Morgan Stanley

INVESTMENT MANAGEMENT

The Water Constraint

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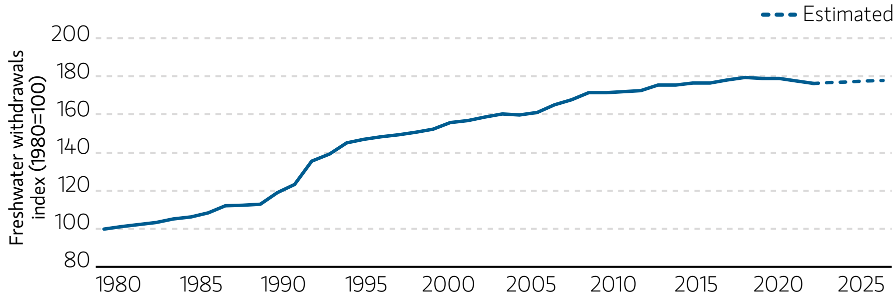
Water is often treated as a public good. In many industries it is regarded as a free input with most large users paying far less than its true economic cost. But the real burden eventually falls back on companies: through higher treatment costs, tighter permitting, operational disruption, reputational risk, and the need to secure access to increasingly scarce supply. The fiction that water is "free" has shaped decades of industrial planning, steering capital into energy efficiency, automation and logistics as if water abundance were permanent.

It is not. In a number of regions, water is becoming a binding constraint on production, permitting and community consent. A recent United Nations report put it bluntly in its title: "Global Water Bankruptcy." While bankruptcy is perhaps too dramatic, water insecurity is increasingly a constraint on growth. This is particularly true in water-stressed regions of the world, where demand is rising in areas already facing freshwater scarcity.

Water stress is not an abstract environmental metric but rather a measure of how much water is being withdrawn relative to the available renewable supply. The World Resources Institute's Aqueduct framework classifies regions where withdrawals exceed 40% of supply as highly stressed and those above 80% as extremely stressed. At those levels, drought, infrastructure failure or competing demand can quickly tip a fragile condition into crisis (Display 1).

DISPLAY 1

The Demand for Water Is Rising Globally



Source: Food and Agriculture Organization AQUASTAT. As of 12/2025. Forecasts/estimates are based on current market conditions, subject to change, and may not necessarily come to pass.

Growth Constraint

Most visible risk is operational. Many industries critical to growth — from copper mining and semiconductors to data centers and power infrastructure — are water-intensive and often concentrated in areas of high water stress (Display 2). Where water is a major input, disruptions in its availability and quality can halt production, cut utilization and raise costs. Companies that actively manage both their water quality and supply gain resilience and control that peers lack.

But operational risk is only part of the story. Water can also become a reputational problem. As fresh water is an intensely local resource, it carries an emotional charge and an immediate constituency in ways climate risk often does not. A mine, fabrication plant or data center may account for a small share of national water use, but still becomes contentious if it appears to compete with local households or farmers. Water mismanagement can also spread into commercial and political risk.

A Chilean mining company encountered resistance from local communities when the Choapa River watershed came under prolonged drought. The river running through the valley was being used for local agriculture and mining operations. Facing production curtailments, the company decided to build desalination plants - at a cost of over $2 billion - to end the need to siphon water from the river. Though the capital expenditure was expensive, the investment was a reputational hedge as much as an operational one. Since then the mine has increased production and extended its life. The lesson? Investing in infrastructure and efficient usage of local fresh water can serve an operational need while enhancing corporate social license – moving from being part of the problem to becoming part of the solution.

DISPLAY 2

The World's Most Stressed Basin Level Hotspots

AREA	COUNTRY(S)
Indus Basin	Pakistan/India
Colorado River Basin	U.S./Mexico
Tigris-Eurphrates	Iraq
Nile Basin	Egypt/Sudan
Murray-Darling Basin	Australia
North China Plain	China
Central Chile	Chile

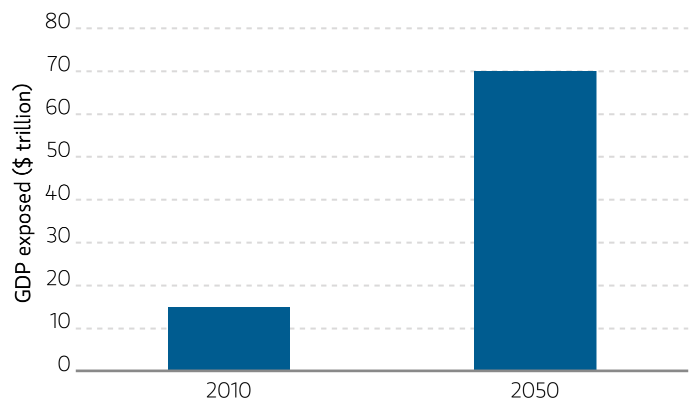
Source: United Nations. As of 12/2025.

Semiconductors and Water Supply

Advanced semiconductor fabrication plants (fabs) are among the most water-intensive industries, requiring large volumes of ultra-pure water on a continual basis to produce chips efficiently at scale. Even short interruptions can be expensive. The paradox is that some of the most advanced semiconductor fabs are built in water-stressed regions, including Taiwan and Arizona. As such, the sector has responded with large-scale recycling and reclaimed water systems.

DISPLAY 3

Global GDP Exposed to High Water Stress Is Expected to Increase Significantly



Source: World Resources Institute; Aqueduct 4.0. As of 8/2023. Forecasts/estimates are based on current market conditions, subject to change, and may not necessarily come to pass.

A Taiwan-based chipmaker reported in its 2024 annual report that by optimizing manufacturing and recycling, they reduced their reliance on municipal water by 31%. At the same time, out of the fab's total water supply, the chipmaker replaced 17% by using reclaimed water. The gap points to a structural limit: reclaimed water can ease freshwater dependence, but does not eliminate the need for continuous input. Recycling changes the source of supply more than the water intensity of the process, and the environmental pressures of large-scale industrial water use remain substantial (Display 3).

While Taiwan faces water volatility, Arizona, home to a number of semiconductor firms, faces chronic scarcity. Building advanced fabs in a drought-prone state requires complex planning around water resilience, coordination with municipalities and significant upfront capital investment.

Public perception often centers on municipal water use, but leading-edge facilities are designed around high recycling rates and reclaimed water systems. One plant operates a 12-acre, on-site water reclamation facility that can treat up to 9 million gallons a day of wastewater.

Data Center Bottlenecks

Data centers are also likely to bring water politics into sharper public view. A medium-sized facility can require around 110 million gallons a year of water for cooling and larger sites may need as much as 5 million gallons a day.

The visibility problem is different from manufacturing. In a chip lab or mine, water is embedded deep in production flows, while data centers place cooling systems in highly visible locations. Cooling relies heavily on evaporative systems, where studies indicate that up to 80% of water is lost as vapor rather than returned to its original source. This makes evaporation a form of true net consumption, requiring continuous replenishment from local water sources and increasing pressure on regional supplies, particularly in water-stressed areas.

Liquid cooling and closed-loop systems can reduce pressure on freshwater supplies but they reduce water intensity rather than eliminate demand altogether. Company disclosures suggest these solutions remain unevenly deployed and can come with hard tradeoffs. For example, eliminating evaporative cooling may cut water use but raise energy consumption. In water-stressed regions the advantage will go to companies that can manage the trade-offs, not just reduce the water intensity.

Takeaway

For investors, the risk is that water moves from a hidden input to a binding constraint on growth and creates operational disruptions. The gap is widening between companies that regard water as a strategic asset and are investing in desalination, recycling and water-positive commitments and those waiting for regulation, community opposition or drought to make the risk visible. As water shortages intensify, that divide is likely to show up in stock performance.

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