CORPORATE WATER STEWARDSHIP AND THE CASE FOR GREEN INFRASTRUCTURE

CONSERVATION INTERNATIONAL - BHP ALLIANCE
AUGUST 2018

CONSERVATION INTERNATIONAL

BHP

This report was produced as part of the Conservation International - BHP Alliance, which was formed in 2011 to provide technical support in improving BHP's management of land and biodiversity and to deliver significant and lasting benefits to the environment in line with the company's voluntary conservation target.

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Citation: Conservation International. (2018). *Corporate water stewardship and the case for green infrastructure*.

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Key Terms

Green infrastructure

A network of natural, semi-natural and restored areas designed and managed at different spatial scales (from local to global) that encompasses all major types of ecosystems (marine, terrestrial and freshwater) and that aims to conserve biodiversity, mitigate emissions of greenhouse gases, enable societal adaptation to climate change and deliver a wide range of other ecosystem services (Silva & Wheeler, 2017).

This report focuses largely on green infrastructure for water, defined as green infrastructure that provides services that are equivalent or similar to gray water infrastructure. Green infrastructure that provides water-related services can produce a range of other services (sometimes represented as co-benefits). These multiple benefits — in the areas of biodiversity conservation, climate change mitigation and adaptation, and human health and well-being — are realized and maximized when green infrastructure is implemented at the watershed or landscape scale (Allen, 2012).

The report also focuses principally on green infrastructure solutions of protecting and/or restoring wetlands, natural floodplains, forests and grasslands, and riparian buffers. Protection and/or restoration may be implemented through any number of activities, including land acquisitions, conservation easements and conservation agreements. Even when these activities are undertaken primarily for reasons other than the provision of water-related services, they may still be considered green infrastructure for water if those services are produced. A portfolio of such activities, implemented at scale, may be represented as watershed/catchment management, conservation or restoration.

Green-gray infrastructure

A hybrid approach that integrates both green and gray infrastructure to achieve a synergistic outcome. Integrated green-gray water infrastructure recognizes that neither green nor gray is inherently better, and both are necessary and complementary to meet water security challenges. This approach can be optimal because it allows for the stacking of benefits and may be more adaptable than green or gray infrastructure alone. In a fully integrated approach, neither green nor gray infrastructure harms the other.

Nature-based solutions (NBS)

"Actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits," as defined by the International Union for the Conservation of Nature (IUCN).

NBS was adopted by the United Nations (UN) in its 2018 World Water Development Report, in which *NBS for water* are described as "inspired and supported by nature and use, or mimic, natural processes to contribute to the improved management of water" (United Nations, 2018a). The recently released Water Infrastructure Criteria under the Climate Bonds Standard highlights that NBS can include both natural features and nature-based features, the latter being "NBS that mimic characteristics of natural features but are created by human design, engineering and construction" (Climate Bonds Initiative Water Consortium, 2018). In short, nature-based solutions cover a continuum from natural to engineered.

Payment for ecosystem services (PES)

Payments to the managers of land or other natural resources in exchange for the provision of specified ecosystem services (or actions anticipated to deliver these services) over-and-above what would otherwise be provided in the absence of payment (Smith et al., 2013). Payments are typically given to service providers (e.g. landowners) by beneficiaries; in the case of water-related services, these beneficiaries are normally downstream while service providers are upstream.

Watershed investments

Any transaction between a buyer and a seller where financial value is exchanged for activities or outcomes associated with the maintenance, restoration or enhancement of watershed services or natural areas considered important for watershed services (Bennett & Ruef, 2016). A watershed investment is a type of PES.

Executive Summary

The next few decades of global water infrastructure investment will be transformative, and the choices that both public and private sector actors make now may determine if the global water crisis that looms in today's headlines will have been a harbinger of things to come or a turning point. This report makes the case for private sector investment in green infrastructure as part of a broader water stewardship approach that benefits companies, stakeholders in watersheds where those companies operate and source their materials, and the global community committed to sustainable development.

An exploration of data, literature, and real-world examples (including case studies from the forestry, packaging and paper, materials, utilities, and food and beverage sectors) has led to the following conclusions and recommendations:

Companies around the world are increasingly facing water-related risks. These include the physical risks of too much or too little water, or of poor or decreasing water quality; the reputational risks of being perceived as contributors to water-related problems; and the regulatory risks arising from poorly managed water use, leading to resource depletion or potentially restrictive future regulations. All of these risks, in turn, have clear financial implications, with companies spending at least US$ 23.4 billion on projects to mitigate water risk last year. Many companies cannot simply move their operations or supply chains to new geographies to reduce these risks, and even if they could, few watersheds in the world will remain untouched by water-related concerns, given the confluence of human activity, increasing water demand and climate change. Recognizing these risks, companies are exploring solutions on the path to corporate water stewardship.

One high-potential but underused corporate water stewardship solution is green infrastructure. Green infrastructure is key for companies seeking to go beyond near-term improvements in operational water use efficiency and reductions in downstream pollution, moving towards a more holistic water stewardship approach. Green infrastructure leverages the services that nature provides that might otherwise need to be furnished by built (or gray) infrastructure. Forests help to secure clean water for communities; wetlands and floodplains reduce flood risk to cities; and intact natural areas can maintain reliable water flows in rivers and the springs that feed them. Some water infrastructure combines elements of green and gray in new and surprising ways: a mangrove combined with a breakwater, a system of dikes overlaid with restored floodplains. Gray infrastructure, such as wastewater treatment plants, pipelines, floodgates, dams and reservoirs, and even desalination plants, will continue to be part of the world's water infrastructure. These engineered solutions, though, are neither sustainable nor sufficient on their own. There are options for how the world spends the estimated US$ 22.6 trillion needed by 2050 to meet water needs. In some cases, green infrastructure can provide an essential complement to gray approaches or be even more cost-effective.

By supporting the development of green infrastructure, companies and other stakeholders reap multiple rewards in the form of co-benefits that include and go beyond reductions in water-related risk. These include climate change mitigation and adaptation, biodiversity conservation, and a range of human health and well-being benefits, all of which contribute to meeting.

Sustainable Development Goal (SDG) targets. For instance, protecting natural systems can maintain good water quality and prevent the escalation of water treatment costs while simultaneously helping to secure clean water for local communities that have insufficient access to water, sanitation and hygiene (WASH) services, conserve habitat for native species, avoid greenhouse gas emissions, and maintain resilience for both people and nature. Watershed-scale investments in green infrastructure can also help companies maintain their social license to operate and build reputational goodwill, especially given that water resources are often pressured by competing demands.

By moving green infrastructure to the forefront of corporate water stewardship, the private sector will not only make its own stewardship goals more meaningful and interconnected, it will also help to advance the field of green infrastructure overall. Through investment and commitment, companies can help to bolster the enabling conditions for green infrastructure, including a supportive regulatory environment; new financing mechanisms and business cases; civic engagement and visibility; and cross-sector partnerships, both with other corporations and with governments and non-governmental organizations (NGOs). In doing so, companies will be able to drive green infrastructure projects that generate benefits for themselves, for local communities in the watersheds where they have a footprint, for governments looking to achieve development and climate goals, and for the environment.

Financing mechanisms provide pathways for companies to invest in green water infrastructure alongside other sectors. These can be direct investments in green water infrastructure that benefit the company, either via individual investments or through collective action programs such as water funds, or they can be return-seeking investments. Emerging developments in the finance space include funds that seed innovations in green infrastructure business models, water bonds for green infrastructure, payment for performance mechanisms and new insurance products. Green infrastructure will be most effective when applied at scale and over multiple years, a model that lends itself to partnership. Cost-effectiveness analyses can be done to compare green, gray and hybrid investment options.

Now is an optimal time for companies to take leadership roles in the green infrastructure space. This includes building expertise in the type of integrated, creative and at-scale water solutions for the next century. The private sector can contribute in important ways to develop proofs of concept and complement the work of other stakeholders — the public sector, civil society, academia and NGOs. Leading companies are beginning to take important steps and can go further, by:

- Investing in demonstration projects and designing them in ways that test uncertainties and collect clear metrics to build the evidence base and outline a path for other companies to follow.
- Developing and disseminating additional business cases that consider and demonstrate the full range of benefits that can accrue from green infrastructure investment.
- Contributing technical expertise to new or existing green infrastructure projects, especially (but not only) where they are being integrated with conventional gray infrastructure to deliver targeted water-related services.
- Advocating for stronger watershed governance and policies that allow for and/or promote green infrastructure and watershed investment.

- Making water stewardship commitments that involve collective action at the watershed scale and dedicating commensurate budgets to those commitments.
- Expanding existing gray WASH initiatives to include watershed protection and restoration as complementary, nature-based WASH solutions for local communities.
- Convening other private sector actors and key stakeholders in specific geographies to develop shared green infrastructure investments at the watershed scale, including through the seeding of green infrastructure funds.
- Pushing for sector associations to elevate the expectations for member performance, taking water stewardship beyond operational fence lines.
- Encouraging companies along their supply chains to support green infrastructure investment.
- Advancing innovative sustainable financing for green infrastructure, such as by issuing a bond for green water infrastructure; investing in such a bond; initiating or joining a regional or basin-scale water fund; designing and/or purchasing insurance for green water infrastructure; and participating in payment for watershed services programs.

Introduction

Private sector investment in green infrastructure can reduce water-related risks and help to fill infrastructure needs.

Green infrastructure leverages the natural ability of forests, grasslands and wetlands to provide services that might otherwise need to be provided by built (or gray) infrastructure. As nature's original solution to a range of water-related risks, green infrastructure is finally and increasingly recognized as complementary and in some cases even superior to gray infrastructure in addressing risks that include reduced availability, reduced quality and increased variability as manifested in floods and droughts (Figure 1) (Abell et al., 2017; Bennett & Ruef, 2016; McDonald & Shemie, 2014; UNEP & TNC, 2014). In fact, this year the World Water Development Report (WWDR), the UN's authoritative assessment of the world's freshwater resources since 2003, focused on nature-based solutions for water, making a strong case for the need to elevate green infrastructure within a broader toolbox of solutions for addressing these risks and simultaneously generating a range of co-benefits (United Nations, 2018).

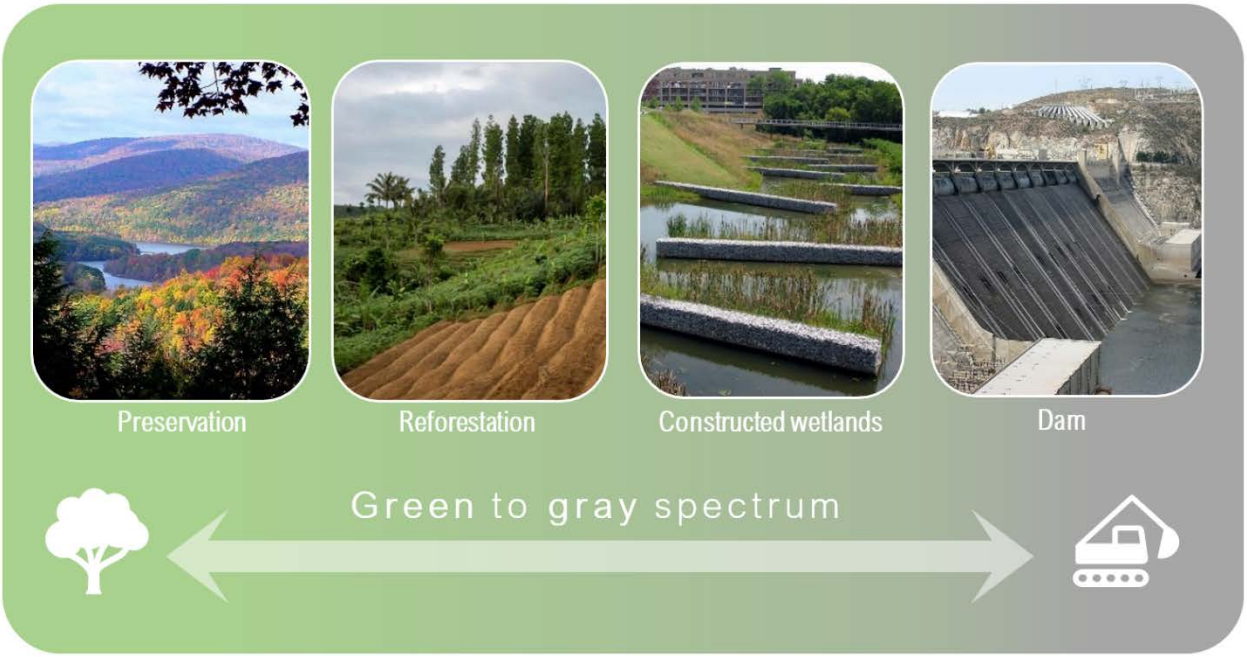


Figure 1: ***Green to Gray Spectrum.*** From left to right: (1) The Catskill Mountains where landowners receive payments for their stewardship to ensure that downstream New York City has clean water; (2) Conservation International's Green Wall reforestation project in Gunung Gede-Pangrango National Park, Java, Indonesia; (3) Kai County, Liyutang Reservoir, where Chevron and Conservation International partner to restore and delimit the watershed and establish nature-based treatment for rural wastewater and sewage; (4) Grand Coulee Dam, a concrete gravity dam in Washington state, USA (Britannica, n.d.). Green infrastructure can provide water supply regulation services that might otherwise be provided by gray infrastructure solutions like dams; water quality regulation services like those provided by water treatment plants; and moderation of extreme events such as floods as might otherwise be provided by levees (Bertule et al. 2014). Figure adapted from (Naylor et al., 2017) and (Bennett & Ruef, 2016

Globally, water infrastructure makes up a modest proportion of overall infrastructure investment, but infrastructure needs assessments show that both will need to grow significantly in the next two decades. These estimates for needed investment in water infrastructure vary, but according to the Global Infrastructure Hub, which tracks infrastructure needs in more than 50 countries, governments will need to nearly double annual water infrastructure investment by 2040 (Figure 2) (Global Infrastructure Hub, 2018). Looking cumulatively over time, the Organisation for Economic Co-operation and Development (OECD) estimates that global water infrastructure needs range from US$ 6.7 trillion by 2030 to US$ 22.6 trillion by 2050, not including funding to support the development of water resources for irrigation or energy (OECD, 2018). This funding is critical to supply clean water for burgeoning populations, provide sanitation services, irrigate agricultural fields and avoid flood damages. Whether investment in water infrastructure will achieve this needed scale is an important unanswered question, but equally important is the question of what kinds of infrastructure these funds will finance. The WWDR and other researchers highlight the need for both public and private actors to invest substantially more in green infrastructure than they currently do.

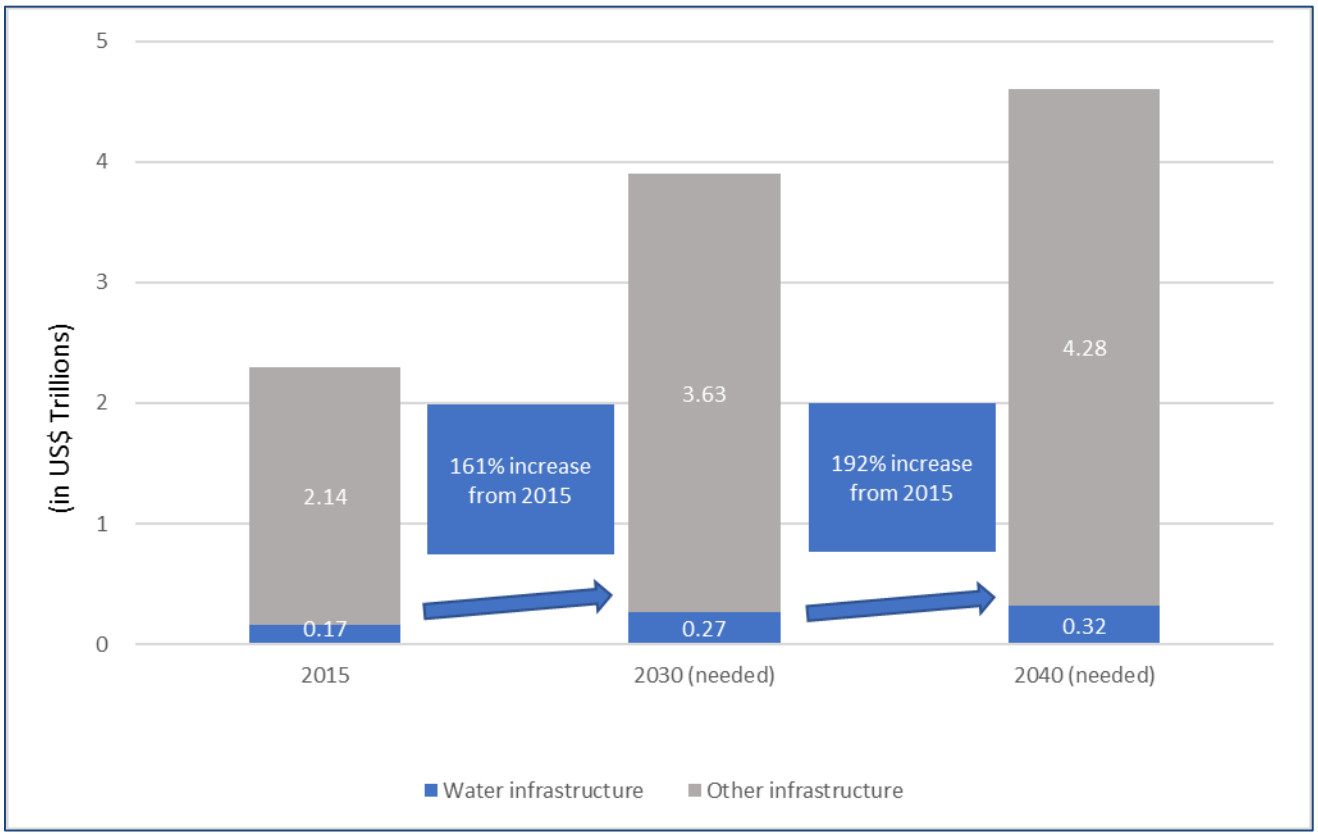


Figure 2: Annual Public Spending on Water Infrastructure. Data from the Global Infrastructure Outlook, which tracks current trends and forecasts future needs for infrastructure investment in 50 countries. The report captures mainly public infrastructure investment, focusing on national statistics, OECD data, and econometric estimates (Global Infrastructure Hub, 2018).

Though governments are primarily responsible for meeting the water needs of their populations, global water infrastructure needs are relevant to private sector actors that benefit from public water infrastructure that is underpriced or under-maintained — and thus may want to supplement

public investment in water infrastructure as they look to set context-based water targets (CDP et al., 2017). There is no comprehensive number for current total private sector water infrastructure investment, but data from more than 700 of the world's largest publicly-listed companies indicates that those companies spent at least US$ 23.4 billion on water projects in 2017 (Figure 3). Robust global data on public or private green infrastructure spending is similarly sparse, though on the public side, Forest Trends tracked US$ 23.7 billion in watershed investments (in 2015), the majority of which came from the Chinese government's investment of US$ 13.5 billion through 'eco-compensation' programs that pay upstream landowners for management activities (Bennett & Ruef, 2016). Total private investment in green as opposed to gray water infrastructure is unknown. Best estimates signal that there is room for greater reporting on and spending by the private sector around investments in green infrastructure.

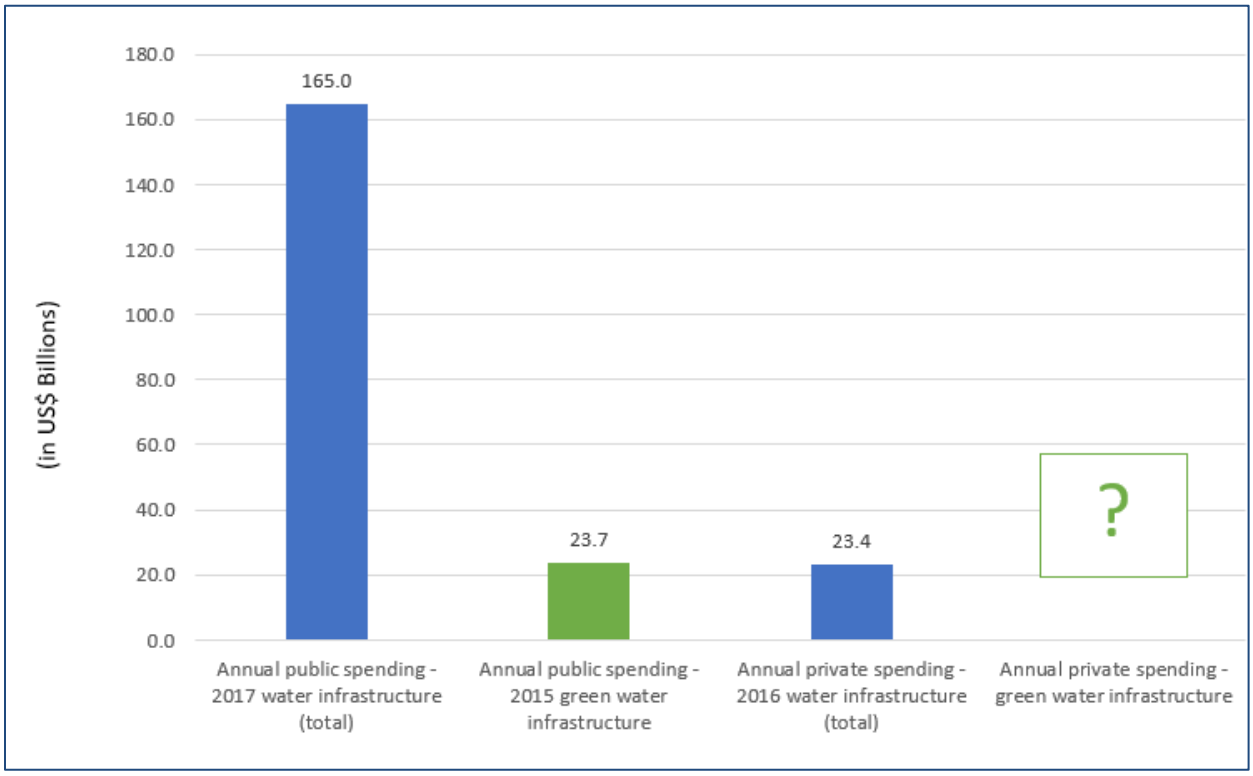


Figure 3: Best Available Estimates on Public vs. Private Water Infrastructure Spending, and Amount of Each that is 'Green'. Data from the Global Infrastructure Outlook (for total infrastructure investment) (Global Infrastructure Hub, 2018), Forest Trends (for annual public spending on green water infrastructure) (Bennet and Ruef 2016), and CDP's 2017 water report (for annual private spending on water infrastructure) (CDP, 2017b). All numbers reflect the most recent year of data available.

Greater utilization of green infrastructure could shrink the overall water infrastructure gap — particularly where green infrastructure can provide a more cost-effective or long-term sustainable option than conventional gray infrastructure, or where the combination of the two via integrated green-gray projects can reduce overall costs and increase longevity. A recent study of the source watersheds for 309 large cities found that 90 percent of them have experienced watershed degradation over the last century, increasing water treatment costs by about half and costing water utilities globally an estimated US$ 5.4 billion annually (McDonald et al, 2016). This degradation is by no means slowing down in the twenty-first century: A study using data from Global Forest Watch

found that global watersheds lost an average of 6 percent of their tree cover between 2001 and 2014, increasing risks of erosion, pollution and flooding (Ozment et al., 2016).

How much would it cost to reverse these trends? A forthcoming survey by Forest Trends and The Nature Conservancy (TNC) hopes to provide the first global cost data for watershed conservation programs (Kroeger et al., 2018). In the meantime, another global study gives one indication: across the likely source watersheds of around 4,000 cities, US$ 6.7 billion annually could achieve a 10 percent sediment reduction with associated water security benefits for 1.2 billion people; nutrient pollution in waterways could be meaningfully reduced for a similar number of people through US$ 41 billion in annual investment (Abell et al., 2017).

If green infrastructure investments for water were to increase to meet the overall water infrastructure challenge, who would foot the bill? Until now, by far the largest share of investments in water-related green infrastructure has come from the public sector. Why should the private sector invest in green infrastructure when the public sector has been largely picking up the tab? For one, it is doubtful that public money will ramp up to the projected amount needed in the near-term, meaning that many companies dependent on reliable water supplies will go without adequate water infrastructure in the absence of increased private investment. Also, there are important efficiencies, technical advances and economies of scale that can be achieved through public-private partnerships, water funds, payments for watershed services markets and water bonds that include private sector participation.

Equally, if not more important, investments in green water infrastructure may in many cases be in a company's own best interest, by helping to achieve both operational and broader water stewardship goals, and to advance other parallel objectives such as environmental commitments. In other words, these investments can help to reduce companies' physical, regulatory and reputational water-related risks (Sustainable Water Partnership, 2017). Investments to reduce these risks can take many forms (see section below on Mechanisms for Financing Green and Green-Gray Infrastructure); the case studies and examples in this report illustrate the diversity of investments.

Multiple objectives drive private sector investment in green infrastructure. As one indicator, company respondents to the 2016 Forest Trends survey reported that, in aggregate, the most frequent motivation for investing in watershed services was to enhance brand value and/or demonstrate leadership on water resource challenges. Not unexpectedly, the objective of reducing physical water risks was also prominent (Bennett & Ruef, 2016). Importantly, while reductions in reputational risk may be harder to quantify than reductions in physical risk, they may also be achieved more rapidly.

Companies have increasingly been focused on improving their corporate water stewardship to reduce these risks, as recent interviews have confirmed (Newborne & Dalton, 2016). However, much private sector water investment has focused on operational water use efficiency and pollution reduction rather than on more advanced collective action engagements such as those noted in the CEO Water Mandate's "Water Stewardship Progression," a framework that illustrates the range of activities that today's responsible corporate water stewards should aim to conduct (Newborne & Dalton, 2016; Winrock International, 2017).
As companies move along this progression and work to set and meet context-based water targets that assess company water needs against those of other water users in a watershed — including

ecosystems themselves — green infrastructure will likely be an important solution (CDP et al., 2017). The process of setting a context-based water target is contingent on collaboration with other water users, many of whom may support the protection of shared green infrastructure with benefits that transcend property boundaries (CDP et al.,2017).

Given the private sector's interest in enhancing its water stewardship to achieve meaningful results that protect companies' dependency on this vital resource into the future, and overall heightened interest in green infrastructure around the world, this report focuses on the intersection of corporate water stewardship and green infrastructure at the watershed (or landscape) scale. Through examination of recent literature and case studies, this report explores how green infrastructure can provide a range of benefits to companies in general and to specific industry sectors in particular; how the private sector can influence key enabling conditions necessary for successful green infrastructure projects; and how businesses can contribute to catalyzing sustainable financing for green infrastructure projects implemented over spatial and temporal scales where they can meaningfully reduce water-related risks and generate co-benefits for a range of stakeholders.

Wetlands like swamps, bogs and marshes absorb rainfall, purify water, and regulate the flow of water to streams and rivers. Wetlands can also store carbon, provide habitat for species like water birds, and support critical fisheries for local communities. © Luciano Candisani/iLCP

1. Private Sector Interests

Companies face a range of physical, regulatory and reputational water risks that cost them billions per year but rarely use green water infrastructure to manage these risks, despite its potential.

Corporate water-related risk

In 2014 in Varanasi, India, the Coca-Cola Company faced protests and was eventually forced to close a bottling plant after the local Pollution Control Board ruled it was over-extracting groundwater and exceeding legal pollution limits in its effluents (The Guardian, 2014). In 2015 in Mozambique, a flash flood destroyed 48 homes, and an Amnesty International report found that the Chinese mining company Haiyu's depositing of sand in wetlands around its operations contributed significantly to the flooding (Amnesty International, 2018). In 2017 in California, Nestlé made headlines for illegally extracting water during an unprecedented drought (Rock, 2017). These unenviable positions for companies all have one thing in common: they arose from the mismanagement of water resources that resulted in physical impacts such as pollution and floods. They also resulted in reputational impacts that played out in communities and in the media.

These are not isolated examples. Executives responding to the World Economic Forum's 2018 Global Risks Report ranked water crises as the fifth most impactful water risk globally. Meanwhile, extreme weather events, natural disasters and the lack of climate change adaptation and mitigation measures (all of which have implications for water) rank in the top five for both "most likely" and "most impactful" risk categories (World Economic Forum, 2018).

Private sector water risks fall broadly into three categories, as defined by the CEO Water Mandate (The CEO Water Mandate, n.d.):

1. Physical water risks include having too little water, too much water or water that is unfit for use.
2. Regulatory water risks occur because of changing, ineffective, poorly implemented or inconsistent water policies.
3. Reputational water risks stem from changes in how stakeholders view companies' real or perceived negative impacts on the quantity and quality of water resources, the health and well-being of workers, aquatic ecosystems and communities.

Water data compiled by CDP, an organization that supports companies and cities to disclose the environmental impact of major corporations, represents disclosures from companies that cover 60 percent of global market capitalization and are therefore a useful benchmark for private sector water risk as perceived and reported by companies. Companies disclosed risks on behalf of 643 institutional investors with US$ 67 trillion in assets (CDP, 2016). While not a comprehensive view and subject to response rate biases (a large number of consumer goods and materials companies responded, versus few energy companies and utilities), the CDP disclosures are still quite useful in detecting trends. As shown in Figure 4, most companies experienced physical water risks such as increased water scarcity, flooding, drought and climate change. Among regulatory risks, companies were most concerned about mandatory water standards, lack of transparency around

water rights and poor coordination among regulatory bodies. Among reputational risks, negative media coverage and community opposition topped the list.

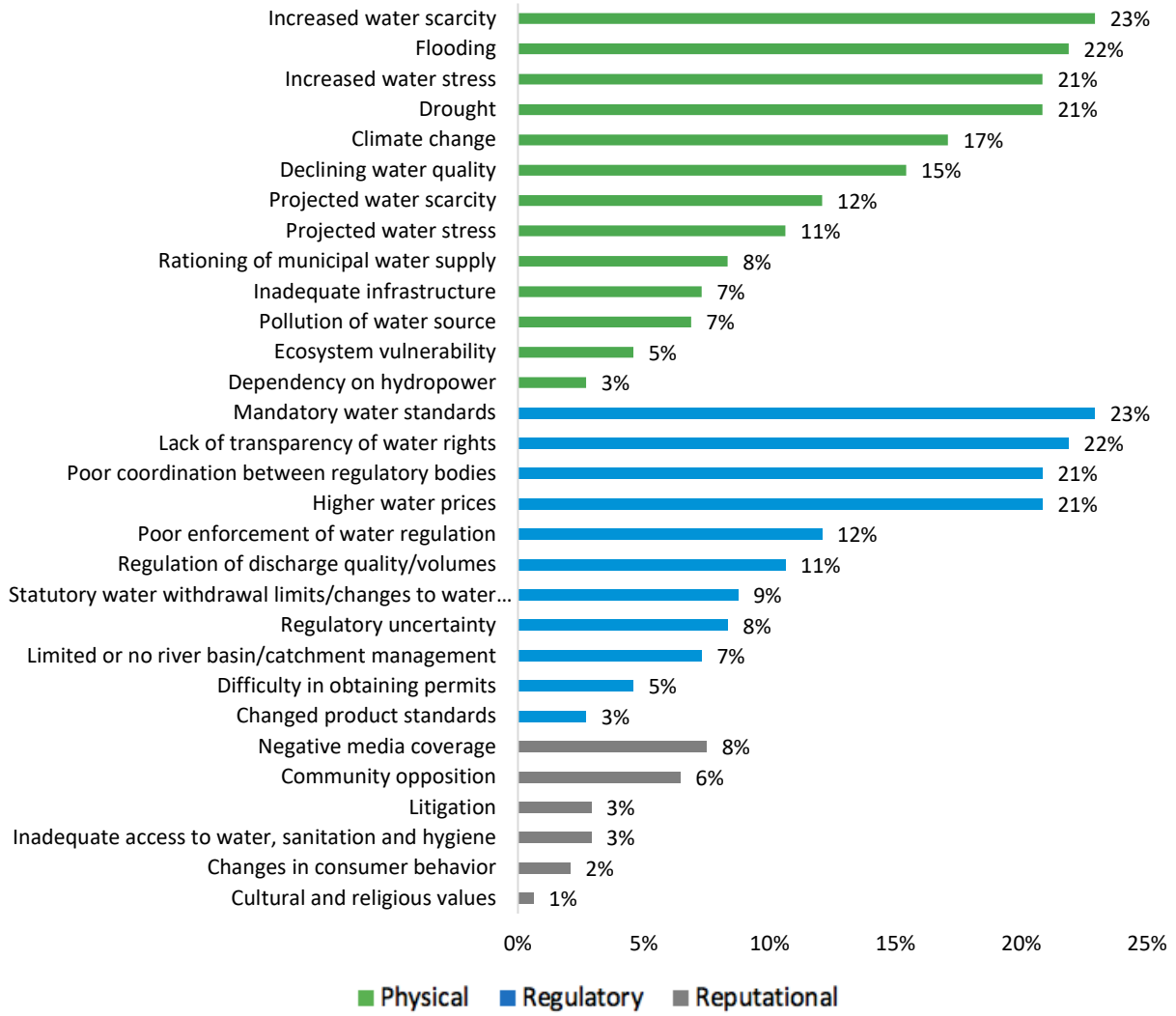


Figure 4: Percentage of Companies Facing Different Water Risks, 2016. Data from the CDP illustrates the types of risks that fall into each of the three risk categories mentioned above, and the percentage of companies that experienced each risk in 2016, out of 480 companies that publicly disclosed water risks to their investors in that year (an additional 127 company responses were submitted to investors but not made public, so not included). (CDP, 2016).

Cost and risk management strategies

In total, companies reported US$ 14 billion in water-related financial impacts from the above risks in 2016 (CDP, 2016). (Data for 2017 were not reported.) The most common financial implications were derived from higher operating costs and plant/production disruption, though companies also reported losses due to constraints to growth, delays in permitting, employee health and brand damages. Business losses from extreme events are also commonly quantified in financial terms. For example, the 2011 monsoon floods in Thailand hamstrung the technology industry, with companies such as Panasonic and Hewlett-Packard reporting more than a billion dollars in losses

each from forfeited sales and hard disk drive shortages. The financial implications of water-related brand damage are more difficult to pinpoint, but no less real; as an indication, recent findings by market-research company Millward Brown showed that brand represents more than 30 percent of the stock market value of companies in the S&P 500 index (The Economist, 2014).

According to responses to investors, many companies are already actively managing these risks, with CDP respondents committing US$ 23.4 billion across more than 1,000 water projects in 2017 (CDP, 2017b).

Use of green infrastructure to manage corporate water risk

Data on what, specifically, the US$ 23.4 billion was spent on is not yet available, so it is not known what percentage of this finance went towards green infrastructure (J. Lott, personal communication, June 27, 2018). However, out of the 480 companies that publicly reported on water management strategies in 2016, the most common water risk management strategies were infrastructure investments (29 percent of respondents) and engagement with public policy makers (22 percent of respondents); relatively few companies (only 3 percent) implemented river basin restoration.

A few green-gray examples are embedded within the "infrastructure investment" category, though this risk management strategy usually refers to gray infrastructure alone, such as investments in water monitoring systems, pumps, new wastewater treatment facilities and combined cycle for electricity generation. The idea that green infrastructure, as a solution, is underutilized by companies is also supported by various reports and working groups trying to address this issue, including the Nexus Dialogue on Water Infrastructure Solutions (Ozment, DiFrancesco & Gartner, 2015) and the World Business Council for Sustainable Development's Incentives for Green Infrastructure review (World Business Council for Sustainable Development, 2017).

In their report, *The Value of Water*, WWF and IFC draw a distinction between company-related water risks that are typically addressed through facility-level efficiency and pollution prevention (termed water management approaches) and basin-related water risks that are addressed through external actions (termed water stewardship approaches). While water management approaches may create short-term value, water stewardship approaches — which include green water infrastructure — can address water risk more comprehensively (Morgan & Orr, 2015).

Though green infrastructure is not the solution to every corporate water challenge, it can be used as part of a company's strategy to reduce physical, regulatory and/or reputational risks (Table 1), and it is an important indicator of a company's progression towards the stewardship end of the management-stewardship continuum.

Table 1: Examples of corporate risks that can be addressed with green infrastructure.

Water-related risk	Green water infrastructure to address risk	Example
Physical – Climate change	In-stream monitoring	U.S. power generator Exelon established a Drought Monitoring Task Force and is installing monitoring systems in rivers to understand changing conditions (Exelon Corporation, 2017).
Physical – Projected water scarcity	Watershed restoration	Beer company Anheuser Busch worked with TNC to create a PES system to incentivize farmers to implement land management practices that reduce erosion and sedimentation in the three watersheds in Brazil (Water & Agriculture Working Group, 2013).
Physical – Ecosystem vulnerability	Company ecosystem fund	French food products company Danone founded its EU100 million Ecosystem Fund in 2009 to reduce watershed vulnerability in the company's value chain (Danone Écosystème, n.d.).
Regulatory – Higher water prices	Engagement in collective watershed action	British beverage company Diageo Plc engaged with the Nairobi Water Roundtable in anticipation of increased water prices associated with greater demand than supply in this watershed, where they have a brewery (Diageo, 2014).
Regulatory – Wastewater discharge regulation	Reforestation	Facing water shortages that led to tighter wastewater regulations in Mexico, Volkswagen reforested 7.5 square kilometers around its production plant in the Puebla Tlaxcala Valley (BAFWAC, 2017).
Reputational – Negative media coverage	Mangrove restoration	Danone subsidiary Bonafont invested a portion of its revenue from bottled water sales into a mangrove restoration project in areas of Chiapas and Oaxaca, Mexico ravaged by hurricanes; they planted a tree for every Facebook like and inspired participation by more than one million Mexicans (Danone, 2016; Pro Natura, 2013; Havas Media, n.d.).

2. Why Invest? The Benefits of Green Infrastructure

Investing in green infrastructure can generate co-benefits that add value for a range of stakeholders and address multiple SDGs.

The protection and restoration of natural and near-natural ecosystems, such as forests and wetlands, are well-established potential solutions for improving water quality as well as supporting biodiversity conservation (Ellis, 2013; Gill, Handley, Ennos & Pauleit, 2007). In addition, green infrastructure is increasingly being put to work in the service of water quality and supply regulation, moderation of extreme events and climate change adaptation, biodiversity conservation, climate change mitigation, and human health and well-being improvements (Abell et al., 2017; UNEP & TNC, 2014). This report summarizes high-level relationships between four major types of green infrastructure and these benefit categories and provides a real-world example of private sector investment for each (Table 2).

Water quality

There is relatively good evidence for the water quality benefits of green infrastructure (including a range of agricultural and grazing best management practices) when implemented at scale, especially in relation to reducing nutrient and sediment pollution. These water quality improvements can have clear economic benefits: for instance, TNC concluded that reducing sediment and nutrients by 10 percent leads to a roughly 5 percent reduction in water treatment costs (McDonald & Shemie, 2014).

Different industry sectors require water of different levels of quality as a production input (Cazcarro, López-Morales & Duchin, 2016), and sectors with requirements for higher quality water, such as the food and beverage sector, may have a high internal motivation for investing in green infrastructure designed to achieve water quality objectives. Investing in water quality protection and improvements can also be important for maintaining a license to operate within a watershed (Newborne & Dalton, 2016). Forest Trends' 2016 survey of private sector investors in green infrastructure found that benefits to local communities, including access to clean drinking water (a water, sanitation and hygiene (WASH) component), were among the top five reasons for those investments (Bennett & Ruef, 2016).

Water supply

For many companies, having water available for cooling, manufacturing processes, energy generation, irrigation and more is an equal or greater concern than water quality. IUCN confirmed this priority, noting that quantity concerns were expressed more often than those around quality, and that "company representatives interviewed reported fears of disruption to company operations, with cases of water access constraints already encountered in contexts of dryness or drought (less as a result of flooding incidents)" (Newborne & Dalton, 2016).

The water supply regulation benefits of green infrastructure are complex, often difficult to predict, and can relate as much to below-ground processes as to what we can measure and model above ground (Brown et al. 2005). Scientists are actively working to understand variation in responses to

activities like reforestation and wetland restoration and to develop rules of thumb about metrics of interest like increases in dry season flow and groundwater recharge. However, to paraphrase one paper, “we need not lose sight of the soil for the trees” when considering eco-hydrologic processes and impacts (Bruijnzeel, 2004). In essence, while the specifics of possible benefits accrued by green infrastructure may not be complete, one relatively straightforward conclusion is that protecting intact natural systems before they are lost can be a cost-effective way of helping to maintain reliable downstream water flows.

Moderation of extreme events and climate change adaptation

Floods, droughts and other extreme climate events are occurring with greater frequency around the world, and green infrastructure has potential for reducing risk and building resilience to climate change (EEA, 2017; USAID, 2017). For companies concerned about floods, drought or both, green infrastructure can be a viable complement or supplement to engineered solutions such as seawalls, water storage tanks or desalination plants. Thus, using green infrastructure to moderate water extremes may become an increasingly attractive strategy.

As with water supply regulation, more on-the-ground empirical — as opposed to purely modeled — evidence is needed to elucidate the contexts and scales at which green infrastructure will be most effective. However, early examples of implementation of this solution include the utility Suez restoring wetlands in New Jersey following the devastation of Superstorm Sandy and the mining company Anglo American Platinum planting trees around tailings dams to help with dust mitigation during dry periods, according to their CDP disclosures.

Biodiversity conservation

Biodiversity plays a critical role in supporting functional ecosystems and the services they provide, including the provision of water. Meanwhile, because of the potential negative impacts that development activities can pose to habitats and species, companies engaged in those activities face a variety of regulatory requirements with respect to assessing and mitigating impacts to biodiversity (United Nations, 2012). To obtain legal permits and license to operate, companies are required to carry out environmental impact assessments and develop environmental management or biodiversity action plans that detail efforts to mitigate identified impacts.

Investments in green infrastructure, if tied to biodiversity conservation, can yield co-benefits in helping companies simultaneously meet biodiversity-related regulatory requirements and reduce water-related risks. One way these co-benefits can be achieved is by supporting the protection (and long-term enforcement and management) of intact natural ecosystems via the creation of strategically located reserves or other effective area-based conservation measures. These areas can help to secure both terrestrial and aquatic native species and communities, both within those reserves and potentially for some distance downstream (Abell et al., 2017).

Climate change mitigation

According to a recent study, natural climate solutions (NCS) such as avoided deforestation and restoration can provide 37 percent of the cost-effective climate mitigation needed between now and 2030 to stabilize warming to below 2 °C (Griscom et al., 2017). According to the same study, per unit area, wetlands hold the highest carbon stocks, and wetlands-related pathways comprise 14 percent of NCS mitigation opportunities (Griscom et al., 2017).

Investor actions are sending powerful long-term signals to companies about their desire to accelerate the low-carbon transition (United Nations Secretary-General, 2015). In response, companies are making voluntary commitments (Summit, 2014). Therefore, though companies may implement green infrastructure solutions primarily to manage water quality or supply, the act of avoiding ecosystem conversion or restoring degraded areas can have the additional benefit of contributing to climate change mitigation. If verified under a carbon accounting methodology, companies might even claim the GHG reductions of green infrastructure against a climate mitigation goal. See, for example, VCS's Coastal Wetlands Creation carbon methodology or TNC's new partnership with insurance giant XL Catlin to bring "blue carbon" credits that capture both the carbon and resilience values of coastal ecosystems to market (Verra, 2014; Capture Ready, 2018).

Human health and well-being

Green infrastructure can provide health and well-being benefits through multiple pathways (Abell et al., 2017). Employees and their families working and living within a watershed where a company operates or sources its materials can benefit from improved water quality and reliability, especially where WASH services in those communities are insufficient. Food security for local communities may improve with more reliable access to water resources for food production, with more productive inland fisheries, and with elevated pollination services from restored habitats. Furthermore, landowners who participate in payments for ecosystem services programs may experience livelihood improvements.

Taken together, these benefits can help a company secure license to operate while also contributing to the long-term sustainability of its green infrastructure investment. This can especially be the case where that investment includes strengthening watershed governance, such as through catalyzing watershed committees with strong community and other stakeholder participation.

Table 2: **Benefits associated with a selection of key green infrastructure solutions for water, with real-world examples of related green infrastructure projects.**

Green Infrastructure	BENEFITS						EXAMPLE
	Water quality regulation	Water supply regulation	Moderation of extreme events	Biodiversity conservation	Climate change mitigation	Human health and well-being	
Forest / grassland protection and restoration	Forests and grasslands reduce erosion and sedimentation of freshwater ecosystems and reduce nutrient runoff where restored areas replace previously cultivated lands.	Protecting intact areas helps secure existing water supplies, including through maintaining infiltration and linked groundwater stocks and flows; the impacts on water supply from habitat restoration, such as tree planting, will be context-specific and dependent in part on soil condition.	Protecting intact landscapes maintains soil infiltration capacity, thereby reducing the rate of runoff and reducing subsequent downstream flood risk; similarly, it reduces landslide risk for moderate events.	Intact landscapes provide habitat for terrestrial species and promote habitat integrity in downstream freshwater systems; restored systems can reduce extinction risk through habitat provision.	Protection of forests and grasslands contribute to avoided greenhouse gas emissions. Restoration of forests and grasslands can remove carbon from the atmosphere and store it.	Livelihoods are sustained by non-timber forest products and sustainably grazed livestock. Intact systems support pollinators critical for proximate crop production. Intact watersheds are linked to reduced downstream water-borne disease. Natural systems provide mental health benefits.	South Africa's Working for Water Programme, founded in 1995, had by 2015 removed 'thirsty' alien invasive plants from 2.8 million hectares across the country's rangelands to help restore water regimes. Private funders in the government-led payments for ecosystem services program, designed to produce environmental and social benefits, include farmers and the forestry industry (Working for Water, n.d. & Kilian, 2015).
Riparian buffer establishment	Forest and grass buffers are well-established as elements that reduce sediment and nutrient inputs to streams by filtering runoff and controlling erosion.	Protecting intact riparian buffers can in some contexts contribute to regulating downstream flows by replenishing groundwater.	Riparian buffers promote groundwater infiltration and can help to make room for a river, contributing to the reduction of flood risk for moderate events.	Riparian buffers are critical habitat to diverse terrestrial species. Their inputs of organic matter to streams and shading to reduce stream temperatures are critical to aquatic and semi-aquatic species.	Some studies indicate riparian ecosystems and floodplains store significantly more carbon per area compared to surrounding uplands.	Riparian buffers can provide recreation and ecotourism opportunities, including by maintaining the ecological integrity of streams, rivers and lakes.	In Malaysia, Nestle's Project RiLeaf reforests riparian buffers to minimize water pollution from sedimentation and agricultural run-off. In its first years, a local community earned US$ 53,244 by producing and planting seedlings (Nestlé, 2014).

Table 2 continued

Green Infrastructure	BENEFITS						EXAMPLE
	Water quality regulation	Water supply regulation	Moderation of extreme events	Biodiversity conservation	Climate change mitigation	Human health and well-being	
Floodplain reconnection to rivers	Floodplains act as natural pollution filters.	Floodplains promote groundwater recharge and slow and spread overland flow in the service of water supply regulation.	During larger flood events, floodplains connected to rivers can hold flood waters and reduce the risk of damage to communities.	Floodplains are highly productive systems and are especially important as nursery areas for fish and other species.	Floodplain restoration can promote carbon sequestration in soils. Protecting intact floodplains promotes carbon storage.	Floodplains support inland fisheries, which can be essential for food security. They provide fertile soil for crops and recreational and ecotourism opportunities.	Real estate developer Oak Tree Development Group chose floodplain restoration for its many co-benefits over gray infrastructure options to manage stormwater at a Pennsylvania development. At least 12 stormwater basins totaling US$ 1.3 million will control runoff, cut pollutant flow, and cut sediment flow to the floodplain by 45 percent (Mekeel, 2017).
Wetland protection and restoration	Wetlands are natural water purification systems, with wetland plants in particular serving as pollution filters.	Wetlands act as sponges, absorbing water and slowly releasing it to promote more reliable downstream flows.	Wetlands can reduce flood risk by storing water and slowly releasing it, with greater benefits from larger wetlands.	Wetlands provide critical habitat for nearly all of the world's water birds, including migratory species.	Peatlands store twice as much carbon as all the world's forests.	Wetlands provide essential habitat for inland fisheries and are also used for crop (e.g. rice) and aquaculture production. They provide recreational and ecotourism benefits and have strong cultural and religious significance.	Louisiana is applying Gulf oil spill funds to restore coastal wetlands using a pay-for-performance model; contractors are paid based on wetland performance (e.g. its ability to slow coastal erosion, reduce flooding and promote biodiversity). Environmental Impact Bonds may be used to accelerate the realization of benefits (Cunniff, 2017).

Mapping green infrastructure benefits to the SDGs

The many benefits of green infrastructure for water can help companies make contributions to achieving the SDGs.

The UN's SDGs define global priorities and aspirations for 2030. These 17 goals and 169 targets provide a common framework of action and language for all actors to mobilize solutions toward addressing the world's biggest sustainable development challenges. The SDGs explicitly call on businesses to apply their leading solutions, technologies and capacity for innovation to advance sustainable development, while still meeting business objectives (GRI, 2015). In addition to a range of benefits, such as identifying future business opportunities or stabilizing markets, there is a more fundamental connection between the SDGs and business: natural capital, which underpins the global economy. Businesses have quickly taken up the SDGs, indicating an awareness of the value offered by aligning strategies with the SDGs; four out of 10 of the world's largest companies already reference the UN SDGs in their corporate reports (Blasco, King & Jayaram, 2018).

To illustrate the ways in which expanded use of green infrastructure for water could contribute to multiple SDGs, particularly those potentially relevant to business objectives, we identified nine SDGs and 12 targets as having direct relevance (Table 3). While there are dozens of connections to make between the benefits of green infrastructure and the goals of the SDGs, our analysis included only those that businesses could feasibly impact and attribute to green infrastructure. Behind each of these targets are indicators that the UN will use to measure progress against the SDGs and that may be relevant to businesses looking to quantify their own contributions.

Table 3: Contributions of green infrastructure to achieving a subset of SDG targets. The multiple benefits that green infrastructure can generate map to numerous SDGs and their targets. These SDGs include and go well beyond SDG 6, the "water goal." Monitoring plans can be designed using SDG indicators to measure contributions toward targets. Note that urban green infrastructure solutions are included here but not elsewhere in the report.

SDG	Target(s) contributed to by potential green infrastructure benefits	Connection to green infrastructure
	3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.	Intact watersheds are correlated with lower incidences of diarrhea from water-borne diseases.
	5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate.	Improved access to clean freshwater sources can free up time for girls to attend school and for women to do paid work.

Table 3 continued

SDG	Target(s) contributed to by potential green infrastructure benefits	Connection to green infrastructure
	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	Green infrastructure can help to filter wastewater, of which 80 percent is returned untreated to ecosystems worldwide.
	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.	Restoring wetlands and floodplains increases freshwater habitat.
	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes.	Green infrastructure solutions like forest and wetland restoration can contribute to climate change mitigation. Urban green infrastructure can be more sustainable and efficient than gray counterparts.
	11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage.	Green infrastructure can provide an economically attractive case for protecting natural heritage.
	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	Green infrastructure improves air quality and can be designed and located to improve waste management.
	11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.	Green Infrastructure can be integrated into urban settings to provide multi-benefits for people and the environment.
	12.2 By 2030, achieve the sustainable management and efficient use of natural resources.	Green infrastructure has a small material footprint as compared to gray infrastructure.
	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.	Forests, wetlands and floodplains can reduce flood risk through promoting infiltration.
	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.	Green infrastructure can improve coastal health by reducing nutrient runoff (thus reducing eutrophication) and by filtering other pollutants.
	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.	Protected areas and other effective area-based conservation measures are key green infrastructure approaches for conserving areas that provide water-related services.

3. Influencing Enabling Conditions for Green Infrastructure

Green infrastructure projects may have the potential to deliver on multiple benefits, but whether the project is viable depends on the presence of enabling conditions — some of which the private sector has the power to influence.

The viability of a potential green infrastructure project hinges on the project's likelihood of reducing risk and producing benefits, and also its likelihood of being implemented given physical, social, political and economic realities. The elements that help to determine this viability are often referred to as enabling conditions. Among these enabling conditions, some will be fixed (e.g. a system may be so arid and vulnerable to climate change impacts that no amount of green infrastructure will be able to meaningfully reduce the impacts of drought) and others subject to influence. Here we focus on the second category, emphasizing the subset that the private sector could help to strengthen: (1) knowledge and evidence base; (2) governance; (3) economics, or leveraging financial and institutional buy-in; (4) society, or civic engagement and visibility of green infrastructure; and (5) cross-sector partners, including through public-private engagement.

Knowledge and evidence base

A collective awareness and understanding of green infrastructure, together with a robust body of evidence supporting its measurable benefits, form the essential basis for new green infrastructure efforts to reach meaningful scale. To implement a green infrastructure project, strong proofs of concept and data-driven predictions are essential elements for bringing on board stakeholders, including: (1) project catalyzers (i.e. decision-makers that incentivize green infrastructure via a top-down approach); (2) project designers (i.e. engineering firms and other technical experts); and (3) project funders (i.e. corporations and foundations interested in minimizing water risk and/or enhancing good corporate citizenship).

Gaps and barriers

Project designers, particularly small to medium-size engineering firms, are perhaps the most essential link in the project implementation chain for green infrastructure. Engineering firms and technical experts may be responsible for finding a project site and ultimately designing a system of green infrastructure complementary to gray infrastructure. While large-scale, multi-national engineering firms or smaller development companies based in developed countries more often have the technical expertise to implement green and green-gray projects, smaller enterprises may simply not have the required capacity — if green infrastructure options are even on the table.

Opportunities for private sector influence

- Contribute to overcoming evidence and data gaps. Private firms are arguably best equipped for this, given their capacity to fund pilots and thus develop proofs of concept and evidence. In the WWF-Mondi Wetlands Programme example, detailed in this report, the forestry company Mondi along with Rand Water invested in critical science to demonstrate that degraded wetlands could be successfully rehabilitated (WWF, 2016).

Governance: Laws and regulations

Public entities, namely policymakers and governing bodies at local, national and regional levels, play a critical role in enabling green infrastructure by: (1) shaping the regulatory frameworks that underpin development decisions; (2) setting priorities and designing programs that incentivize green and green-gray infrastructure; and (3) providing substantial funding (via subsidies or public-private partnerships) and administrative support (e.g. permitting). Governments are (ideally) responsive to their constituents and key stakeholders such as business, which allows for bottom-up strategies to be reflected in public water management actions (Krchnak, 2011).

Regulatory signals can galvanize water utilities and others in the private sector to support green infrastructure projects and achieve compliance before a regulation is announced. In the U.S., a 2007 regulation by the Environmental Protection Agency recognized green infrastructure as an important approach for stormwater management and called for leadership in spreading it widely; by 2015, the White House directed federal agencies to incorporate the value of natural infrastructure into land and infrastructure planning decisions (Francis, 2010; Gartner et al., 2017; Zaidi, Dickinson & Male, 2015). These signals have not only raised awareness of green infrastructure as an important approach, but they have also led to the incorporation of green infrastructure values into cost-benefit assessments by land managers and infrastructure decision-makers (Ozment et al., 2016; Gartner et al., 2017).

Gaps and barriers

High turnover of decision-makers and short (two-to-four year) term limits can hinder planning or progress toward long-term goals, causing inertia against green infrastructure integration in decision-making (Gartner et al., 2017). Though short-sighted governance is an issue for all infrastructure planning and investments, green infrastructure may be particularly disadvantaged in these contexts because of its longer timeframe and larger geographic scale, with less opportunity for one-off projects that produce quick political wins. Another obstacle to governments effectuating green infrastructure is a fragmented policy landscape. Even in countries with a harmonious political landscape, state and local governments' support of green infrastructure projects may be limited by jurisdictional boundaries that don't align with logical green infrastructure landscapes (watersheds).

Opportunities for private sector influence

- Advocate for legislation that would enable green infrastructure, such as by promoting its inclusion in large-scale omnibus bills or legislation to increase public funding in public-private infrastructure funds, which often include natural infrastructure "set-asides" (Gartner, Mulligan, Schmidt & Gunn, 2013; United Nations, 2018a). For instance, in 2016, the Doñana Strawberry and Sustainable Water Management Group — a Spanish consortium of retailers, food companies and processing companies — released a position statement in support of the Doñana Land Use Plan (Plan de Ordenación de la Corona Forestal Doñana) issued by the government of Andalucía and calling for its urgent implementation. That plan includes protected areas alongside areas designated for other management levels (Doñana Strawberry and Sustainable Water Management Group, 2016; Junita de Andalucía, 2014).

- Identify opportunities for green infrastructure to support existing planning approaches, especially in places lacking enabling legislation for green infrastructure (United Nations, 2018a).
- Advocate for policies such as carbon pricing, which promote green infrastructure indirectly by accounting for the climate externalities of gray infrastructure while acknowledging the emissions reduction potential of green infrastructure (World Economic Forum, n.d.). Companies may signal their support for (and prepare for) national carbon pricing by implementing their own internal carbon prices in the meantime: As of 2017, more than 600 companies reporting to CDP currently had an internal price on carbon to guide business decisions, while more than another 780 planned to implement one in the next two years (CDP, 2017a).

Economics: Institutional buy-in and leveraging finance

Growing private sector finance in green infrastructure requires sound business cases that recognize that many benefits of green infrastructure, however real, may not be well-described via traditional accounting. Solid business cases should help to: (1) increase awareness and buy-in from finance specialists and institutional investors to leverage untapped capital; (2) reduce perceived risk by building a track record of standardized and reliable risk-return profiles across financial mechanisms; and (3) overcome larger upfront costs and long-term funding barriers by leveraging innovative finance (Mcdonald & Shemie, 2014; United Nations, 2018a; World Economic Forum, n.d.). Improvements across these three frontiers will in turn work to decrease related economic barriers, such as transaction costs (A. Morgan, personal communication, June 15, 2018).

Gaps and barriers

Accessing capital for green infrastructure investment requires increased communication from technical experts or sustainability-minded investors about its benefits and risks. Often private investors are unaware of green infrastructure and its multiple co-benefits (Mcdonald & Shemie, 2014; World Economic Forum, n.d.). Institutional and corporate funders that are knowledgeable and interested in advancing green infrastructure may encounter another hurdle: pervasive uncertainty. Applying a standardized approach to an increasing number of feasibility assessments, cost-benefit analyses and calculations of return on investment may help to reduce that uncertainty. However, while these economic analyses may aide in strengthening the academic evidence base for green infrastructure, this does not automatically translate into more certainty for investors.

Opportunities for private sector influence

- Participate in green and green-gray infrastructure projects (by submitting bids for them, offering engineering or project management expertise, etc.), provide a signaling effect and incentivize additional investment (Bielenberg, Kerlin, Oppenheim & Roberts, 2016). For example, a partnership between Bechtel Corporation, a global engineering firm, and Conservation International involves collaboration on design and implementation of a green-gray infrastructure project, enabling information exchange and dissemination of key concepts with potential to extend beyond the specific project.
- Strive to reduce uncertainty for green infrastructure investment by filling knowledge gaps and communicating across technical experts and finance specialists.

- Assess the feasibility of integrating green infrastructure projects into future project plans; conduct and publish a financial analysis (Krchnak, 2011).
- Invest in green infrastructure using conventional and/or innovative financing mechanisms (see section on Mechanisms for Financing Green and Green-Gray Infrastructure for ideas). For instance, East Africa's Lake Naivasha Growers Group, a voluntary horticultural association, has contributed funding for a PES program in which smallholder farmers in the lake's upstream catchment are incentivized to implement soil and water conservation on their farms (Lake Naivasha Growers Group, 2018).

Society: Civic engagement and visibility

Local social awareness, knowledge and acceptance are important enabling conditions for green infrastructure implementation. There are few more powerful market signals than consistent demand by the public (Mcdonald & Shemie, 2014). In the long-term, social understanding can aide project sustainability if community members play an active role in delivering successful outcomes. Whether awareness of green infrastructure is cultivated through proactive communications campaigns, born from highly visible events such as natural disasters, or promoted through newly released research, meaningful civic engagement is an important minimum requirement.

Gaps and barriers

Unlocking public demand for green infrastructure is limited due to a general lack of awareness and understanding about green infrastructure, including technical expertise in local businesses. Urban permutations of green infrastructure — e.g. small-scale projects such as rain gardens and green spaces — are increasingly recognized by city dwellers. But for more rural green infrastructure projects that target floodplain and watershed restoration, for instance, the connection between upstream ecosystems and downstream freshwater conditions is often made opaque by geography. Implementers and investors therefore struggle to point to a mass of end-users supporting green infrastructure, causing gray infrastructure to continue dominating freshwater regulation and provisioning.

Opportunities for private sector influence

- Capitalize on windows of opportunity, e.g. newly released research or a natural disaster, to communicate the benefits of green infrastructure. To illustrate, when Superstorm Sandy hit the U.S. Mid-Atlantic in 2012, significant media attention was given to scientific studies that used insurance industry simulations to calculate that wetlands prevented more than half a billion dollars in direct damage (Meyer, 2017; Narayan et al., 2017).
- Develop a thoughtful community and local stakeholder engagement plan that involves: (1) communicating to build public understanding of green infrastructure; (2) inclusive, regular forums for bilateral dialogue and participation in decision-making; and (3) follow-through and responsiveness to upstream and downstream user comments.
- Leverage corporate risk-assessment capacity towards a participatory, regional water risk rather than an in-house one focused only on company assets (Mason, 2013).
- Incorporate social safeguards into project management plans to protect the interests of local partners, such as the equitable distribution of revenues or fresh water (UNEP & TNC, 2014). For instance, the extractive company Anglo-American established agreements with

the South African communities surrounding one of its operations that committed to allot 50 percent of water to industry and 50 percent to surrounding communities (Winrock International, 2017).

Cross-sector partners

Engaging players across government, civil society and corporations promotes equity in decision-making, builds consistent demand across sectors, and unlocks critical investment opportunities. Cross-sectoral partnerships are regular facets of landscape-level water management plans. One example is the Strategic Partners Network in South Africa established by GIZ, an international-focused development bank, to coordinate water risk mitigation efforts among companies (Coca-Cola, AngloAmerican, Nestle and SABMiller), NGOs (WWF) and government stakeholders (Water Ministry and the South African government) (Winrock International, 2017). In the green infrastructure for water management space, efforts are evolving beyond regional networks to engage across sectors at even grander scales: WWF, from the vantage point of an international nonprofit, will be launching a multi-national cooperation and cross-sector alignment of current networks that it enables (A. Morgan, personal communications, June 15, 2018).

Gaps and barriers

Water risk-based partnerships (such as the Strategic Partners Network or the California Water Action Collaborative) are evolving to better meet the needs of green infrastructure at scale. This entails bridging geographic and sectoral gaps to effectively pool knowledge, resources and willing champions for green infrastructure together for a truly holistic approach that overcomes shortfalls in existing institutional arrangements — which did not develop with green infrastructure's unique cooperative needs in mind. These cooperative efforts at a basin or landscape scale are essential for intaking various stakeholders' priorities and weighing appropriate solutions. Private sector partners with the capacity and interest to strengthen these processes are important to garner (United Nations, 2018).

Opportunities for private sector influence

- Bridge the gap of green infrastructure-specific partnerships by coordinating the convening of interested private sector, nonprofit and public actors to build a core consortium for advancing green infrastructure, and by exploring new partnership models (Mason, 2013).
- Leverage existing communities of “mobilizers” (e.g. experts, consultants and institutional investors, among others) by actively participating in initiatives to scale up green infrastructure as a freshwater management strategy. This may involve supporting research projects or sharing water data (Gartner et al., 2013). For example, in 2015 the Caterpillar Corporation held a summit on restoring green infrastructure in which it promoted plans to expand education, outreach and partnerships (United Nations, 2018b).

4. Case Studies: Showcasing Green Infrastructure Investments by Sector

This section offers examples of companies from various sectors making direct investments in green infrastructure, illustrating the various points of entry, pathways and results.

The case studies below are from around the world and highlight the many ways that companies from different sectors have invested in green infrastructure and how these commitments and engagements have evolved over time. While they hint at what is possible to achieve with green Infrastructure, clear examples of private sector investment in green infrastructure at scale (watershed/landscape) are scarce; thus, the cases profiled occur along the green-gray spectrum, and most still lean more towards the gray end of that spectrum. The presentation of case studies from different sectors affords an opportunity to illustrate the unique drivers and different possible pathways for how green infrastructure can help meet specific sector objectives.

Forestry, packaging and paper sector

The forestry, packaging and paper sector has a clear connection to green infrastructure, as forestry operations in particular can require conversion of natural areas into planted systems, often using non-native species. At the same time, the health of forest plantations depends on broader hydrological functioning of the surrounding landscape. Common forest product certification programs include requirements around maintaining areas of high conservation value, including those supplying critical ecosystem services like flood regulation and water purification.

Case Study: WWF-Mondi Wetlands Programme

A privately-funded program that has elevated and advanced wetlands science and conservation across South Africa.

Problem: Around the world, wetlands — transitional areas between land and water — have been lost at an alarming rate, with about half having been drained or otherwise converted to various uses. These losses have implications for biodiversity, climate change and water security. In South Africa, a country suffering from perennial water stress and where national demand is projected to outstrip supply by 2025, an estimated 35 percent to 60 percent of wetlands have been lost or severely degraded (DEA, 2018; WWF-MWP, 2016). Much of this loss has been attributed to the forestry sector, whose plantations have both infringed on wetlands and affected water supply.

Solution: In 1991, WWF-South Africa and the Wildlife and Environment Society of South Africa (WESSA) established the Rennies Wetland Project in KwaZulu-Natal, with funding from the Rennies Group, the Mazda Wildlife Fund and SAB (South African Breweries, now part of AB InBev). The project went national in 1996 and soon thereafter began collaborating with the forestry sector and the government on wetlands delineation, with the goal of creating buffers around wetlands to ensure their protection from conversion to forestry and other uses. In 2001, the forestry company Mondi became the primary funder and in 2013 the project name was changed to the WWF-Mondi Wetlands Programme (WWF-MWP). The program has now been active for over 25 years and

constitutes one of the longest-running privately-funded conservation programs in South Africa (WWF-MWP, 2016).

Results: The impacts of the WWF-MWP have been wide ranging and are well documented. One noteworthy success has been its catalyst: in 2000, South Africa's Working for Wetlands Programme (a subsidiary of Working for Water) launched, through which previously unemployed people are paid to rehabilitate degraded wetlands. Evidence that Mondi and Rand Water collected to demonstrate that degraded wetlands could in fact be rehabilitated was critical to making the case for the government program. On the policy front, WWF-MWP lobbied aggressively and successfully for a clear definition of wetlands to be integrated into the National Water Act of 1998 and the revised Conservation of Agricultural Resources Act (CARA) Regulations of 2001.

In terms of advancing science and knowledge, WWF-MWP developed a scientifically defensible method for delineating wetlands, which was key for establishing buffers. It also developed a number of tools to support wetlands learning and practice among a range of stakeholders. On the ground, WWF-MWP has helped to establish the 1,100-hectare Ntsikeni Ramsar site, restored the 450-hectare Zoar wetland, and has worked with dairy producers and sugarcane farmers to make their practices more sustainable. These and other successes are detailed in a 25-year anniversary report celebrating the partnership (WWF-MWP, 2016).

Materials sector

The materials sector is comprised of metals and mining, construction materials, and chemicals companies. Water is a primary ingredient of some products (i.e. cement and chemical compounds) and plays an integral part in the production process of others (e.g. metals and mining). Thus, the sector is dependent on the availability of water and in some subsectors (e.g. chemical companies) the availability of high quality water. Investments in green infrastructure can in certain contexts ameliorate water quantity and quality issues. Green infrastructure can also complement gray infrastructure solutions aimed both at improving operational water use inside the factory and at reducing downstream pollution.

Case Study (Chemicals): BASF and Espaço ECO Foundation

Contributing to a federal PES program through a company-founded foundation.

Problem: As of 2016, 23 percent of BASF's operations were located in "water stress" areas, or regions in which more than 60 percent of available water is used by industry, households and agriculture (BASF, 2016b). BASF, which is the largest chemical producer in the world and a CDP Water A-list company, has made a commitment to introduce sustainable water management at 100 percent of its sites in water stress areas.

Solution: To achieve its goal, BASF is applying the European Water Stewardship Standard, which includes four main pillars: sustainable water abstraction, maintenance of good water quality, preservation of conservation areas, and continuous improvement processes. In 2005, BASF, in partnership with the German Agency for International Cooperation (GIZ), launched the Fundação Espaço ECO (FEE) in the city of Guaratinguetá, Brazil. This foundation is focused on promoting sustainable development by transferring knowledge and technology, particularly through the

implementation of solutions in eco-efficiency, environmental education and reforestation. Together, they are engaged in restoring the Ribeirão River basin, which provides 90 percent of water to the local population (BASF, 2016a).

The on-the-ground work is being undertaken through the Guaratinguetá Water Producer Program, a type of water fund in which upstream land owners are paid directly for stewardship activities. The Guaratinguetá Water Producer Program began in 2011 and spans 10,500 hectares with over 100,000 potential beneficiaries (Taffarello, Calijuri, Viani, Marengo & Mendiondo, 2017). Restoration activities include soil conservation, riparian forest recovery and the establishment of protected areas for native vegetation and water springs (Meio Filtrante, 2017). Two years after its founding, the FEE also launched the Mata Viva Education and Environmental Conservancy Program (EECP), which promotes the recovery and restoration of permanent forests, water resource conservation and environmental education (Espaco ECO Foundation, n.d.).

Results: By 2016, over 42 percent of BASF's sites managed their water sustainably according to the European Water Stewardship Standard (Dittrich-Kraemer & BASF, 2015). Since its implementation six years ago, the Guaratinguetá Water Producer Program has maintained 143 hectares of forest, conserved 85 hectares of soil through terrace construction to reduce erosion, reforested 73 hectares of protected area, and planted over 42,000 trees along riparian forests and springs. By 2017, over R$ 409,000 Brazilian Reais (BRL) were distributed to participants (Prefeitura Estância Turística Guaratinguetá, 2017). Since the introduction of the EECP in 95 Brazilian cities, over 2,000 teachers have been trained, 1.126 million native seedlings have been planted and 702 hectares have been restored (BASF, 2017).

Consumer staples sector

The consumer staples sector includes food and beverage processing, retail and household products. The sector depends on water for agricultural commodities in its supply chains, for direct inputs into its product and for some manufacturing processes. As a consumer-facing sector with often-broad supply chain footprints, investments in green infrastructure can help address reputational risks through collaboration with stakeholders to improve water access and achieve broader sustainability goals.

Case Study I: Food and beverage companies and the California Water Action Collaborative

A coalition of companies, environmental nonprofits, agricultural producers and others with a stake in California's water future working together on collaborative projects.

Problem: California recently emerged from a historic five-year drought, but major water users know that the state's water future is far from secure. Water insecurity is of concern for local and regional water managers responsible for providing water to the state's 39 million residents; the farmers who grow over a third of the United States' vegetables and two-thirds of the country's fruits and nuts (CDFA, 2016); the many large companies for whom California's crops are essential parts of their supply chains; and companies like Nestlé Waters North America, The Coca-Cola Company,

Anheuser-Busch and MillerCoors, which all incorporate California's water directly into their products.

Solution: Following a 2014 meeting of businesses and environmental groups hosted by the CEO Water Mandate, a subset of participants formed the California Water Action Collaborative (CWAC) to develop and implement collective solutions to California's water challenges. CWAC began as an informal working group and has since evolved into a formal coalition with 20 members, including the companies noted above. The group focuses on three priority areas:

- Building social capital for improved local water management
- Returning water to natural systems — both surface water and groundwater
- Driving corporate water stewardship aligned with the Governor's California Water Action Plan (CWAC, 2017)

Results: The CWAC is working on projects that include restoring landscapes to protect source waters, piloting context-based water targets, testing new agricultural best practices to promote groundwater recharge, and mobilizing private sector actions to align with the California Water Action Plan. One green infrastructure project entails restoring, via forest thinning to reduce high-severity wildlife risk, 10,000 acres in a headwaters catchment draining to two water supply and hydropower reservoirs. Importantly, this project has a strong monitoring and evaluation component focused on testing the hypothesis that thinning activities will also increase downstream water supply.

Another project involves removing 67 acres of 'thirsty' invasive plant species from part of Los Angeles County's source watershed to increase water supply. A third project is working with farmers to allow floodwaters to cover and infiltrate fields and replenish groundwater aquifers. These and other projects demonstrate a range of green infrastructure approaches that go beyond more typical tree-planting. CWAC projects are still young, so measured results are forthcoming, but the CWAC has produced a working model for collaborative funding and action among companies, environmental nonprofits, government and private land-owners (CWAC, 2017b).

Case Study II: Food and beverage companies in the Kafue River Basin

Competing water users in Zambia come together to address water risks using a multi-stakeholder approach.

Problem: The Kafue Flats is a vast area of wetlands and floodplain within Zambia's Kafue River Basin. The ecosystems provide livelihoods for an estimated 900,000 people who partake in smallholder maize production, cattle rearing and fisheries; are home to parks and other reserves critical to the country's tourism industry; supply irrigation water for sugarcane and other crops; supply water for hydropower, much of which is consumed by the mining industry; and provide food and water for Lusaka, Zambia's capital and largest city (PEGASYS & WWF, 2016; Chomba & Nkhata, 2016). Water stress and the decline of ecosystem services have been identified as significant risks to local livelihoods, the national economy, food security, and the mining and food and beverage sectors whose operations are tied to the Kafue Flats. The Zambian government has lacked the capacity to manage the competing water needs on its own (PEGASYS & WWF, 2016).

Solution: In response to water challenges, WWF-Zambia gathered information on the risk narratives and brought together the private sector, public sector and civil society organisations to discuss its initial findings. The engagement led to a strong willingness to work collectively to address the risks through a private sector water stewardship platform, the Kafue Flats Joint Action Group (KF-JAG). As of 2017, five major companies (Zambeef, Zamsugar, Parmalat, Lusaka Water Supply and ZESCO – national electricity company) formed KF-JAG's core group, and government authorities and civil society organizations played an observatory role.

Results: KF-JAG and its members have been active since the group's establishment. KF-JAG contributed to the Water Resources Management Authority's (WARMA) Zambian economy study, conducted in conjunction with WWF, which stressed the importance of collective private-public action for water management (WWF, 2017). In 2017, KF-JAG participated in the awareness-raising event, Journey of Water, alongside citizens, civil society organizations, government authorities and Zambian celebrities. Among individual member actions, Zambian Breweries (part of AB InBev) has committed resources to environmental protection, with a focus in 2016 and 2017 on protecting a critical spring supplying water to both the company and the broader community (Zambian Breweries, 2017).

KF-JAG's activities are considered by WWF to constitute early-to-intermediate steps along the water stewardship progression, with the path leading to collective action and influencing governance. However, WWF notes that the Zambian government has already committed, as a result of the work of KF-JAG and partners, to developing a catchment management plan in the Lower Kafue (WWF, 2017).

Utilities sector

The utilities sector includes both energy and water utilities. For obvious reasons, water utilities require clean, reliable water supplies. Hydropower companies also require clean water, as sediment-laden water fills up reservoirs more quickly and creates costly wear and tear on turbines and other machinery. Thermoelectric plants require water for cooling. Intact and restoration of natural areas can help prevent soil erosion and resulting sedimentation and can better regulate nutrient loads and downstream water flows. In the case of cloud forests, natural areas even capture rainfall; as riparian zones they can regulate water temperature; and in some regions they can reduce the risk of catastrophic fires, which can lead to landslides and massive sedimentation.

Case Study I: KenGen and the Upper Tana-Nairobi Water Fund

A first comprehensive business case for green infrastructure investment by the private and public sectors, taking into account a range of monetized and non-monetized benefits and showing a positive ROI over a 30-year timeframe.

Problem: The Upper Tana River supplies 95 percent of Nairobi's drinking water and half of Kenya's hydropower output. Conversion of the basin's forests and wetlands to agriculture, quarries and dirt roads, often on steep slopes, has caused land degradation and sedimentation of the river, which in turn has reduced hydropower reservoir capacity and raised water treatment costs. Additionally, dry season water flows have been reduced (Abell et al., 2017).

Solution: The first of its kind in Africa, the Upper Tana-Nairobi Water Fund is a public-private partnership of donors and major water consumers established to promote better land stewardship, with the objectives of increasing water yields, reducing sediment, promoting sustainable food production and increasing household incomes in farming communities within the upper basin (Abell et al., 2017; TNC, 2015b). The management board of the fund includes the county government, the water resource authority, the forest service, the regional council of governors, the Nairobi water utility, a leading beverage company and Kenya's leading energy generation company, Kenya Electricity Generating Company Limited (KenGen).

Key to bringing many of these stakeholders on board was a detailed business plan that quantified the benefits anticipated to accrue over a 30-year time span (Figure 5). For KenGen, the benefits that could be monetized were reduced service interruptions and increased electricity generation from increased water yield, valued at a total of US$ 6.15 million. Taking into account all costs and savings, the project was expected to have a two-to-one ROI over 30 years. With consideration of all non-monetized benefits, such as reduced reservoir sedimentation and turbine maintenance for KenGen, the ROI would be even higher (Abell et al., 2017; TNC, 2015.

Figure 5 illustrates TNC's conservative calculation of benefits, which sees returns of US$ 21.5 million in economic benefits of 30 years, with the investment's payback period calculated at approximately 20 years (TNC, 2015).

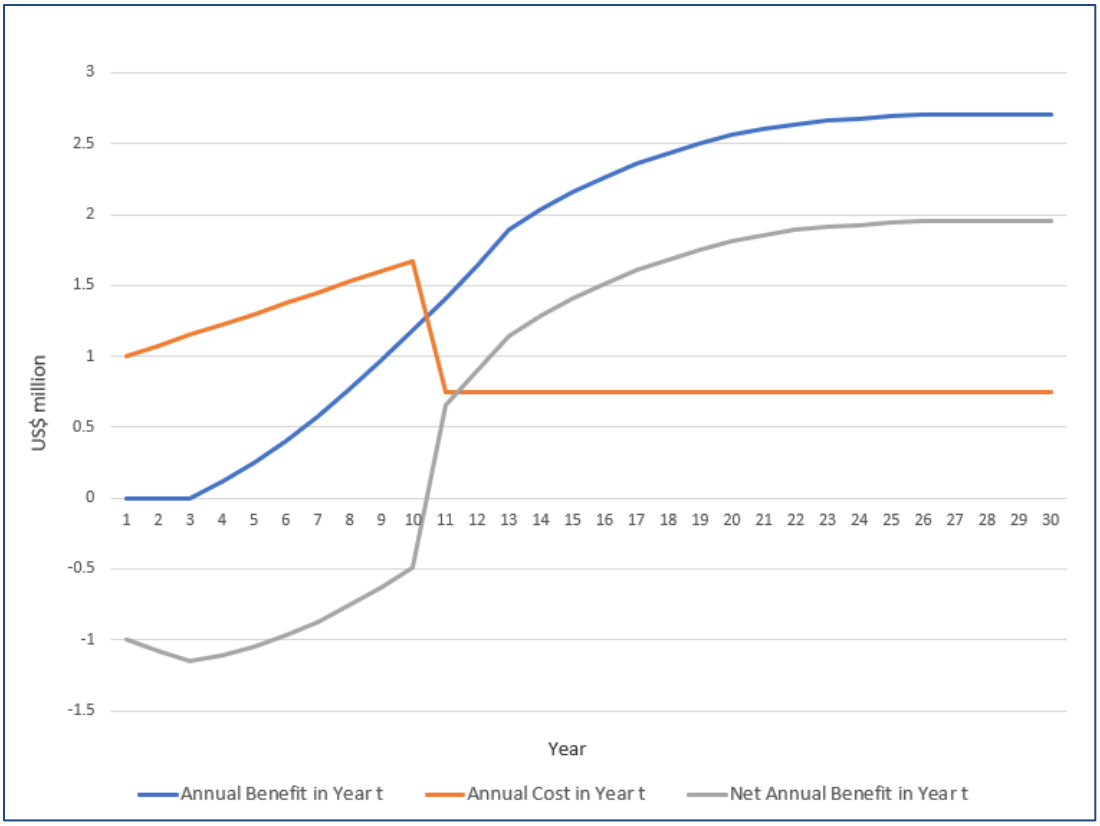


Figure 5: Total annual benefits and costs over a 30-year timeframe including continued maintenance after 10 years (in US$ million). Adapted from "Upper Tana-Nairobi Water Fund: A Business Case" (TNC, 2015a).

Results: The Upper Tana-Nairobi Water Fund was launched in 2015. Projected monetized benefits are expected to accrue not only to KenGen but also to the Nairobi City Water and Sewage Company via avoided flocculant costs, avoided electricity costs and revenue from saved process water. Upstream farmers would benefit from improved productivity and livelihood benefits. Additional non-monetized benefits such as increased pollination of crops and increased carbon storage are expected to be realized by other water suppliers, municipal water processors, urban private sector processors and local communities (TNC, 2015).

While the fund's operation is young enough that many of these benefits are yet to be realized, the promise of the fund has continued to attract partners and investors. As of 2017 these included Pentair Inc, the Coca-Cola Africa Foundation, East Africa Breweries Ltd, International Centre for Tropical Agriculture, the Government of Kenya, Water Resources Management Authority, Tana & Athi Rivers Development Authority, International Fund for Agriculture and Frigoken Kenya Ltd. In a show of confidence, in March 2017, the Coca-Cola Foundation made an additional investment of US$ 1.6 million (Pflanz, 2017).

Case Study II: Yorkshire Water and the Natural Capital Protocol

Monetizing ecosystem service impacts of water treatment works upgrade options to allow for comparison with more conventional gray infrastructure costs and benefits.

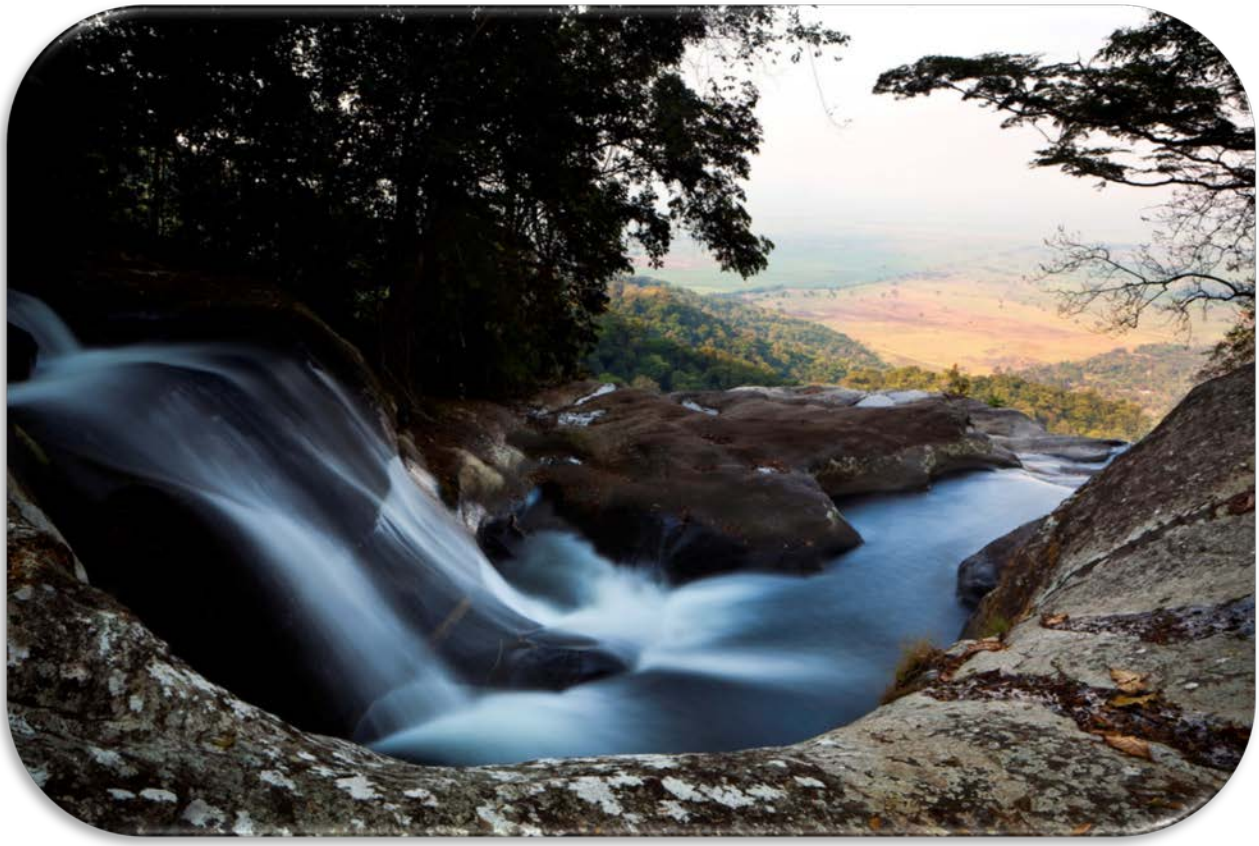
Problem: Yorkshire Water is a water and waste water services utility company serving five million domestic customers and 136,000 business premises in Yorkshire, England (Yorkshire Water, 2017). The company owns and manages 28,000 hectares of land in its source watersheds. The degradation of these lands — such as through peatlands draining, unsustainable grazing practices and burning — results in loss of species, the release of greenhouse gases and poor water quality. Companies like Yorkshire Water regularly face decisions about how to address water treatment needs, but without comparability between natural and social impacts and more conventional gray infrastructure costs and benefits, they are hampered in efforts to make truly sustainable business decisions (Yorkshire Water, 2017).

Solution: Through an integrated green-gray approach, Yorkshire Water actively manages the lands that it owns while simultaneously investing in necessary water treatment upgrades. Its catchment management strategy includes the restoration of peatlands to improve downstream water quality and simultaneously deliver multiple co-benefits. Yorkshire Water's decision-making around treatment works upgrades has trialed use of the Natural Capital Protocol, a framework designed to support decisions through the incorporation of the values provided by nature (or "natural capital") (Natural Capital Coalition, 2018).

Working with AEOCOM, the company trialed the Protocol for the Rivelin Water Treatment Works, which was undergoing a £24 million upgrade. Application of the Protocol included consideration of "beneficiaries affected by ecosystem services, importance of each service to local communities, and the degree of management control of the delivery of these services on site." The positive and negative impacts of different upgrade options included those related to global climate, air quality, pollination and local cultural and spiritual values (Yorkshire Water, 2017).

Results: Within its lands, Yorkshire Water restored 3,250 hectares of degraded peatlands over the course of 10 years. It also decommissioned a reservoir to reduce flood risk and restore stream habitat, and it reintroduced a rare and threatened wetland plant species. The company undertook this work and more under the umbrella of catchment management through various partnerships with local, regional and national organizations and agencies (Yorkshire Water, 2017).

Although application of the Natural Capital Protocol to the Rivelin Water Treatment Works upgrade was done retrospectively, the exercise confirmed that the selected option had maximized environmental benefits (such as through pollination services provided by a green roof) and minimized deleterious environmental impacts (though there were unavoidable carbon emission impacts). More important, the monetization of certain environmental impacts allowed for discussions across business units that would not have taken place otherwise, resulting in a shared interest in integrating natural capital into future business decisions (Yorkshire Water, 2017).



Businesses and other downstream water users benefit from the water regulating and provisioning services of healthy watersheds. © Benjamin Drummond

5. Mechanisms for Financing Green and Green-Gray Infrastructure

The private sector may invest in green infrastructure that meets their own water needs or that meets the needs of other water users/beneficiaries and offers a return on investment. New funds for green water infrastructure, advances in the green bond market, payment-for-performance mechanisms and new insurance products offer emerging opportunities for companies to invest in green infrastructure.

Globally, the majority of finance for green water infrastructure flows from the public sector — often through urban water utilities — to compensate or incentivize landholders to undertake activities that benefit water resources such as forest conservation, riverine restoration or agricultural or pastoral management (Bennett & Ruef, 2016). However, as companies face increasing risks to water resources and gain an understanding of green infrastructure as a viable option for reducing that risk, private and public-private financing mechanisms for green (and green-gray) infrastructure are on the rise. This is particularly the case as more businesses consider context-based water targets that include the surrounding landscape. Companies may choose to invest in green infrastructure either because: (1) they are direct users or beneficiaries of that infrastructure, which they deem to be more cost-effective than gray alternatives; or (2) they are providing financing to the direct users/beneficiaries in the form of debt or equity instruments and are seeking a risk-adjusted return.

In contrast to gray infrastructure, which is usually more targeted, benefits from green infrastructure often flow to both private and public water users; financing mechanisms that blend private and public money or that are designed to pay for performance may therefore be a good fit (Table 4). Private finance can help to advance the field of green infrastructure not just by providing additional dollars for project implementation, but it can also work to advance robust monitoring and evaluation of results (through performance-based payments), provide needed upfront investment (through debt instruments), and more accurately assess and price risk (through insurance mechanisms). Though some companies invest in green or green-gray infrastructure philanthropically or semi-philanthropically (e.g., as ‘R&D’ for future investment), return-seeking investments may ultimately provide longer term sustainable financing for green infrastructure compared to one-time grants or public programs that are subject to political whims.

Table 4: **Summary of major available private sector financing mechanisms for green water infrastructure.**

Financing mechanism	Description	Best suited for…	Scale ($)	Enabling conditions
Private grants / donations	Philanthropic private money flowing to a green infrastructure initiative outside of company operations.	Pilot projects; R&D; Projects that address water issues in surrounding community.	Unknown	NGO or government partnerships; Relationships with communities in the watershed.
Direct company spending	Company pays for and implements green infrastructure to address operational risk or improve water quality/quantity.	Projects that provide clear benefits to the company.	Unknown	Knowledge of green infrastructure implementation; Favorable comparison to gray options.
Collective action programs (direct company spending, pooled)	Money from actors (both public and private) in a watershed is pooled to finance ecosystem management that benefits all actors; Often functions more like a grant, though 'returns' may be quantified in terms of water improvements and associated cost savings.	Situations in which multiple stakeholders have an interest in a particular watershed's health.	US$ 8.2 million (minimum estimate of private money going to water funds in 2015, across 94 programs tracked) (Bennett & Ruef, 2016).	Partnership structure (e.g. a water fund); Benefits sharing; Ability to affect watershed health at-scale.
Institutional investing	Return-seeking investment in green infrastructure through debt or equity; includes green bonds for water infrastructure.	Projects with clear revenue stream (often calculated as cost savings to the direct user/beneficiary) that can deliver a return. Projects that require an upfront investment and will deliver monetizable benefits over time are good candidates for green bonds.	Unknown overall; US$ 32 billion in green bonds for water infrastructure were issued in 2017.	Revenue generation; Quantification of co-benefits such as tourism revenue, fisheries income or carbon credit potential can help.

Table 4 continued				
Financing mechanism	**Description**	**Best suited for…**	**Scale ($)**	**Enabling conditions**
Payments for watershed services and/or market mechanisms	Company participates in a market mechanism that pays upstream landowners or others for results (e.g. nutrient offsets, storm water offsets, river salinity trading); Company may also participate as a seller.	Situations in which a market mechanism can achieve environmental results with greater economic efficiency.	US$ 31.8 million (transaction value from 19 operational programs in 2015).	Program needs to be in place (often regulation-driven; options in U.S., UK, Australia, New Zealand); Environmental outcome translated into transferable 'credit.'
Insurance	Insurance company designs new product for green infrastructure or incorporates risk reduction from green infrastructure into existing products or pricing.	Places where ecosystems reduce basis risk or protect people/assets.	Negligible	Risk pricing (e.g. through ecosystem modeling); Insurable asset that benefits from green infrastructure; Parametric insurance models triggered by weather events may allow for simplified design.

Financing mechanisms for green water infrastructure: Developments to watch

Perhaps the most straightforward way for a company to fund green water infrastructure is directly, by paying for forest or other ecosystem management activities in communities surrounding their operations (private grants/donations) or as part of overall operational infrastructure expenditures (direct company spending). They do this if such investments result in sufficient improvements in water quality and quantity and/or other co-benefits, which make the investment profitable. However, because green water infrastructure is often most effective when implemented at a large (watershed-level) scale, funds or collective action programs that aggregate private money may be prudent, though transaction costs in terms of coordination and negotiation may be higher. In particular, because green infrastructure usually benefits various actors in a watershed, the design of financing mechanisms must address the free rider problem, or the incentive for individual actors to enjoy the benefits of green infrastructure without sharing in its costs. Some collective action finance models that attempt to address this challenge — such as the Upper Tana-Nairobi Water Fund and the Guaratinguetá Water Producer Program — are detailed in the previous section.

Here, we focus on other developments to watch, including new funds for green water infrastructure; advances in the green bond market; payments for performance, including through environmental impact bonds; and insurance mechanisms for green infrastructure. It should be noted that, overall, the 'innovation' needed is not necessarily in the financing mechanisms themselves but rather in the way returns are monetized, as the full value of green infrastructure

often lies in avoided costs (e.g. of water treatment, dredging), co-benefits (e.g. biodiversity, community well-being), or need-to-be-quantified ecosystem services (e.g. flood mitigation, water purification). There is also a need for a growing pipeline of investable projects aimed at institutional investors. Groups such as the Coalition for Private Investment in Conservation (CPIC) are focused on building that pipeline, with CPIC's working group on Green Infrastructure for Watershed Management co-led by WWF and ARC Fiduciary (CPIC, 2018).

New funds seek to seed innovation in green water infrastructure business models. Key examples here are the European Investment Bank's Natural Capital Financing Facility and NatureVest, the impact investing unit of TNC.

- The Natural Capital Financing Facility (NCFF) (EUR 100-125 million) will finance nine to 12 projects through direct and/or intermediated debt financing and equity investment funds, backed by an EU guarantee, through 2021. The Facility will support projects in the EU-28 developed by public, private or nonprofit organizations and delivering on biodiversity and climate adaptation. The finance facility that can provide between EUR two to 15 million per project (up to 75 percent of total project costs as debt and up to 33 percent as equity) and a technical assistance facility that can provide up to EUR 1 million in a project preparation grant. The overall objective is to develop a pipeline of projects and test different financing options to demonstrate proof of concept to investors. Importantly, target projects include green infrastructure (including ecosystem-based rainwater collection and wastewater reuse systems and flood protection) and PES programs (including to reduce water pollution). For example, one project under appraisal is the Renaturalization of the Alzette River in Luxembourg, which seeks to restore 20 kilometers of the river to reduce flood risk. The first loan for the NCFF was signed in April 2017 (European Investment Bank, 2017).
- NatureVest, the impact investing unit of TNC founded in 2014 with funding from JPMorgan Chase & Co, aims to deploy US$ 1 billion in impact capital investment for measurable conservation outcomes. Natural infrastructure for stormwater management, sourcewater protection and/or coastal resilience is one of seven key conservation priorities. For example, one NatureVest project, the Murray-Darling Balanced Water Fund in southeastern Australia (AUD $27 million) helps farmers to acquire water rights, generating returns through selling or leasing those rights back into the agricultural community, while also funding wetlands restoration on private land. NatureVest investors include individuals, foundations, pension funds and development finance institutions. In 2017, NatureVest inaugurated a small grant program called the Conservation Investment Accelerator to advance proof-of-concept projects — up to 25 of them at the US$ 50,000 to US$ 250,000 level (applicants may be for-profit or not-for-profit entities) (TNC, n.d.).

Developments in the green bond and water bond market, including improved certification criteria. Debt instruments, in particular bonds, are already a major source of finance for green investments and water infrastructure and could increasingly be used to fund green water infrastructure, in part by attracting more private finance. As of 2017, the green bond market for water infrastructure reached US$ 32 billion, with 336 bonds by 204 issuers. For context, this represents 3 percent of the now US$ 895 billion green bond market and less than 0.1 percent of the US$ 90 trillion global bond market.

- U.S. municipalities comprise the majority of green water bond issuers, though utilities including Iberdrola (Spain), TenneT Holdings (Netherlands), EDF (France) and Engie (France) have issued large corporate water bonds (Whiley, 2017). The biggest need in the green water bond space is to continue to build a pipeline. Private sector actors can help to do this through more investment in R&D to value green infrastructure (see section below titled Is Green Infrastructure Really Cost Effective?), by financing pilots of new approaches, and by financing initiatives to standardize and replicate new approaches, such as through CPIC. The development of certification criteria may help with standardization and with building the credibility needed to increase the percentage of green water bonds within the massive global bond market.
- Certification criteria: It is currently difficult to pinpoint what percentage of water bonds might be financing green infrastructure. However, the Water Infrastructure Criteria under the Climate Bonds Standard, developed by experts from the Climate Bonds Initiative, Ceres, the World Resources Institute, and the Alliance for Global Water Adaptation, should help to address this (Climate Bonds Initiatives, 2015). The Phase 1 criteria cover engineered water infrastructure and were released in October 2016. The Phase 2 criteria, released in April 2018, cover nature-based and hybrid water infrastructure "for such purposes as water collection, storage, treatment and distribution, flood protection and drought resilience." Labeled water bonds under the Climate Bonds Standard — for projects such as restoration of riparian buffers for flood storage, construction of wetlands for water filtration, or vegetation planting to reduce water temperature or evaporation rates — can now be issued into the growing green bonds market.

Payments for performance through financial instruments that shift risk and reward to investors. A common barrier to the implementation of green infrastructure is that its performance is untested. Environmental Impact Bonds (EIBs) in which the return to investors is based on performance or other quasi-equity instruments that similarly transfer risk to investors can provide the upfront finance needed for yet-to-be-proven approaches. Two examples from the U.S. are DC Water's EIB (already launched) and Blue Forest Conservation's Forest Resilience Bond (under development).

- DC Water's EIB, the water utility for Washington, D.C., issued a first-of-its-kind EIB in 2016. The US$ 25 million 30-year municipal bond was placed with two institutional investors, Goldman Sachs and Calvert, and will fund green infrastructure projects (including rain gardens and permeable pavement) in the District designed to absorb stormwater and reduce combined sewer overflows that pollute the city's waterways and increase water treatment costs (Goldman Sachs, DC Water & Calvert Foundation, 2016). Investors receive a 3.43 percent interest coupon, but at the five-year mark, DC Water will make a US$ 3.3 million payment to investors in the event that the green infrastructure overperforms or investors will make a risk share payment of the same amount if the project underperforms. Building on this example, the Rockefeller Foundation is now supporting two U.S. cities to design and market EIBs for stormwater management or other "equitable resilience" projects (Khalamayzer, 2017).
- Blue Forest Conservation is designing a public-private Forest Resilience Bond as part of an effort to ameliorate fire risk in the western U.S. by financing activities such as thinning over-treed forests and clearing extra fuel (Koren, 2016). The US Forest Service (USFS), electric and water utilities and state agencies would carry out this work on a contract basis. The bond would offer investors returns through annual payments by beneficiaries that hinge on

predetermined metrics, for example reduced sedimentation of waterways, improved water quality, flood control and added hydropower (BFC, 2017). The bond is being designed in partnership with Encourage Capital and the World Resources Institute and is supported by the Rockefeller and Packard Foundations; its vision is to eventually secure billions of dollars for restoration. The USFS now spends more than half of its US$ 5.8 billion annual budget to put out fires, which have severe impacts on water quality, however forest restoration for fire prevention is vastly underfunded (Gartner & Madeira, 2017). The Forest Resilience Bond concept aims to create a mechanism for return-seeking investment to help solve this problem. (Note that the 'bond' label may be misleading here as the mechanism does not have the characteristics of debt; as all principal repayment is subject to success measures.)

Insurance innovations in incorporating ecosystems into risk reduction. Much of the world's gray water infrastructure — its wastewater treatment plants, pipe systems, reservoirs and floodwalls — are insured, and insurance companies play a critical role in off-taking risk that enables other finance. Therefore, green and green-gray water infrastructure must be similarly de-risked if they are to truly be considered alongside traditional water infrastructure investments. Insurers could advance this by: (1) directly investing in green infrastructure; (2) developing insurance products for green or green-gray infrastructure; and/or (3) leading research on the risk reduction potential of ecosystems.

- In an example of direct investment, Tokio Marine & Nichido Fire Insurance Co., a Japanese insurer, quantified the risk reduction associated with its work (with partners) to plant 8,994 hectares of mangroves in nine Asia-Pacific countries since 1999. Although the company's main goal was to offset the emissions of its business operations, a recent evaluation showed that the initiative provided disaster risk reduction to at least half a million people, valued at US$ 55.8 million; shoreline stabilization and erosion control provided an additional US$ 71.1 million in ecosystem services (Tokio Marine & Nichido Fire Insurance Co., Ltd., n.d.).
- In an example of insuring green infrastructure, Swiss Re recently announced a parametric insurance policy for a coral reef in Quitana Roo, Mexico, in which coastal hotel owners that benefit from the reef pay the premiums. When a storm hits a "rapid response" team goes out and repairs the reef, reducing its recovery time (Swiss Re, 2018). Parametric insurance pays out according to an external threshold (e.g. the strength of the storm) rather than assessed damage and may therefore be a good fit for green infrastructure (e.g. it may be more difficult to assess actual damage to a coral reef compared to a seawall). Parametric policies also allow for faster payouts — essential for ecosystems that may recover more readily if they are repaired shortly after a degradation event.
- In an example of leading research, Willis Towers Watson in 2018 launched the Global Ecosystem Resilience Facility to apply the powerful analytics of their insurance experts to ecosystems such as coral reefs, mangroves and seagrasses, focusing first on the Caribbean. Initial work involves mapping these ecosystems and developing risk and value models for coral reefs that could later be used to structure risk finance (Willis Towers Watson, 2018).

Is green infrastructure really cost-effective?

"An often-overstated assumption about NBS is that they are 'cost-effective,' whereas this should be established during an assessment, including consideration of co-benefits."

So reads the most recent WWDR. This holds true for green water infrastructure. We do not have enough evidence, nor would it be practical, to state that green infrastructure is 'cost-effective' overall — just as it would be disingenuous to claim that a gray infrastructure solution is always cost-effective. Instead, we can show that green water infrastructure is cost-effective in particular situations.

Here are examples of analyses in which natural water infrastructure was indeed shown to be cost-effective compared to gray infrastructure:

- In the late 1990s, New York City decided to pay upstream landowners in the Catskills to manage farms and forests at a cost of US$ 1.5 billion, compared to the US$ 6 billion cost of a filtration plant (Gartner et al, 2013).
- In 2006, a utility in Oregon compared the cost of reducing thermal pollution in the Tualatin River by either establishing forests on the banks to shade the water or installing mechanical chillers to cool the water before it was released. The natural option cost US$ 4.6 million, compared to an estimate of US$ 60 to 150 million for the mechanical chillers (Gartner et al, 2013).
- A study evaluating the Sao Paulo Water Fund found that restoring native forest in São Paulo's primary source watershed could reduce sediment pollution by roughly a third, generating a 20 percent return on investment for the local water company (Ozment et al, in press).
- At its Seadrift plant in Texas, Dow Chemical determined that a constructed wetland would provide 100 percent compliance with U.S. effluent regulations while saving the company almost US$ 39 million per year in capital costs (US$ 1.2 to 1.4 million for wetlands versus US$ 40 million for sequencing batch adaptors). The project has now been operational for 15 years (WBCSD, n.d.).

These examples demonstrate that cost-effectiveness analysis can be done to compare investment options apples-to-apples. However, this type of analysis is still relatively rare, and on the green infrastructure side, it is often limited by the underlying biophysical and/or econometric modeling. If robust modeling is not possible (due to limited available data and/or limited time/money/expertise to do additional modeling), analysts must rely on very conservative assumptions about the effectiveness of green infrastructure. Quantifying the co-benefits of both gray and green investments could often help to make the cost-effectiveness argument — but co-benefits quantification is not always standard practice.

The take-home point? Green water infrastructure can be cost-effective, but its efficacy should be assessed and not assumed.

6. Future of green infrastructure for the private sector

The green infrastructure landscape is rapidly expanding, especially as government entities at local, provincial and even national levels recognize the multiple benefits and potential cost-savings associated with using nature to replace or complement conventional gray infrastructure. Interest in corporate water stewardship is growing in tandem. Yet, examples of corporate investment in green infrastructure at scale, especially outside the food and beverage sector, remain relatively rare.

This review suggests that a number of gaps and barriers are broadly hindering the expansion of green infrastructure. These include:

- Lack of an empirical evidence base specifically but not only related to reductions in water-related risk.
- Few business cases for investment that can serve as templates.
- Tragedy of the commons dilemma: Even when green infrastructure is in the public interest, it may be difficult to monetize enough private benefits to justify investment.
- Limited corporate expertise as it relates to designing green infrastructure and quantifying its co-benefits.
- Policy environments that make private sector investment in gray infrastructure the path of least resistance and may hinder collective action (e.g. risk-sharing, public-private partnerships).
- Overall lack of demonstrations on the ground.

Companies can help to fill these gaps, largely by showing a willingness to lead. More specifically, companies can:

- Invest in on-the-ground demonstrations at scale in collaboration with local/regional governments and watershed stakeholders. A key part of that investment will be conducting baseline assessments and monitoring and evaluation over time to build an evidence base, understanding that some benefits could take years to be fully realized. Socioeconomic impacts such as livelihood improvements via payments for upstream land stewardship may be measurable before some biophysical changes. Meaningful reductions in water-related risk, especially as it relates to droughts and floods, will be achievable in some settings but not others; industry can participate in ongoing efforts to better understand the contexts in which green infrastructure works.
- Contribute to building a ‘library’ of business cases that can serve as templates and catalyze investment on the ground. Most business cases and cost-benefit analyses have looked at water treatment savings from the perspective of water utilities, and more from the perspective of the hydropower industry are on the horizon. There is a need for additional cases from other industry perspectives, taking into account both monetized and non-monetizable benefits, and understanding that no one actor will typically bear all the costs (or reap all the rewards) of a green infrastructure investment. Business cases in which green infrastructure was considered but not implemented because of an unfavorable cost-benefit analysis or because it didn’t meet risk criteria are just as helpful as “success” stories.
- Where appropriate, companies can bring their technical expertise to bear, especially as it relates to designing integrated green-gray infrastructure to meet specific water quality or

coastal protection targets. Companies' expertise in project management, site selection criteria, and other areas where governments, civil society or NGOs might be less strong could also be leveraged. Open design specifications for certain green-gray infrastructure interventions could help to advance the field.

- Advocate for legislation that would enable green infrastructure, such as by promoting its role in existing regulatory frameworks. And, where supportive legislation or political will for green infrastructure already exist, align investments with existing priorities. For instance, through the California Water Action Collaborative, companies are coming together to support specific items, including green infrastructure-related actions, within the Governor's California Water Action Plan.
- Contribute to strengthening watershed-level governance that empowers stakeholders as green infrastructure stewards. For example, in Colombia's Cauca Valley, a consortium of the sugarcane industry and other companies, public oil and electric utilities, NGOs, the Colombian environmental authority and 18 river basin organizations formed the water fund, Fondo Agua por La Vida y La Sostenibilidad, whose activities include strengthening community organizations focused on watershed management (Abell et al., 2017).

The private sector can take a leading role in actualizing the full potential of green and integrated green-gray infrastructure.

- Companies committed to water stewardship need to move further along the CEO Water Mandate's 'water stewardship progression' into engagement, which involves collective action at the watershed scale. This is messier than optimizing water management in facilities, but it will ultimately lead to a greater range of benefits for a wider set of stakeholders. From a company perspective, it can also reduce reputational risk as well as contribute to addressing multiple SDGs. Food and beverage companies have taken a lead — presumably because they are consumer-facing — but there is no reason why others couldn't do the same.
- Building green infrastructure typically involves working with upstream communities who are positioned to be land and water stewards. In many parts of the world, these communities lack access to basic WASH services. An important initial piece of community engagement may be helping to provide/upgrade WASH services and simultaneously building an improved understanding of how green infrastructure (via land and water stewardship) can support and complement built (gray) WASH infrastructure. This may provide a relatively low barrier to entry for green-gray infrastructure investment, and it serves as a parallel to the 'water stewardship progression' in which a company first provides sufficient WASH access for its workers and later moves toward collective action (WaterAid et. al., 2017).
- Companies can make water stewardship commitments and realize them with the allocation of commensurate budgets for green infrastructure investment. For instance, The Coca-Cola Company's Replenish target ('for every drop we use, we give one back') provides an example of a commitment that has led to watershed investments beyond the company's immediate footprint, and Dow has a specific budget for nature-based solutions.
- Market improvement initiatives, like the Alliance for Water Stewardship with its International Water Stewardship Standard, offer opportunities for companies to leverage their collective assets and resources to address sustainability issues like water insecurity that no one company can solve alone, through industrywide cooperation and standard setting (Enright et al., 2018).

- Leading-edge companies can, through a combination of example and advocacy, push their sector associations to elevate expectations of members in the area of corporate water stewardship, encouraging movement into watersheds through collective action. According to the United Nations Global Compact, a survey has confirmed that 'business and industry associations are the most preferred partner of companies actively engaged in corporate sustainability collaboration' (United Nations Global Compact, 2018).
- Similar in some ways to the California Water Action Collaborative, multiple companies operating in or sourcing from the same geography could come together to seed a fund for green infrastructure in that place. Contributions could come in the form of technical expertise, funding or both.
- Companies can reach beyond their own direct operations to influence companies along their supply chains to support green infrastructure investment. This would represent a new area for even many leading companies engaged in corporate water stewardship, as recent analyses by the CEO Water Mandate have found (The CEO Water Mandate, 2018).
- A company could show leadership in terms of innovative sustainable financing, such as by issuing a water bond for green infrastructure following the emerging guidelines of the Climate Bonds Initiative.

Protecting and restoring floodplains and riparian zones along rivers is a good example of green infrastructure as it yields multiple benefits for people and nature, including reducing vulnerability to climate change. © Conservation International/photo by Tory Read

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