EPA

Office of Research and Development

Safe and Sustainable Water Resources Research Program

Suzanne van Drunick, Ph.D.
National Program Director

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Where does the National Water Program need to be in 5 - 10 years?

CWA and SDWA provide EPA with the national framework and authority for our many regulatory, financial, partnership, and assistance efforts to support two key "Protecting America's Waters" objectives:

Protecting Human Health and Protecting

Restoring Watersheds and Aquatic Ecosystems

The "new normal" threats and challenges to clean water supply and healthy ecosystems require new, more dynamic solutions.

Examples of "New Normal" Challenges

- Cyanotoxins and HABs
- Aging infrastructure
- Unchecked proliferation of impervious surfaces
- Drought and flooding
- Threats to water supply
- Population change

Key Research Needs/Priorities

Emerging Contaminants

- Implications of emerging contaminants and pathogens on aquatic life and human health, and water reuse
- Mixtures/groups of contaminants
- Pharmaceuticals, nanoparticles, microplastics
- Broader knowledge about the impacts of climate change/variability and how we address their impacts on contaminants and pathogens

Key Research Needs/Priorities

Green Infrastructure:

- Advancing GI implementation in communities
- Understanding GI benefits, including air quality impacts
- How will groundwater be impacted? How do we protect it?
- How will climate scenarios impact green infrastructure function and maintenance?

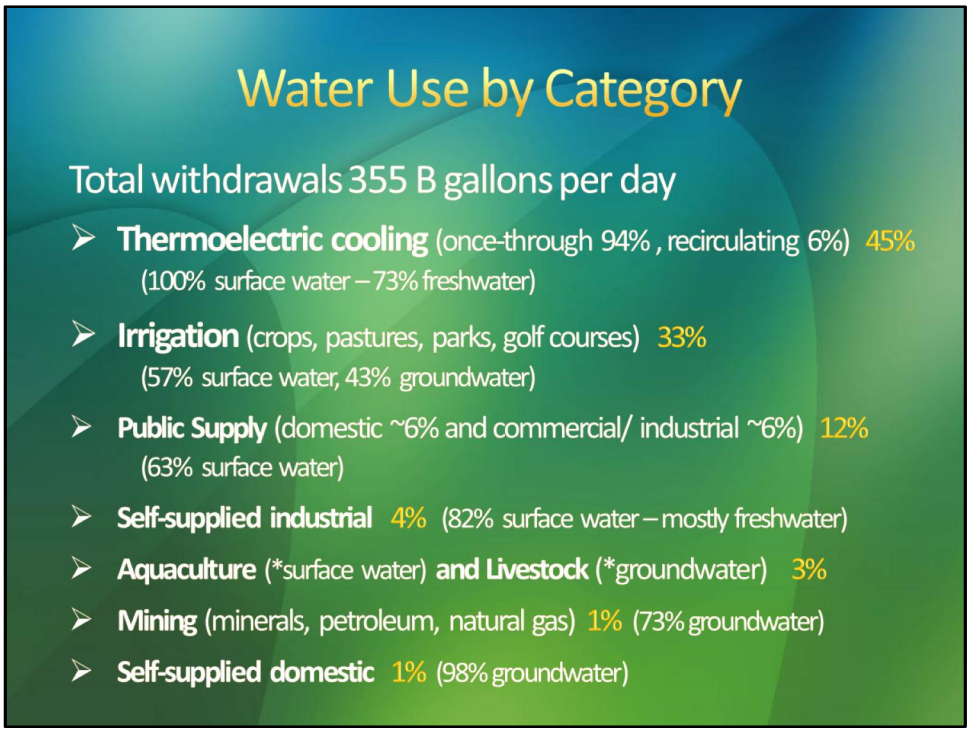
Wet Weather:

How do we manage / protect water and wastewater quality under scenarios of more violent, more impactful storm events and still meet discharge requirements?

Systems-Level Solutions

One of our biggest challenges is to think broadly at a systems level about protecting and restoring the services water and aquatic ecosystems provide, and regulate in an effective, efficient, and scientifically sound manner.

Example – solutions to replace aging infrastructure or build new infrastructure take into consideration population change, energy and cost efficiency, and resilience to extreme weather events.



Thermoelectric: water for thermoelectric is used in the process of generating electricity using steam-driven generators. **~Large volumes of water are needed for cooling in thermoelectric plants which is why they are usually located near coasts, large lakes or large rivers. But what if they didn't have to be?**

Public supply = 63% surface water
Domestic = 57% of public supply withdrawals (DW, sanitation, landscape watering) = ~6-7% total withdrawals. Commercial/Industrial ~5-6%

Self supplied Industrial (manufacture and produce food, paper, chemicals, refined petroleum, wood products, primary metals).

Aquaculture (primarily surface water) and Livestock (primarily groundwater)

Mining; solids minerals (copper), liquids (petroleum), natural gas, injection of water for unconventional oil and gas recovery (HF). **73% comes from groundwater of which 58% was saline**

Self supplied Domestic: 1% of total withdrawals, >98% from groundwater, serving **~14% US population.**

Trends in Water Use by Category

2005-2010

- Thermoelectric - **20%**
- Irrigation - **9%**
- Public supply - **9%**
- Self supplied Industrial - **12%**
- Livestock - **7%**
- Aquaculture + 7%
- Mining + 39%

Agriculture and Thermoelectric Cooling

1) Largest proportion of withdrawals (78% combined)

2) High potential for more efficient use (~30% combined)

3) Vulnerability - water availability and predictability will be altered by changing temperatures, shifting precipitation patterns, and more extreme weather.

- Energy - rising temperatures increase demand for electricity and decrease efficiency and capacity of thermoelectric generation
- Agriculture - rising temperatures, more frequent and intense drought, and higher ET increase increases irrigation demand

Nontraditional Waters

Reclaimed water and other sources of non-potable quality water

Current Sources

- Municipal wastewater
- Grey water
- Rainwater
- Brackish/saline water
- Impaired groundwater

Potential Sources

- Stormwater
- Field surface runoff
- Agricultural return flows
- Food processing wastewater
- Animal/ animal facility wastewater
- Vegetable/egg wash water
- Plant processing water
- Cooling equipment blowdown water
- Flowback/produced waters

Current and Potential Utilization

- Thermoelectric cooling
- Stack scrubbing
- Oil and gas production
- Carbon sequestration
- Geothermal power generation
- Various industrial processing
- Irrigation for crops, pastures, turf and biofuels
- Livestock watering
- Vegetable and egg washing
- Agriculture equipment and facility washing
- Firewater
- Frost/freeze protection

Benefits

- Freshwater preservation
  - Quantity
  - Quality – less wastewater discharged to surface waters and groundwater for improved potable use and ecosystem health
- Cost
  - Less expensive to purchase
  - Nutrient-rich for agriculture
  - Wastewater disposal savings (produced and flowback waters from oil/gas activities)
  - Retrofitting thermoelectric systems for nontraditional waters is less than for dry-cooling technologies

Benefits, continued

- Security
  - Source water during drought and extreme high temperatures
  - Increase flexibility of proposed energy plants and agriculture facilities
- Minimize roadway traffic at oil and gas development sites (noise, air quality, safety, fuel to transport)
- Reduce saltwater intrusion into aquifers from excessive groundwater drawdown

Barriers

- Unmatched regional supply and demand
  - Variable water quantity and quality demand by users
  - Short-term and regional variations in water quantity and quality supply
- Water transportation costs
- Limited characterization and water use data in energy sector
- Health concerns - food contamination and aerosol drift
- Reduced soil and crop health
- Identification and disposal of final waste products
- Real-time monitoring capabilities
- Treatment technologies - total dissolved solids
- Equipment damage – corrosion, scaling, biofouling

Barriers, continued

- Downstream water rights
- Institutional – complex structures and fragmented policies of federal, state, tribal and local agencies
  - **30 agencies across 10 different departments generate guidelines and policy for water management**
  - **impacts of multiple sectors**
  - **no single agency responsible for impacts of multiple sectors**
- Social acceptance

Opportunities

- Research
  - Microbial risk assessments to molecular epidemiology, occupational exposure, and contaminant biouptake studies (lab and field)
  - Treatment/pretreatment technologies and processes
- Federal Activities
  - Develop treatment and water quality guidelines for various end use
  - Challenge competitions
  - USDA-EPA Water for Agriculture
    1. Water Availability for Diverse Agricultural Uses: The Right Water for the Right Place and Times
    2. Understanding the Human Health Impacts to Exposure from Nontraditional Water Used in Agriculture.

Opportunities

- **Public-Private Partnerships** (regional authorities, federal/state agencies, private utilities, agriculture, NGOs, general public)
  - Address barriers of unmatched regional supply and demand, water transportation costs, water characterization information (composition, quantity, and end use)
  - Promote the benefits of nontraditional water use
  - Incentivize the use of nontraditional waters

    Example: incorporate with other market-based approaches (water banking, ecosystem goods and services credits, habitat credits, Blue Carbon credits, water quality trading credits?)
  - Implement a systems approach to assessment and management of nontraditional waters for reuse that explores environmental, social, and economic aspects.


Thank you!
Vandrunick.Suzanne@epa.gov