ENVIRONMENT & SUSTAINABILITY

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Water Scarcity Could Put Your Data Center at Risk

FOCUS | APRIL 2019

By Emilio Tenuta, Vice President, Corporate Sustainability, Ecolab

Data center managers must be prepared for a range of potential threats to IT operations, including cyberattacks or power outages. But there's another threat that you may not have considered – water scarcity.

The threat of water scarcity is real, and it affects many regions of the world today. For example, Cape Town, South Africa's second-largest city, nearly ran out of water in 2018. While Day Zero did not arrive, Cape Town is struggling with ways to cope with water scarcity.

And most other areas with growing economies also are confronting water scarcity. A BBC News report cites 11 other cities that could run out of water, including Sao Paulo, Bangalore, Beijing, Cairo, Jakarta, Moscow, Istanbul, Mexico City, London, Tokyo and Miami. These water shortages are caused by a number of factors, including increased population growth and demand for goods, services, and natural resources, as well as prolonged droughts. Figure 1 shows where these conditions have led, or may lead to, water shortages.

Globally demand for fresh water to support all people and all industries is expected to exceed available supplies by 40 percent by 2030. In areas with growing populations and increasing water scarcity, such as California, which hosts more than 800 data centers, companies have become more aware of these risks, and many have actively increased their water conservation efforts over the past decade and adopted water reduction goals. But despite these efforts global water use is growing.

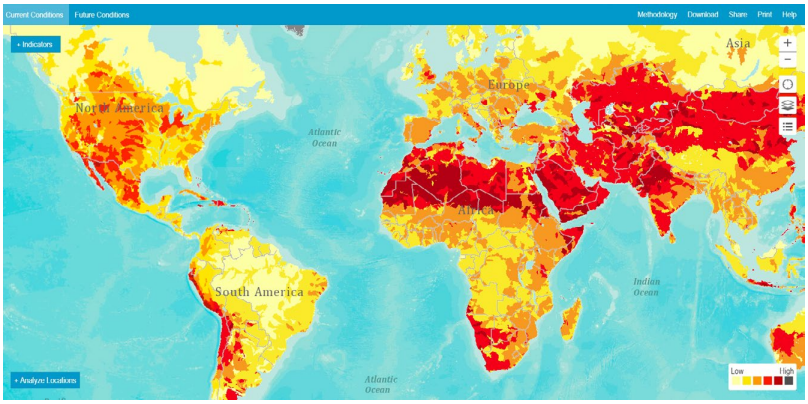

Figure 1. The heat map shows areas likely to be affected by water shortages.

Inaction is often due to the mispricing of water, which is historically cheap for companies to buy and rarely reflects the actual availability, or true cost, of water.

At the same time, the cloud computing market is experiencing a growth spurt (CAGR 18 percent) as people and industries continue to shift to cloud and IoT-based solutions. Cloud computing relies on data centers, an essential element of the current infrastructure that provides extensive amounts of data to the modern world. These data centers require large amounts of fresh water to cool servers.

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A typical data center cooling system uses up to eight million gallons of water a year per megawatt of electricity, according to the Uptime Institute, an advisory organization focused on improving the performance, efficiency and reliability of business-critical infrastructure. A recent study conducted by Lawrence Berkeley National Laboratory, Stanford, Northwestern, Carnegie Mellon and the U.S. Department of Energy estimated that U.S. data centers will require approximately 174 billion gallons of water a year to maintain operations in 2020.

Increasing Data Center Water Resiliency

To reduce the vulnerability of data centers to water scarcity, water must be valued as an asset rather than a commodity. This paradigm shift must include the understanding that water stress is a function of both quantity and quality. This requires a more comprehensive water stewardship approach that assesses risks in three areas: physical (water quantity and quality), regulatory, and reputational.

Given the growing demand for water-thirsty cloud services, it is essential for data centers to adopt an integrated water management strategy. The benefits to data center managers will be reliable performance and operational resiliency. Organizations that want to ensure sufficient supplies of water now and in the future must assess their water risk and price, develop a water resiliency plan, and prepare for a disruption.

Assess: Where are you sourcing your water?

In many areas, water is undervalued and underpriced even when it is scarce. For most facility managers, low price obscures water risk. To protect against near or long-term business disruptions, savvy data center managers must stop relying on the metered price of water as the sole key performance indicator driving water management practices.

By understanding the water quantity and quality risks related to the watersheds that supply a data center's water, facility managers can make the case for investing in smart water management practices, such as reduction, reuse and recycling. Publicly available tools can help data centers assess the risks that water poses to their operations and then adopt smart water management practices to address them on the local site level.

The Water Risk Monetizer (see Figure 3), highlights these location-based factors and offer businesses a risk-adjusted water cost that takes into account currently unpriced physical, regulatory, and reputational risks. This risk-adjusted cost is a vital factor when considering site upgrades or where to expand existing operations (see Figure 4). The tool is available at www.WaterRiskMonetizer.com.

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The Smart Water Navigator, introduced in March 2019, is a free online tool to help businesses throughout the world improve water management at their facilities in the face of growing water scarcity. More and more businesses, including data centers, have water reduction targets but they often lack the tools and expertise to achieve them. The Smart Water Navigator helps bridge this gap.

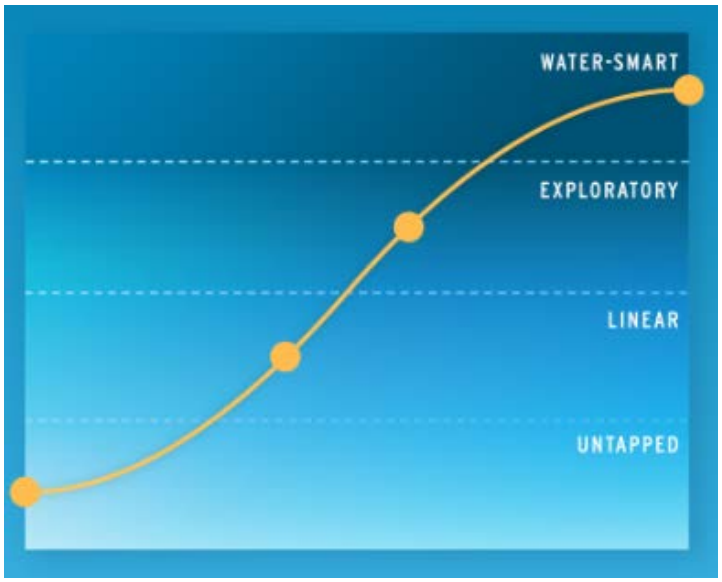

Figure 2. The Smart Water Navigator's Water Maturity Curve. By following a practical, step-by-step program, facilities can go from a state of "untapped" to "water-smart" and achieve more sustainable outcomes.

Based on a straightforward, 13-question assessment, the Smart Water Navigator shows companies how their individual facilities are performing compared to industry-leading water management practices. The tool places each facility on a Water Maturity Curve, and generates an industry- and location-specific guide with practical action steps to help a company build sustainable, "water-smart" practices and achieve the next level on the Water Maturity Curve (see Figure 2). The tool is available online at www.SmartWaterNavigator.com.

Figure 3 illustrates how data centers in different locations have different water risk profiles. Each data center in Figure 3 has a different risk profile based on water quantity, water quality, the price of water (risk premium), competition and projected competition for the water basin (revenue-at-risk). Higher numbers indicate higher risk and are broken out by risk related to quantity and quality, water risk premium, and revenue-at-risk. The quantity and quality risk numbers are based on an index from 0-5, while the water risk premium is based on the volume of water that the data center needs to operate annually. Other factors to consider include:

- How efficiently the facility uses water
- The extent that water treatment and delivery costs are subsidized
- How water use is governed by regulatory agencies or water authorities

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These variables can come together in surprising ways. For example, the Midwest data center has a very high quality risk, because it is located in an area with a high concentration of wastewater treatment plants and little unprotected land to help filter water for downstream users. Meanwhile, the Southeast data center has a medium quantity risk but a very high financial risk because the price the data center currently pays for water is very low (less than half the cost of the Northwest data center, for example) – and will likely rise to reflect actual supply and quality conditions.

Using the Water Risk Monetizer, we calculated the financial implications of water quantity and quality risks. The tool provides two financial measures of risk:

- Water risk premium, which is the additional cost a user will likely pay for water because of scarcity or pollution, and
- Revenue-at-risk, which is the potential loss of revenue because there is not enough clean fresh water available for operations as a result of water stress and competition for scarce resources in the basin.

	Environmental Issue		Financial Implication		Comments
Location	WRI Quantity Risk (0–5)	WRI Quality Risk (0–5)	Water Risk Premium Relative to Market Price (normalized to 1)	Revenue-at-Risk from Water Scarcity* (%)	
US Midwest	3.81	4.19	2.2x	75	Poor quality and high demand put revenue at risk
US Northern Virginia	2.73	2.92	2.2x	83	Growing demand for water puts future revenue at risk, even though quality and quantity risks are moderate
US Southwest	2.63	3.25	1.1x	92	Quality risk and increasing water demand drive up revenue-at-risk
US Southeast	2.36	1.32	4.6x	78	Water is underpriced, resulting in a high risk premium, while increasing water basin competition puts revenue at risk
US Northwest	1.84	2.01	0.4x	96	Current water prices reflect value, lowering the risk premium, but increasing competition and population growth leads to a high revenue-at-risk
Cape Town, South Africa	3.68	3.39	6.8x	100	High quantity and quality water risk in a drought-stricken, populous area results in a high water risk premium and revenue-at-risk

Figure 3. 2018 Data Center Water Risk Table. Each data center has a different risk profile based on risks related to water quantity, water quality, the full value of water (risk premium), and competition for the water basin (revenue-at-risk). Sources: WRI Aqueduct Water Risk Atlas and Water Risk Monetizer, 2018.

For additional data center water scarcity illustrations, see Figure 3.

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Information on where water is sourced can help inform decisions on where to locate a data center as well as the types of issues that will need to be addressed. The risk premium estimate also takes into account the likelihood of regulatory pressure on water use in a region. For example, in 2014 California passed the Sustainable Groundwater Management Act, which places strict regulations on groundwater use beginning in 2020. This may lead to more stringent limits on water use for data centers that source water from wells or aquifers in the state.

Plan: What is your water resiliency plan?
Water conditions may change significantly over time, and it is important to integrate these forecasts into long-range planning, investments, and operational decisions. Several elements to consider include:

- Where to source alternative water supplies if current sources are compromised
- How to budget for likely increases in future water prices
- When to make investments in smart water management
- Which stakeholders to engage to manage reputational risk or collaborate with on governance of shared water resources

A Microsoft data center in San Antonio, Texas, assessed its water footprint and water sources using the Water Risk Monetizer and found that the risk-adjusted cost of water was more than 11 times greater than the center's current water bill. San Antonio is an area with increasing water scarcity, so Microsoft chose to invest in smart water technology for using recycled water (gray water) at the site to lessen its dependence on municipal water supplies. These investments led to more than $140,000 in water savings and a reduction of nearly 60 million gallons a year.

Figure 3 also shows potential revenue-at-risk from water scarcity. These estimates take into account current and projected competition for water from other users in the water basin as well as the data center's water efficiency compared with the sector average. All of these data centers have a high revenue-at-risk calculation, suggesting that it will be increasingly difficult for them to secure adequate water given the growth of industries, such as agriculture, or competition from domestic water users for the same gallon of water in the basin. Investing in water efficiency and circular water management strategies (recycling) decreases the chances of these centers losing revenue or being disrupted due to long-term water risk.

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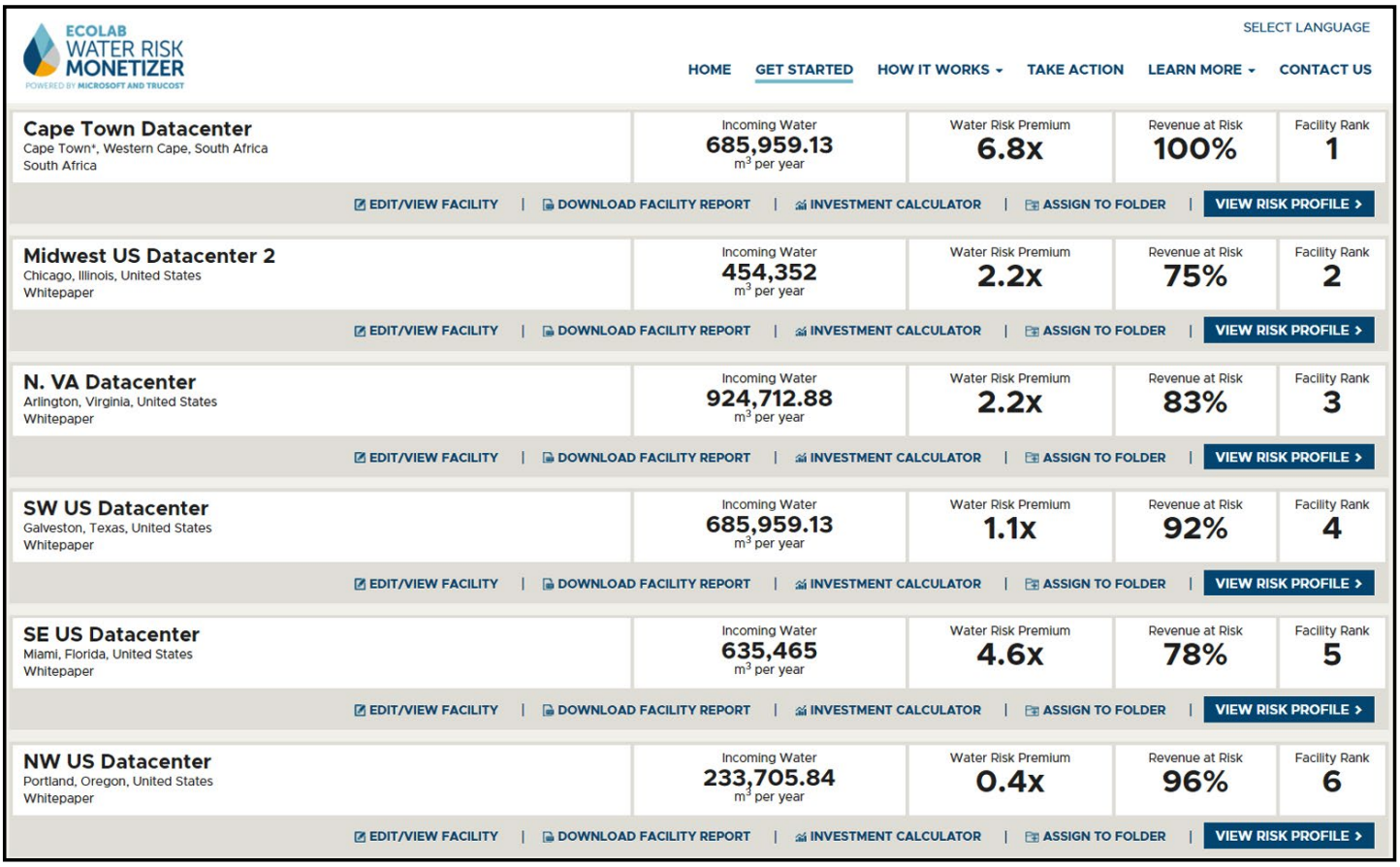

Figure 4. Ecolab uses the Water Risk Monetizer to capture and express the threat posed by regional water conditions.

Ramp-up Redundancy: What is your plan in case of a water disruption?

Develop a redundancy plan to ensure that you have a sufficient supply of water in case of an unexpected disruption. When a water main breaks, or basin managers curtail allocations during a drought, you need to be prepared. Are you going to have enough water onsite? How many hours of water will your facility need?

Uptime Institute recommends that data centers in Tier III and Tier IV have at least 12 hours of on-site water storage to maintain cooling towers and makeup water to support total condenser cooling capacity in a worst-case scenario. The amount of makeup water for evaporative cooling towers stored on-site must be sufficient to provide a minimum of 12 hours of on-site makeup water storage that adheres to the requirements of the Tier objective.

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Tier III requires 12 hours of Concurrently Maintainable makeup water systems and Tier IV requires 12 hours of Concurrently Maintainable and Fault Tolerant makeup water systems. For Tier IV, a thermal energy storage tank integrated into a chilled water system as part of a continuous cooling solution can be used to provide a large volume of readily available on-site water to sustain evaporative cooling processes during a disruption of public utility water. The 12-hour makeup water minimum requirement was calculated by determining the makeup water required in a worst-case scenario, based on ASHRAE extreme wet bulb conditions, multiplied by 12.

How to Determine if Your Data Center is at Risk

With these three steps in place, a data center can position itself to remain competitive and interruption-free in a future with increasing business competition and water scarcity. But how does an enterprise know if its data center is at risk?

- Use the Water Risk Monetizer to obtain a risk profile. This will help identify and prioritize improvements to existing data centers and test how future data centers would fare in a specific location.
- Employ the Monetizer to calculate the facility's revenue-at-risk score (the likelihood of a loss in revenue as a result of water scarcity) for three, five, and ten years into the future.
- Use the results from this tool and the Smart Water Navigator to help formulate a plan for addressing water scarcity and quality risks.

This information can help guide your decision-making and enable you to better manage and mitigate water-related risks. Water scarcity is a genuine threat to data center growth, reliability and reputation. The time has come to rethink operations and implement aggressive water strategies to optimize systems, reduce costs and enable reliable growth.

For technology companies facing intensifying public demand for information, downtime is simply not an option. To hedge against water issues that can negatively affect mission-critical IT, data centers should invest in smart water management strategies or consider relocating to watersheds that have less water stress. Reduction, reuse and recycling are not just smart solutions, they are important financial decisions that can help ensure a secure and reliable future for your business and the communities it serves.

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