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Safe and Sustainable Water Resources

Joint SAB/BOSC Meeting June 29-30, 2011

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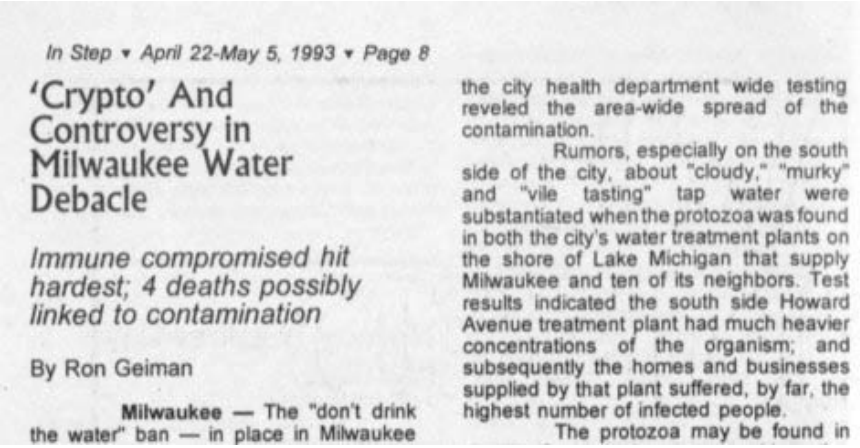
Problem Definition - 20th Century Challenges and 40 Years of Progress in Protecting Aquatic Resources

Cuyahoga River, 1969

Love Canal, 1978

Acid Rain impacts to water quality



In Step ▾ April 22-May 5, 1993 ▾ Page 8

'Crypto' And Controversy in Milwaukee Water Debacle

Immune compromised hit hardest; 4 deaths possibly linked to contamination

By Ron Geiman

Milwaukee — The "don't drink the water" ban — in place in Milwaukee

the city health department wide testing reveled the area-wide spread of the contamination.

Rumors, especially on the south side of the city, about "cloudy," "murky" and "vile tasting" tap water were substantiated when the protozoa was found in both the city's water treatment plants on the shore of Lake Michigan that supply Milwaukee and ten of its neighbors. Test results indicated the south side Howard Avenue treatment plant had much heavier concentrations of the organism; and subsequently the homes and businesses supplied by that plant suffered, by far, the highest number of infected people.

The protozoa may be found in

1993 Cryptosporidium outbreak

Problem Definition - 21st Century Challenges

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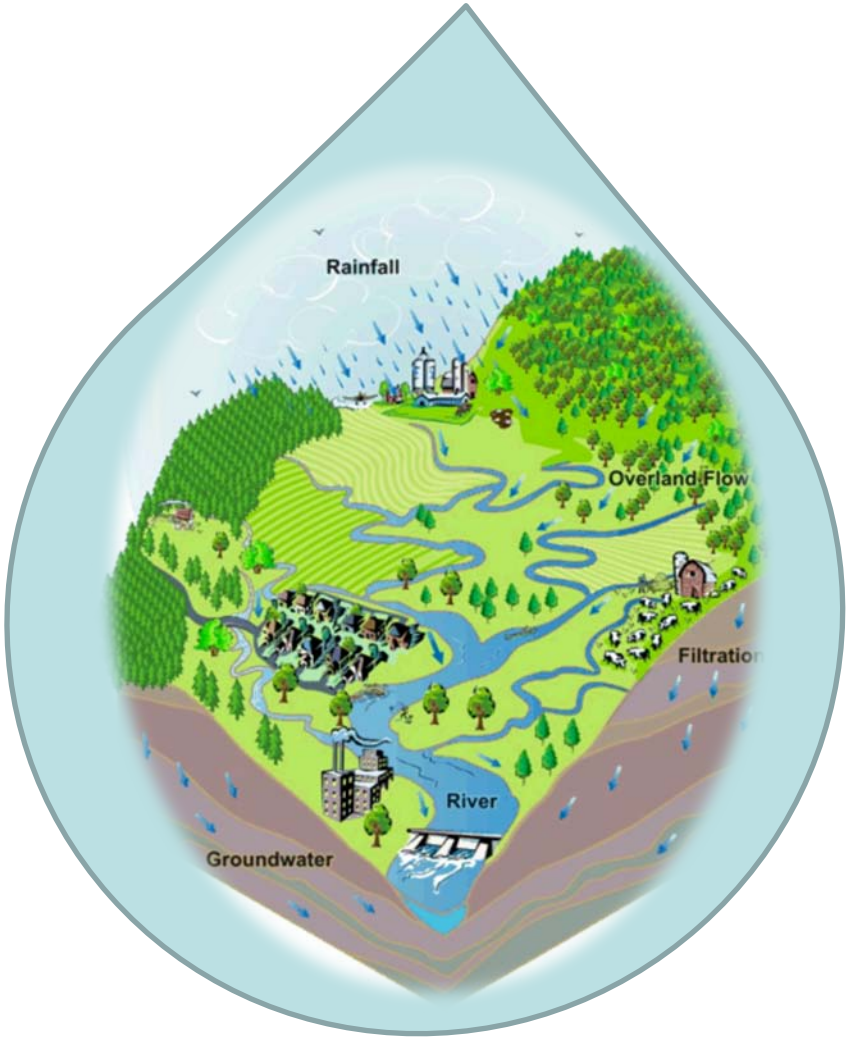
- Rate of waters listed for impairment exceeds rate at which they are being restored
- Causes of degradation are more complex; less visible
- Multiple sources of pollution requiring new, innovative approaches
- Key challenges include
  - aging water infrastructure - pathogens
  - legacy and emerging contaminants - nutrients
  - competing demands for water

Problem Definition -

Water resources are not sustainable using 20th century approaches to address 21st Century problems

Goal of EPA Safe and Sustainable Water Resources (SSWR) Research Program:

- Seek sustainable solutions to 21st century problems facing our Nation's water resources
- Integrate the existing Drinking Water and Water Quality research programs into one holistic program



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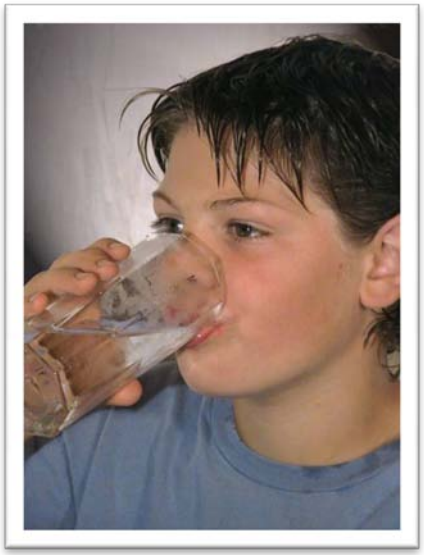
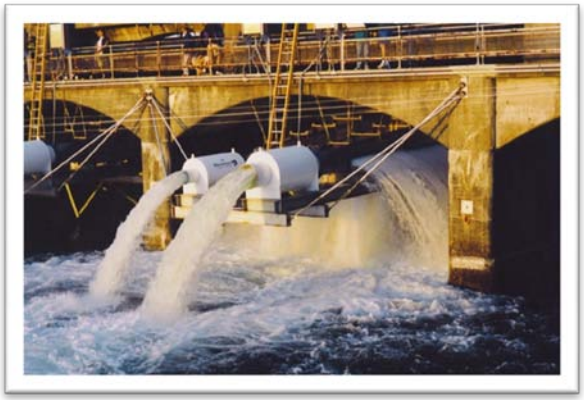
Why Integrate?





Problem Definition - Overarching Goals

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- Protect public health and the environment
- Provide safe and sustainable water to meet societal, economic and environmental needs
- Water resources are managed in a sustainable manner that:
  - integrates drinking water, wastewater, stormwater, and reclaimed water;
  - maximizes energy production, nutrients and materials management, and water recovery; and
  - incorporates comprehensive water planning (such as low impact development and smart growth) and optimum combinations of built, green and natural infrastructure

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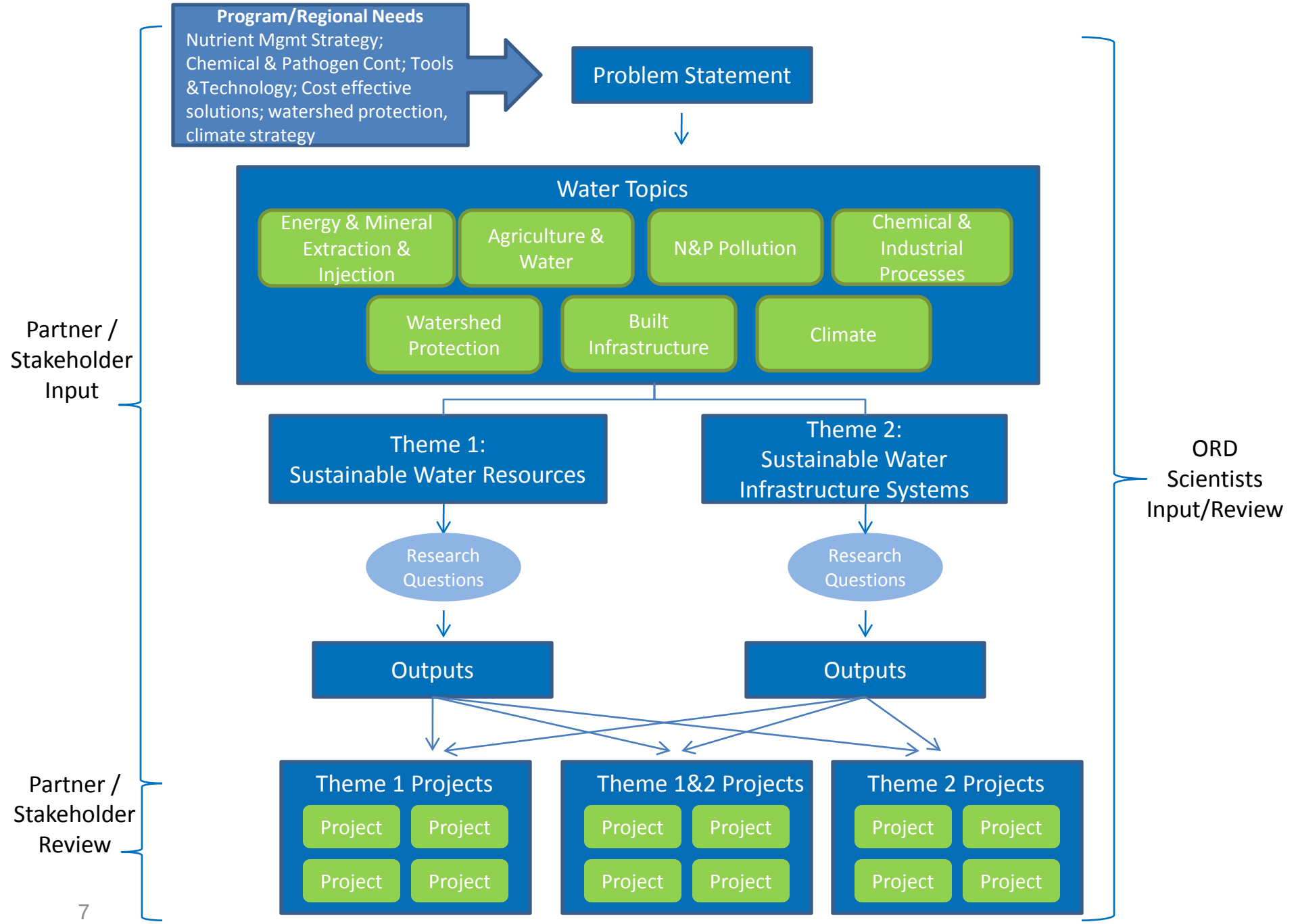
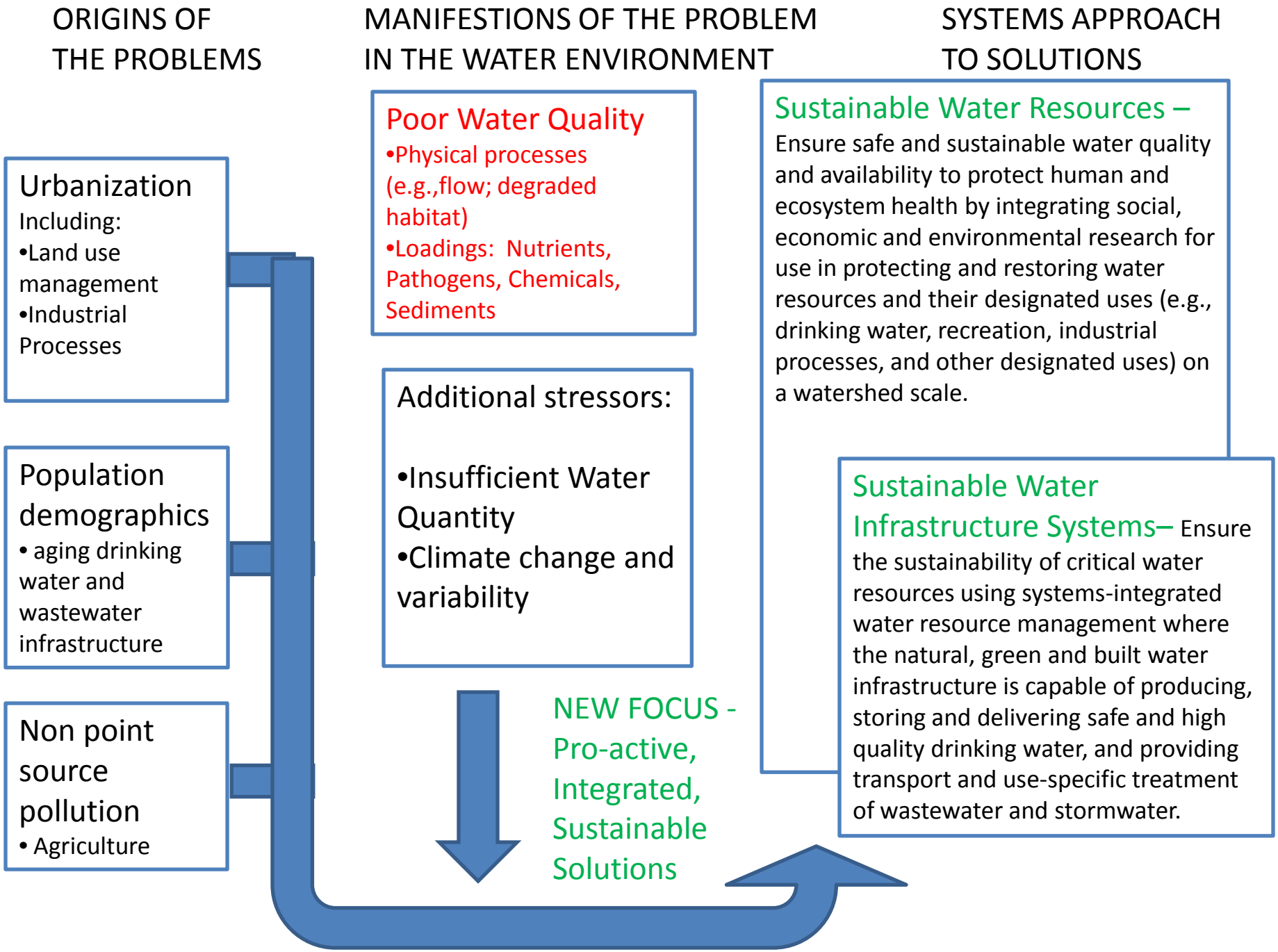
Problem Statement

Increasing demands for sources of clean water combined with changing land use practices, growth, aging infrastructure, and climate change and variability, pose significant threats to our Nation's water resources. Failure to manage our Nation's waters in an integrated, sustainable manner will limit economic prosperity and jeopardize both human and aquatic ecosystem health.

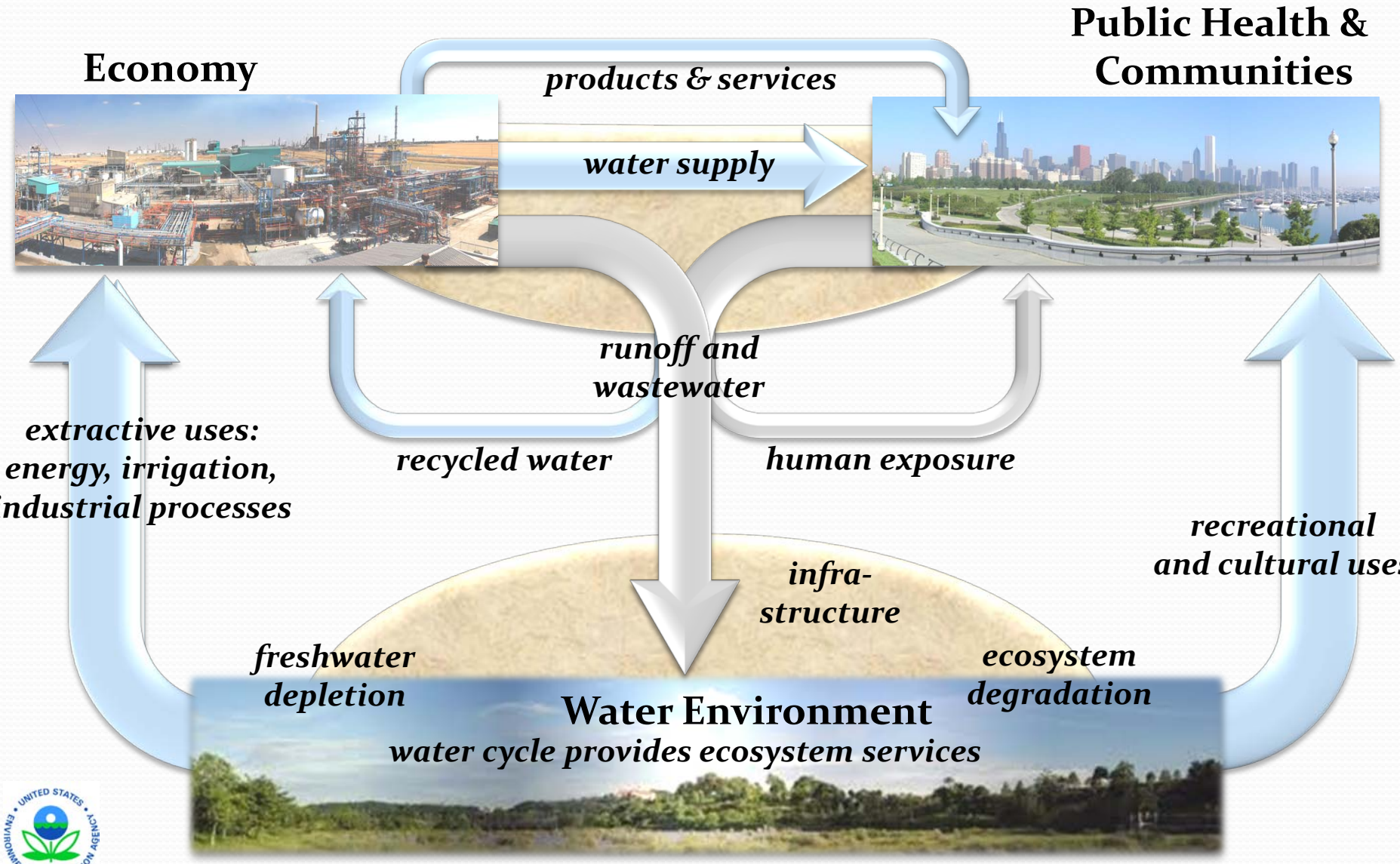
Vision

SSWR uses an integrated, systems approach to research for the identification and development of the scientific, technological and behavioral innovations needed to ensure clean and adequate and equitable supplies of water that support human well-being and resilient aquatic ecosystems.

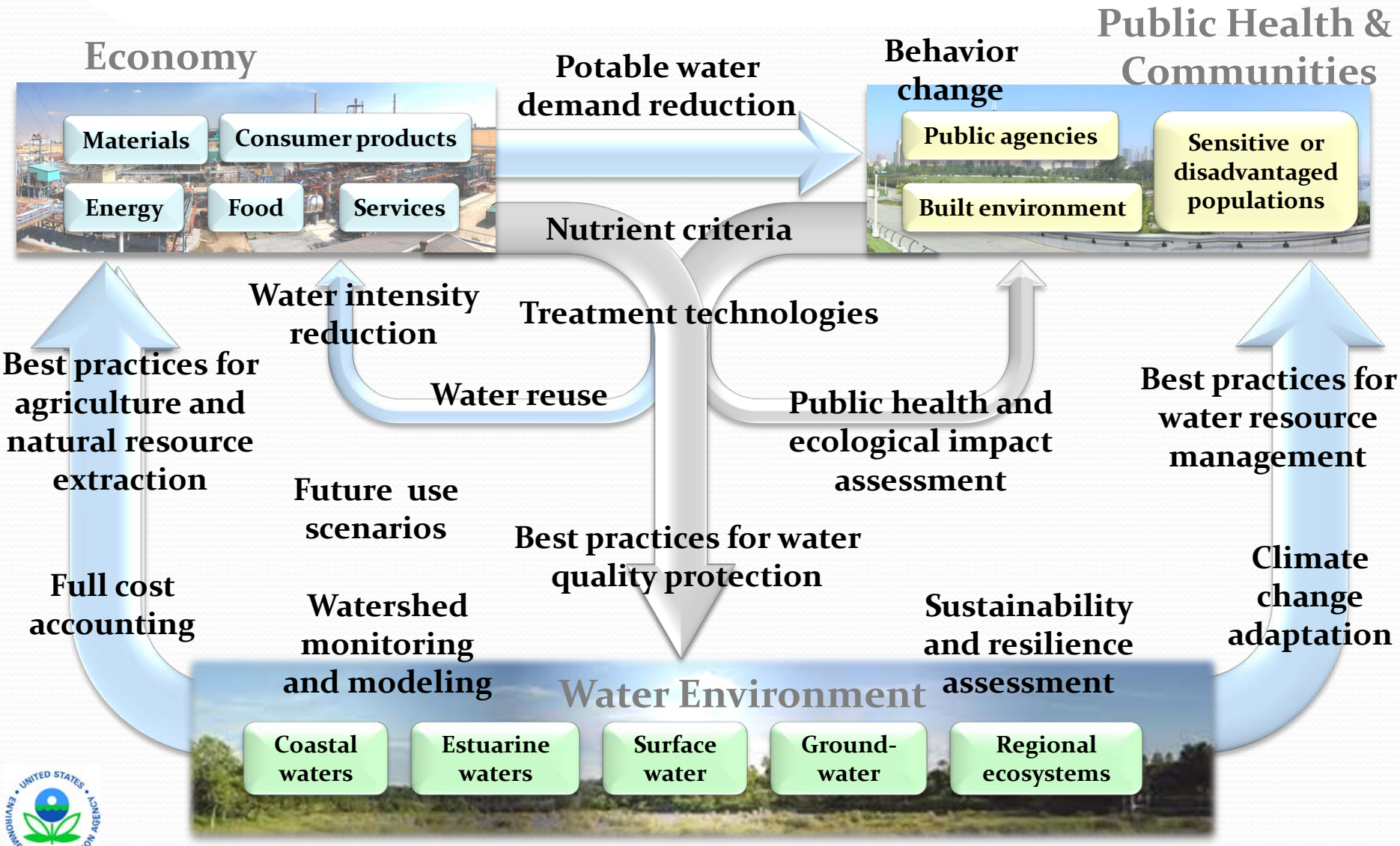

Program/Regional Needs
Nutrient Mgmt Strategy; Chemical & Pathogen Cont; Tools &Technology; Cost effective solutions; watershed protection, climate strategy
Problem Statement
Water Topics
Energy & Mineral Extraction & Injection
Agriculture & Water
N&P Pollution
Chemical & Industrial Processes
Watershed Protection
Built Infrastructure
Climate
Theme 1: Sustainable Water Resources
Theme 2: Sustainable Water Infrastructure Systems
Research Questions
Research Questions
Outputs
Outputs
Theme 1 Projects
Project
Project
Project
Project
Theme 1&2 Projects
Project
Project
Project
Project
Theme 2 Projects
Project
Project
Project
Project
Partner / Stakeholder Input
Partner / Stakeholder Review
ORD Scientists Input/Review


ORIGINS OF THE PROBLEMS
MANIFESTIONS OF THE PROBLEM IN THE WATER ENVIRONMENT
SYSTEMS APPROACH TO SOLUTIONS
Urbanization
Including:
•Land use management
•Industrial Processes
Population demographics
• aging drinking water and wastewater infrastructure
Non point source pollution
• Agriculture
Poor Water Quality
•Physical processes (e.g.,flow; degraded habitat)
•Loadings: Nutrients, Pathogens, Chemicals, Sediments
Additional stressors:
•Insufficient Water Quantity
•Climate change and variability
NEW FOCUS - Pro-active, Integrated, Sustainable Solutions
Sustainable Water Resources –
Ensure safe and sustainable water quality and availability to protect human and ecosystem health by integrating social, economic and environmental research for use in protecting and restoring water resources and their designated uses (e.g., drinking water, recreation, industrial processes, and other designated uses) on a watershed scale.
Sustainable Water Infrastructure Systems– Ensure the sustainability of critical water resources using systems-integrated water resource management where the natural, green and built water infrastructure is capable of producing, storing and delivering safe and high quality drinking water, and providing transport and use-specific treatment of wastewater and stormwater.

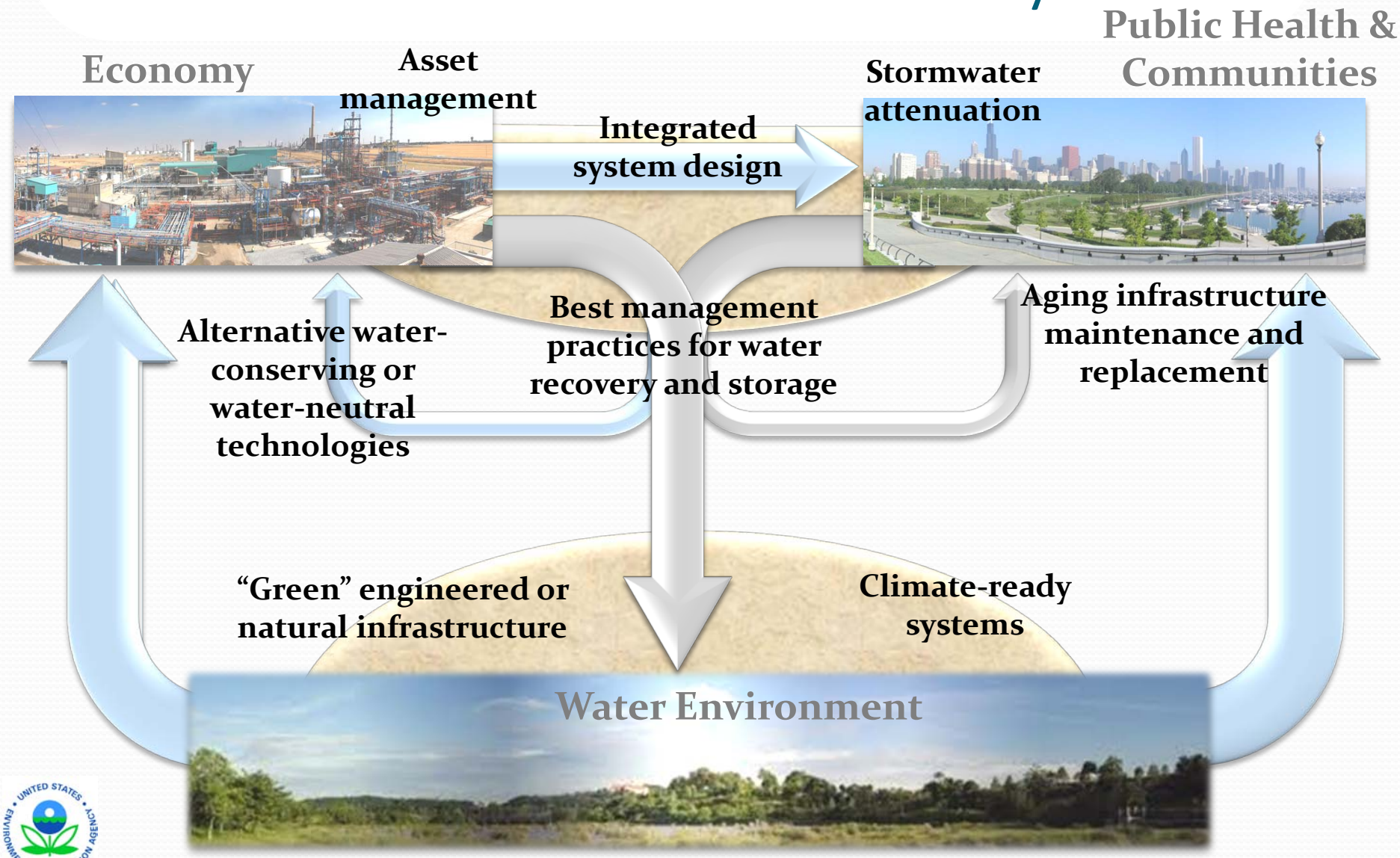
Sustainable Water Resource Systems



Theme 1:
Sustainable Water Resources



Theme 2:
Sustainable Water Infrastructure Systems



Example Science Questions, Outputs and Outcomes

- Theme 1

Science Question	Objective	Outputs	Outcome	Linkages
What factors are most significant and effective in ensuring the sustainability and integrity of water resources?	Establish metrics of water resources and watershed resiliency (including coastal and other receiving waters), Regions, OWOW, OST	1) Biological, chemical, and physical indices that are characteristic attributes of integrity necessary for sustaining water quality and quantity within a watershed including downstream users, and identifying stressors, including non-indigenous species, from headwaters to coastal systems. 2) Quantify anthropogenic impacts on water resources and watershed integrity, including methods to detect and identify pathogens in wastewater, biosolids, and animal wastes. 3) Watershed classification to improve application and effectiveness of monitoring and modeling approaches to multiple watersheds; processes at various scales.	Supports Criteria Derivation; Standards Implementation; Healthy Watersheds Initiative; Waters of the US; Mountaintop Mining; NARS, Gulf Hypoxia, Future guidance on developing numeric nutrient criteria, Vessel General Permit, CAFO Rule.	Link to ACE, SHC, CSS, HS

Example Science Questions, Outputs and Outcomes

- Theme 2

Science Question	Objective	Outputs	Outcome	Linkages
What are the most effective and sustainable approaches which maintain and improve the natural and engineered water system in a manner that effectively protects the quantity and quality of water?	Develop and promote integrated water management approaches that integrates wastewater, stormwater, drinking water, reclaimed water; maximizes energy, nutrients, materials, and water recover; minimizes DBP formation and incorporates comprehensive water planning (such as low impact development and smart growth) and optimum combinations of built, gray, and natural infrastructure. (Regions, OWM, OST, OGWDW)	1) Innovative BMPs for water reuse, recycling, and storage (including satellite systems) 2) Advanced technologies for energy efficiency and recovery at drinking water treatment and wastewater facilities (including improved economics of advanced combined heat and power precesses) 3) Management options for sustainable water availability for communities at the watershed scale 4) Optimized water treatment approaches and technologies for removal of contaminants 5) Optimized climate ready designs for water management systems	Supports CCL, UCMR, Drinking Water Strategy, Six Year Review, Standards Implementation, Sustainable and Integrated Infrastructure, nutrient policy implementation, Climate Change Mitigation	ACE, SHC

Working with Partners and Stakeholders

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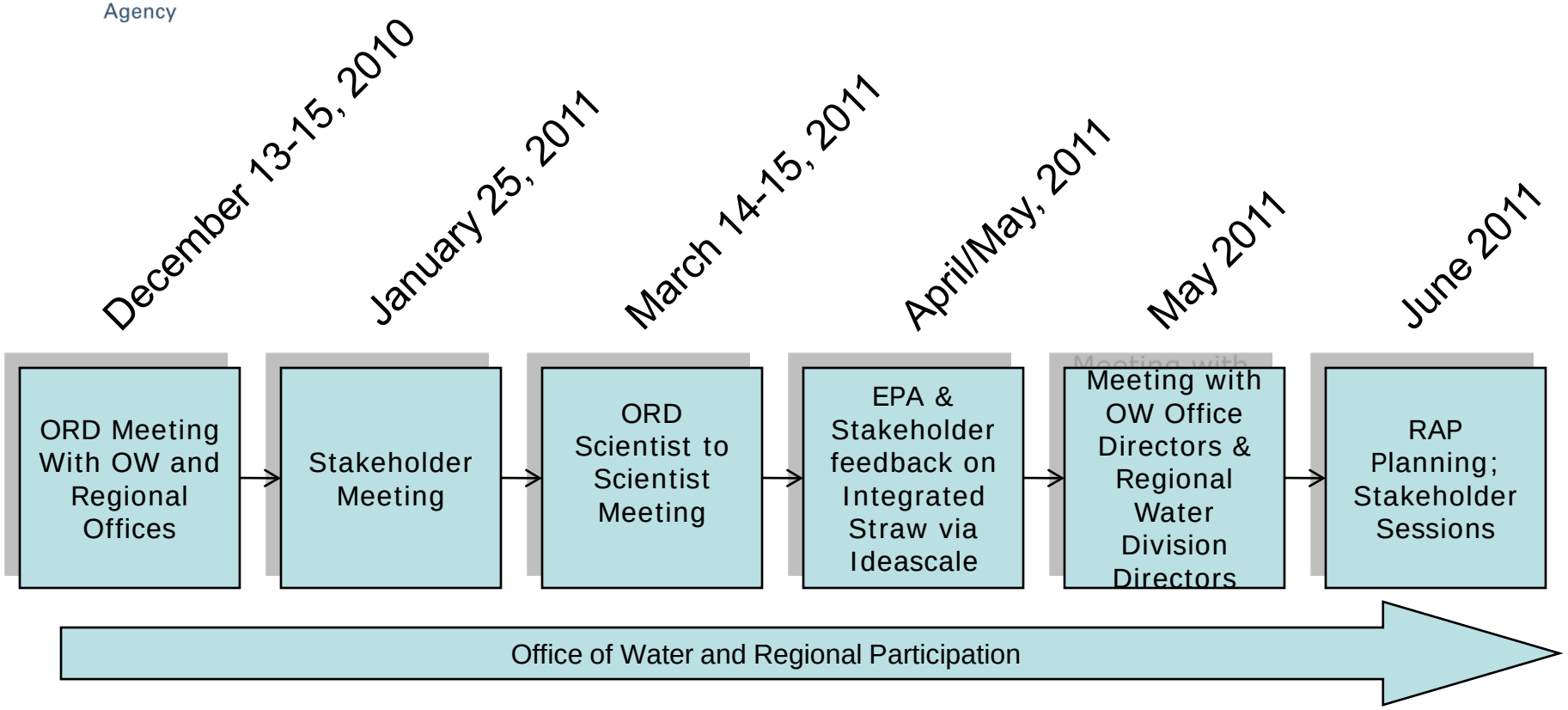

Coordination and Communication with Other Federal Agencies and Non-Federal Organizations

•Briefed the Committee on Environment and Natural Resource and Sustainability Subcommittee for Water Availability and Quality

•Initiated discussions with USGS and DOE

•Working with the National Water Quality Monitoring Council

•Several Federal and Non-Federal entities participated in our January Stakeholder Meeting, follow up webinars and Ideascale:

- American Water Works Association
- Association of Metropolitan Water Agencies
- National Association of Clean Water Agencies
- National Association of State Drinking Water Administrators
- National Congress of American Indians
- National Ground Water Association
- National Sanitation Foundation International
- National Rural Water Association
- Water Environment Research Foundation
- Water Research Foundation
- Water Reuse Foundation

Efforts to Stimulate/Foster Innovation

Educating ORD researchers and OW & Regional partners about the value of applying a solution-oriented, systems approach to research.

- Webinars about how to apply systems model to SSWR (FIRST)
- Scientist to Scientist Meeting
- SSWR Blog in the Intranet
- Ideascale
- Factoring social sciences into SSWR research (NCER Town Hall)
  - Example research outputs:
    - Develop innovative economic valuation tools to assess sustainability of water resource management options
    - Metrics for triple bottom line sustainability that considers feedback from stakeholders, quantifies environmental and societal impacts, and adequately addresses tradeoffs between environmental and economic cost impacts
    - Better communication and education tools promoting desired public behaviors in water use and protection in the face of climate change and increasing populations in watersheds
- Cross Lab/Center Planning teams for each question
- Joint project planning with ACE, CSS, and SHC

Current State	Desired State
Not all communities receive high quality drinking water	All US communities receive high quality drinking water
Human health and aquatic life are challenged by known and emerging contaminants in our water resources	Human health and aquatic ecosystems are proactively protected
Lack of resilience to climate change or other destructive forces	Resilient, climate ready, flexible, efficient, and adaptive systems
Failure of aging water infrastructure outstrips resources to repair, replace, and restore function and uncharacterized public and ecosystem health impacts	Synergistic use of natural ecosystem services and built infrastructure to achieve well characterized and safe public and ecosystem health
Many water bodies are impaired by excessive nutrients	Nutrient levels are in balance with natural water systems and associated safe public and ecosystem health
Watershed integrity is compromised by improper land use practices	Watershed/ basin hydrology has been restored to maintain integrity
Increased urbanization and land development threaten healthy watersheds	Environmental stewardship is incorporated into our societal fabric and land use planning, resulting in an increase in healthy watersheds
Wasteful practices threaten water resources and water treatment capacity is often insufficient for existing loads	Water availability and quality is consistently maintained in an affordable manner to support human and ecological needs
Potable water demand is increasing in populated areas	Potable water demand is safely met by local sources while maintaining ecological needs

Next Steps

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- Finalize the Framework
- Develop Research Action Plan
- Develop Research Portfolio
- Determine how we measure success