SECURE TOMORROW SERIES TOPIC PRIMER: WATER AVAILABILITY

WHAT IS WATER AVAILABILITY?

For Secure Tomorrow Series activities, water availability entails having access to water resources of both sufficient quantity and quality. Without enough water, for example, water distribution systems can lose pressure and fail to deliver water to end users. In comparison, insufficient water quality (because of contamination) can prevent water distribution systems from treating water to appropriate standards for most intended uses. Both situations result in end users needing to obtain water from alternative—often distant—sources, which can be expensive and logistically challenging.

Water availability can be assessed through the lens of water supply and demand, which is not evenly distributed throughout the country. Some areas are water rich, while others are water poor. Meanwhile, water demand is often concentrated in specific regions, driven by demographic and economic trends. For example, in the United States, withdrawals for manufacturing account for only six percent of total withdrawals nationwide. However, for the 60 U.S. counties where manufacturing is the most concentrated, manufacturing accounts for more than 75 percent of total water withdrawals.[1]

Several factors complicate the effective management of water resources to ensure water availability. One key complication is that water often has not been priced to reflect its value. Because it is critical to human health and well-being, water must be kept relatively cheap through a mix of cost-saving measures and government subsidies. As a result, water utilities are not profitable, which has led to underinvestment in water infrastructure. Another complication is that water availability cannot be measured accurately, authoritatively, and holistically. Approaches to measure water availability are hindered by (1) insufficient data tracking of water supply and demand at smaller geographic scales (versus at the national level), (2) challenges in following a single standardized means of water accounting, and (3) difficulties in collecting data not only on water quantity but also water quality.

WHY SHOULD PEOPLE CARE ABOUT WATER AVAILABILITY?

Water—directly or indirectly—is necessary for all 16 critical infrastructure sectors and 55 National Critical Functions. For example, disruptions to water availability can jeopardize food, energy, and drinking water in the following ways:

- Power plants rely on water for power generation (at hydroelectric power plants) and for cooling (at fossil fuel plants).
- Agricultural productivity relies on water for irrigation and fertilizer production.
- Depletion of navigable waterways leads to supply chain issues, which can, for example, affect the delivery of supplies to growers and of agricultural commodities to consumers.

Although water supplies are finite, demand is not. Demand for water continues to grow nationwide, leading to competition for the rights and access to water among farmers, ranchers, cities, towns, and companies. Disagreements over water rights can be extremely contentious, leading to flashpoints of conflict.

[1] James McCall et.al., "U.S. Manufacturing Water Use Data and Estimates: Current State, Limitations, and Future Needs for Supporting Manufacturing, Research, and Development," *ACS ES&T Water Journal*, 1, no. 10 (2021), https://www.osti.gov/servlets/purl/1821641.

Additional concerns that may disrupt water availability include climate-related impacts (e.g., drought, reduced snowpack, saltwater intrusion); exposure of water resources and infrastructure systems to theft, damage, or contamination; failures of aging water infrastructure; and inadequate cybersecurity in water utility systems.

WHAT IS DRIVING CHANGE IN WATER AVAILABILITY THAT COULD LEAD TO EMERGING AND EVOLVING RISKS IN THIS DECADE?

In the next 3 to 7 years, many of the same drivers shaping the current risks in water availability will persist and become more pressing, including the following:

- Demographic shifts that will affect localized demand for water.
- Climate change impacts that will alter historical weather patterns.
- The presence of novel contaminants (e.g., pharmaceutical byproducts, perfluorinated compounds, nanoplastics) that are often poorly monitored, difficult to remove, and whose health effects are inadequately understood.
- Competition over water resources can lead to political and civil conflict.
- Aging infrastructure can result in water loss and increasing water system failures.