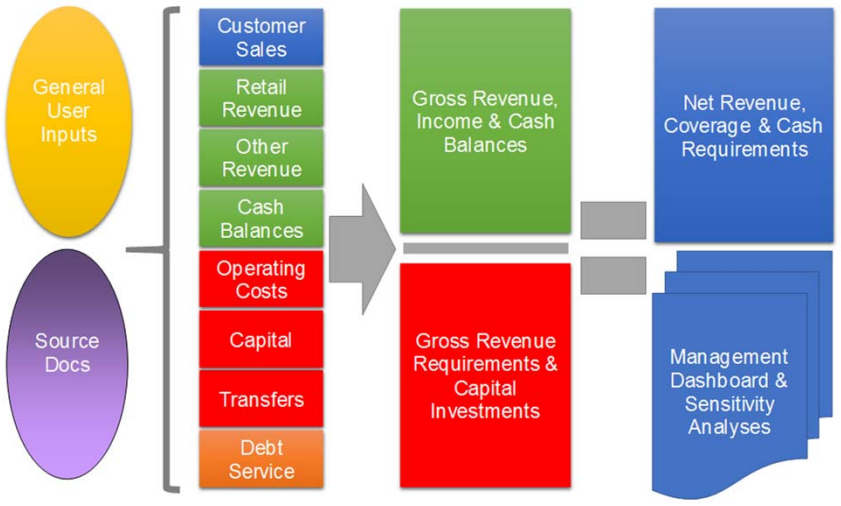
Long-Range Planning Model Flow Chart (Ch. 5)



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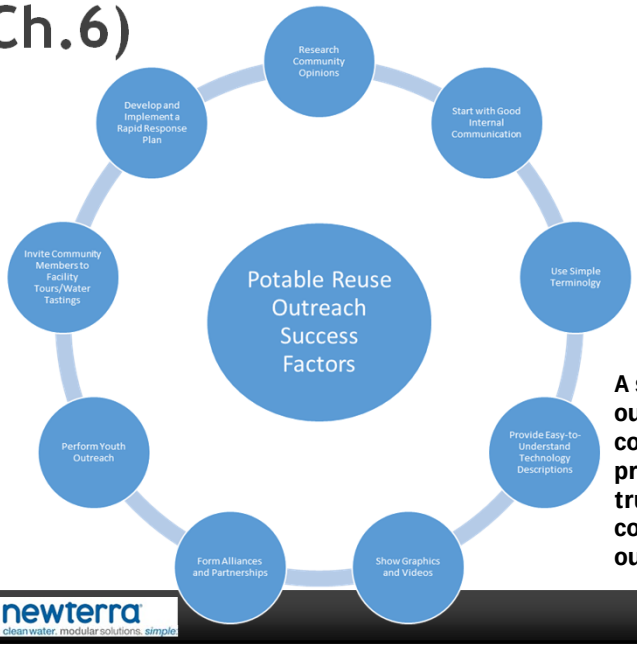
Reuse Project Success Factors (Ch.6)



A successful community outreach and communication program is based on trust, transparency and consistent/sustained outreach efforts.

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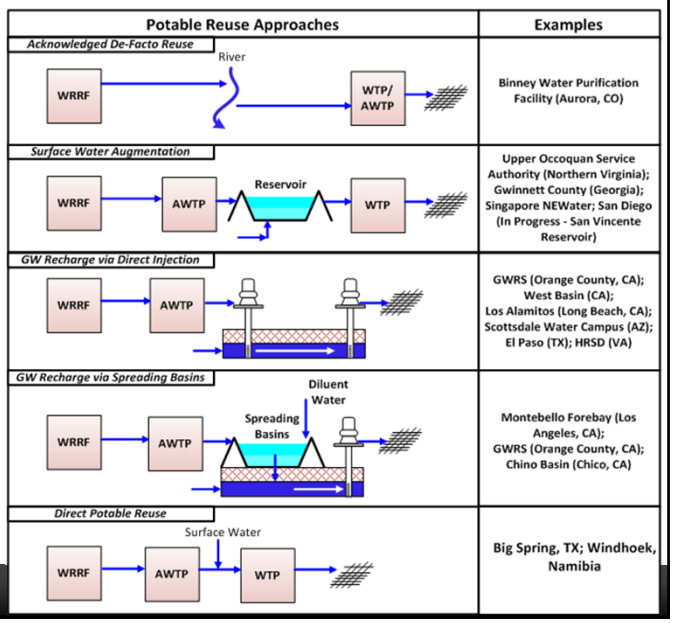
Potable Reuse Approaches (Ch. 7)



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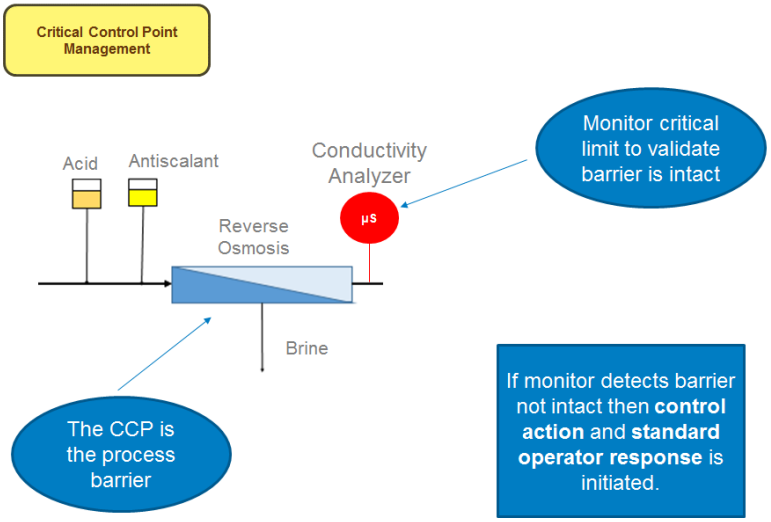
Critical Control Point Monitoring (Ch. 8)



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Critical Control Point Monitoring

Critical Control Point	Risk Management	Analyzer / Monitor	Trigger Point / Failure Mode CCP	Reason for Failure
Ozone	Pathogens Organic Chemicals Bromate	UVT Analyzer Ozone Dose Analyzer	• Insufficient dose. • Overdose	• UV Transmittance Analyzer failure • Ozone dose monitoring failure.
Ozone-BAC	Biological Stability DBP Precursors	Ozone BAC Dose Analyzer Magnetic flow Analyzer	• Insufficient dose. • Insufficient contact time with BAC.	Ozone dose monitoring failure. Magnetic flow meter failure.
Coagulant-BAC	Pathogens	TOC Analyzer Flow Meter Analyzer	• Insufficient coagulant dose. • Filter breakthrough.	• TOC Analyzer failure. • On line turbidity analyzer failure • Flow meter/switch failure.
GAC	Organic Contaminants	TOC Analyzer UV Analyzer	• Carbon too old. • Filter bypass	• Failure of TOC analyzer • Failure of UVT analyzer.
UV	Pathogens	UVT Analyzer	Insufficient UV dose. Poor transmissivity.	
Chlorine	Pathogens DBP Formation Organic Chemicals	Chlorine Analyzer	Insufficient dose (dosing pump failure)	• Chlorine analyzer failure • Flow meter failure.

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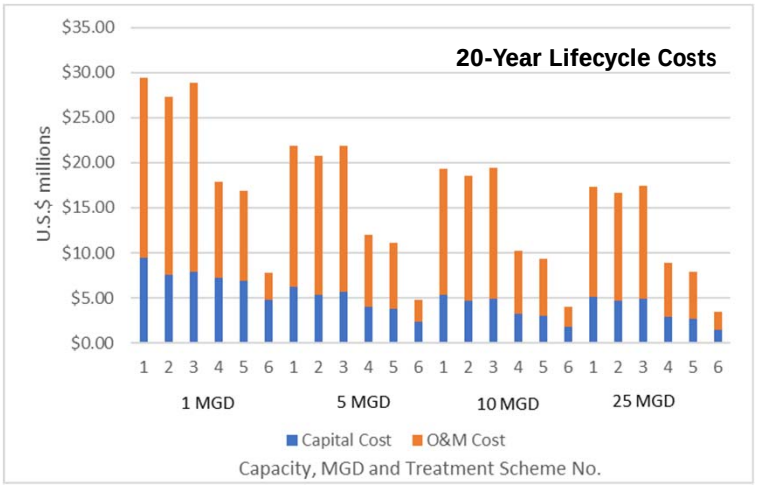
Ongoing Maintenance and Monitoring Progress (Ch. 9)



Source: Texas Development Board, 2015.

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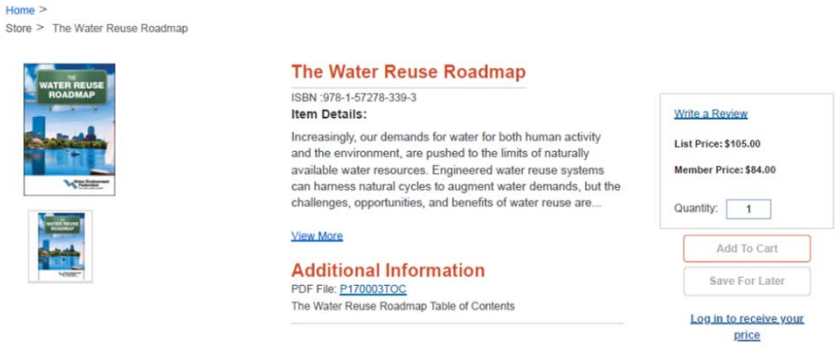

Our Next Speaker

Allegra da Silva

Rocky Mountain Region
Water Reuse Practice Leader

Stantec

Strategic Planning (Ch. 3)

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Project Planning

Vision & Goals	• Long-term planning horizon ("One Water")
Scope & Objectives	• Defines major objectives of the project
Performance Measures & Decision tool	• Metrics of success • Service goals • Decision matrix vs. complex models
Uncertainties	• Supplies, demands • Institutional, regulatory • Social
Options	• Individual projects
Alternatives	• Packages of individual options combined into a portfolio

→ Formulate Plan

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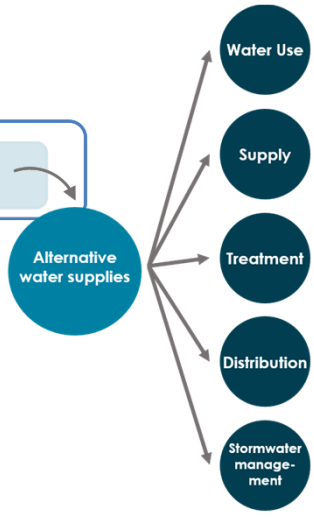

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Project Planning

Vision & Goals	• Long-term planning horizon ("One Water")
Scope & Objectives	• Defines major objectives of the project

1. *What is the "problem" the plan is trying to solve?*
2. *What options and alternatives should be considered in the plan?*
3. *What should be integrated to the planning process?*
4. *What is the right planning horizon?*
5. *How much public engagement?*

Project Planning

Vision & Goals	• Long-term planning horizon ("One Water")
Scope & Objectives	• Defines major objectives of the project
Performance Measures & Decision tool	• Metrics of success • Service goals • Decision matrix vs. complex models

Category	Example level of service goals	Example metrics
Supply	Use X% local water supply	Annual use of local supplies
Storage	Meet variations in demand, short-term and seasonal; resilience	Volume of water in storage; frequency of watering restrictions; number of customer complaints
Energy conservation	Volume based energy conservation targets	Energy usage

Project Planning

Vision & Goals	• Long-term planning horizon ("One Water")
Scope & Objectives	• Defines major objectives of the project
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Integrated Modeling

Table 3.2 – pro/cons of 6 decision-making tools:

1. Many-objective robust decision-making (MORDM)
2. Decision matrix analysis (DMA)
3. Multiple criteria decision analysis (MCDA)
4. Probabilistic models
5. Deterministic models
6. Triple bottom line (TBL)

+ Envision rating system

Project Planning

Vision & Goals	• Long-term planning horizon ("One Water")
Scope & Objectives	• Defines major objectives of the project
Performance Measures & Decision tool	• Metrics of success • Service goals • Decision matrix vs. complex models

Decision matrix analysis (DMA)

Criteria	Cost	Quality of water	Public perception	Reliability of source quantity	Envision score	Project funding stability	Total
Weights	4	5	1	2	3	3	
Alternative 1	4	0	0	2	500	4	1532

Project Planning

Vision & Goals	• Long-term planning horizon ("One Water")
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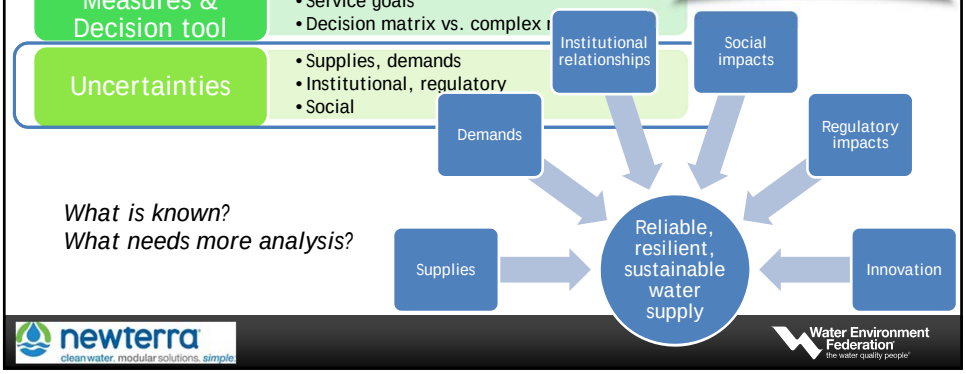

What is known?
What needs more analysis?

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Project Planning

Vision & Goals	• Long-term planning horizon ("One Water")
Scope & Objectives	• Defines major objectives of the project
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Risks	• Supplies, demands • Institutional, regulatory • Social
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→ Formulate Plan

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Project Planning

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Public engagement

Formulate Plan

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Integrated Water Management in Santa Monica, CA

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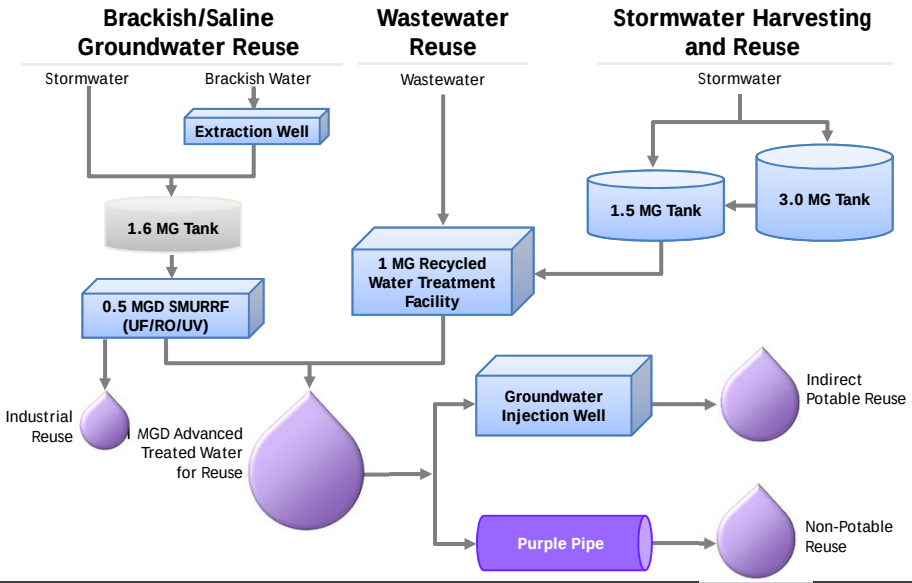
SWIP's Driving Factors

- City of Santa Monica currently relies on other agencies for imported water and treatment of their wastewater
- City's Sustainable Water Master Plan set a goal for water self-sufficiency by 2020
- Uniquely combines multiple local water resources projects into a unified approach to address water supply reliability
- Reduce water pollution in Santa Monica Bay
- Finding solutions for infrastructure in built-out environment
- Be seen as a leader in potable reuse

Santa Monica Sustainable Water Master Plan



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Case Study: Denver, CO

Expanding reuse statewide

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Water supply and reuse in Colorado

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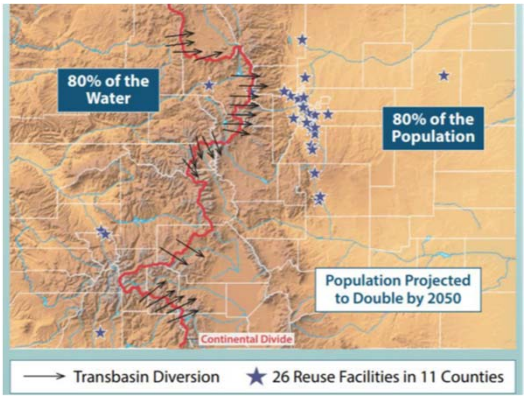
Water Supply in Colorado

Colorado.gov

Water Supply in Colorado

Population: Double by 2050
Municipal water gap:
As high as 560,000 AFY by 2050

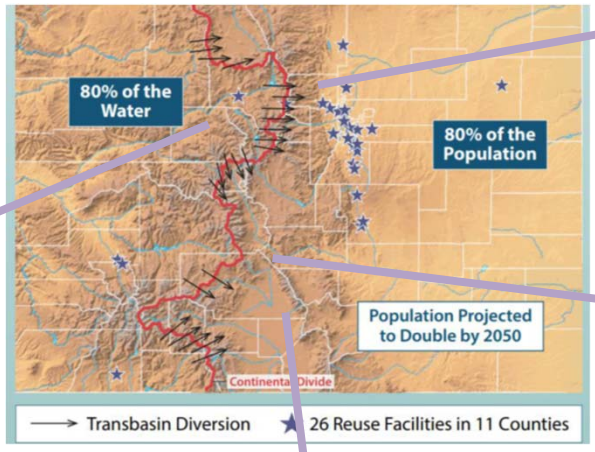
Colorado.gov



Colorado State University extension

DudeTrek.com

Why this matters to you: Major rivers start in Colorado



South Platte (to Missouri River)

Colorado River

Arkansas River

Rio Grande River

Strategies to meet the supply gap

- **Agricultural water transfers**
- **Growth into existing supplies**
- **In-basin projects**
- **New transbasin projects**
- **Water storage**
- **Water conservation and reuse**

Strategies to meet the supply gap

- **Agricultural water transfers**
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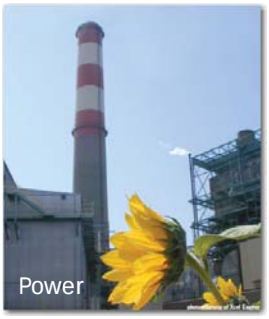
Politically Sensitive

• Water Reuse in Denver

Non-potable reuse



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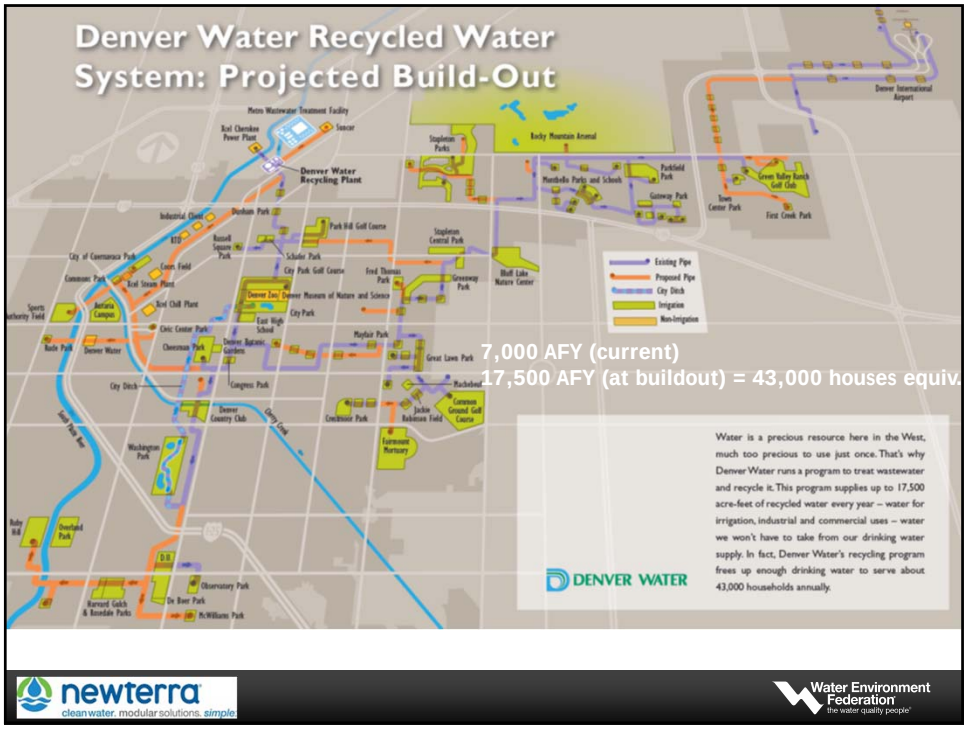
Denver Water Recycled Water System: Projected Build-Out
7,000 AFY (current)
17,500 AFY (at buildout) = 43,000 houses equiv.
Water is a precious resource here in the West, much too precious to use just once. That's why Denver Water runs a program to treat wastewater and recycle it. This program supplies up to 17,500 acre-feet of recycled water every year – water for irrigation, industrial and commercial uses – water we won't have to take from our drinking water supply. In fact, Denver Water's recycling program frees up enough drinking water to serve about 43,000 households annually.
DENVER WATER
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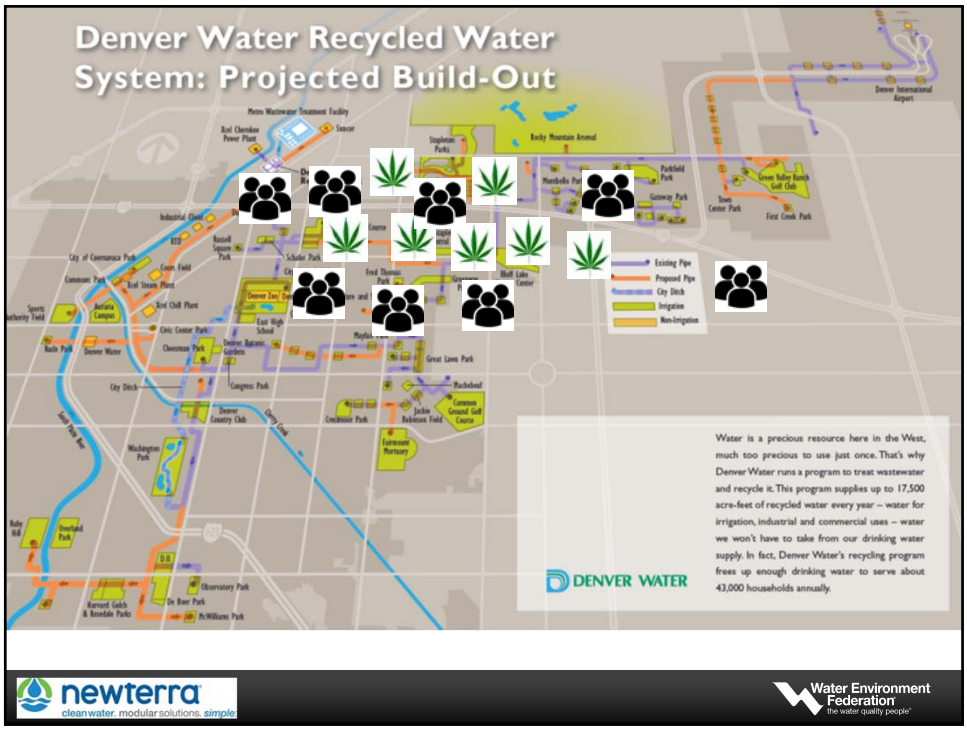
Denver Water Recycled Water System: Projected Build-Out
Water is a precious resource here in the West, much too precious to use just once. That's why Denver Water runs a program to treat wastewater and recycle it. This program supplies up to 17,500 acre-feet of recycled water every year – water for irrigation, industrial and commercial uses – water we won't have to take from our drinking water supply. In fact, Denver Water's recycling program frees up enough drinking water to serve about 43,000 households annually.
DENVER WATER
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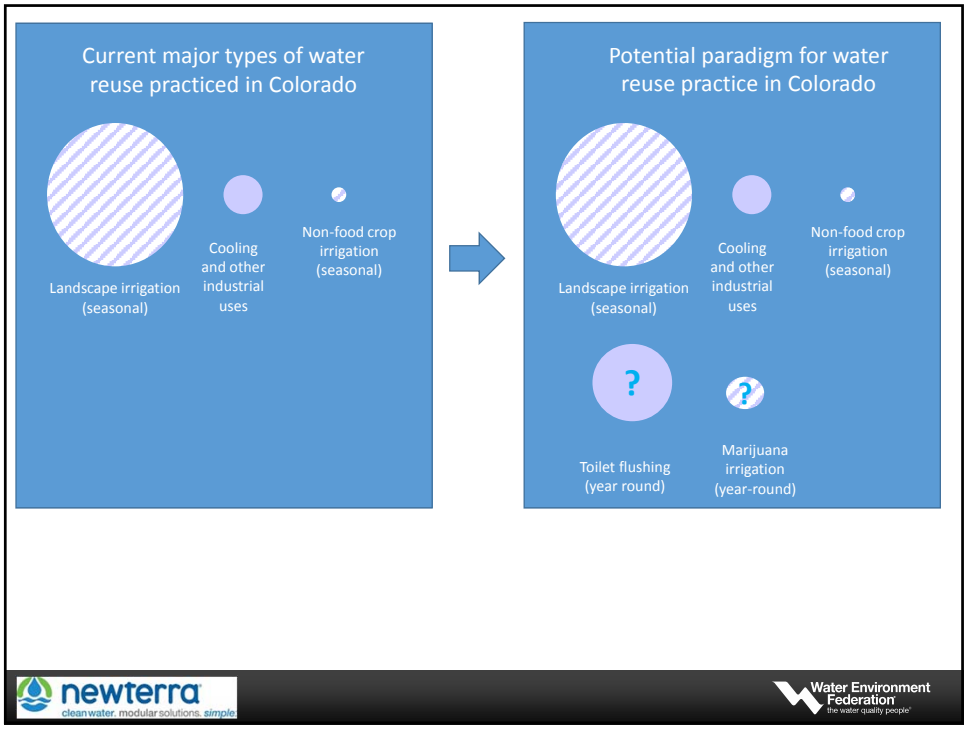


Reg 84 – Roles of key Actors

DENVER WATER

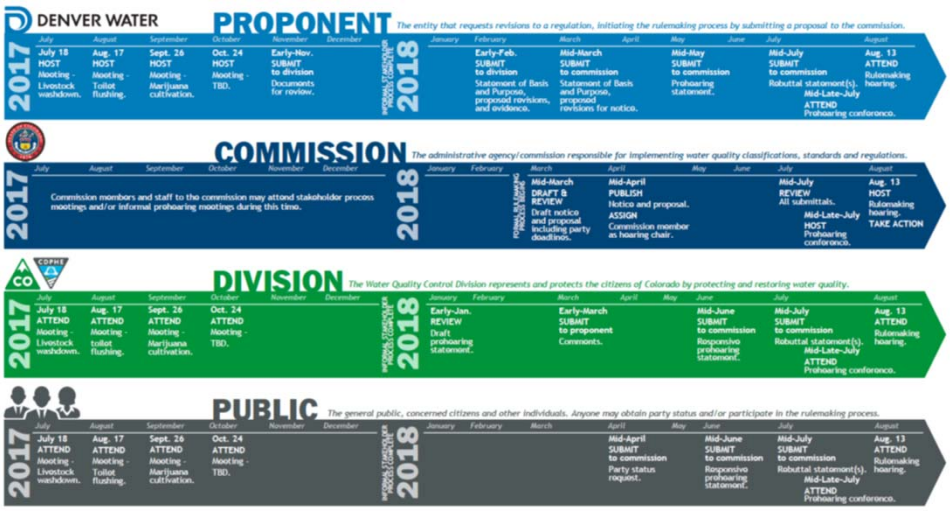
Denver Water acting as a "proponent" to change the regulation

CDPHE CO COLORADO Department of Public Health & Environment

Regulatory body

Stakeholders/Public – provide input

Reg 84 Process



Stakeholder Discussion:

Public concerned with:

- Antibiotic resistance, hormones

Ag community concerned with:

- Long-term impacts to state's TDS, water flows

Customers concerned with:

- Mandates

Stakeholder Discussion:

Public concerned with:

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Customers concerned with:

- Mandates

Regulators concerned with:

- New rules being "scientifically defensible" (risk assessment)
- Small systems
- Need "teeth" to require sufficient treatment

Conclusion

- Water reuse has always been a relevant tool in the integrated water resources toolbox, and…
- It's more accessible than ever!
- Stakeholder engagement is key

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Our Next Speaker

Patricia Tennyson

Executive Vice President

KATZ & Associates

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The Water Reuse Roadmap, Chapter 6

Communication and Outreach

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Little Known Water Facts

- The water we drink has been used and reused since the beginning of time.
- Recycled water projects have operated for 100+ years
- De-facto potable reuse occurs on every river system

Water Supply Goals: Sustainability, Resilience

- Water use efficiency programs widespread
- Awareness of need: drought/climate change
- Water reuse/desalination potential solutions
- Outreach necessary to "level playing field" for reuse – especially potable reuse

Successful Outreach Programs

- Based on trust, transparency
- Consistent/sustained
- Adequately funded and staffed
- Project need: clear/understandable
- Strategically planned

Outreach Plan Elements

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Outreach Illustrated

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Key Audiences

- Utility/agency staff
- Policy makers
- Community leaders
- Media

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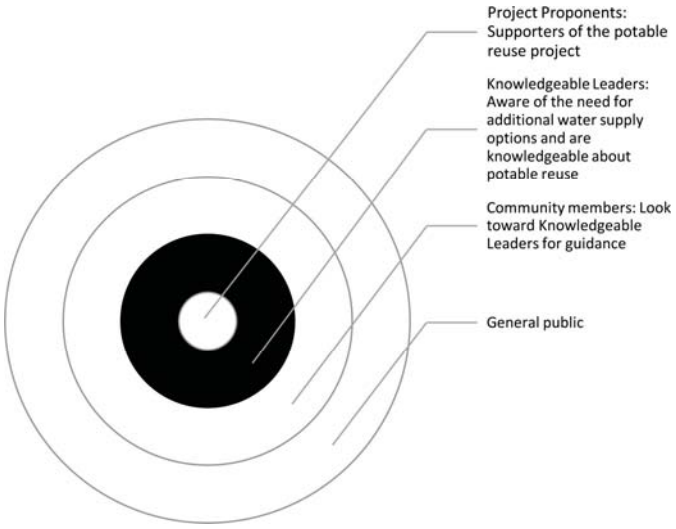
Community Leader Focus



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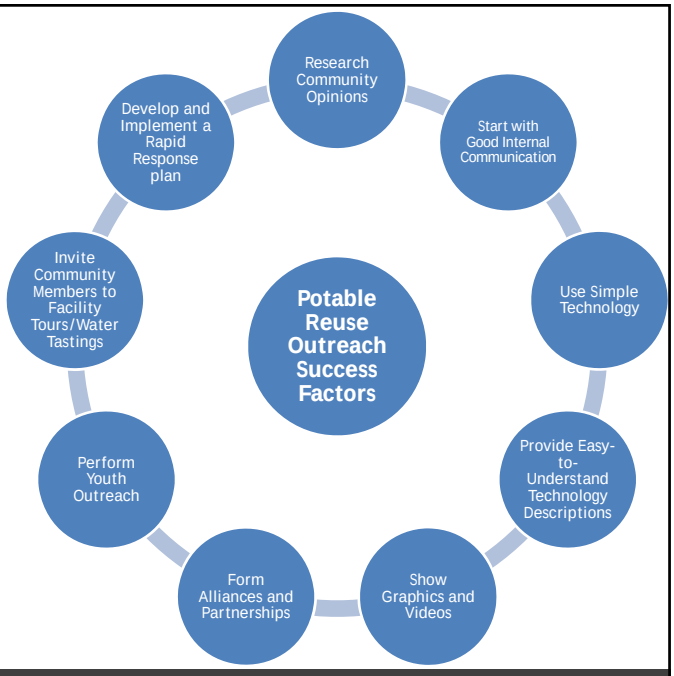
Potable Reuse: All of the Above and More!



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Potable Reuse Successes

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Where to Find Help

- Water Reuse Roadmap (WEF)
- Existing research
- Operating projects
- WEF, WateReuse Association, American Water Works Association

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Modular MBR Facilities

Kevin Dufresne P.Eng.
Product Manager – Decentralized Systems
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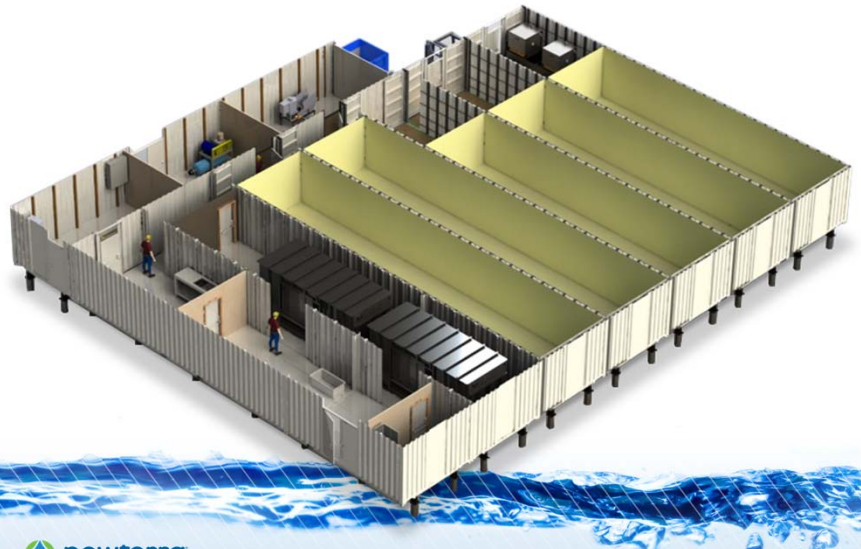
Modular MBR Facilities



Prefabricated for Quick Installation

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Reuse-Ready Modular MBR Facility

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Modular Facilities; Not Packaged Equipment

Designed to be Operated

Designed to be Maintained

Newterra's Modular MBR Facilities - Takeaways

- **Provides the benefits of prefabricated equipment**
  - Cost-effective
  - Compressed project schedule
  - Simplified onsite work
  - Highly scalable
- **Without compromising on performance**
  - High-quality effluent; reuse ready
  - Custom configured for the specific application
  - Full-featured facility
- If you have projects that could benefit from a modular MBR Facility, we want to hear about it


Questions?
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