UPSTREAM STRATEGIES: Future Water Research & Innovation Solutions

ENVIRONMENTAL SYSTEMS

Climate Change Adaptation

How can utilities continue to manage climate change challenges in a way that allows them to deliver high-quality services to their customers, protect the environment, and meet regulatory requirements?

CRITICAL FUTURE DISRUPTORS

For the purposes of this effort, a disruptor is defined as something that interrupts an event, activity, or process by causing a disturbance, problem, or opportunity. Disruptors can arise as barriers to normal operations or may present opportunities to do things differently/innovate.

The following items were chosen by a diverse group of water leaders and experts as the most significant future disruptors that water utilities must anticipate and plan for.

CLIMATIC VARIATION

Utilities must anticipate an unprecedented level of unpredictability in weather patterns. Past climate records will be of diminishing use for future planning. This unpredictability is likely to impact all aspects of water use, including changes to growing seasons, planting zones and broader ecosystem services, water availability, intensity and timing of precipitation and drought, and sea level rise and its impact on populated coastal areas.

REDUCED WATER CONSUMPTION

Reduced water availability will necessitate reduced water consumption and will test the flexibility of existing infrastructure to manage reduced flows, more concentrated sewage, greater water age, and the associated challenges with transmission and distribution system management.

WATER QUALITY IMPACTS

The changing climate will lead to significant source water changes, including changes in temperature, dissolved organics, nutrient loads, turbidity, road salt impacts, seawater intrusion, and increases in harmful algal blooms and cyanotoxins. Utilities will be challenged by uncertainty in the correct parameters and most appropriate locations for monitoring.

INFRASTRUCTURE MAINTENANCE COSTS

Infrastructure repair and replacement costs may increasingly become unsustainable. The existing aging infrastructure will become increasingly vulnerable to natural disasters. Extreme weather may result in increased runoff and CSOs, leading to setbacks in water quality improvements that have been achieved over the past 50 years.

REGULATORY

Regulations will continue to become more stringent. Treatment facilities will be increasingly challenged to meet quality requirements due to source water quality and changes in flow. The existing regulatory regime may become poorly suited to address the extreme fluctuations in surface water volumes. Utilities will increasingly be required to address regulatory constraints around GHG emissions and energy use.

SOCIOECONOMIC/FINANCIAL EFFECTS

Climate change will create greater affordability and equity and water access challenges in communities. Meeting regulatory requirements and building resilient systems will come at extra-ordinary costs. Utilities will be increasingly challenged to identify and recruit their future workforce.

SUPPLY CHAIN IMPACTS/UNRELIABILITY

Utilities will experience increasing competition for limited emergency supplies, less availability of raw materials, and instability and unpredictability of energy costs.

RESEARCH OPPORTUNITIES

Based on these critical future disruptors, experts prioritized the following targeted research areas:

DECENTRALIZED SYSTEMS

Research is needed to determine the extent to which decentralized systems can mitigate some of the above disruptors (e.g., reliable building-scale potable water reuse systems, reuse for non-potable applications [cooling towers, toilet flushing, etc.]), as well as the degree to which these systems could be managed by the centralized water and wastewater authorities.

UPDATED FLOODPLAIN MAPS AND METEOROLOGICAL DATA

Research is needed to update floodplain maps and meteorological data as trends from the past 100 years are quickly diminishing in value for the purposes of water resource planning.

GOVERNANCE

Research is needed to advance holistic One Water management of water resources at the community and watershed level, factoring in measures to address growing affordability and equity concerns to respond to all aspects of community climate challenges.

ENERGY AND GHG EMISSION MATRIX

Research is needed to better understand the GHG footprint of utility operations, and identify opportunities for climate mitigation through reduced energy use and associated water utility GHG emissions while generating more energy from water resource recovery facilities.