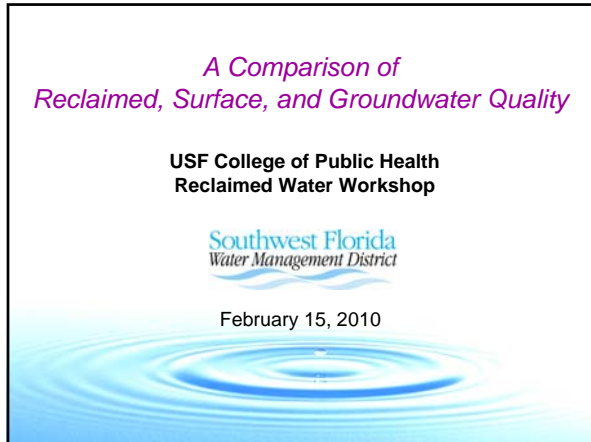


A Comparison of Reclaimed, Surface, and Groundwater Quality

**USF College of Public Health
Reclaimed Water Workshop**

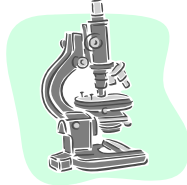
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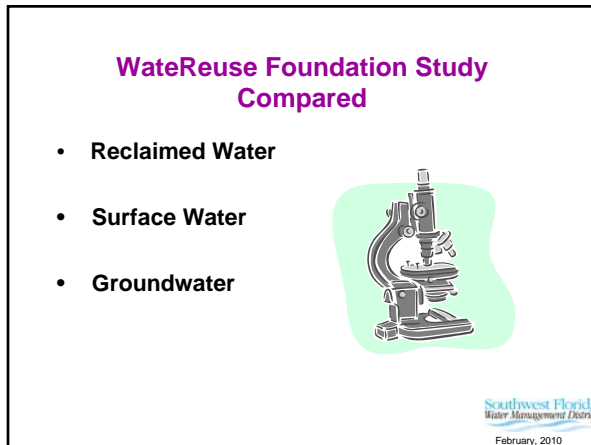


WaterReuse Foundation Study Compared

- **Reclaimed Water**
- **Surface Water**
- **Groundwater**



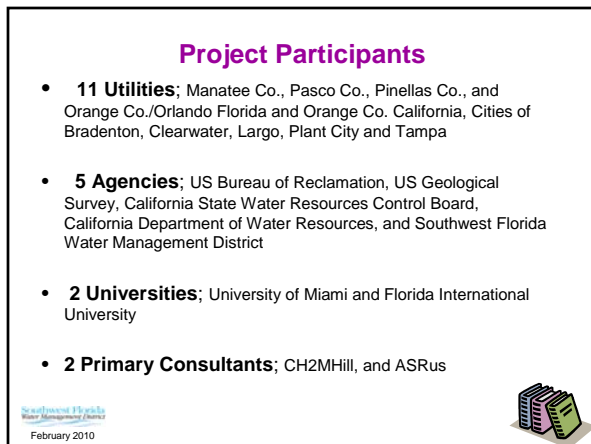
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Project Participants

- **11 Utilities;** Manatee Co., Pasco Co., Pinellas Co., and Orange Co./Orlando Florida and Orange Co. California, Cities of Bradenton, Clearwater, Largo, Plant City and Tampa
- **5 Agencies;** US Bureau of Reclamation, US Geological Survey, California State Water Resources Control Board, California Department of Water Resources, and Southwest Florida Water Management District
- **2 Universities;** University of Miami and Florida International University
- **2 Primary Consultants;** CH2MHill, and ASRus

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Project Team

(7 Internationally Renowned Members)

- **Theresa Slifko, PhD,** LA Sanitation District
- **Kimberly Kunihiro,** Orange Co. Fl
- **James Englehardt, PhD, P.E.,** Univ. of Miami
- **Piero Gardinali, PhD,** Florida International Univ.
- **Michael Meyer, PhD,** USGS
- **David York, PhD, P.E.,** (formerly of FDEP)
- **James Crook, PhD, P.E.** (independent consultant)

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Focus of Study

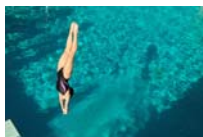
- Pathogens
- Pharmaceuticals
- Personal Care Products
- Other Microconstituents



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Perspective on Size

- Part Per Million=
1 grain of sand in a teacup full of sand
- Part Per Billion=
1 grain of sand in a wheelbarrow full of sand
- Part Per Trillion=
1 grain of sand in a swimming pool full of sand



Samples

- **Reclaimed Water;** Manatee Co., Pasco Co., Pinellas Co., and Orange Co./Orlando Florida and Orange Co. California, Cities of Bradenton, Clearwater, Largo, Plant City and Tampa
- **Surface Water;** Manatee River, Braden River, Hillsborough River, Stream in Los Angeles CA, Lake in Pasco Co., Lakes in Pinellas Co., Lakes in Orange Co., Lakes in Largo, Lake in Clearwater, and a Lake in Plant City
- **Groundwater;** Manatee Co., Pasco Co., Pinellas Co., Bradenton, Clearwater, Plant City, Tampa, Orlando/Altamonte Springs, and in Los Angeles CA

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Main Findings

- No significant differences in health risks between water types.
- Reclaimed water can safely be used on lands within critical (drinking water) watersheds.
- Reclaimed water was generally not found to cause the quality of surface water to be significantly different.
- The primary difference between waters is that reclaimed water is disinfected and thus has a higher level of disinfection-by-products.
- Constituents have multiple pathways into the environment and many are now ubiquitous in the environment.

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Some Surprising Results

- DEET (a bug repellent), and Caffeine were found in all water types and virtually in all samples
- Triclosan (in anti-bacterial soap & toothpaste) was found in all water types
- Halocedric acids (a disinfection by-product) were found in all water types



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Results

(Published in May 2009)

- Study results indicate that reclaimed, surface, and groundwaters are more similar than dissimilar with regard to microconstituents.

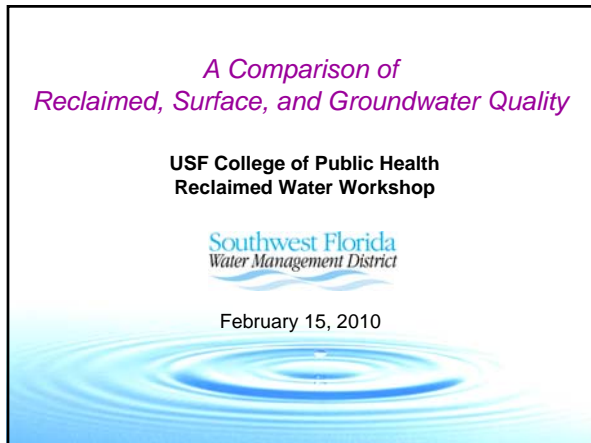
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Water Management District

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Perspective on Water Quality

- Arsenic Highest in Groundwater (p.67)
- Mercury Highest in Surface Water (p.68)
- Ammonia (nutrient) Highest in Groundwater (p. 71)
- Atrazine (pesticide) Highest in Surface Water (p.123)
- Bisphenol A (endocrine disruptor) Highest in Surface Water (p.123)

"The presence of such things as pharmaceuticals, hormones and steroids, volatile organics, nutrients, microbiologicals and synthetic organic chemical constituents alone is not an indictment of reclaimed water use." (p. 125)

Perspective on Reclaimed Water Nutrients

- 20 years of reuse *no negative effect on groundwater quality* (WEF, 2008 Loxahatchee)
- *No correlation* between reuse application and phosphorus levels in groundwater (USGS, 1990 Reedy Creek)
- *Nitrogen levels similar* between reuse sites and groundwater irrigation sites (USGS, 1982 Tarpon Springs)
- Reuse irrigation resulted in *effective nitrogen removal* (USGS, 1979 St. Petersburg)
- *No nitrogen or phosphorus detected* under study site (USGS, 1977 Lakeland)