

# Water Reuse and Desalination: Global Status and Forecast

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**Presented to:  
2009 Idaho Wastewater Reuse Conference**

**May 13, 2009**

**Presented by:  
Richard Atwater, President  
WateReuse Association**

# Topics

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- WaterReuse Association
- Some Basic Facts
- Water Reuse
- Desalination
- WaterReuse Foundation's Research Program
- The Future of Water Reuse & Desalination in the U.S. and Globally
- Conclusions

# WateReuse Association

## *A Trade Association*

### *Four Strategic Initiatives*

- Advocacy (Lobbying) -- National & State
  - Obtain Funding for Local Projects
  - Obtain Funding for Research
  - Influence National Water Policy
- Research (through WateReuse Foundation)
- Education & Outreach (Publications, Conferences)
- Membership

# Membership

- Evolution from State to National to International Association
- Organizational Membership Totals More than 390
- ~180 Water Agency Members
- Virtually all Major Consulting Engineering Firms (e.g., CH2M Hill, Black & Veatch)
- Many Major Equipment Suppliers (e.g., GE Water, Siemens)
- Membership Growing at Approximately 10%/Year

# WaterReuse Association

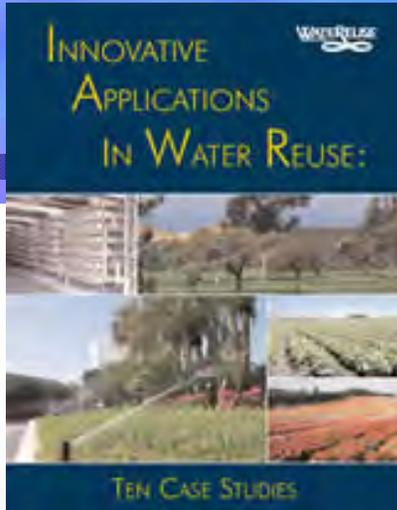
## *Education & Outreach*

- WaterReuse Symposium is Only National Conference Devoted to Reuse

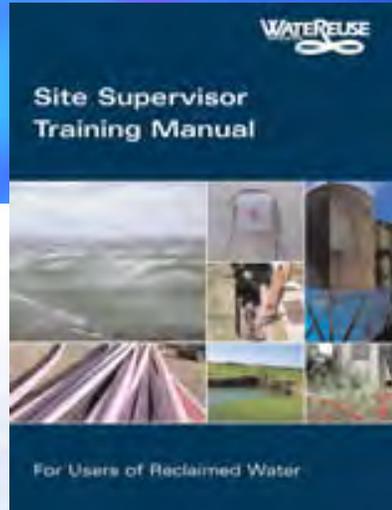
***24th Annual Symposium -- Seattle --  
September 13-16, 2009***

- Communications Workshop Held in Newport Beach on March 27-28
- Several New Publications Being Planned
- ***National Database of Water Reuse Facilities*** Launched in late 2008

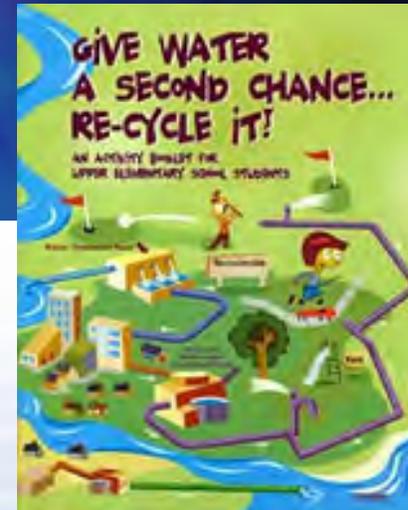
# WaterReuse Association Products



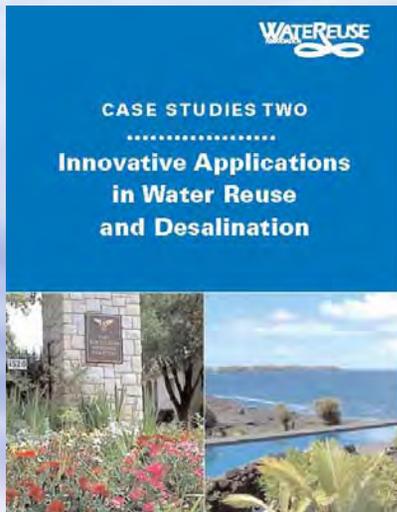
2004



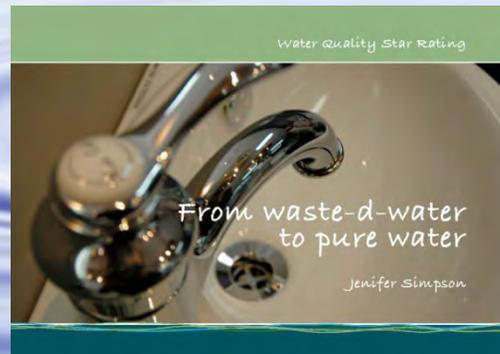
2006



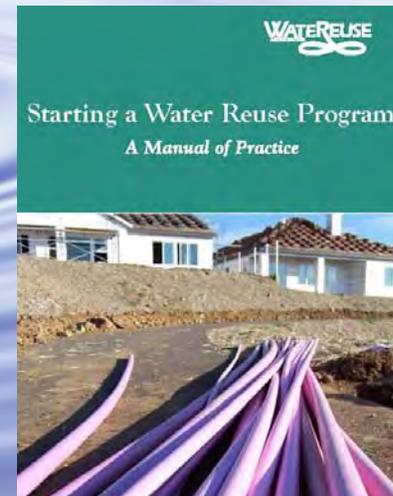
2006



2007



2007



2008

**POTABLE REUSE FOR  
WATER SUPPLY SUSTAINABILITY**  
Critical Today — Essential Tomorrow

November 16-19, 2008  
Hyatt Regency Long Beach  
Long Beach, CA



International  
Water Association

# WaterReuse Australia

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- First International Division of WaterReuse
- Formed through an MOU with WSAA
- Focus is on Shared Experiences, Technology Transfer
- Every Three Years, WaterReuse will Convene a Specialty Conference in Australia
- Currently Have Five Australian Members
  - Sydney Water
  - Melbourne Water
  - Barwon Water
  - ACTEW Corporation
  - South East Water

# Other WateReuse International Initiatives

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- Established International Committee
- Partnered with IWA on Potable Reuse Conference in Long Beach
- Working on an MOU with Singapore PUB
- Will Have a Session Devoted to WateReuse at Singapore International Water Week 2009
- Opportunity to work with U.S. Trade & Development Initiative Administration on China
- WateReuse Foundation Partnering with USEPA, AwwaRF, and WERF on a Technical Conference with Japan in Las Vegas in March '09



*Why Water Reuse and  
Desalination?*

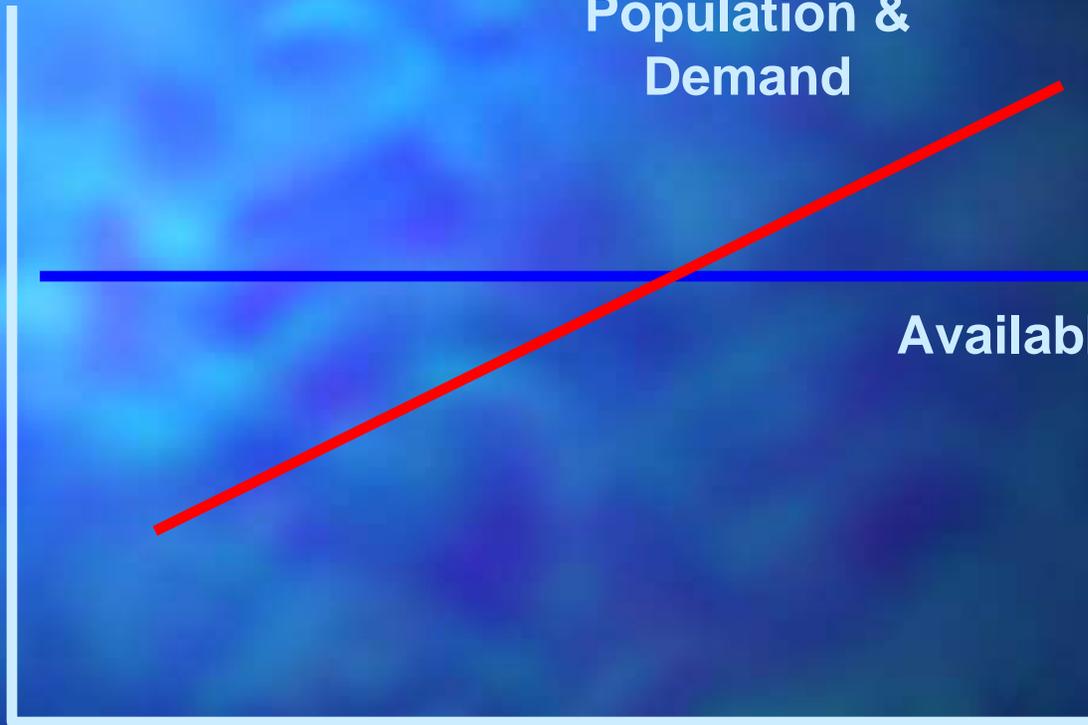
# Supply & Demand

MGD

Population &  
Demand

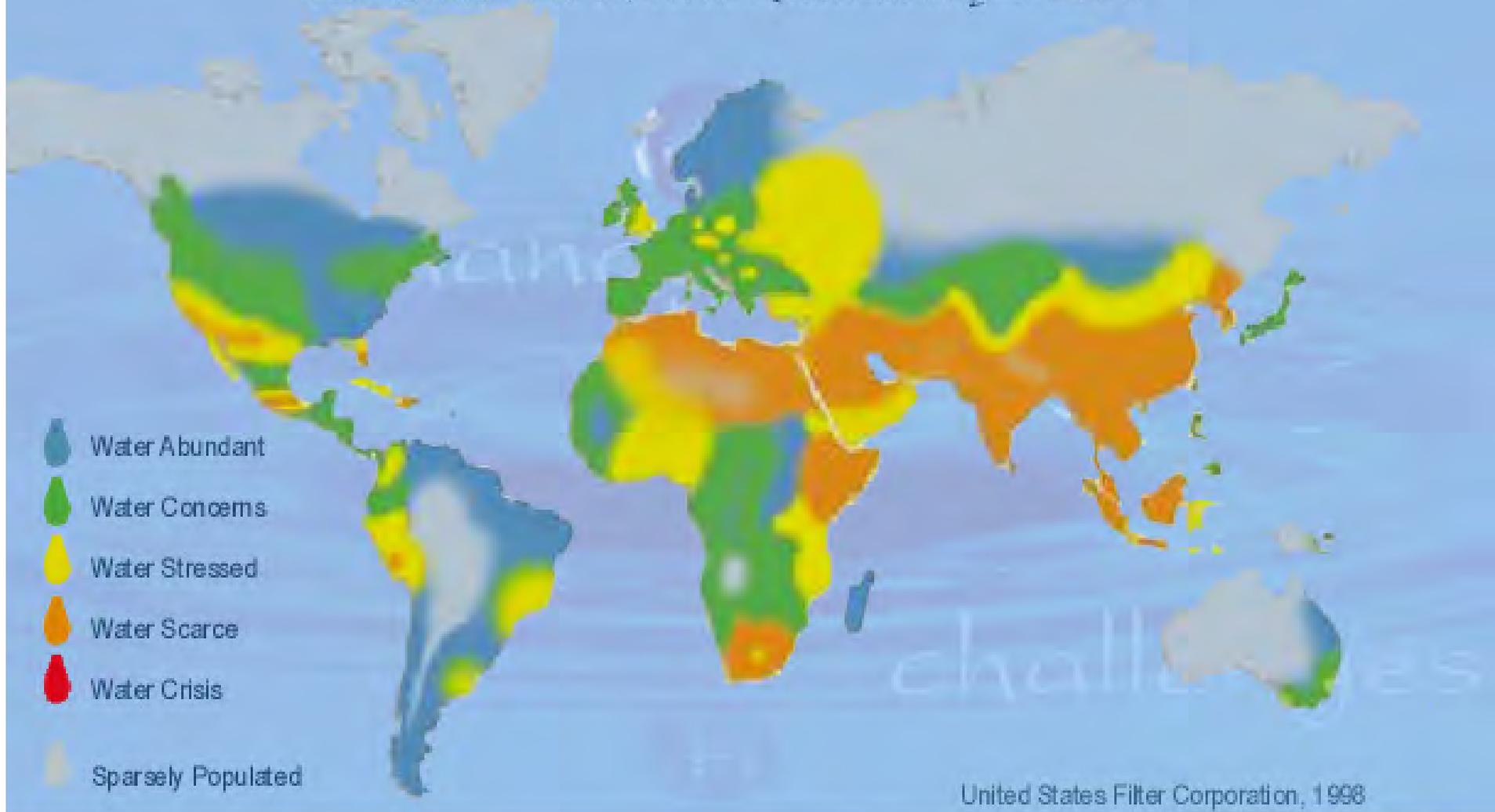
Available Water

Time



# Areas of Water Stress in 2020

Worldwide Fresh Water Availability in 2020



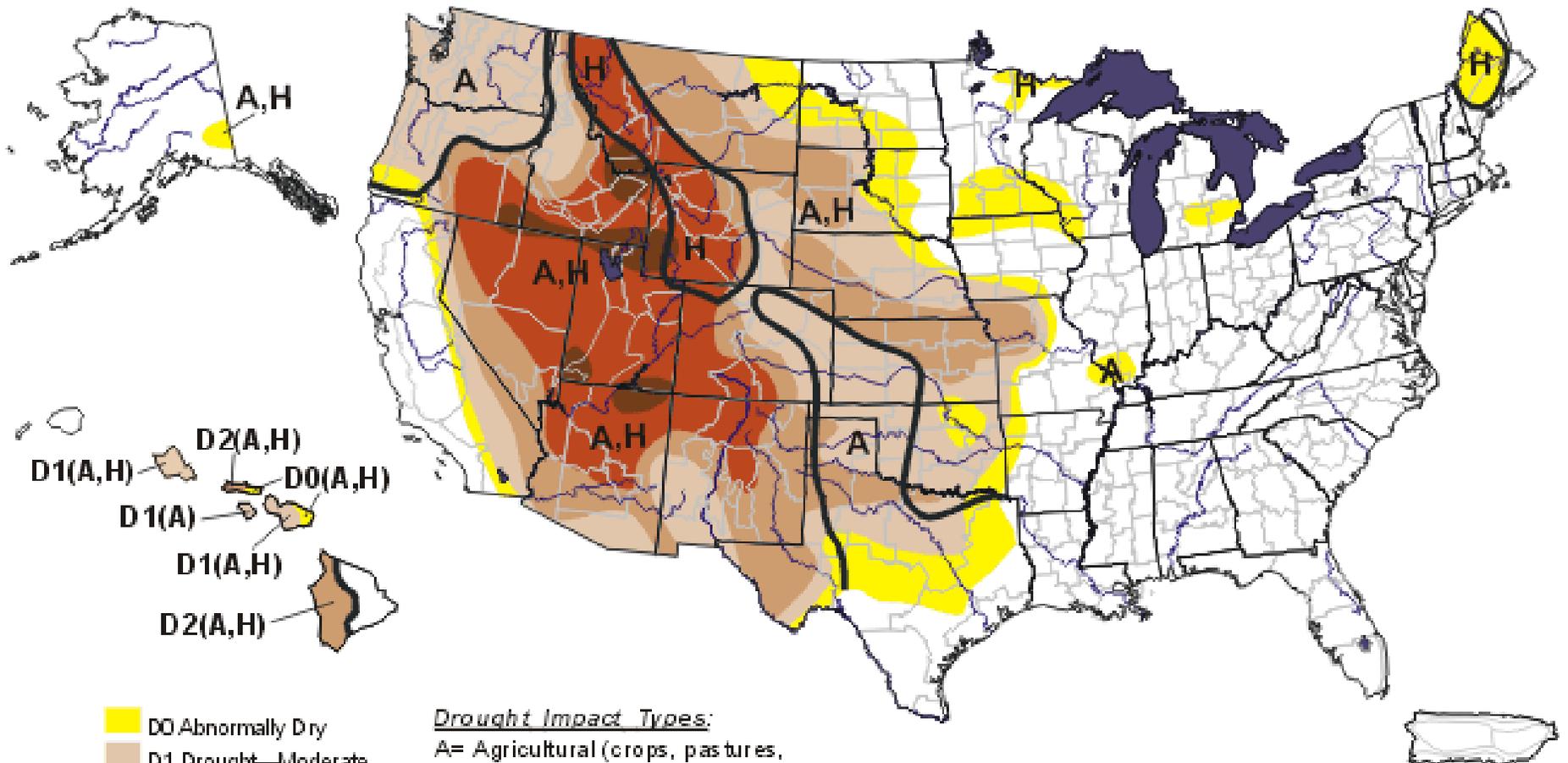
United States Filter Corporation, 1998

Department of the Interior  
Bureau of Reclamation  
Science and Technology Program



# U.S. Drought Monitor

August 5, 2003  
Valid 8 a.m. EDT



- D0 Abnormally Dry
- D1 Drought—Moderate
- D2 Drought—Severe
- D3 Drought—Extreme
- D4 Drought—Exceptional

Drought Impact Types:  
 A= Agricultural (crops, pastures, grasslands)  
 H= Hydrological (water)  
 No type = both impacts  
 — Delineates dominant impacts

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://drought.unl.edu/dm>

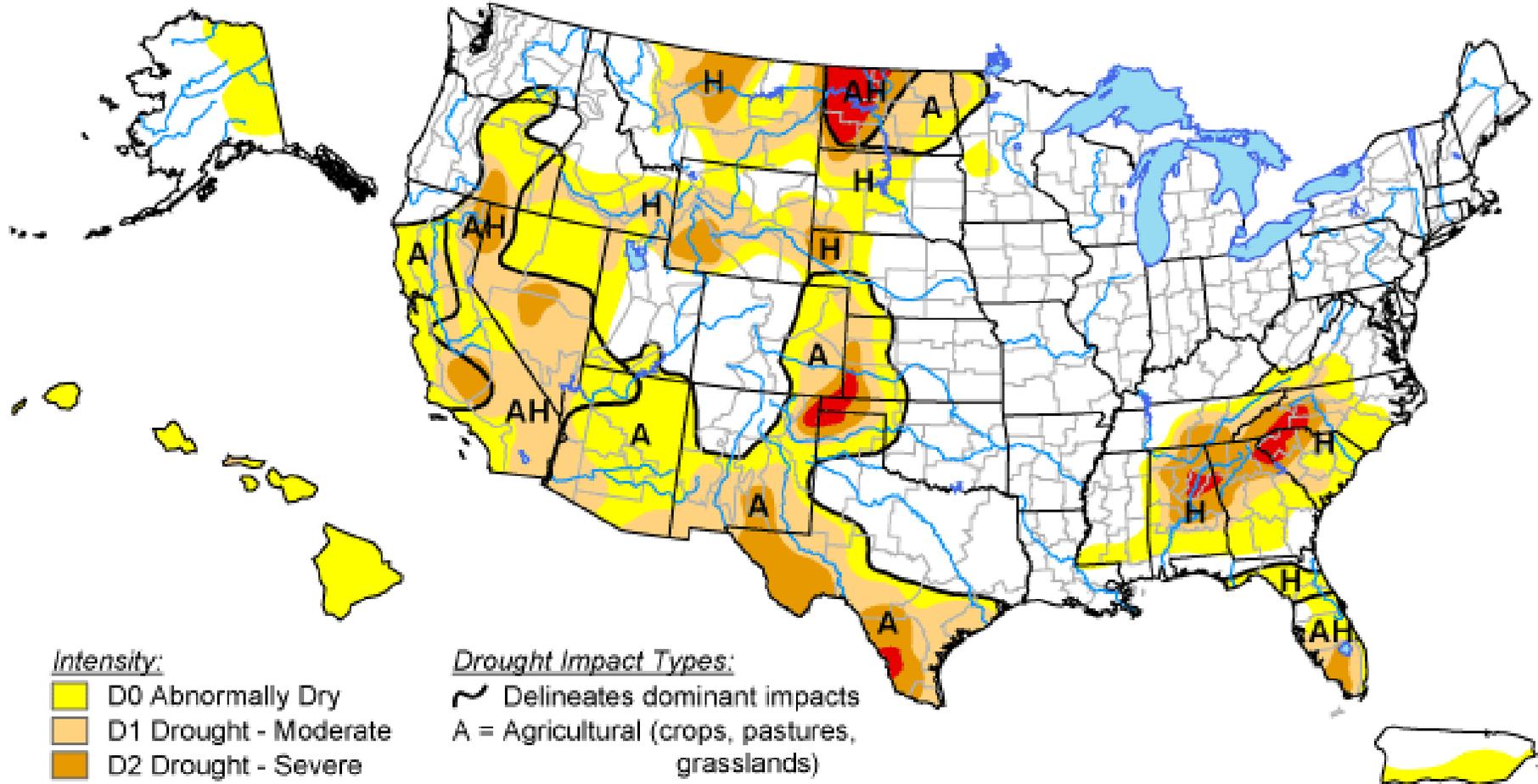


Released Thursday, August 7, 2003  
 Author: Douglas LeCompte, NOAA A/CPC

# U.S. Drought Monitor

May 20, 2008

Valid 8 a.m. EDT



Intensity:

-  D0 Abnormally Dry
-  D1 Drought - Moderate
-  D2 Drought - Severe
-  D3 Drought - Extreme
-  D4 Drought - Exceptional

Drought Impact Types:

-  Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
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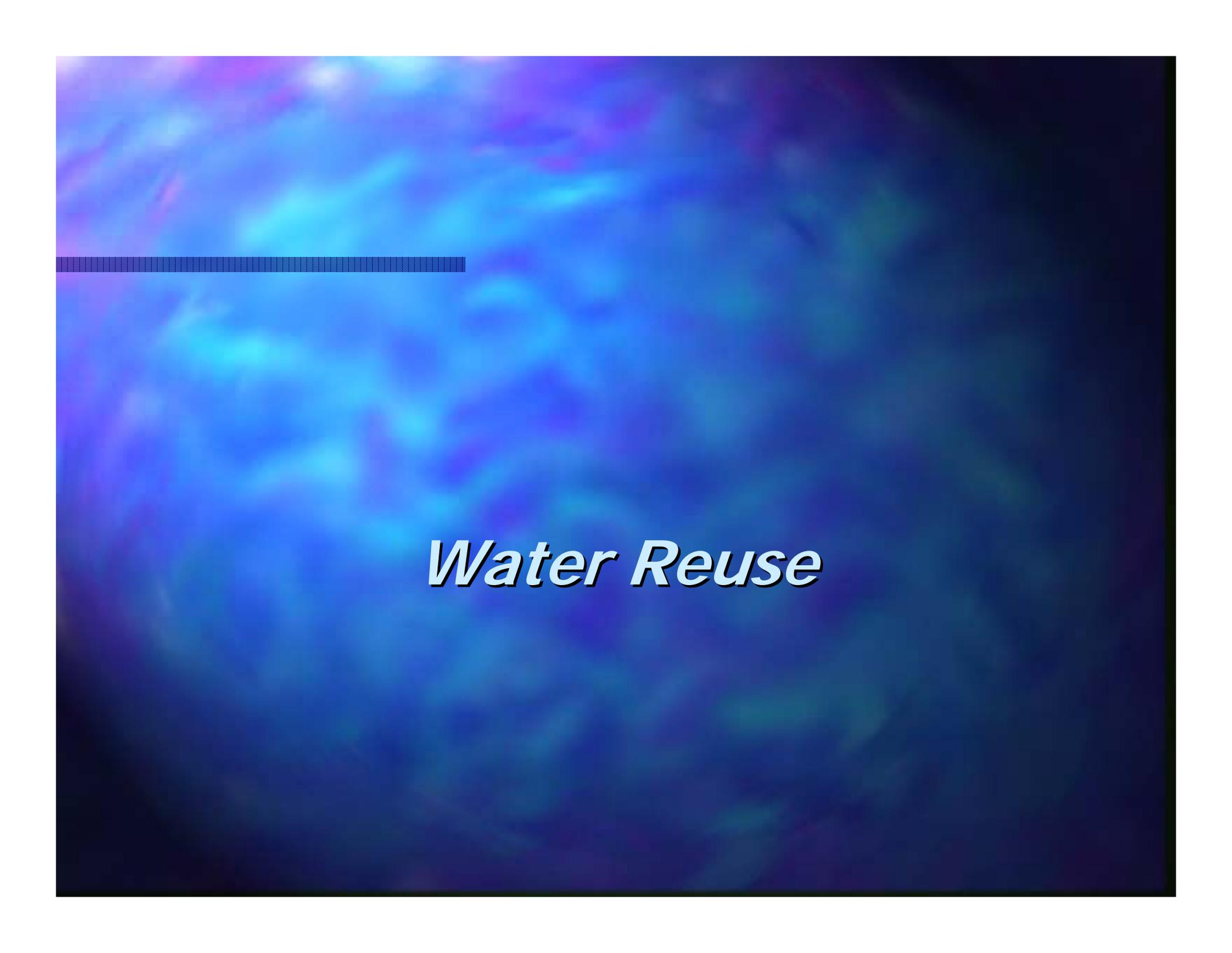
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://drought.unl.edu/dm>



Released Thursday, May 22, 2008

Author: David Miskus, JAWF/CPC/NOAA



# *Water Reuse*

# Some Basic Facts

- All Water is Reused
- There is Substantial Unplanned Reuse (e.g., the Mississippi River, Thames, Rhine, Seine, etc.)
- Water is a Manufactured Product
- "Purity" of Water Should be Matched to its Intended Use
- History of Water is of Little Importance
- In Planned Water Reuse, we Emulate "Mother Nature" – With Technology, can do it better and faster
- Water reuse is "green" and "eco-friendly"

# Factors Driving Water Reuse (and Desalination)

- Drought
- Population growth
- Increased municipal, industrial, and agricultural demand
- Dependence on single source of supply
- TMDLs/Nutrient load caps



“Water scarcity”

# Significant Trends in Water Reuse

- Reuse is Gaining in Prominence Around the Globe (e.g., Australia, Singapore, South Africa, Israel, Spain, Belgium)
- Technology Marches Forward with AOP & MBRs
- Constant Challenge in Public Acceptance Arena
- Research Focus is Now Global
- Climate Change and Energy are Significant Emerging Issues
- Progress Being Made Internationally on Indirect Potable Reuse Front

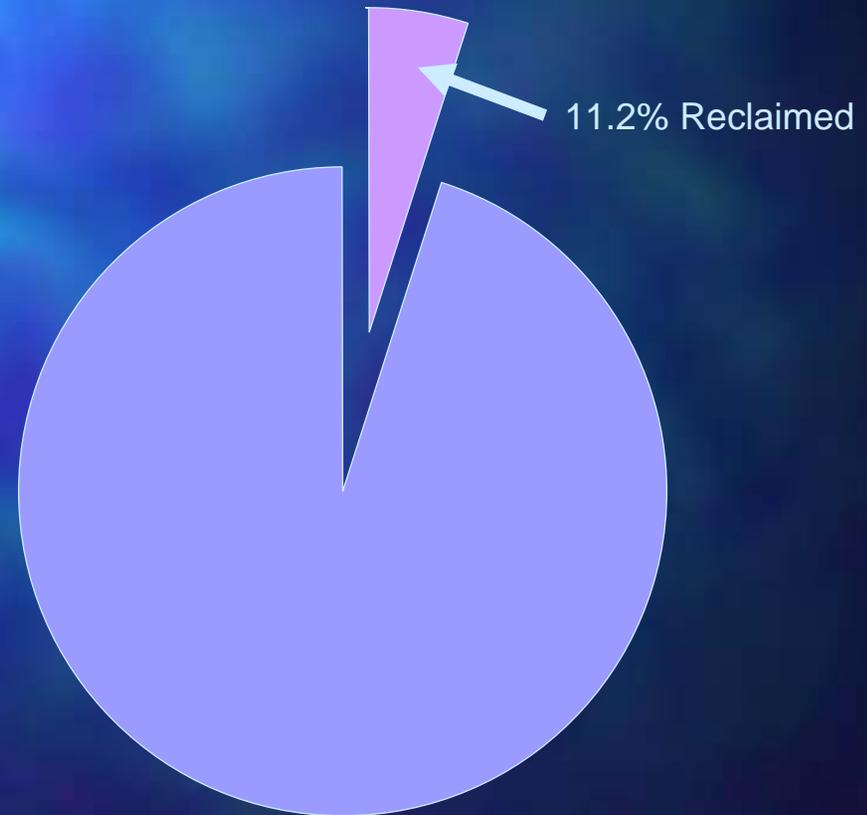
# What is Possible with Water Reuse?

- Answer: Virtually Anything Given Current Technology
- With MF/RO/UV/AOP, Can Produce Water that is Virtually Pure Dihydrogen Monoxide
- Problem is that Technology has Surpassed our Ability to Communicate Effectively with Public
- Need to Resolve Issues with EDCs/PPCPs

# Potential for Water Reuse

- Approximately 11.2% of municipal wastewater effluent in the U.S. is reclaimed and beneficially reused

About 34.9 bgd Municipal Effluent in the U.S.



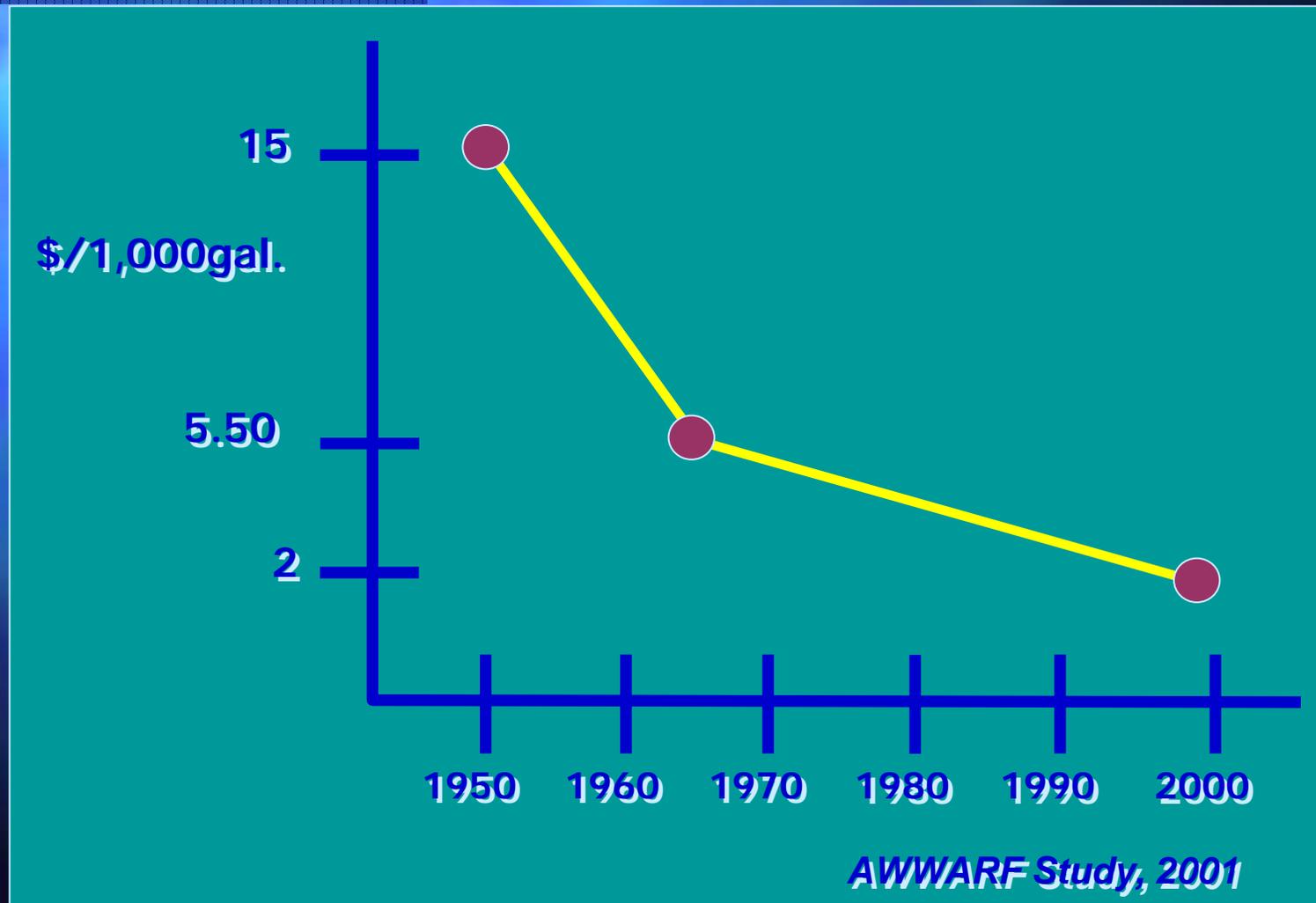
# Best Available Technology

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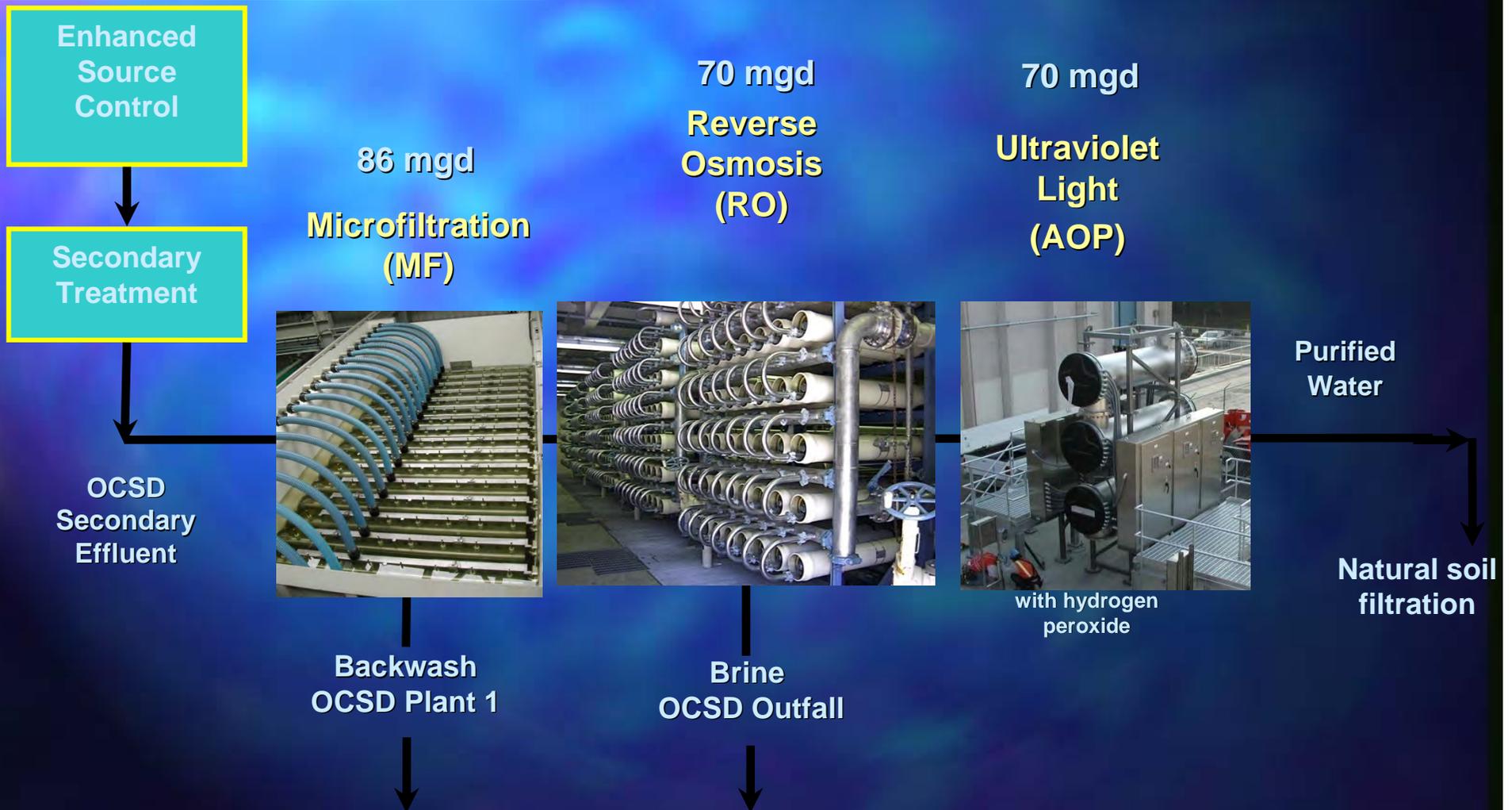
Membranes are the technology of choice around the world today as the “best available technology” for water purification.

- Singapore, Japan, China, Australia, Spain
- Orange County, California
- Tampa Bay, Florida
- Trinidad & Tobago, WI

# Reverse Osmosis Costs



# GWR System (OCWD and OCSD) Advanced Water Treatment Flow Diagram

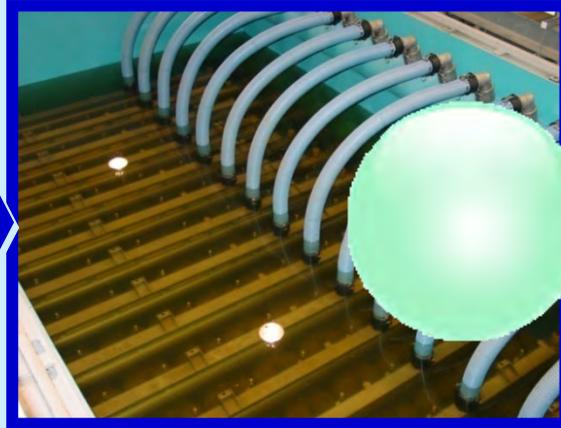


# NEWater Production Process

Reverse Osmosis



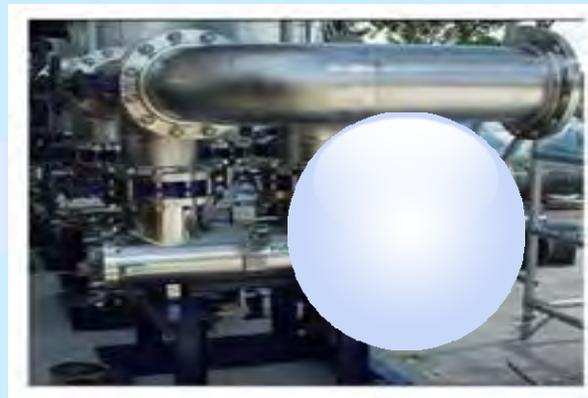
Treated  
Used Water



Microfiltration /  
Ultrafiltration



NEWater



Ultra-Violet





## Desalination Plant - Technology

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- Two stage reverse osmosis, supply and blend wells, collector and transmission pipelines, and deep-well injection concentrate disposal system
- At capacity produces 15.5 million gallons per day (mgd) of permeate and 3 mgd of concentrate
- 16 new blend wells produce 12 mgd
- Concentrate injected into porous rock through 3,000-4,000-ft-deep wells
- Total supply 27.5 mgd

# Applications

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- Landscape Irrigation
- Agricultural Irrigation (Edible & Non-Edible Crops)
- Industrial and Commercial
- Environmental Uses
- Non-Potable Urban Uses (Urinal Flushing in High Rise Buildings)
- Groundwater Recharge
- Potable Water Supply Augmentation

# Benefits

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- Dependable Source of Supply
- Locally Controlled
- Environmentally Friendly
- Low or No Capital Costs
- Augments Existing Supplies

# Regulations and Criteria

- No Federal Regulations
- 28 States Have Water Reuse Regulations
- 2004 U.S. EPA Guidelines for Water Reuse:
  - Recommended treatment processes
  - Water quality limits
  - Monitoring frequencies
  - Setback distances
  - Other controls
- [www.epa.gov/ORD/NRMRL/pubs/625r04108/625r04108.htm](http://www.epa.gov/ORD/NRMRL/pubs/625r04108/625r04108.htm)

# Issues in Water Reuse

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- Public Acceptance
- Unknowns about Chemical Risks
- Poor Differentiation by Public and Politicians of Planned vs. Unplanned Reuse
- The Media
- Lack of Political Support
- More Cost-Effective Technologies
- Funding
- Better Understanding of Economics
- Energy/Water Nexus
- Climate Change

# Public Acceptance of Water Reuse

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- Public generally strongly supports nonpotable uses
- Uses involving no or minimal contact with reclaimed water (e.g., irrigation) are favored
- Acceptance related to knowledge of reuse (e.g., public education and participation programs)
- Acceptance of indirect potable reuse has been problematic in recent years
- Proposed projects in San Diego, East Valley, Dublin San Ramon, and Tampa have been unsuccessful



# *Desalination*

# Meaningful Quote

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*"If we could produce fresh water from salt water at a low cost, that would indeed be a service to humanity, and would dwarf any other scientific accomplishment."*

-- John F. Kennedy  
April, 1961

# Most of World's Water is in the Ocean!

- **97.2 % - Saline Water**
- **2.1 % - Ice Caps & Glaciers**
- **0.6 % - Groundwater**
- **0.1 % - Surface Water & Moisture**

# Desalination Trends

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- Improved membrane performance
- Large diameter membranes
- MF/UF pretreatment
- Improvements in energy efficiency
- Growth in inland BWRO
- Larger capacity plants = economies of scale

# Issues in Desalination

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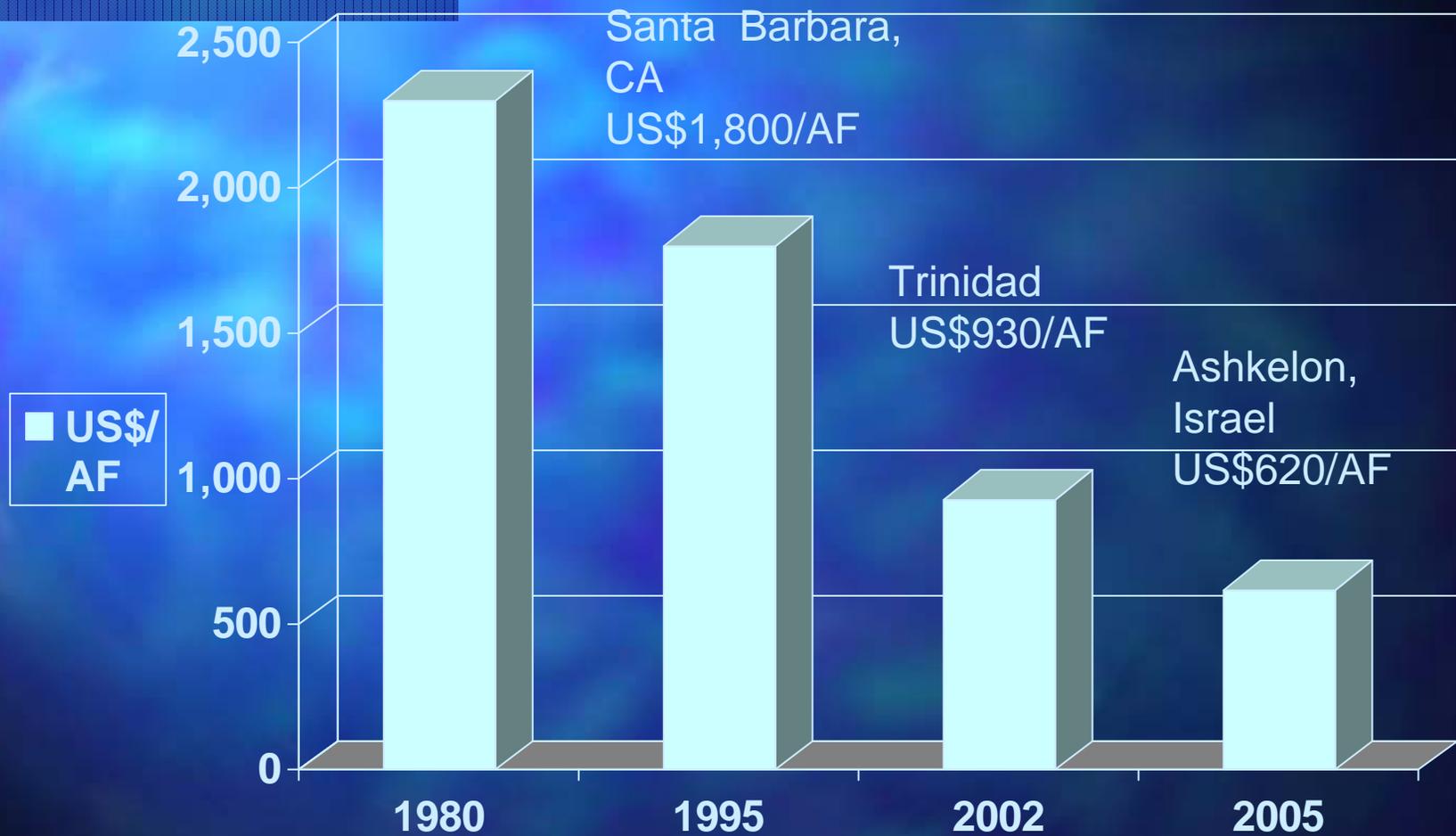
- Environmental: Impingement/Entrainment, Disposal of Concentrate
- Technical: Fouling of Membranes
- Cost: Energy Intensive
- Energy: Greenhouse Gas Emissions
- Institutional: Environmentalists Oppose in CA; Allege it's Growth Inducing
- Alternative Technologies: What is Beyond Membranes

# Desalination Is On the Rise!

- Over 17,000 Desalination Plants in 120 Countries Worldwide
- Total Production Capacity Today – 38 MM m<sup>3</sup>/day (1% of World's Drinking Water Supply)
- US\$10 Billion Investment Expected in Next 5 Years to Add 6 MM m<sup>3</sup>/day of New Desalination Capacity Worldwide
- Total Desalination Capacity Expected to Double by Year 2015
- RO Desalination - Dominating Technology

Source: Nikolay Voutchkov -- Poseidon Resources Corporation

# Desalination Costs Were Falling until 2005





*WaterReuse Foundation*

# Mission Statement

“The mission of the WaterReuse Foundation is to conduct and promote applied research on the reuse, reclamation, recycling, and desalination of water.”



# Identifying High Priorities of Subscribers & Stakeholders

- WRF RAC Strategic Planning Session
  - 24 Priority Questions Developed and Ranked
- Survey Sent to Subscribers/Stakeholders
  - 30+ Responses received
  - List of 10 priority questions generated
- Research Needs Assessment Workshop
  - 65 experts identify high-priority research projects
  - Policy/Social Sciences, Micro, Chemistry, Treatment
  - 85 projects developed based upon 10 priority questions



# 2008 Solicited Research Projects

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- Investigation of Social, Environmental, Natural and other Informational Factors that Influence Judgments and Decisions about Water Reuse
- Approaches to Maintain Consistently High Quality Reclaimed Water in Storage and Distribution Systems
- Use of Ozone in Water Reclamation for Contaminant Oxidation
- Evaluation of Alternatives to Domestic Ion Exchange Water Softeners
- Disinfection Guidelines for Satellite Water Recycling Facilities
- Implications of Future Water Supply Sources on Energy Demands (CEC)

# Snapshot of 2007 Approved Research Projects

- Talking about Water: Vocabulary and Images that Support Informed Decisions About Water Recycling
- Recycled Water Use in Zoo and Wildlife Facility Settings and Potential Effects on Animal Health and Well Being
- Evaluation & optimization of existing and emerging energy recovery devices for desalination and membrane treatment plants (CEC)
- Renewable energy, peak power management, and optimization of advanced treatment to reduce greenhouse gases at water reuse/desal facilities (CEC)
- Assess water use requirements and establish water quality criteria needed for application of water reuse in energy, power, and biofuels production (CEC)

# Research Partnerships

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- U.S. Bureau of Reclamation
- Global Water Research Coalition
  - Funding *Water Reuse in 2030* jointly with WSAA and Singapore PUB
- CA State Water Resources Control Board
- CA Department of Water Resources, Sandia, AwwaRF on Desalination
- California Energy Commission
- Southwest Florida Water Management District



*Conclusions & Future  
Forecast*

# Conclusions

- Water Reuse and Desalination are “the last rivers to tap”
- They are both Key Components of Water Supply in 21st Century
- Public Acceptance is Key to Widespread Water Reuse
- Desalination Issues Can Only be Resolved through Applied Research
- National Governments Need to Provide Leadership

# The Future

- Indirect Potable Reuse is Inevitable
- Increased Desalination – both Brackish Groundwater and Seawater – Also is Inevitable
- Education & Outreach/Stakeholder Involvement is Key to Acceptance of Water Reuse
- Public Should Not Hold Recycled Water to Higher Standard than Drinking Water
- Efficacy of Technology is Not an Issue
- Concerns About EDCs/PPCPs Must be Addressed
- Research is Key Component

# Thank you

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Wade Miller

Executive Director

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