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eBook

A Thirst for Knowledge: Harnessing the Power of Data to Solve Our Water Challenges

An exploration of four key water data management milestones to ensure the sustainability of our most valuable resource.

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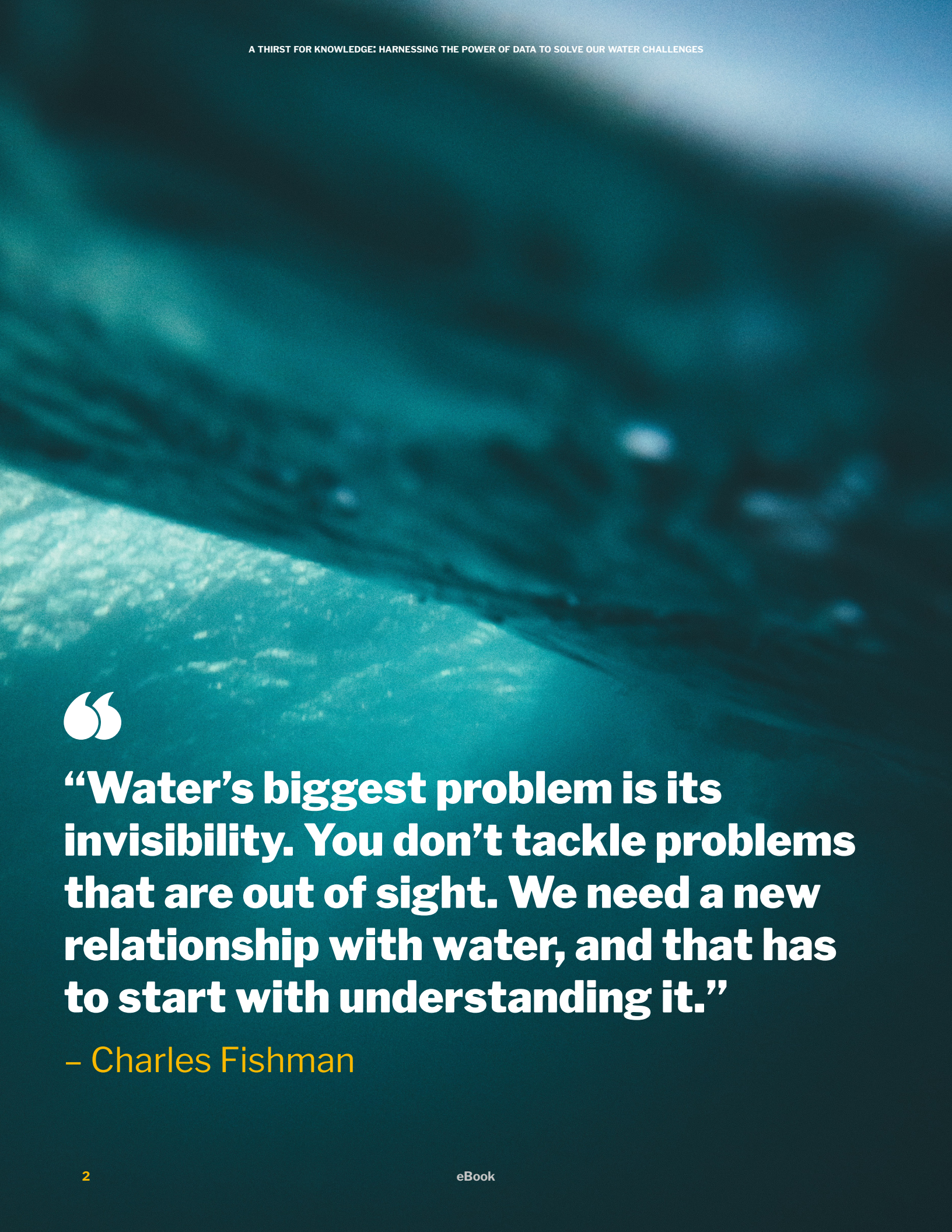

“Water’s biggest problem is its invisibility. You don’t tackle problems that are out of sight. We need a new relationship with water, and that has to start with understanding it.”

– Charles Fishman

In this eBook , we take a deep dive into leading industry trends and technologies by using a four-milestone data management framework. We provide recommendations that organizations should strive towards in order to gain a true understanding of their water management systems plus the knowledge and power to secure our most valuable resource for generations to come.

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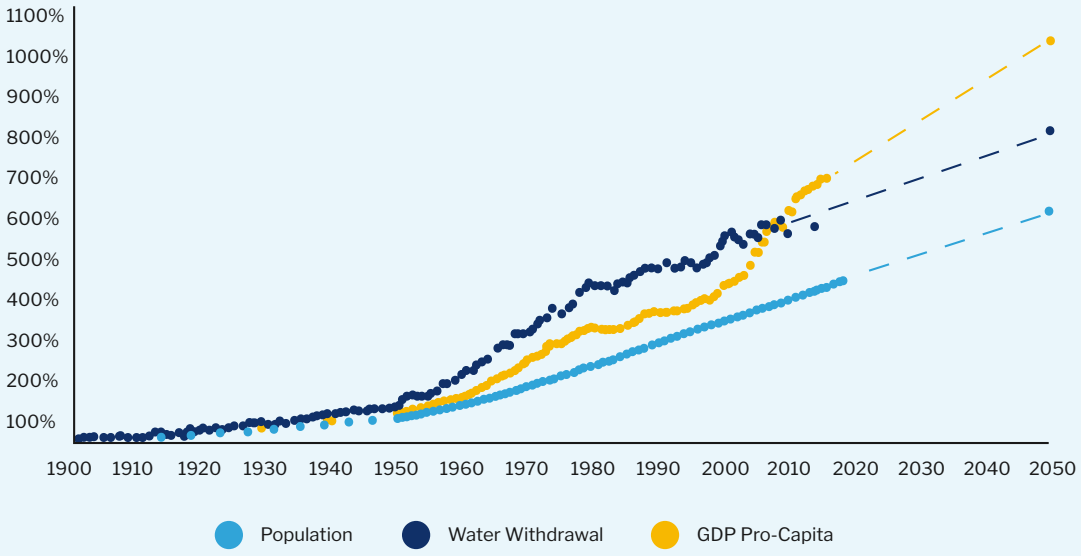
Water Challenges in 2021

Although mostly unpriced, water is the most valuable commodity in the world.

For decades, the western world has taken water for granted. Few people consider that fresh water, like oil, is a finite resource. With the global population expected to hit 8.5 billion[1] in the next 10 years, demand for this precious, life-sustaining resource is rising inexorably.

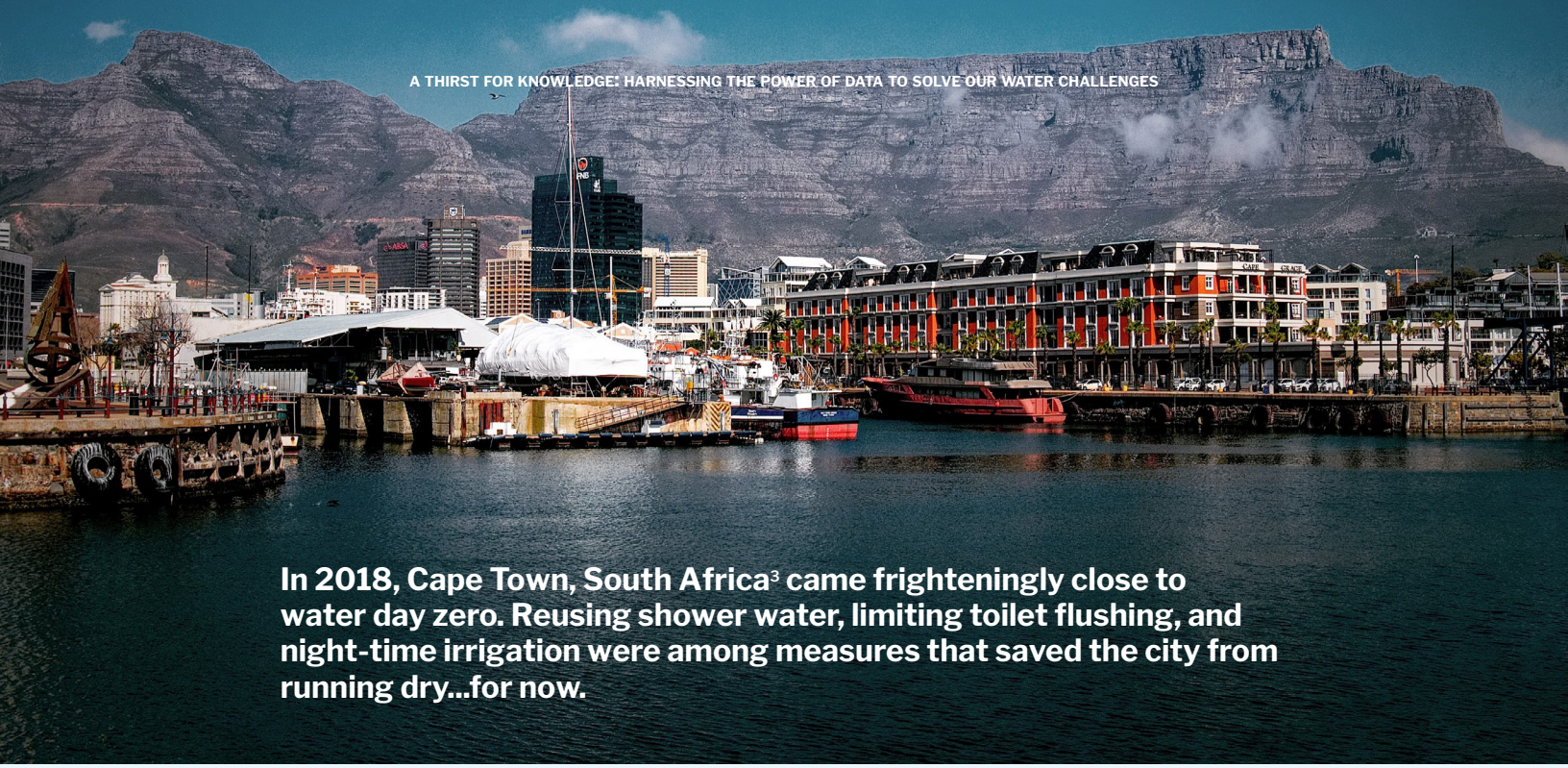
Projections of the World Water Development Report



Reassessing the Projections of the World Water Development Report[2]

As well as population growth, other factors that affect water include migration, industrialization, climate change, drought, groundwater depletion, weak infrastructure, and poor urban planning. In developed municipalities, increased energy costs, aging pipes, and reduced capital budgets are serious threats that affect water availability and quality.

Taking action to successfully connect multiple data sources is vital as the compounding effect of these factors is pushing some cities towards a “water day zero” — an event that will see taps run dry.



In 2018, Cape Town, South Africa[3] came frighteningly close to water day zero. Reusing shower water, limiting toilet flushing, and night-time irrigation were among measures that saved the city from running dry...for now.

Many areas of the world are in crisis — already facing either water shortages or water that's unsafe for human consumption:

Water Scarcity

- Four billion people[4] live in water-scarce and stressed regions — one billion of whom have no access to safe drinking water.
- Two-thirds of the world population faces water scarcity for at least one month[5] every year.
- The over-pumping of underground aquifers are depleting water tables[6] in many parts of the world, including America, India, and China.
- Dams and lakes across America are drying up[7] from drought and overuse.
- Droughts and natural disasters[8] cut off access to potable and sanitary water anywhere in the world - Haiti is still known as a "pipeless nation[9]," after the catastrophic earthquake in 2010.

Water Pollution

- Globally, there are almost 1 million deaths[10] per year from waterborne diseases.
- 21 million[11] Americans are getting water from systems that violate health standards.
- 33 major US cities[12] have skirted water quality testing in similar ways to Flint, Michigan, which prompted criminal charges.

The bottom line is that, if we remain on the same path, the world is facing a 40 percent shortfall[13] in freshwater resources by 2030. It's no surprise that the World Economic Forum ranked the water crisis in the top 5 of global risks[14] for the eighth consecutive year.

While the natural supply of water cannot be increased — we can't control how much rain falls — there are ways we can manage it better to reduce waste.

The World Bank[15] demonstrated how improved water stewardship can pay high economic dividends. When governments respond to water shortages by boosting efficiency — allocating even 25 percent of water[16] to more high value uses such as more efficient agricultural practices — water loss declines dramatically. For some regions, losses may even vanish. In developed economies, identifying process optimizations and introducing regulations to drive efficiencies can accomplish great results with reduced spending.

Charles Fishman, author of *The Big Thirst: The Secret Life and Turbulent Future of Water*, observed[17] that our modern water crises stem from a lack of data. Modernizing water data would unleash a much-needed era of water innovation and preventative action.

Only by gaining a firm understanding of every part of the water ecosystem and water management lifecycle can real change come. In order to gain this knowledge, governments, utilities, and environmental agencies need to take control of their water data.

The world is facing a 40 percent shortfall[19] in freshwater resources by 2030.

Deep Dive Into Water Data Management Milestones

The UN General Assembly launched the Water Action Decade 2018-2028[20] to create urgency and encourage action in transforming how we manage our water. Each of the four workstreams outlined in the Action Plan Resolution rely on data quality, data management, and knowledge sharing to address water challenges.

UN's Water Action Plan Resolution

1. Facilitating **access to knowledge** and the exchange of good practices
2. Improving **knowledge generation and dissemination**, including new information relevant to water-related SDGs
3. Pursuing **advocacy, networking, and promoting partnerships and action**
4. Strengthening **communication actions** for implementation of the water-related goals

While the action plan is straightforward, the sheer magnitude of our water problems can be daunting. The head of water stewardship for WWF International[21] explained how, while the big picture numbers garner public interest, they can stymie action by making our water problems seem too big to solve.

To avoid analysis paralysis and apply the UN's action plan to real-world problems, governments, utilities, and industries that manage and use water should strive towards four water data milestones:

1. **Water data consolidation to break down data silos**
2. **Water data analysis to turn raw data into actionable insights**
3. **Internal knowledge sharing across organizations, government departments, and international bodies**
4. **External knowledge sharing with industry and the public to educate, inform, and encourage respect for our most important resource**

These four water data milestones are just as applicable to local organizations on a municipality, city, state, and federal level as they are to global policy. Water providers large and small still struggle to analyze information across data silos and transform that data into actions that are easily communicated into public action.

The data gathered from these water management applications often lives in various silos across state and local government and industry organizations. So, despite the availability of potentially helpful technologies such as sensors and software tools, water utilities often lack the information they need[22] to better conserve and adequately manage water.

The drive to have more data, more often is only increasing. Data is becoming more dense and diverse as new parameters and instruments are added to networks, with data being recorded more frequently. No matter the amount of data being collected, it is crucial to glean insights from that data. Without proper analysis, these utilities are missing out on information that could be critical to understanding the data and completing key tasks such as repairing aging water infrastructure or assessing non-revenue water[23] losses.

To address the UN Water Action Plan, organizations need to find a way to break down data silos to consolidate and analyze data in order to achieve better, more sustainable water management.

1. Water Data Consolidation

The first milestone on the journey to a sustainable water system is to break down some of the many data silos that currently exist. Many water organizations are entrenched in legacy systems which can hinder progress. While many of them have been automating data collection in several areas for some time (e.g. SCADA[24]), few are examining the data sources alongside other data sources (like LIMS[25], GIS[26], billing data, compliance data, etc.) to connect the dots and uncover real insights.

Understanding the relationships between the consolidated water data sources is powerful. It can unveil insights we would never have found otherwise and offer correlations that we can use to test new hypotheses about the cause and effect of different water activity.

For example, changes in water temperature, pH, dissolved oxygen, and chlorophyll individually may not raise alarms but when read together, they indicate signs of agricultural runoff pollution that can cause harmful algal blooms.

When it comes to data consolidation, organizations can start small, breaking down data silos one by one to showcase the benefits in real-world scenarios.

2. Water Data Analysis

The second step towards a more sustainable water system is to analyse the consolidated data to get a true view of the bigger picture.

Currently, water utilities can struggle to extract real value from all the disparate data at their disposal. IT teams often lack insight into the use cases that would help them justify the allocation of resources to water data projects and departments and teams simply don't know what they don't know.

Wondering where your organization should start? Firstly, your IT teams (business intelligence and/or data science teams) should collaborate with managers across the organization who can ask the right questions. These questions should map back to the goals of your specific organization.

For example, environmental agencies may ask questions to find solutions in extreme weather scenarios:

- What is the likelihood of a flood in the coming months?
- At what water level should we evacuate an area for safety purposes?
- Do these precipitation levels indicate that this may be a flood hotspot?

Water resource managers may ask questions to monitor local water supplies:

- At what rate is our groundwater being withdrawn?
- How will climate change affect water supply in this area?
- What are the trends in water temperature?

Water utilities may ask questions to ensure water quality:

- What nitrate concentrations exist in fresh surface and groundwater?
- When are we likely to see harmful algal blooms?
- What are the nutrient levels in this area?
- Is there an excessive amount of phosphorus and nitrogen in this freshwater?

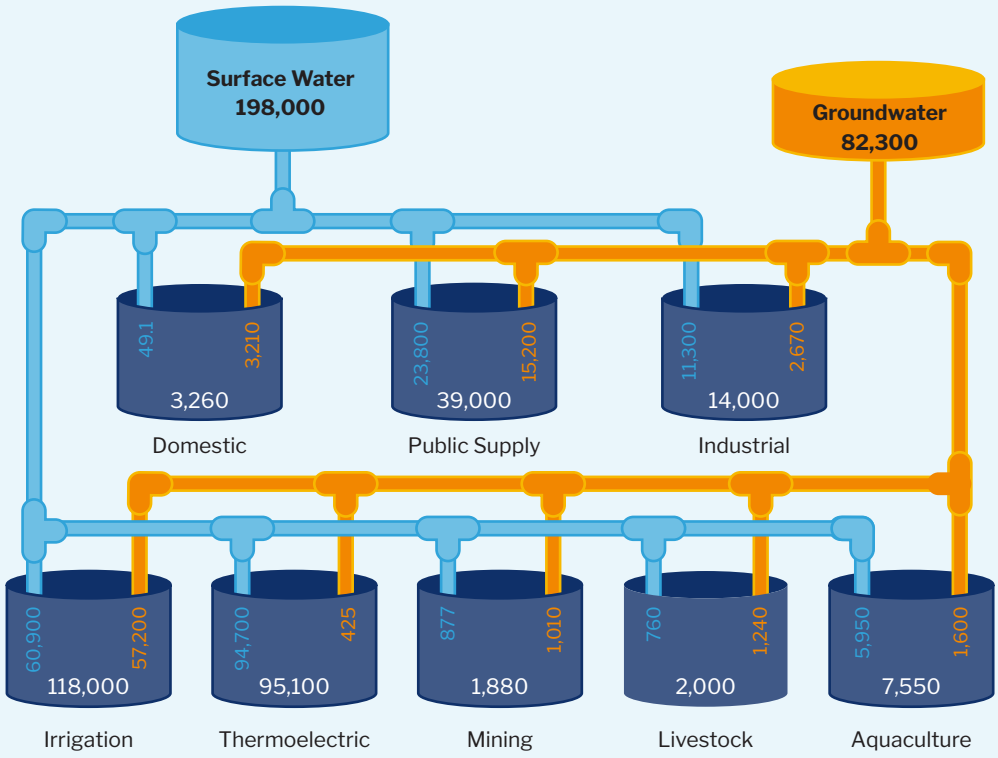
Good questions create demand for good information which creates demand for good data. In other words, once you know what you can know, you will want to know more. When organizations start to get answers to all these questions at once, real data analysis can occur.

3. Internal Knowledge Sharing

Are you relying on the same water dashboards you have had in place for the last decade? What efforts are you taking to uncover the next problems? This knowledge comes from looking at different data sources to develop a 360 degree view of your water network.

The data consolidation and analysis discussed in this eBook will bring an era of water transformation. Today, the biggest water users are power plants, farmers, and water utilities. Sharing data will help us identify the industries and communities that use water well, and those that don't. This knowledge sharing can help establish best practices and form helpful water regulations.

Source and Use of Fresh Water in the United States, 2015



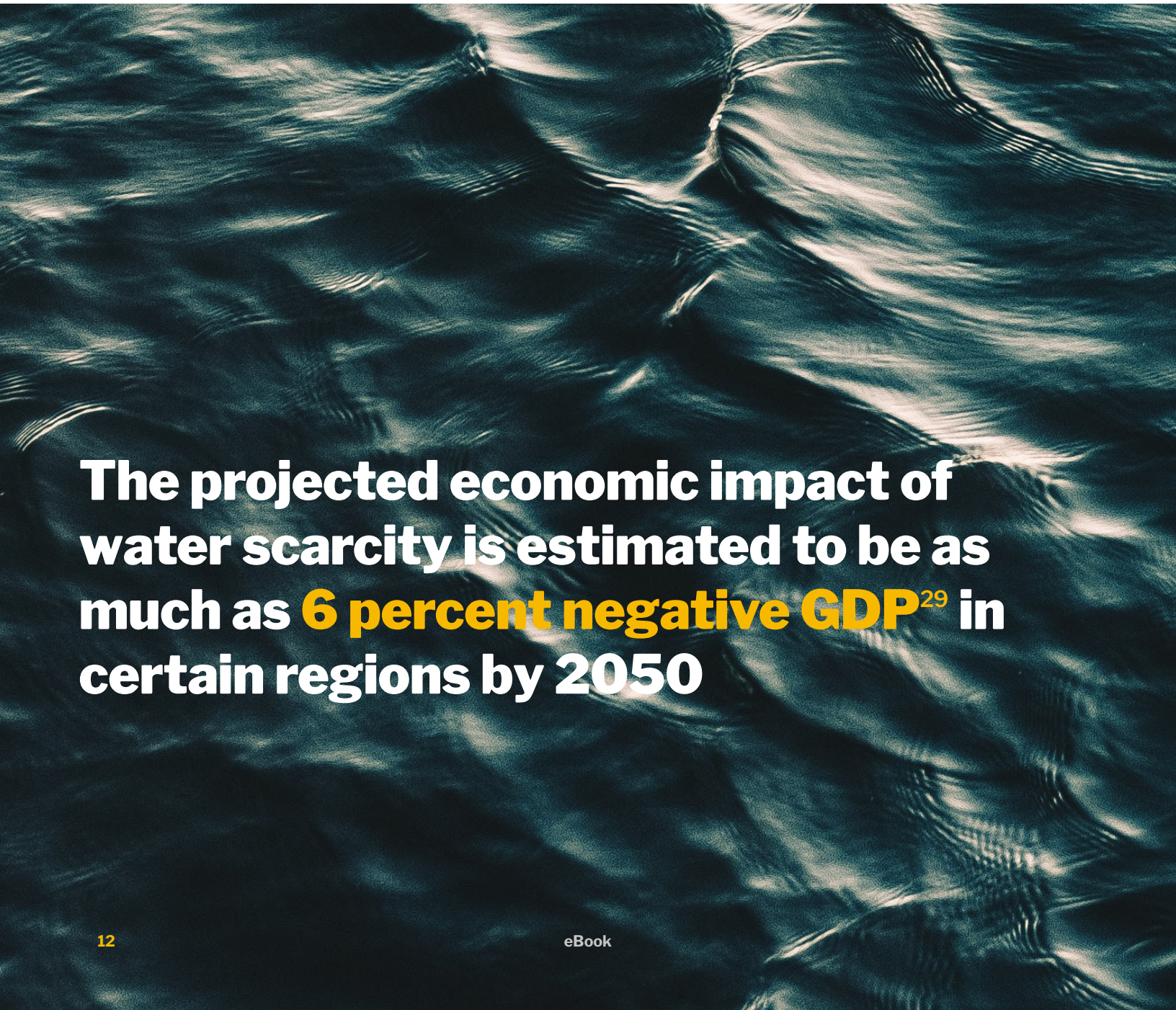
1,234 **Surface water**
1,234 **Groundwater**

1,234 **Total water use.** Data are in million gallons per day and rounded U.S. Geological Survey[27]

4. External Knowledge Sharing

According to a World Bank study[28], the projected economic impact of water scarcity is estimated to be as much as 6 percent negative GDP in certain regions by 2050. To solve a global problem, we need collaboration at all levels from national to state to local organizations. For example, by sharing water data with neighboring municipalities, organizations can drive collaboration on event planning and complimentary public works projects.

By connecting all water data, we can proactively predict issues, and ultimately protect life. By sharing this data with the public, with regulators, and with international bodies, we can raise awareness and drive real change. For example, NASA shares water data to support water management efforts in the US and Internationally.



NASA Shares Data to Support Water Management

NASA's Gravity Recovery and Climate Experiment (GRACE[30]) satellites measure the environmental and human impacts on water across the planet.

In the US, the agency's Western Water Applications Office works with multiple entities in the western U.S. to track how drought affects agriculture and water supplies[31].

NASA also works with the U.S. Agency for International Development to provide satellite data, computing tools and training through the SERVIR program. The program is intended to help African partners generate better flood forecasts.

GRACE satellites also monitor water and ice inventory in the glacier-covered Himalayas[32] to improve understanding of how the climate is changing snow packs.

Consolidating NASA data with local water data could have a huge impact on the sustainability of water sources worldwide.

Sharing Data to Change Attitudes

There is mounting financial pressure facing water utilities. The gap between citizen expectations and water system revenue to fully recover costs is ever widening, for cities and countries all over the world.

Perhaps because water is largely unpriced, global water infrastructure is drastically underfunded. Sharing data about water can change this. By sharing information with the public about water conservation efforts in their communities, governments can help change attitudes about the value of water. This can open dialogue about new pricing opportunities for water, similar to other government-owned utilities, whereby the resource is based on supply and demand.

Building a Business Case for Regional Water Data Projects

Usually it's a crisis that spurs action. The societal shock of running out of water will make governments, industry, and the public demand change — but will it be too late? The World Economic Forum[33] warns that widespread water shortages could exacerbate divisions in society and even lead to conflict over water resources.

The only way we can solve our water problems and avoid these shockwaves is by harnessing our data. Today, however, only 45 percent of government data[34] is clean, accurate, and in a usable format to glean real insights. If organizations can't get a handle on the data soon, they run the risk of falling further and further behind as the rate of technological change increases.

To secure a budget for valuable data initiatives, organizations should try to solve a small data problem like connecting lab data to compliance data. Showcase the results from these small data wins to your executive team and use them as your leverage to get more funding to build the people, process, and technology for data initiatives.

Water Data Management Milestones:

1. Water data consolidation to **break down data silos**
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3. Internal knowledge sharing across organizations, government departments, and **international bodies**
4. External knowledge sharing with industry and the public to **educate, inform, and encourage** respect for our most important resource

A strong business case should have representation from across the organization including people on the ground, strategic planners, IT, data science, and business intelligence. Each person has a role to play in unlocking value from water data.

Today, only 3 percent of an organization's data[35] meet the quality standards needed for true analytics and insights. As such, the time to act is now.

In the face of our current challenges, data is the only way we can make an impact on water sustainability.

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