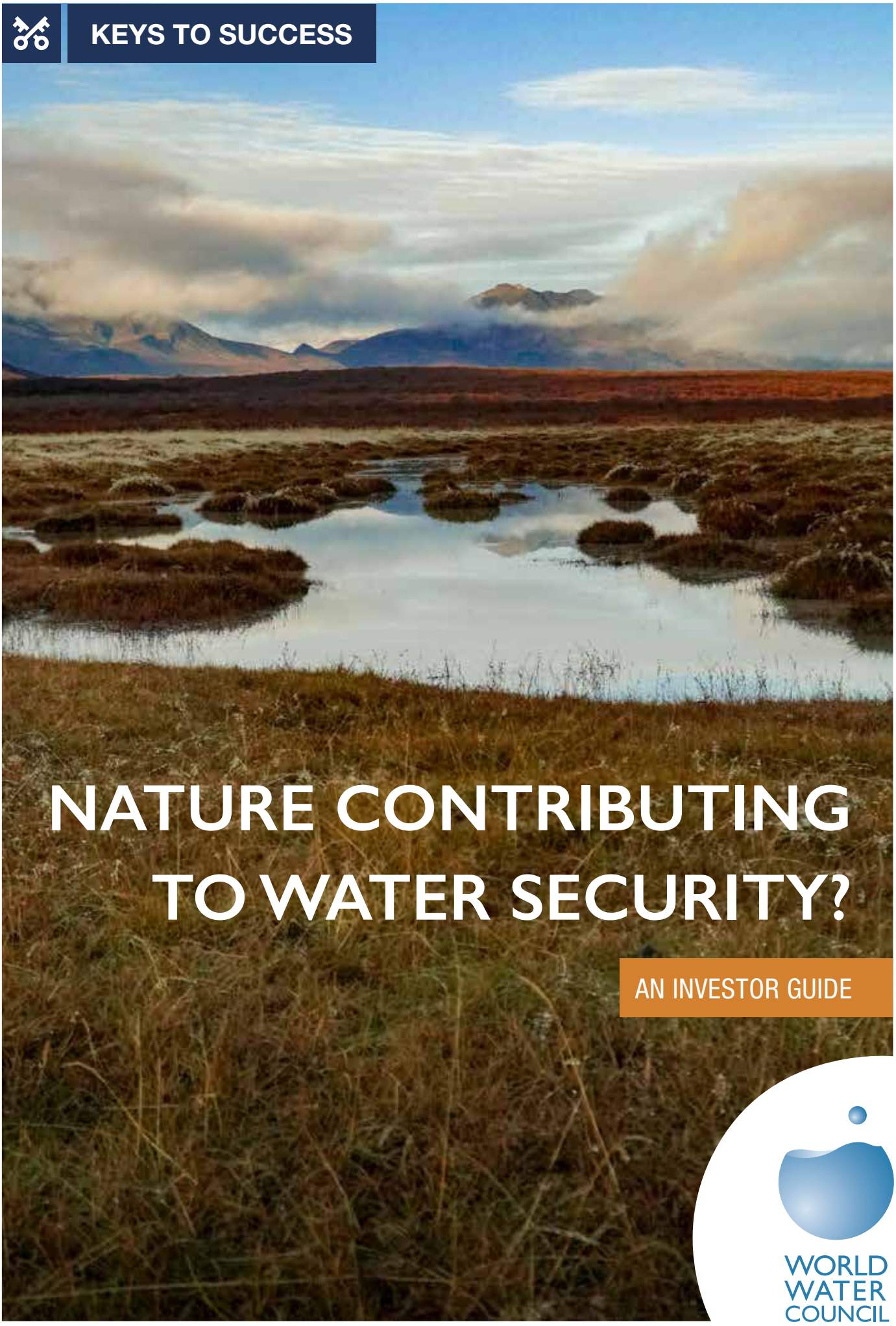
KEYS TO SUCCESS



NATURE CONTRIBUTING TO WATER SECURITY?

AN INVESTOR GUIDE

WORLD WATER COUNCIL

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KEYS TO SUCCESS

NATURE CONTRIBUTING TO WATER SECURITY?

AN INVESTOR GUIDE

MARCH 2022

FOREWORD

For nearly two centuries, economic growth along with demography and other social progresses have led to an extremely important increase in water and sanitation needs.

To meet all those needs, it was necessary to carry out works on a large scale. These operations aimed to mobilize water resources and ensure transfers and evacuations, often attacking nature and landscapes, and frequently breaking nature's balance. As a result, the natural cycles of the fauna and flora have been disturbed, sometimes in an irreversible way.

Today, we may consider that these actions were necessary, or decide that we acted badly. Judging after the fact is always easy. Regardless, damage has been done. Population growth and climate disruption, to name only those, are undoubtedly the result of those actions and are already dramatically affecting our planet.

Fortunately, the human mind does have strength and tenacity, even more so when its own survival is threatened.

For several years now, an almost general awareness has been growing with the clear message that it is necessary to act, and act quickly.

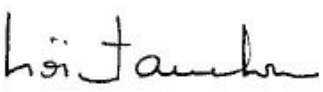
Act to reduce greenhouse gas emissions, but also act to to conceive sustainable projects that are more respectful of nature, while respecting the legitimate imperatives of development, and eventually repair what can still be repaired.

However, let us not fool ourselves. An all or nothing approach will not be possible in the immediate future. We will not be able to solve all problems overnight and in an ecologically friendly manner. The legislative, technical and financial environments must be reviewed and improved, and training programs expanded.

Change has already begun, and progress has visibly been made. The notion of nature-based solutions is spreading, carried efficiently by a young generation strongly concerned by environmental topics and respecting nature.

This report is a modest contribution to explain what nature-based solutions are. It also includes the presentation of successful cases studies, and proposals of what should be done to enable these types of solutions to be used more often.

Good reading to all



Loïc Fauchon
President
World Water Council

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EXECUTIVE SUMMARY

The world's forests, wetlands and natural ecosystems are being degraded at an alarming rate, threatening the biodiversity that they support, the livelihoods of local populations and the supply of freshwater for billions of people. Inland waters and freshwater ecosystems are of particular concern and have among the highest rates of decline of all habitats.

"Nature-based Solutions for Water Security" ("NbS-WS") are actions that help to secure clean and reliable water supplies while generating wider benefits for people and nature. This report aims to identify the main types of NbS-WS that can generate investment opportunities around the world. The report is targeted at investors in water security such as water utilities, large water users and their financiers, and all those that are interested in channelling a greater share of investment towards NbS.

While most investments in NbS-WS have to date been public or philanthropic in nature, these funding sources are far from sufficient to mitigate growing water security risks. This report showcases a range of emerging funding and financing mechanisms that can help attract a broader range of public and private capital sources, including repayable financing. Traditional human-built solutions such as dams, water treatment plants and concrete structures, also known as "grey infrastructure", are commonly used to mitigate water security risks and secure clean water supplies. In contrast, NbS-WS, comprising "green infrastructure", have received comparatively less attention and investment, even though they can offer practical and cost-effective solutions with multiple co-benefits.
One of the main reasons for this is that the technical cases, revenue models and associated markets for NbS-WS are currently deemed too uncertain and under-developed to attract private investment at scale. Several barriers hinder the availability of private investment for NbS-WS and project developers typically face a range of challenges, including: technical barriers (uncertainties around assumptions and scenarios); compliance barriers (restrictive local regulatory environments); financial barriers (uncertainty in project costs and investment time horizons); commercial barriers (a lack of standardised revenue models); knowledge barriers (limited awareness); and logistical barriers (complexity of multiple interventions and stakeholders).

This report identifies six investment areas or "business lines" of NbS-WS that are especially relevant to addressing water security risks and appear to offer the most promising models for international replicability. These are:

1. **Sustainable Drainage Systems ("SuDS");**
2. **Woodland creation, restoration and management;**
3. **Improved agricultural practices;**
4. **Aquifer recharge;**
5. **Wetland creation and restoration, and;**
6. **Natural Flood Management ("NFM").**

For each NbS-WS business line, the report looks at environmental benefits, potential revenue streams, the most suitable financial models, and challenges and success factors in project development.

The revenue streams explored include: payments for ecosystem services ("PES"), such as remuneration for interventions that improve soil health or sequester carbon; cost savings, whereby NbS-WS projects lead to lower

capital and/or operational expenditure costs for entities like water utilities; fees and taxes charged by utilities and public authorities for water and wastewater services; and commercial enterprise revenue from the sale of products or services, such as potable water or ecotourism. Real world case studies are presented to show how a range of revenue and financial models, including water funds, green bonds, environmental impact bonds, NbS Bonds, blended finance and habitat banks, have been deployed to attract private investment into NbS-WS.

The final chapter proposes a series of recommendations for potential NbS-WS investors and project developers as to how project risks can be effectively managed and results sustained, as well as how further knowledge can be developed in this nascent sector. These recommendations are summarised below.

Building the technical case for investment through robust data on performance

Technical evidence and the ability to reasonably predict NbS-WS performance are fundamental to creating a viable business case. There are several global initiatives to collate and disseminate NbS performance data; however, there is limited real world data on the track record of NbS-WS projects and few technical standards for NbS performance, which acts to increase the relative costs and complexities of technical project modelling. At the same time, a growing number of technologies and tools are being developed to identify potential NbS-WS and quantify impacts. Successful solutions often seek simple metrics and proxies to measure performance that are easily understood by investors and other stakeholders, while recognising that NbS performance is likely to be to some extent variable and location-specific, owing to the nature of working with natural processes. Projects also benefit from close collaboration with organisations such as environmental NGOs ("eNGOs"), with experience in on-the-ground delivery, technical performance appraisals and natural capital approaches, all of which can help to build investor confidence. There would be significant value in the creation of a centre of excellence or dedicated programme to collate technical data, engage and advocate NbS-WS application within the water sector and its investment community.

Building the financial case for investment through robust data on costs

There is insufficient data on the capital and operational costs associated with NbS-WS projects. This reduces investor confidence in financing models deployed to finance them. Specialist technical advisers can provide a level of cost guidance and due diligence. Blended finance structures provide some scope for mitigating inaccurate costing information, while also providing opportunities to alter the risk-return profile of the investment, through the use of concessionary capital. Market development would be further supported by the establishment of a global comprehensive NbS-WS project data platform, through which water sector infrastructure project developers can share costing and performance information.

Overcoming performance uncertainty through risk-sharing financing models

Investors are often reluctant to engage in new asset classes, where performance and risk profiles are unfamiliar and challenging to compare to existing asset classes. This report highlights the opportunities presented by financial mechanisms designed to overcome such uncertainty in performance and risk profile, by sharing the risks of underperformance and the rewards for overperformance between investors and investees. These include impact bonds, an outcome-based repayment mechanism; and "NbS bonds", a term the Authors have created to describe a green bond that has a more flexible repayment profile

Overcoming regulatory barriers through capacity development of regulators in NbS-WS

Regulatory frameworks for water security actors can restrict the ability of utilities and other water system operators from trialling new techniques. For many water system operators, NbS-WS are fairly new and under-explored, limiting the industry's NbS-WS technical capacity and knowhow. These factors combined limit the number of opportunities identified as suitable for NbS-WS. Working closely with regulators and regulatory experts to facilitate regulatory "sandbox" environments where NbS-WS models can be pioneered and tested can help build capacities and over time shift industry perceptions.

Overcoming complexity in financial models through increased standardisation

The barriers identified in this section, together with the wide range of revenue models and lack of common approaches, makes assessment and development of NbS-WS business cases complex. The lack of standardised revenue models for NbS-WS acts to limit market demand as potential buyers struggle to assess and compare services and products from similar nature-based interventions. The development of internationally-standardised revenue models, associated standards and proxy technical performance metrics could significantly aid the development of NbS-WS markets.

Overcoming governance barriers by developing best practices in governance models

NbS-WS projects often impact a large number of beneficiaries and stakeholders that are critical to successful projects outcomes. Given the wide range of NbS-WS project types and locations, there are currently limited standardised governance models with proven steps to implementation. Investors and project developers would benefit from the collation of best practices in governance models which can then be tailored to the specific NbS-WS projects. Robust governance models are also important in ensuring projects are aligned with the interests of local communities to secure their buy-in, which is vital to support project outcomes and their longevity.

Overcoming barriers caused by small scale nature of projects through aggregation

Some forms of NbS-WS consist of multiple small-scale interventions potentially spread over a large spatial area, presenting implementation challenges and relatively higher costs. Aggregation vehicles and other structures that bring together multiple projects can reduce transaction costs by aligning multiple small investments into a single portfolio, enabling investors to finance multiple interventions through a single investment. This can also be useful from a risk management perspective.

Overcoming market hesitancy by developing the NbS-WS market through blended finance

NbS-WS projects often need capital to fund development costs and bridge the gap until revenues can be generated. However, given the nascent stage of many NbS-WS revenue streams and limited proven investment models, projects often struggle to deliver risk-adjusted return profiles that will attract commercial sources of finance. To help overcome this, the strategic use of development capital through blended finance approaches can help reduce project risks and lower the cost of finance, enabling private investment to be ‘crowded in’. Technical assistance from the non-profit sector, development partners and other actors can also help to build investment cases, ensure robust impact measurement frameworks are developed, relevant stakeholders are included, and that adequate monitoring and evaluation processes are in place. These efforts can help to strengthen investor confidence in project quality and the capacity to deliver. Donors and philanthropists could do more to move concessionary funding away from relatively mature sectors, like renewables, towards more nascent markets like NbS. Learning and insights from past projects also needs to be shared more widely, despite commercial sensitivities. This will help to build and accelerate the market over time.

Ensuring the longevity of projects through inclusive multi-stakeholder engagement processes

Inclusive and early stage consultation is important in aligning key stakeholders including local communities, which may be required to play an important role in ensuring the site remains in good condition and generating benefits in the long term. The collation of best practices in stakeholder engagement from successful NbS-WS projects, particularly where local communities have played a role, would act as a helpful resource for project developers and investors who are often unfamiliar with the local context. This would be especially useful for those seeking to deliver projects in the Global South, where local communities often stand to benefit the most from projects that are environmentally sustainable and create jobs-, but where the principle of informed consent is not necessarily always followed by developers. There is a role for the international donor community to play in disseminating lessons learned and best practices in local stakeholder engagement.

The way forward

Successful investments and scalable business models have been developed in the NbS-WS categories of SuDS; woodland creation, restoration and management; and wetland creation and restoration, but often depend upon favourable local regulatory environment and demand drivers in place for ecosystem services, and blended finance structures. There are also examples of investment and governance structures discussed in this report that facilitate funding for improved agricultural practices; aquifer recharge; and NFM projects, again typically relying on regulatory demand drivers and blended finance with active public sector contributions and/or support to acknowledge the wider public benefits of such projects beyond those that can be directly monetised in the private sector. All NbS-WS business lines covered in this report have their own bespoke set of funding and financing challenges and potential solutions that can be deployed to increase investment. To date, the NbS-WS sector is too nascent to have developed standalone asset classes within it with distinct financing characteristics. Instead of taking generalist views on the attractiveness of particular NbS-WS business lines, potential investors should consider each NbS-WS project on its merits as determined by the individual technical and financial case and the total level of benefits created.

The urgency of the inter-linked biodiversity and climate change emergencies means that all stakeholders have a responsibility to consider how NbS-WS can be implemented as a compliment or alternative to engineered solutions. In many situations, NbS-WS, from large-scale habitat restoration sites to multiple smaller-scale interventions, have been found to reduce or remove the need for grey infrastructure solutions by delivering some or all of the targeted water security risk management outcomes. Due to the large array of benefits generated by NbS-WS, there are opportunities to involve a wide range of stakeholders in identifying, implementing and financing NbS-WS. The case studies and recommendations in this report are intended to increase awareness and interest in NbS-WS and stimulate efforts to more clearly define current and potential market sizes for each NbS-WS business line. This will serve to accelerate the establishment of individual asset classes and refine understanding of enabling factors and associated risks of investment within those asset classes, which will ultimately help to mobilise greater flows of finance into sustainable, nature-positive water management.

Forests protecting watersheds. Photo courtesy of Blue Forest Conservation.

INTRODUCTION

The world's forests, wetlands and natural ecosystems are being degraded at an increasing rate, threatening the biodiversity that they support, the livelihoods of local populations and the supply of freshwater for billions of people. Human interventions on natural habitats over the last five decades have led to a 30% loss of global terrestrial habitat integrity and up to one million species being threatened by extinction. Inland waters and freshwater ecosystems are now being lost at 0.8% per year, among the highest rates of decline of all habitats (IPBES, 2019).

The IUCN (2022) defines Nature-based Solutions ("NbS") as "actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits". NbS often enhance existing or man-made infrastructure to address issues resulting from poor use of land and resources, climate change or societal challenges. NbS can also help to secure clean and reliable water supplies while generating wider benefits for people and nature (UN-Water, 2018). These are referred to in this report as "Nature-based Solutions for Water Security" ("NbS-WS").

The objective of this report is to identify the main types of NbS-WS that can generate investment opportunities across the globe, including in the poorest countries where financing gaps are the highest. The report is primarily aimed at investors in water security such as water utilities, large water users and their financiers that are interested in channelling a greater share of investment towards NbS.

Most NbS-WS investments to date have been funded through public and philanthropic grants. Such funding is in relatively short supply, limiting the potential for replication and scaled-up implementation. This report showcases a range of emerging funding and financing mechanisms that can help attract a broader range of public and private funding sources, including repayable financing. The report also indicates how grants can be used effectively through blended finance structures to catalyse investments in NbS-WS, either on a standalone basis or in conjunction with traditional grey infrastructure solutions. As multiple NbS-WS can be deployed to address a particular water security risk, the report examines the most promising "business lines" that may combine several NbS-WS for an identified challenge, in order to highlight key investment opportunities.

The rest of this report is structured as follows:

- **Section 1** provides an overview of NbS-WS, their benefits, the main revenue streams that can be mobilised to cover their costs and the types of funding and financing mechanisms that can be implemented to align those revenue streams into a financeable investment package;
- **Section 2** examines in more practical detail how this can be achieved for six of the most important NbS-WS investment opportunities, referred to as "business lines". These are: sustainable drainage systems ("SuDS"); woodland creation, restoration and management; improved agricultural practices; aquifer recharge; wetland creation and restoration; and natural flood management ("NFM") interventions. For each of these business lines, the report explains the potential benefits, beneficiaries and revenue streams, and provides examples of promising investment models and governance arrangements supported by case studies.

Finally, the report draws together main conclusions from the analysis and formulates recommendations for accelerating and scaling up investments in NbS-WS.

The report also contains a glossary of key terms and a list of references.

1. NATURE-BASED SOLUTIONS FOR WATER SECURITY: AN OVERVIEW

Securing and protecting water resources is becoming increasingly challenging as the global population approaches eight billion people and the effects of climate change continue to impact the built and natural environments. A rapid increase in global water investment is required to achieve water security and deliver on the United Nation's Sustainable Development Goal (SDG) 6 to "ensure availability and sustainable management of water and sanitation for all" (United Nations, 2021).

One of the more commonly used definitions of "Water security" is:

> "The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability"
>
> (UN-Water, 2013).

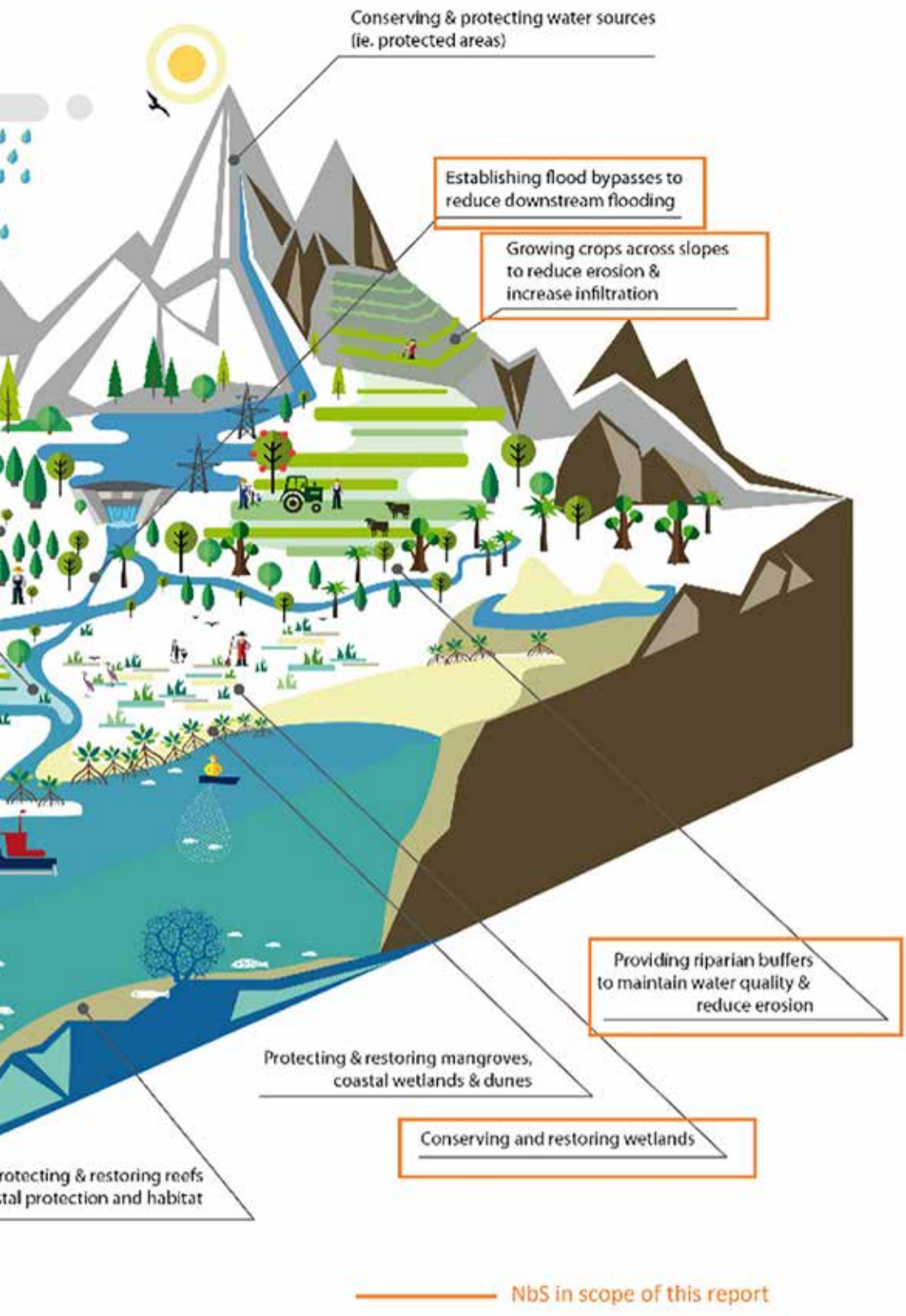
This report focuses on NbS-WS that can mitigate against the three main water security-related risks indicated in this definition and detailed in Table 1.

Risk:	Water scarcity	Poor water quality	Flooding (pluvial and fluvial)
Evidenced by:	Low river flows or falling groundwater levels.	Contaminated surface water or groundwater resources.	Overflowing water bodies and/or drainage channels.
Caused by:	Droughts; unsustainable agricultural, industrial and/or domestic water consumption.	Sediments and excessive nutrients from soil erosion and agricultural run-off; wastewater discharges from municipal and industrial uses; sewage overflows associated with heavy rains.	Changes in the natural course of water bodies and floodplains due to economic development and extreme weather events.

Table 1: Water security risks covered in this report


Forest landscape restoration
to reduce flood impacts,
stabilise slopes & provide clean water
Connecting rivers to floodplains & aquifers
Capturing rainwater
with green roofs
Improving infiltration using
urban run-off
(ie. permeable pavements)
Providing infiltration &
bio-retention
(urban green spaces)
Purifying wastewater &
alleviating flooding
(healthy wetlands)
Water harvesting
© IUCN Water

Figure 1: NbS



S-WS examples

1.1. WHAT ROLE CAN NBS PLAY TO ALLEVIATE WATER SECURITY RISKS?

Traditional human-built solutions such as dams, water treatment plants and concrete structures, also known as "grey infrastructure", are commonly used to mitigate water security risks and secure clean water supplies. Alongside these traditional approaches, NbS-WS such as wetlands, woodlands and SuDS, sometimes referred to as "green infrastructure", can also help to mitigate water security risks. However, NbS-WS have received comparatively less attention and investment, even though they can offer practical and cost-effective solutions with multiple co-benefits.

Figure 1 shows a range of NbS-WS (see pages 18-19), many of which can be deployed to enhance existing natural or traditional grey infrastructure to generate long-term economic, social, and environmental benefits (IUCN, 2022). NbS-WS can enhance water security, implemented either on a standalone basis or in combination with grey infrastructure. Typical NbS are presented in Table 3, based on a review of evidence performed by The Nature Conservancy ("TNC") (TNC, 2022a).

1.2. PROMISING AREAS FOR NBS-WS INVESTMENT

This report identifies six investment areas or business lines for which NbS-WS are especially relevant to address water security risks and appear to offer the most promising models for international replicability (Table 2). The types of NbS-WS that would be deployed in these business lines vary to the extent that they are "natural" solutions, but all require some degree of human management, creating local employment opportunities.

Table 2: Select NbS-WS categories covered in this report and water security risk mitigation

		Water Security Risk		
		Water Scarcity	Poor Water Quality	Flooding
NbS-WS business lines	Sustainable urban drainage systems ("SuDS")		✓	✓
	Woodland creation, restoration, and management*	✓	✓	✓
	Improved agricultural practices	✓	✓	✓
	Aquifer recharge	✓	✓	
	Wetland creation and restoration	✓	✓	✓
	Natural flood management ("NFM") interventions			✓

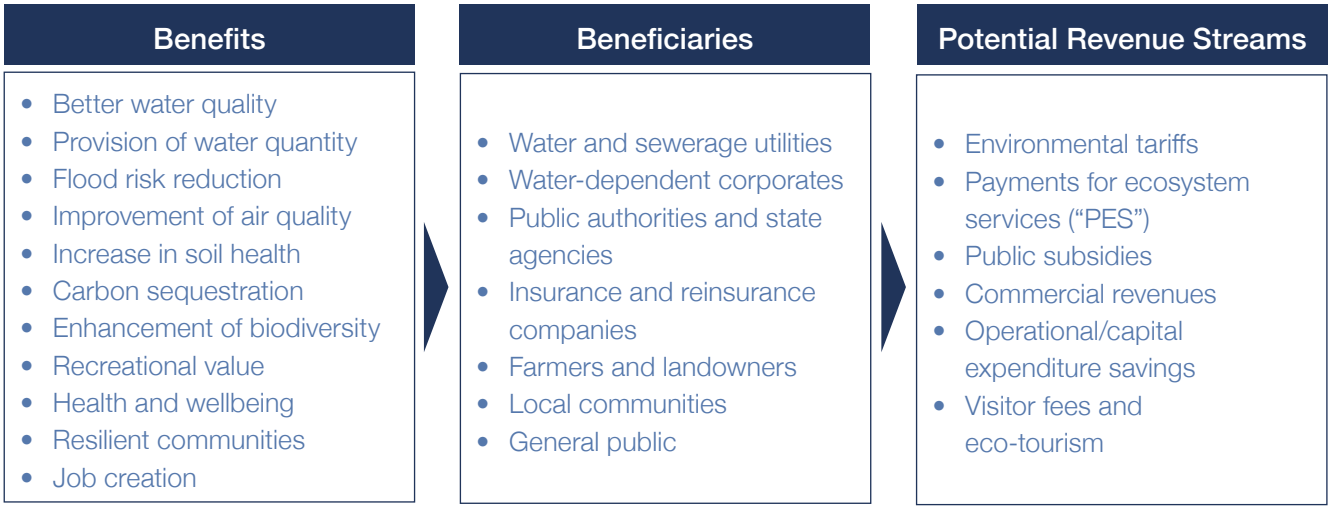
* includes afforestation, reforestation and best forestry management practices.

1.3. WHAT ARE THE POTENTIAL REVENUE STREAMS THAT CAN BE GENERATED BY NBS-WS?

One of the key challenges in preparing investment cases to enable access to finance is identifying viable revenue streams for investors. NbS-WS can provide a range of benefits to multiple beneficiaries in the form of ecosystem services (see below), some of which have the potential to be monetised into revenue streams. A lack of awareness and/or technical understanding of these services can hinder the development of a business case for investing in NbS-WS. Figure 2 outlines the potential benefits from NbS-WS that can apply to multiple stakeholders across the private and public spheres, and the potential revenue streams that can be established by monetising these benefits; these are discussed in more detail in later sections of this report. For further information on NbS and their potential benefits, a collaboration of the Pacific Institute, CEO Water Mandate, Danone, TNC and LimnoTech have developed NBS Benefits Explorer, a practical resource for organisations looking to invest in NbS (NBS Benefits Explorer, no date)

> **Ecosystem Services** are "the benefits provided by ecosystems that contribute to making human life both possible and worth living" (UK National Ecosystem Assessment, 2009). Ecosystem services are categorised under the UN System of Environmental-Economic Accounting ("SEEA") framework into Provisioning, Regulating/Maintenance and Cultural Services. Provisioning ecosystem services include products that can be obtained from ecosystems, such as freshwater, food and wood. Regulating ecosystem services are the benefits obtained from ecosystem processes, including water quality and carbon sequestration. Cultural ecosystem services are the non-material benefits provided to people such as recreation and spiritual enrichment (UN SEEA, 2021).

Figure 2: Benefits, beneficiaries and potential revenue streams for NbS-WS



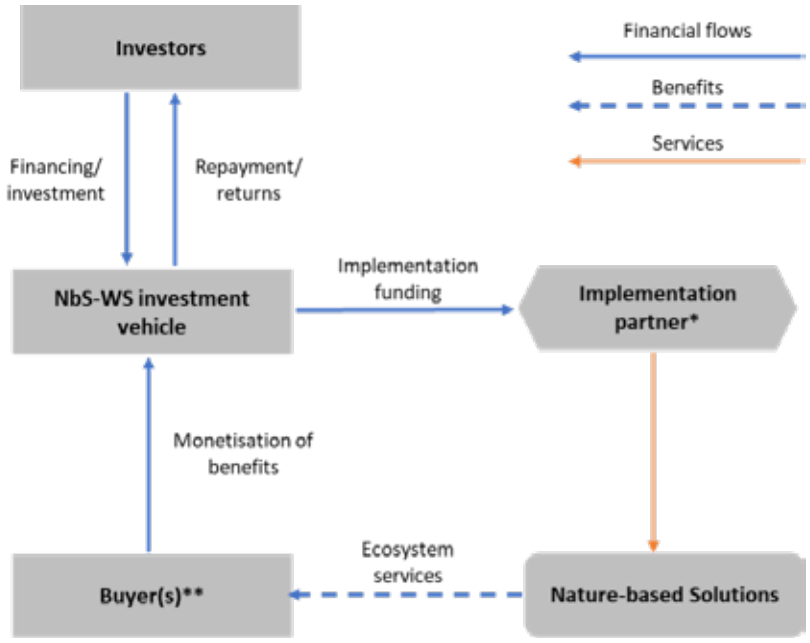
Adapted from Trémolet, S. et al. (2019)

1.4. ESTABLISHING REVENUE STREAMS FOR NBS-WS TO SUPPORT FINANCE

Revenue streams are cash inflows into a project that can be generated from the sale of services or products. Evidencing these cashflows is necessary to give finance providers confidence that they will be repaid and generate a return on their investment. To identify potential revenue streams, it is necessary to establish a clear understanding of the benefits that a proposed investment is likely to generate and how those benefits can be monetised. This typically requires a detailed technical analysis and comprehensive engagement with potential beneficiaries to establish the optimum approach to monetising the benefits.

NbS-WS can generate a variety of ecosystem services to a wide range of beneficiaries. The ability for these services to be monetised and form revenue streams is dependent on the willingness of beneficiaries to pay for these services. For example, a wetland constructed for wastewater treatment to improve water quality (a "regulating" ecosystem service) could theoretically generate revenue from selling water quality outcomes to a utility that stands to benefit from meeting environmental objectives and potentially reducing or avoiding grey infrastructure spend. The same intervention could also generate recreational benefits ("cultural" ecosystem services), which can potentially be monetised, for example through ecotourism activities. Accordingly, a single project has the potential to generate multiple revenue streams, which serves to increase and diversify project cashflows and reduce investment risk. Table 4 describes potential revenue streams for NbS-WS and the associated benefits they are derived from in further detail. The extent and ease that ecosystem services can be monetised relies on the technical evidence and ability to demonstrate attribution of the benefits to a given beneficiary. In many situations, the lack of technical evidence and beneficiaries willing to pay for benefits are material barriers which prevent ecosystem services from being monetised. NbS-WS may also provide significant co-benefits that are harder to monetise, such as health and wellbeing improvements for local people. Public and philanthropic bodies are increasingly recognising the value of these co-benefits to local communities and providing opportunities for projects to access non-repayable funding which can complement other revenue streams from private sources (see Section 1.8).

Figure 3: Illustrative NbS-WS project structure



** Examples include water utilities, developers, corporates, public sector bodies.*
*** Examples include local communities, environmental NGOs ("eNGOs"), government agencies, businesses.*
Source: Authors

Table 3: Illustrative potential revenue streams for NbS-WS

Payments for Ecosystem Services ("PES")	PES are payments through which beneficiaries of ecosystem services reward the providers of those services. PES are an important emerging potential revenue stream for NbS. These can be accessed through established markets, such as the sale of carbon credits to corporates seeking to offset their greenhouse gas (GHG) emissions via carbon trading markets where they exist; or via bespoke bilateral arrangements, such as the sale of water quality outcomes to a beneficiary responsible for providing clean water. PES, including water quality trading services but excluding voluntary carbon credit sales, generated US$51 million of private sector financing for NbS in 2019 (UNEP, 2021).
Cost savings	Cost savings are net reductions in expenditure for providing water services, such as for maintaining water networks and related infrastructure. An important potential method to secure funding for NbS-WS projects is the identification of capital and/or operational expenditure savings created as a result of the benefits generated. For example, when green infrastructure solutions retain water during stormwater surges, they can help reduce sewer network management and/or system upgrade costs for water utilities.
Tariffs and charges	Tariffs and charges are fees charged by utilities for water and wastewater services. Tariffs and charges are a common method used by water utilities to fund capital and operational expenditures and may cover the costs of NbS-WS where allowable by regulators.
Commercial / enterprise revenue	Commercial / enterprise revenues are generated from the sale of products or services. NbS-WS can deliver provisioning ecosystem services such as potable water supplies and timber that can be sold into established markets. Other commercial revenues can be generated through cultural ecosystem services such as recreation that can bring ecotourism opportunities.

Environmental credits, which are tradeable units for offsetting negative environmental impact resulting from infrastructure development, are an emerging potential revenue stream for NbS-WS. Offset markets allow the trading of credits or units between NbS-WS project developers acting as sellers and infrastructure developers acting as buyers. Trading mechanisms exist in certain markets and regulatory regimes around the world, as detailed in Table 4.

Table 4: Overview of credits, buyers, and global offsetting markets

Credit Market	Buyers	Market Jurisdictions
Wetland mitigation credits **Stormwater retention credits** **Biodiversity units**	Residential, commercial and infrastructure developers	United States United Kingdom
Carbon credits	GHG-emitting organisations	Global
Water quality credits	Water utilities, landowners/farmers	United States, Canada, Australia

1.5. ADDRESSING THE FUNDING GAP FOR NBS-WS INVESTMENT

Global demand for water is increasing at around 1% per year, and it is expected that 4.8-5.7 billion people will be living in water-scarce areas by 2050. Up to 71% of the world's natural wetlands, essential for supplying freshwater, have been lost since 1900 (UN-Water, 2018). With degraded ecosystems, increasing industrial production and growing population centres, trillions of U.S. dollars of investments will be required by 2050 to secure safe access to potable water (Hutton and Varughese, 2016).

Despite the multiple benefits of NbS-WS, investments to date have been limited and almost entirely publicly funded. The evidence base for the technical performance of NbS-WS and the models for monetisation of their outcomes is developing. However, to date the technical cases, revenue models and associated markets are typically too uncertain and under-developed to attract private investment at scale. UN-Water estimates that only 0.1% of investments in water resources infrastructure relates to NbS (UN-Water, 2018). A 2016 study found that of US$25 billion of investments in the restoration, creation and rehabilitation of forests, wetlands, grasslands, and other ecosystems for water security across 62 countries, 96% were funded through public subsidies for watershed protection compared to only 2.6% through PES. The same study analysed 146 user-driven watershed investment programs and identified that eight out of every ten dollars of investment were made by national and local governments/municipalities rather than private actors (Bennett and Ruef, 2016).

Public funds alone are insufficient to meet global water infrastructure investment needs. With institutional investors holding over US$100 trillion of assets in OECD countries alone, and given the increased financial sector interest in projects that have positive impacts on climate and the environment, private capital represents a major potential source of long-term funding for NbS investments (OECD, 2021a). Development finance and strategic deployment of public and philanthropic funds can play a crucial catalytic role in unlocking and helping to crowd-in private investments in "blended finance" approaches, especially in lower income countries where investments are considered much riskier for private investment (see Section 1.8). These blended finance approaches can help to develop the evidence base and demonstrate the application of NbS-WS techniques in addressing water security risks, whilst helping to stimulate new ecosystem service markets.

1.6. NBS-WS INVESTMENTS: FUNDING VS. FINANCING

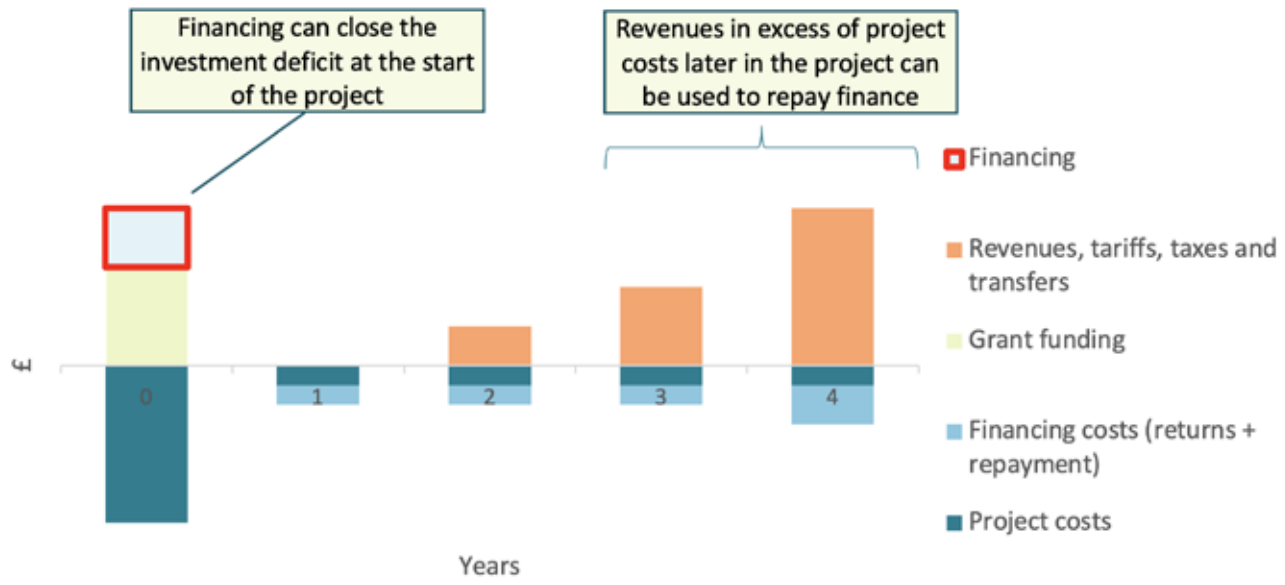
To understand the investment landscape for NbS-WS, this report distinguishes between "funding" and "financing" as two distinct ways to cover the costs of investing in NbS, as follows:

Funding refers to "filling the gap", i.e. monies received or generated by NbS-WS projects to pay for upfront capital requirements or ongoing management of NbS, with no expectation of being repaid. Typical and significant sources of funding for water companies are water tariffs, taxes, and public transfers. Other funding sources may include public and philanthropic grants, PES, and enterprise revenues.

Financing refers to "bridging the gap", i.e. forms of capital used to pay for project costs and bridge the time gap until revenues can be generated; in this case, monies received are expected to be repaid, usually including a financial return that typically increases as the perceived investment risk increases. This may include debt and equity financing instruments.

Figure 4 shows illustrative cashflows of a typical NbS investment. Upfront capital expenditures can be funded through a combination of grant funding and repayable finance. Revenue streams generated through a range of monetisable benefits support project and financing costs including capital repayments.

Figure 4: Illustrative example of how financing can enable NbS investments



Source: Authors

1.7. NBS-WS: BARRIERS TO SCALING INVESTMENT

A number of barriers hinder the availability of capital investment for NbS-WS. Project developers who create NbS-WS investment opportunities face a range of challenges in creating sufficiently compelling proposals to attract investment. Developers often struggle to create reliable projections of revenue streams, costs, and financial returns within NbS-WS investment cases. These issues are often compounded with additional complexity over designing robust governance structures and implementation plans. Project preparation costs are therefore often very high. Investors are typically reluctant to enter into new asset classes such as NbS-WS that have unfamiliar risks and as a result usually require higher returns to compensate for the perceived risk of a nascent asset class. This acts to increase the cost of capital and the required financial returns which NbS-WS projects must deliver, in turn reducing the number of opportunities which are viable. Table 6 summarises the key barriers to investment encountered in nascent NbS-WS markets today.

Table 5: Key barriers and potential solutions for investments in NbS-WS

Barrier	Description	Potential Solutions
Technical Limited data on NbS-WS performance and track record.	Modelling and projecting the benefits of NbS-WS can be challenging given the complexity of biophysical processes, which are highly context dependent and require robust sets of historical data. Uncertainties around assumptions and scenarios used in forecasts can reduce investment confidence and replicability of models. Bespoke and complex upfront modelling to provide assurance for investors can be prohibitively expensive, especially for smaller projects.	Outcome-payment mechanisms can address the performance uncertainty in the payment structure (see Section 2.1).
Regulatory Restrictive regulations on investments in NbS.	Local regulatory environments can restrict the ability of utilities or other entities to invest in alternative water security techniques given the potential risks of non-performance. Requirements to ensure value-for-money for regulated utility customers reduces the risk appetite of utilities for innovative approaches, disincentivising investment in less proven techniques such as NbS-WS.	Regulatory “sandboxes” can provide the appropriate environment within which to trial innovative NbS approaches and solutions.

Financial / Investment Uncertainty in financial requirements and investment time horizons.	NbS-WS require upfront funding to meet implementation costs and the lack of accurate cost data on the required capital and maintenance expenditures can pose a barrier to build a robust financial case necessary to gain investment confidence. Revenue streams can also take long periods to materialise, which can require long investment periods (as is typically the case for infrastructure investments).	Independent technical guidance / due diligence on expected lifetime costs can support the development of an evidence-based financial case. Blended finance approaches can mobilise required funding where public funding is not sufficient alone. Revenue support mechanisms such as floor price guarantees and forward purchase arrangements where available reduce the risk of long term investments.
Commercial Lack of standardised revenue models.	Lack of monetisable revenue streams can pose a barrier to realising investment in NbS-WS. However, past successful and proven revenue models are often not easy replicable and/or scalable outside specific parameters such that other opportunities for investment in NbS-WS can be facilitated.	Developing standards for revenue monetisation models and creating regulatory drivers to encourage markets to form around appropriate ecosystems.
Limited transaction data Lack of investor awareness and understand	Investors are typically reluctant to enter into new asset classes such as NbS-WS that are unfamiliar to them. There are proportionally few completed NbS-WS transactions compared to traditional grey infrastructure, and investment data is often disparate with limited investor information channels preventing investors from conducting asset class due diligence. As a result investors typically require higher risk adjusted returns for the perceived or unknown risk profiles.	Blended finance approaches can mobilise required funding where public funding is not sufficient alone. Outcome-payment mechanisms can address the performance uncertainty into the payment structure (see section 2.1).
Governance Absence of standardised frameworks to facilitate co-funding.	NbS-WS can generate multiple benefits for a range of stakeholders and therefore often require multi-party collaborations. However, there is typically no standard or clear framework for cooperation to facilitate joint funding models, creating challenges in aligning stakeholders and allocating financial responsibilities.	Multi-party governance mechanisms can provide a formal framework to govern the process, roles and responsibilities among multiple stakeholders (see Section 2.3 case study).

Stakeholder engagement Challenges in securing long-term community support.	While NbS-WS can provide multiple benefits for local communities, securing long-term support of communities for the proposed interventions is key to ensure that ecosystem services are generated over the project lifetime. This is especially true in contexts where implementation, maintenance and monitoring rely on local communities to maintain the proper functioning of the NbS-WS intervention. Early engagement, cooperation, ongoing communication with local communities and representation through appropriate governance can facilitate securing community buy-in and support (see in Section 2.3 case study).	Early engagement, cooperation, ongoing communication with local communities and representation through appropriate governance can facilitate securing community buy-in and support (see in Section 2.3 case study).
Small scale Complexity of multiple small scale interventions.	Some NbS-WS such as SuDS typically require smaller individual interventions across multiple sites to deliver benefits. This can present logistical challenges in securing sufficient appropriate sites and increases the complexity of a transaction structure. The complexity of multiple small-scale interventions often exacerbates many of the other barriers, and aggregation may be required to reach minimum investment thresholds for investors.	An aggregation of interventions can reduce complexity of structuring and facilitate implementation of Section 2.1 case study).

1.8. MECHANISMS TO MOBILISE FUNDING AND FINANCING FOR NBS-WS

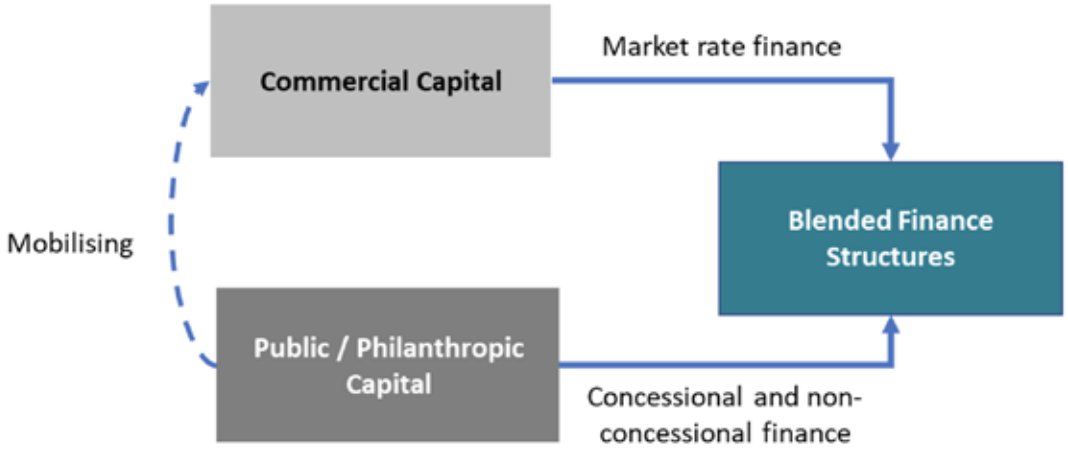
The nature of NbS and natural ecosystems can present challenges in developing business models with clear risk and return profiles that are attractive for investors. The time lag between upfront investment and monetisation of benefits from NbS-WS can require long investment horizons, which increases investment risk. Public and philanthropic funding can be pivotal in mitigating some of these financial risks during the early-stage development of investment opportunities. Non-repayable and concessionary finance can be combined with commercial repayable investment in "blended finance" structures. These structures are designed to reduce risk for private investors and thus incentivise them to invest in NbS.

"Blended Finance" is defined as:

> "a structuring approach that involves using grants, concessional and non-concessional development finance to mobilise additional finance from commercial (public and private) sources"
>
> (WWC, 2022).

This approach is applicable in both developing and developed countries, although it has higher additionality in countries where less commercial finance is currently available, such as in least developed countries (LDCs) (OECD, 2021b). Blended finance is typically used in the early stages of market development where projects cannot evidence and/or deliver sufficient risk-adjusted returns to attract commercial investment. Development grants can fund the design of investment-ready projects, while capital grants and concessionary finance improve risk profiles by absorbing financial losses ahead of private investors. Once revenue models are proven and markets become established for ecosystem services, investors become more familiar with business models leading to a reduction in required returns. This blended finance approach helps to increase early-stage viability of business cases and accelerate their commercialisation. As business models mature, and investors' knowledge and understanding increases, public and philanthropic funding can increasingly be replaced by private investment.

Figure 5: The Blended Finance approach



Adapted from Convergence (2021)

Several financing mechanisms have been deployed to attract finance into NbS-WS investments internationally, as described in Table 7. Figure 6 outlines the range of actors that can utilise these financing mechanisms.

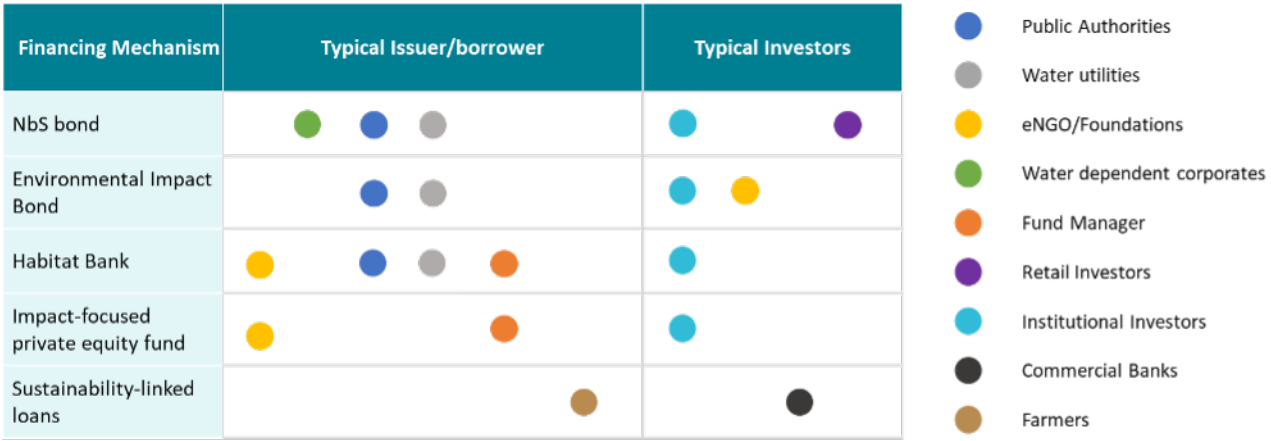
Table 6: Examples of funding and financing mechanisms that can be applied to NbS-WS

Funding/Financing mechanism	Description	Example
Water Fund	A governance mechanism which brings together public and private stakeholders to fund and/or finance NbS. Water fund models provide a framework for sustainable watershed management by connecting downstream water users or beneficiaries with the providers of watershed services or interventions upstream.	Upper Tana Nairobi Water Fund (see Section 2.3)

Green Bond	A debt instrument issued by an entity (e.g. a corporate or public authority) used to finance sustainable projects. Issuers often define a framework that sets out the use and management of proceeds in accordance with "green" criteria, such as the ICMA's Green Bond Principles. The use of proceeds can be independently verified, which helps to improve investors' confidence that capital is being allocated to appropriate uses. Green bonds tend to be for large amounts (multi-US$millions) in order to absorb additional transaction costs. As debt instruments they typically require predictable cashflows for annual payment of coupons to bondholders. As cashflows associated with NbS projects are often not sufficiently predictable, few green bond issuances have been used exclusively for investment into NbS to date.	Dutch Sovereign Green Bond (see Section 2.6)
NbS Bond	A debt instrument where proceeds are used solely to finance NbS. Structures and repayment profiles for NbS bonds can differ from traditional Green Bonds to enable them to adapt to the less predictable cashflows relating to the underlying NbS. There are very limited issuances to date and the instruments tend to be bespoke structures and of low monetary value compared to Green Bonds.	Forest Resilience Bond (see Section 2.2)
Environmental Impact Bond	A financing mechanism used to finance NbS interventions, which transfers NbS performance risk from an outcome payer or beneficiary, to investors via an outcome-based (performance) payment mechanism. This mechanism ties the financial return of the bond to the underlying performance of the NbS asset that is independently assessed over a pre-determined period. Environmental Impact Bonds can be complex to structure and negotiate and often carry high transaction costs.	DC Water Environmental Impact Bond (see Section 2.1)
Sustainability-linked loan	Similar to a traditional loan issued by a commercial lender, but the interest rate of the loan is linked to pre-agreed sustainability performance targets to incentivise the borrower. Under the loan terms, the borrower can benefit from below-market loan interest rates if specific targets are achieved, with the interest rate reverting to market rates (or higher) if the targets are not achieved.	BNZ Sustainability-linked loan (BNZ, 2021) (see Section 2.3)

Habitat Bank	A financing vehicle used specifically to fund habitat creation and restoration (e.g., wetlands, streams, or other specific ecosystems) to compensate for environmental damage caused by developers. The sale of mitigation credits generates a revenue stream to fund operational expenditure and repay project financing. Habitat banks are typically created where established markets in mitigation credits exist, enabling the provision of mitigation credits in advance of when environmental damage occurs. This creates an 'off the shelf' solution for developers seeking offsite mitigation.	Petersen Ranch Mitigation Bank (see Section 0)
Impact-focused private equity fund	Private equity funds pool capital into projects aiming to provide a market-level return to the investors. Projects are selected based on eligibility with pre-established investment criteria. Increasingly, private equity funds are being established that target specific social and/or environmental impacts. For private equity funds focused on NbS, typical investors include specialist impact investors and family offices.	Sustainable Water Impact Fund (see Section 2.4)

Figure 6: Illustrative financing mechanisms for NbS-WS with typical issuers/borrowers and investor



Source: Authors

The subsequent sections of this report focus on each of the most promising business lines for NbS-WS investment, and describe how different funding and financing solutions have been used to overcome some of the barriers to investment encountered through their real world deployment.

2. FUNDING AND FINANCING MECHANISMS FOR PROMISING NBS BUSINESS LINES

2.1. SUSTAINABLE DRAINAGE SYSTEMS ("SuDS")

Stormwater surges are a leading cause of freshwater pollution and flooding in urban areas. These problems are worsening due to the increasing frequency of extreme weather events caused by climate change, as well as urbanisation and the associated loss of natural green and blue spaces to development. Heavy and sudden rainfall increases the risk of Combined Sewer Overflows ("CSOs"), which are spills of sewerage pipes into water bodies when their capacity is exceeded. CSOs can lead to sediments, pesticides, heavy metals, and sewage entering lakes and rivers (TNC, 2021a).

Examples of SuDS in the US. Photos courtesy of DC Water.

SuDS are water management systems which mimic natural processes to slow the flow of stormwater into watercourses while providing a range of co-benefits, and include bioretention systems, rain gardens, swales, green roofs, infiltration trenches and permeable pavements (TNC, 2021b). Increasingly, urban authorities and water utilities are integrating "green infrastructure" such as SuDS into modern drainage systems to more effectively deal with stormwater runoff and reduce the risk of sewer and surface water flooding events while providing wider benefits to local communities.

There are many initiatives across the world promoting SuDS for water security. The EU-funded Nature Smart Cities programme is piloting SuDS to reduce the risk and damage of urban flooding across seven European cities. These include Copenhagen, which has jointly built and funded blue-green spaces in public areas with the local water utility to combat pluvial flooding challenges; and The Hague, which has implemented a rain and surface water collection, biofiltration and storage system that can hold the equivalent of 14 Olympic swimming pools (Trémolet et al., 2019; Nature Smart Cities, 2021). In China, the government's Sponge Cities programme has seen over 30 cities reducing flood risk by installing SuDS such as wetlands, gardens, and permeable pavements (Gill, 2021). In Wisconsin, USA, the water utility Milwaukee Metropolitan Sewerage District ("MMSD") has implemented a green infrastructure programme to address CSO issues while engaging proactively with the regulator to incorporate green infrastructure initiatives in federal-level funding mechanisms (TNC, 2019a).

What are the benefits, beneficiaries and potential revenue streams?

The main benefits of SuDS are the reduction of stormwater runoff reducing the risk of sewer flooding and contamination of water bodies. This can benefit water utilities, insurance and reinsurance companies by reducing network repair and maintenance costs and insurance claims respectively, while protecting water quality for local communities. Revenue streams can be created by monetising these cost savings and benefits via PES schemes and/or outcome payment mechanisms (see Section 2.1 case study).

SuDS not only generate flood management and water quality ecosystem services, but can also provide wider co-benefits including climate regulation, health and wellbeing and biodiversity. However, these co-benefits may be more difficult to monetise as markets or mechanisms do not necessarily exist to support a revenue stream. However, regulatory incentives can provide an environment under which payers for benefits can be identified. In the UK for example, the Water Service Regulation Authority ("OfWAT") has established a system of financial incentives and penalties for the country's water utilities, many of which relate to environmental performance. United Utilities, one of the UK's largest water companies, has agreed a bespoke incentive with OfWAT to encourage investments in green infrastructure solutions that also have the capacity to generate specific ecosystem services including those aforementioned above (OfWAT, 2019).

Table 7: Benefits, beneficiaries, and monetisation opportunities for SuDS

Benefits	Monetisation opportunity	Beneficiaries
Reduction of sewer flooding risk and network management costs		Water and sewerage utilities
		Insurance companies
Reduction in surface water flood risk		Local authorities Insurance companies
		Local communities and residents
Reduced risk of pollution of water bodies		Local authorities Water utilities
		Local communities and residents
Increased amenity in urban areas		Local communities and residents Developers and property owners
Clean air Urban heat island effect		City authorities City residents
Health and wellbeing Biodiversity and local environment		Local communities and residents

Established track record of monetisation and accessible market for selling ecosystem services

Limited track record of monetisation or hard-to-access market for selling ecosystem services

No market for selling ecosystem services in short term although market may develop in future

What are the key barriers to investment and potential funding and financing solutions?

Among the investment barriers highlighted in Table 7, evidencing the technical performance and attributing outcomes to SuDS is a particular challenge due to often disparate small-scale implementation across multiple sites. To address this uncertainty, outcome-payment or pay-for-success mechanisms such as those deployed in impact bonds can be effective for managing performance risk. However, they require an appropriate measure of performance which can be difficult and/or expensive to reliably assess. Through pay-for-success mechanisms such as those deployed in the world's first Environmental Impact Bond in Washington DC, USA in 2016 (see case study below), potential beneficiaries such as water utilities can share performance risk with impact investors to reduce costs incurred in the event the interventions fail to deliver the targeted benefits. Care must be taken to ensure that perverse incentives are avoided, i.e. performance indicators must not be set too low such that they lack ambition or impact, or too high such that investors are unconvinced they are achievable.

There is increasing evidence for SuDS effectiveness in dealing with flooding and water quality issues. This evidence is being developed through higher levels of SuDS deployment around the world, which is helping to improve contractor expertise in delivery, in turn enabling technical cases for investment to become easier to develop. Aggregation approaches are especially relevant for SuDS as typically multiple smaller interventions within a sub-catchment are required to tackle flooding issues. Early engagement and cooperation with communities is essential to support the implementation of SuDS and the investment thereof, especially when partly funded through public grants. Community support can also facilitate securing the buy-in from local stakeholders that can assist in the maintenance of green and blue spaces to ensure their ongoing function and effectiveness.

Regulatory "sandboxes" are useful approaches by regulators that allow regulated organisations to test and trial innovative approaches. These can be especially useful in encouraging utilities to explore the use of green infrastructure solutions such as SuDS in tackling urban flooding problems.

Parking lane permeable pavement. Photos and pictures courtesy of DC Water.

CASE STUDY
DC WATER ENVIRONMENTAL IMPACT BOND

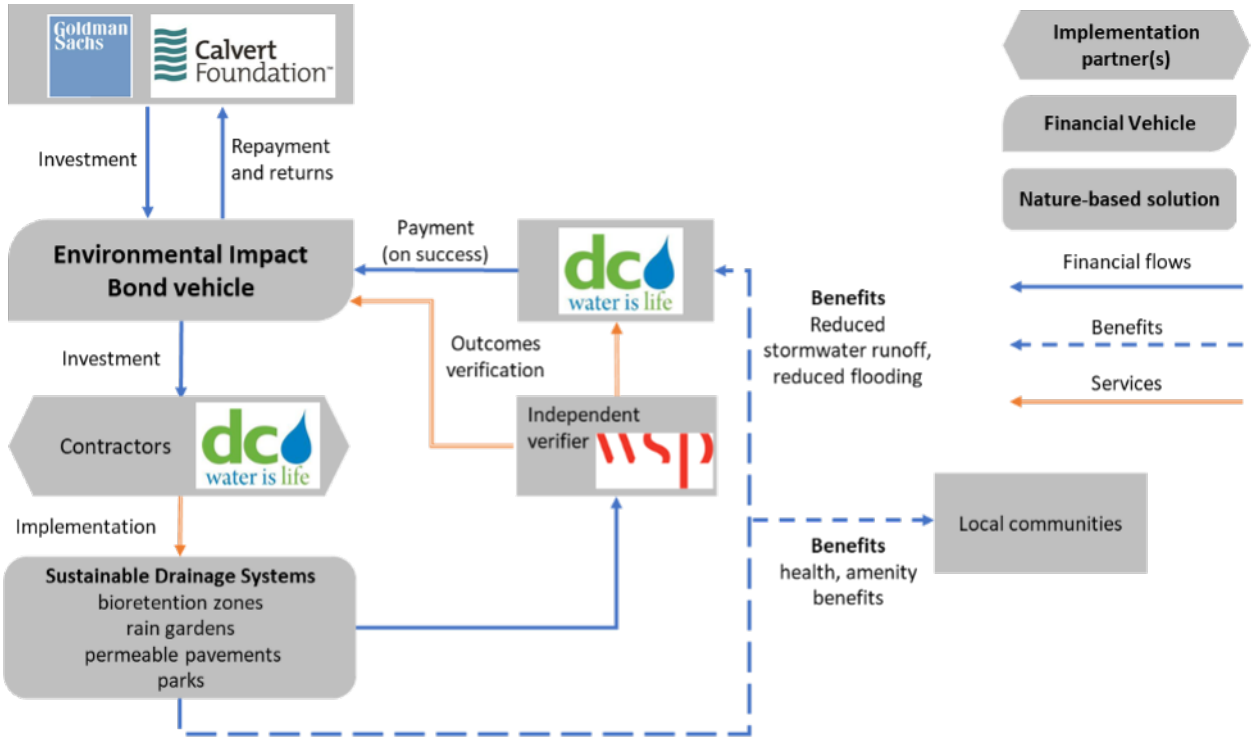
Overview

In 2016, the District of Columbia Water and Sewer Authority ("DC Water") launched the world's first Environmental Impact Bond ("EIB") to fund a series of SuDS in Rock Creek, Washington DC, to address flooding and water quality issues arising from the high frequency of CSOs. These events were caused primarily by storms and resulted in raw sewage being released into the Potomac River annually. The EIB issuance consisted of a US$25 million, tax-exempt five-year bond, privately-placed to an institutional investor, Goldman Sachs, and the Calvert Foundation, a non-profit impact investing organisation. Quantified Ventures served as the investment intermediary and advised on financial structuring and execution (Quantified Ventures, 2016).

Financing Structure

The innovation of this EIB relates to its payment structure which was designed such that DC Water, the issuer, shared the performance risk with the investors via three distinct outcome scenarios (Figure 7). These scenarios were based on expected performance thresholds and prescribe additional payments paid or received by the investors. The outcomes are linked to SuDS performance over the investment period as measured in terms of surface water runoff reduction compared to a pre-installation baseline. As detailed in Figure 8, the investors agreed that, if at the end of the investment period the SuDS were confirmed to have underperformed against expectations of monitored runoff reduction compared to baseline measurements, they would make a payment back to DC Water, thereby reducing their own effective return and DC Water's cost of capital to 0.5%. Conversely, if the SuDS were shown to outperform by achieving a greater runoff reduction compared to baseline measurements than expected, DC Water agreed to make additional payments to investors, acknowledging the greater network management cost savings generated by the SuDS, thereby increasing the investment return and DC Water's cost of capital to 6.3%. In defining these three outcome scenarios, DC Water EIB was able to provide financial incentives for investors to participate in the performance of NbS-WS, distributing the investment risk among DC Water and the investors.

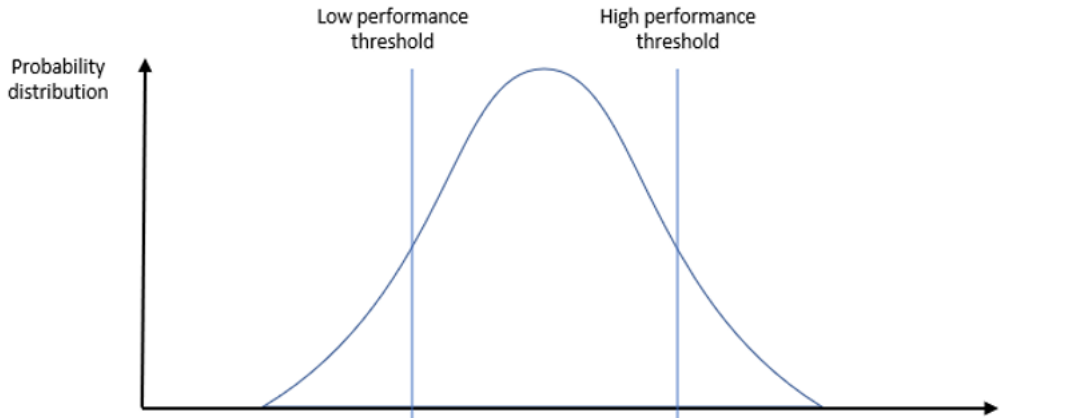
Figure 7: DC Water Environmental Impact Bond transaction structure



Source: Authors

Through hydraulic modelling, DC Water was able to calculate a range of performance outcomes, predicting the expected reduction in run-off arising from the proposed interventions. Probability simulations and statistical analysis was then used to assign probabilities of different performance outcomes. Interest rates were designed for each performance threshold to ensure that even in the event of outcomes exceeding performance targets, the interventions would still generate an overall financial benefit for DC Water through avoided expenditure on hard engineering solutions. Independent third party reporting of the impact of SuDS was completed in 2021 by WSP USA and confirmed a 20% reduction in runoff, in line with 'base case' expectations and therefore leading to no contingent payments being triggered (DC Water, 2017).

Figure 8: DC Water EIB Performance Structure



Performance	Low	Base	High
Fixed Interest Rate	3.43% (market rate)	3.43% (market rate)	3.43% (market rate)
Additional Payment	$3.3m (Investors pay)	None	$3.3m (DC Water pays)
Probability	2.5%	95%	2.5%
Effective Return (%)	0.5%	3.43%	6.3%

Adapted from Quantified Ventures (2016)

The risk transfer within the bond's flexible outcome-payment mechanism helped DC Water to mitigate the technical performance risks of the SuDS, which lacked the required evidence to enable DC Water to fund the interventions through its traditional financing routes. This issuance set the blueprint for other US municipalities to replicate similar structures and build confidence in SuDS as an effective green infrastructure, and there have since been subsequent successful EIB issuances across other US cities, including Hampton, Atlanta and Buffalo.

Revenue source(s)

To meet its regulatory requirements in managing stormwater, DC Water assessed a US$2 billion grey infrastructure package consisting of building two concrete underground tunnels to redirect stormwater. In parallel, DC Water explored alternative solutions using SuDS as a cost-effective and complementary green solution. The SuDS analysis indicated that they may offer a capital investment and network management cost saving compared with an exclusively grey infrastructure solution; however, there were uncertainties over the technical performance of the SuDS. DC Water chose to adopt a hybrid approach of grey and green solutions to address the scale of the CSO challenge while also generating wider environmental and social benefits (Quantified Ventures, 2016).

Table 8: Challenges and Success factors for DB Water EIB

Challenges	Solutions/Success factors
Identification of performance metric It was a challenge to identify an appropriate performance metric for the bond which could be easily understood by investors and cost-effectively independantly verified.	• DC Water defined a simple, measurable and understandable performance metric in stormwater runoff that it was able to assign financial value through technical and statistical modelling. The metric was easily understood by key stakeholders and could be monitored and verified cost-effectively.
Uncertainty in SuDS performance A lack of track record for the performance of SuDS made it challenging for DC Water to take on full capital investment risk. Investors required sufficient confidence in the technical case for SuDS to deliver the targeted outcomes.	• DC Water was willing to trial an innovative investment structure. The design of the outcome payment mechanism transferred performance risk across the issuer and investors. DC Water's capacity to co-develop the EIB and carry out performance monitoring and reporting increased investor confidence. • Quantified Ventures' role as a trusted intermediary with experience in financial structuring facilitated engagement and successful negotiations between the issuer and the investors.
Uncertainty in pioneering an innovative financing solution The transaction structuring presented some difficulties given the lack of precedent in the use of impact bonds in the environmental sector.	• DC Water's strong balance sheet, credit standing and experience as a municipal bond issuer helped increase the attractiveness of the investment proposition to the investors. • Investors Goldman Sachs and Calvert Foundation were interested in the project's role in growing the NbS investment market. Their flexible approach in taking on performance risk via the outcome payment mechanism was essential for success.
Regulatory restrictions DC water was legally obligated by the regulator to address CSO issues within a limited time period.	• An accommodating regulatory environment is crucial in trialling new financing models. DC Water received support from the US regulator (EPA) in relaxing the original time constraints to meet its regulatory requirements to allow sufficient time to develop the EIB.
Securing community buy-in Local communities needed to be convinced by the economic and social benefits of the proposed solutions in multiple areas.	• Community buy-in was a key requirement for the SuDS to be implemented as a long term solution. DC Water's investment in developing a training programme to create local green jobs and wider social benefits alongside environmental impact played an important role in securing community support.

Specialised transaction expertise required Specialist transaction structuring and legal advice was needed to ensure the EIB achieved tax-exempt status to provide tax benefits equivalent to regular municipal bonds.	• Quantified Ventures and DC Water mobilised the required professional legal and tax expertise to design an EIB attractive to investors. DC Water brought together supporting parties which included specialised legal firms with expertise in tax regulation and municipal bond documentation which helped to optimise the tax and financial structure of the mechanism.
Ensuring long-term benefits To ensure SuDS continued to generate long-term benefits, the responsibility for ongoing maintenance of the SuDS needed to be clearly assigned.	• DC Water understood and secured the required resources and capacity for maintaining SuDS for the long term. It was established at the outset that DC Water employees and specialised contractors would carry out the ongoing maintenance of the SuDS.

Sources: North and Gong (2017); interviews conducted by Authors

2.2. WOODLAND CREATION, RESTORATION AND MANAGEMENT

Forests cover an estimated 30% of the Earth's land surface and provide critical habitat to more than three quarters of terrestrial life (WWF, 2021a). As trees grow, they sequester carbon, providing essential climate regulation services. Alongside oceans, forests function as the world's largest natural carbon sinks holding an estimated total carbon stock of 662 gigatonnes alone, which is approximately fourteen times the total greenhouse gas emissions emitted in 2018 globally (FAO, 2020). Additionally, they provide multiple ecosystem services underpinning the provision of water, food, commodities and livelihoods to 1.25 billion people globally. However, across the world, forest habitats are threatened by expansion of agricultural and farmland, and unsustainable logging for timber. Meanwhile, climate change increases the prevalence and size of wildfires, which destroyed more than 4 million hectares (10 million acres) in 2020 in the US alone (WWF, 2021b; NIFC, n.d.). By creating, restoring and effectively managing woodlands, watersheds can be protected and wildfire risks reduced.

Pilot Forest Resilience Bond project site (see below). Picture courtesy of Blue Forest Conservation.

Multiple international public and private initiatives have been launched to address forest degradation and destruction, and to support restoration. For the period 2015-2020, the European Agricultural Fund for Rural Development allocated €8.2 billion (US$9.3 billion) of funding to EU member states for the implementation of measures to restore and improve forest resilience, recognising the range of ecosystem services forests provide including their role in the water cycle (EU Factsheet, 2021). TNC's Cumberland Forest Project, a US-based impact investment fund, has raised US$130 million of private equity and debt to fund conservation activities across over 102,000 hectares (253,000 acres) of forest land in the Central Appalachian Mountains. One of the key aims of this sustainable forestry fund is to safeguard the water quality and supply for surrounding communities through active forest management activities (TNC, 2019b). In Brazil, São Paulo's water utility (SABESP) designed an NbS programme prioritising reforestation and revegetation to protect its catchment areas from degradation.

This approach required engagement with a diverse group of water users, local partners and regulators to deliver an expansive watershed conservation programme which included preserving 33,000 hectares (81,545 acres) of land across four watersheds. SABESP also worked with local regulators on developing new models for long term protection of water supply across a watershed, including how NbS can be integrated into regulatory tariff frameworks (SABESP, 2020).

What are the benefits, beneficiaries and potential revenue streams?

When managed effectively, forests can generate a wide range of key ecosystem services. It is estimated that 75% of the world's accessible freshwater resources are provided by forested watersheds (Millennium Ecosystem Assessment, 2005). Forests are crucial in securing clean water supplies for human consumption, agricultural and industrial use. Forests can provide commodities for livelihoods and commercial use and act as important carbon sinks, with tropical forests alone absorbing up to 1.8 gigatonnes of carbon annually from the atmosphere (Pacheco, 2021). These benefits can generate revenue streams from the sale of voluntary carbon credits to corporates seeking to substantiate carbon neutrality claims, or via other PES schemes and/or outcome-based mechanisms for other ecosystem services.

Table 9: Benefits, beneficiaries and monetisation opportunities from woodlands

Benefits	Monetisation opportunity	Beneficiaries
Carbon sequestration		GHG emitters
Commercial products - timber, non-timber forest products (NFTPs)		Landowners Local communities
Water quality Water supply		Water utilities Hydropower companies Forest agencies Public authorities Local communities Water end users
Reduced wildfire risks		Public authorities Forest agencies Insurance companies Landowners and local communities
Biodiversity and local environment		Developers
Clean air		Local communities Public authorities
Health and wellbeing		Local communities

Established track record of monetisation and accessible market for selling ecosystem services

Limited track record of monetisation or hard-to-access market for selling ecosystem services

No market for selling ecosystem services in short term although market may develop in future

What are the key barriers to investment and potential funding and financing solutions?

A key financial barrier for woodland projects in delivering water security is that often the quantified and monetisable water security benefits are not sufficient by themselves to attract investment. Many projects therefore explore the potential for "stacking" different revenue streams to develop viable investment cases. Helpfully, forests generate a wide range of ecosystem services and products which facilitates stacking. Revenues can be generated from a range of co-benefits, including sustainable timber harvesting, sale of carbon credits and ecotourism. Blended finance approaches can also be used, especially where grants are available to bridge the time gap between implementation costs and revenue streams, a gap that can be significant where carbon credits or timber revenues are being relied on.

There are governance and community-related challenges in designing investment-ready woodland projects for water security, as often target areas span multiple properties, jurisdictions and communities. In some developing countries in particular, property ownership may be uncertain. Moreover, these projects, as they may impact the land use and livelihoods of local communities, need strong buy-in from these communities to ensure the sustainability of interventions. This, combined with limited public agency budgets and resources, means that public-private-philanthropic partnerships which combine technical expertise and financing from the different partners are often needed to make projects viable.

Solving funding and resourcing challenges for on-the-ground delivery is key to the success of forest management partnerships at scale (EPA, 2021). The shared stewardship financing approach deployed in the Forest Resilience Bond (see case study below) can be effective in mobilising multiple stakeholders and collaborative forest restoration efforts across ownership boundaries. Early and targeted engagement with local communities, explaining proposed interventions, their benefits (to both the environment and the community) and the proposed financing mechanisms are also vital in building local community support.

A lack of technical evidence is also often a major barrier to investment, undermining confidence in project outcomes. Risk transfer mechanisms like outcome-payments that use measures such as water quality and quantity have the potential to attract impact investors to projects to share performance risk and over time increase the technical evidence base of outcomes, however these approaches can be complex to structure. See Sections 1.8 and 2.1 for a more detailed review of EIBs that utilise these mechanisms.

Table 10: Benefits, beneficiaries and monetisation opportunities from woodlands

CASE STUDY
FOREST RESILIENCE BOND

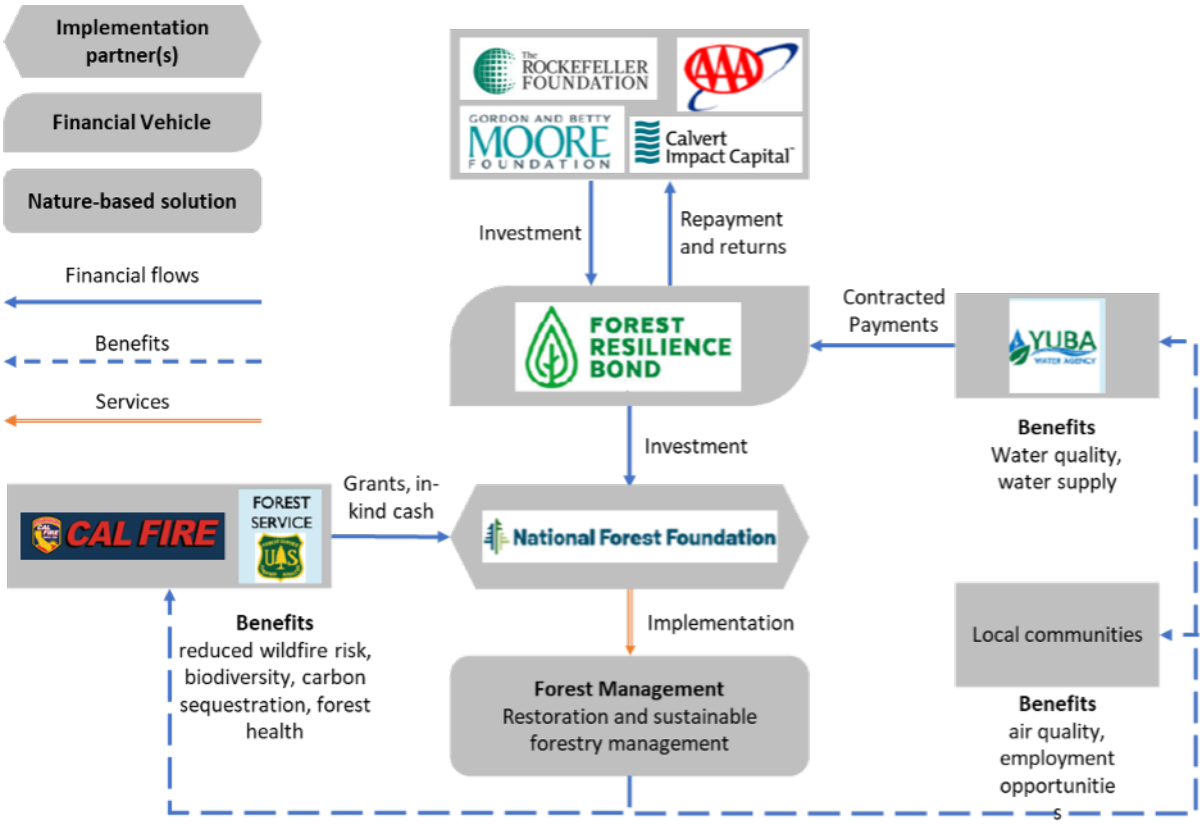
Overview

The State of California needs to restore over 202,000 hectares (500,000 acres) of forests each year to develop resilience to wildfire risk (USDA, 2021). In 2018, recognising the need to mobilise private capital in this effort, Blue Forest Conservation ("BFC") in partnership with the World Resources Institute ("WRI") and the US Forest Service, developed the first Forest Resilience Bond ("FRB"). This was an innovative blended finance mechanism targeting forest restoration programmes to mitigate wildfire risks. The issuance consisted of a US$4 million bond with a 5-year tenor, privately-placed to a combination of commercial and impact investors and philanthropic bodies (Blue Forest Conservation, 2017). The proceeds of the bond were used to fund forest restoration works on Tahoe National Forest. BFC served as a lead partner and project sponsor.

Financing Structure

As illustrated in Figure 9, a Special Purpose Vehicle ("SPV") was set up to issue the FRB and mitigate the financial risks for the beneficiaries and investors. The SPV entered into contracts with the implementation partner, the National Forest Foundation, as well as with beneficiaries to agree financial payments based on completion of verified restoration works. The main beneficiaries, Yuba Water Agency, the United States Forest Service ("USFS") and the California Department of Forestry and Fire Protection ("CAL FIRE"), also provided US$4.3 million of grant funding to compliment the bond proceeds. By using a blended finance approach whereby philanthropic investors, the Rockefeller Foundation and the Gordon and Betty Moore Foundation, agreed to receive a concessional return of 1% per annum, the FRB was able to offer a more attractive return of 4% per annum to commercial investors, Calvert Impact Capital and CSAA Insurance Group, who provided the remaining balance of finance required (Convergence, 2020).

Figure 9: Forest Resilience Bond transaction structure



Source: Authors

Since the launch of the first FRB, US federal support has been secured to expand on this public-private-philanthropic partnership model. In 2019, the USFS National Partnership Office initiated the Innovative Finance for National Forests grant programme to support the development of finance models that invest in the resilience of the National Forest System and surrounding areas. In 2020, over US$1.8 million in grants have been awarded to multiple recipients, including BFC (EPA, 2021). The funding provided to BFC enabled it to refine and replicate the FRB model with the launch of a second FRB of US$25 million in October 2021. This issuance received funding from utilities, corporates and state agencies to finance the conservation of over 19,000 hectares (48,000 acres) of the Tahoe National Forest (BFC, 2021).

Revenue source(s)

Cal Fire and USFS gain from anticipated cost savings in avoided treatment of wildfires and associated commercial losses from damage to natural assets such as timber, property, livestock, and land. Yuba Water Agency benefits from a healthy watershed and secured water quality and quantity as a result of enhanced forest resilience, accessing cost savings from avoided treatment of polluted water.

Table 10: Challenges and success factors for the Forest Resilience Bond

Challenges	Solutions/Success factors
Structuring challenges for an unprecedented transaction Given the lack of precedent financial structures for NbS investment, developing a robust legal and commercial framework acceptable to the multiple stakeholders involved was challenging.	• BFC identified and brought together public and private stakeholders in a shared vision, and its role as a trusted financial advisor facilitated agreement. • BFC pursued contractual flexibility with each benefits payor enabling it to reach acceptable terms to deliver value for money for beneficiaries and a return on investment for investors. • Pro-bono support was obtained from specialist legal firms to advise on the bankruptcy remote SPV structure and other legal and contractual arrangements.
Development of business case for investment Building the technical case for investment was challenging given the limited track record of evidence showing forest restoration could generate quantifiable environmental outcomes.	• BFC and WRI partnered with Yuba Water Agency for data gathering and development of the cost-benefit analysis for the proposed interventions. • Collaboration with WRI, which co-developed the FRB and provided expertise in economic analysis and outcome valuations for targeted interventions, was instrumental in the FRB's success. • Philanthropic grants from CAL FIRE and USFS provided early-stage development funding for BFC to develop the FRB business case.
Designing a risk-return profile to attract investment It was necessary to structure the bond and agree terms that delivered a risk-adjusted return to meet commercial investor's risk- return requirements.	• BFC developed the business and financial model through close collaboration with stakeholders and investors, ensuring a flexible and adaptive approach to optimise the FRB's design. • The use of blended finance by including concessional finance from philanthropic bodies within the FRB structure enabled acceptable returns to be offered to commercial lenders and improved the likelihood of repayment.

Sources: Convergence (2020); EPA (2021); interviews conducted by the Authors

2.3. IMPROVED AGRICULTURAL PRACTICES

Conventional agricultural practices, such as the use of chemical fertilizers, excessive water use and single crop farming are having detrimental effects on the natural environment across the world leading to degradation of natural resources. The application of pesticides and fertilizers can cause soil erosion and run-off leading to contamination of water resources. Intensive agriculture can contribute to water scarcity by depleting limited water supplies and can also contribute to flooding events where man-made drainage infrastructure moves water off farms too rapidly, exacerbating the impact of heavy rainfall downstream. Global demand for food is expected to increase by more than 50% by 2050, placing increasing pressure on agricultural production and its associated use and management of water resources (FAO, 2016).

Improved agricultural practices can deliver sustainable food production while addressing associated water security risks. Practices include utilising nitrogen-fixing 'catch and cover' crops, adopting minimum soil cultivation systems, creating vegetative buffer strips and integrating agroforestry practices. These approaches can help to directly address the negative impacts of traditional agricultural practices on water systems, whilst also generating significant wider benefits to society, including climate change mitigation and adaptation, improving the health of water bodies and restoring biodiversity.

TNC experts performing biodiversity monitoring. Photo courtesy of TNC.

There are multiple initiatives that are encouraging sustainable agricultural approaches to reduce negative impacts on water resources. For example, in the Vittel catchment in France, Nestlé agreed to pay farmers to adopt sustainable farming practices to address water contamination impacting the quality of its bottled water, caused by increasing nitrate levels from fertilizer use (FAO, 2013). Similarly, in the Cerrado region of Brazil, agricultural manufacturer Syngenta and TNC established the Revert project to improve the sustainability of agriculture in the region. The initiative was formed as a private-public partnership aiming to introduce crop rotation and cover crops to recover degraded pastures, helping to improve soil health, water quality and ultimately safeguard long-term agricultural productivity on participating farms (TNC, 2020). To support farmers with monetising carbon and other ecosystem

services, including water security from sustainable agricultural practices, Plan Vivo, an internationally recognised certification body, provides a framework and independent standard that promotes sustainable land-use by agricultural communities (Plan Vivo, 2021).

What are the benefits, beneficiaries and potential revenue streams?

These nature-positive techniques help to protect the environment and water resources, benefitting a range of stakeholders including water companies, farmers and local communities. Through better nutrient management and the adoption of sustainable grazing and animal practices, nature-based agricultural approaches can increase soil health and help to conserve water quality and quantity. These techniques can also create sustainable food production systems and support climate adaptation and resilience. Approaches such as reducing fertilizer use, planting trees and other plants amongst crops and extending harvest rotations can improve soil organic matter and the ability to retain carbon. Revenue streams can be generated from potential cost savings by water utilities and water end users through avoided treatment of polluted water and improved soil health can increase long-term agricultural productivity for farmers while reducing input costs. Where carbon and offset mechanisms exist, material carbon benefits can be converted into revenue streams.

Table 11: Benefits, beneficiaries and monetisation opportunities from improved agricultural practices

Benefits	Monetisation opportunity	Beneficiaries
Reduced agricultural input costs		Farmers/Landowners
Water quality Water supply		Water and sewerage utilities Public authorities Farmers/Landowners Local communities Water end users
Carbon sequestration		GHG emitters
Improved soil health and long-term agricultural productivity		Farmers/Landowners
Health and wellbeing Biodiversity and local environment		Local communities General public

Established track record of monetisation and accessible market for selling ecosystem services

Limited track record of monetisation or hard-to-access market for selling ecosystem services

No market for selling ecosystem services in short term although market may develop in future

What are the key barriers to investment and potential funding and financing solutions?

Water security beneficiaries of improved agricultural practices tend to be diverse and distributed downstream from where the practices are being implemented. To have a measurable and attributable impact, these practices typically need to be deployed at a large scale and across multiple landholdings which can be challenging when land ownership and control is fragmented. As a result, there are governance-related barriers to funding and financing such interventions due to the complexity of engaging and securing agreement with multiple landowners and beneficiaries. These issues can be exacerbated if key stakeholders have varying objectives, needs or require different incentives.

One governance solution that has been deployed by TNC and others around the world is the water fund model.[1] This is a collaborative private-public partnership approach that brings together beneficiaries and delivery partners under the common goal of improving watershed resilience (see case study below). An intermediary-based approach is also being explored in the UK through the Landscape Enterprise Networks ("LENs") model, developed by Nestle and 3Keel.[2] This approach seeks to develop a market-led mechanism by which businesses dependent upon natural resources in a defined area can invest in targeted natural assets and interventions to improve landscape functions, such as flood risk mitigation and water quality improvement. The LENs approach has already delivered bilateral payments, structured as trades, between corporate beneficiaries, including Nestle and United Utilities, a UK water utility, and farmers, to pay for agricultural interventions that deliver soil health and water quality (LENs, n.d.).

Barriers often exist within the culture of farming communities and their perception of unfamiliar or unproven techniques, especially where there is the perception of risk of reducing short-term agricultural yields. In recent years, the financial sector has developed products such as sustainability-linked loans that have been deployed by commercial banks operating in the agricultural sector to provide a financial incentive to adopt sustainable farming practices. For example, in 2021, Southern Pastures, a New Zealand dairy producer, entered into a US$50 million sustainability-linked loan with the Bank of New Zealand ("BNZ"). BNZ offered a discounted interest rate available upon independent verification of the borrower's performance against agreed biodiversity and water quality targets (BNZ, 2021). This potentially entails additional transaction costs over and above conventional loans which may make the model a less viable option for smaller transactions.

Woodland cover on farmland. Photo courtesy of TNC.

1 TNC's Water Funds Toolbox provides an overview of global Water Funds. www.waterfundstoolbox.org
2 LENS model: https://landscapeenterprisenetworks.com/cumbria

CASE STUDY
NAIROBI WATER FUND

Overview

The Tana River in Kenya is critically important for the country, providing 95% of the City of Nairobi's water and 50% of Kenya's energy generation (TNC, 2021c). Over recent decades, the conversion of forests and wetlands into agricultural land in the Upper Tana region has caused soil erosion and sediments to run into the river, increasing treatment costs for water utilities. In 2015, to address the growing challenge for Nairobi to secure sufficient water of adequate quality, TNC, Nairobi City Water & Sewerage Company and Pentair established the Upper Tana Nairobi Water Fund ("UTNWF"). This was a pilot governance and funding mechanism designed to deliver conservation activities upstream in the Upper Tana watershed. Stakeholders in UTNWF recognise that there is a net return on investment in protecting the water source upstream, as this helps to avoid costs of inaction, as explained further below (TNC, 2015).

UTNWF supports farmers in adopting sustainable agricultural practices such as terracing, implementing grass strips, agroforestry methods and establishing water pans to harvest rainwater, delivering significant environmental and social impact. By mid-2021, 45,000 farmers were participating in the conservation programme, supporting 1.9 million cubic metres of water to be harvested annually and helping to improve water quality by 11% (TNC, 2021d). Being the first water fund in Africa, UTNWF's success to date has enabled TNC and its partners to develop and implement similar structures across other cities in Africa to address water security risks, including Cape Town, Mombasa and Addis Ababa.

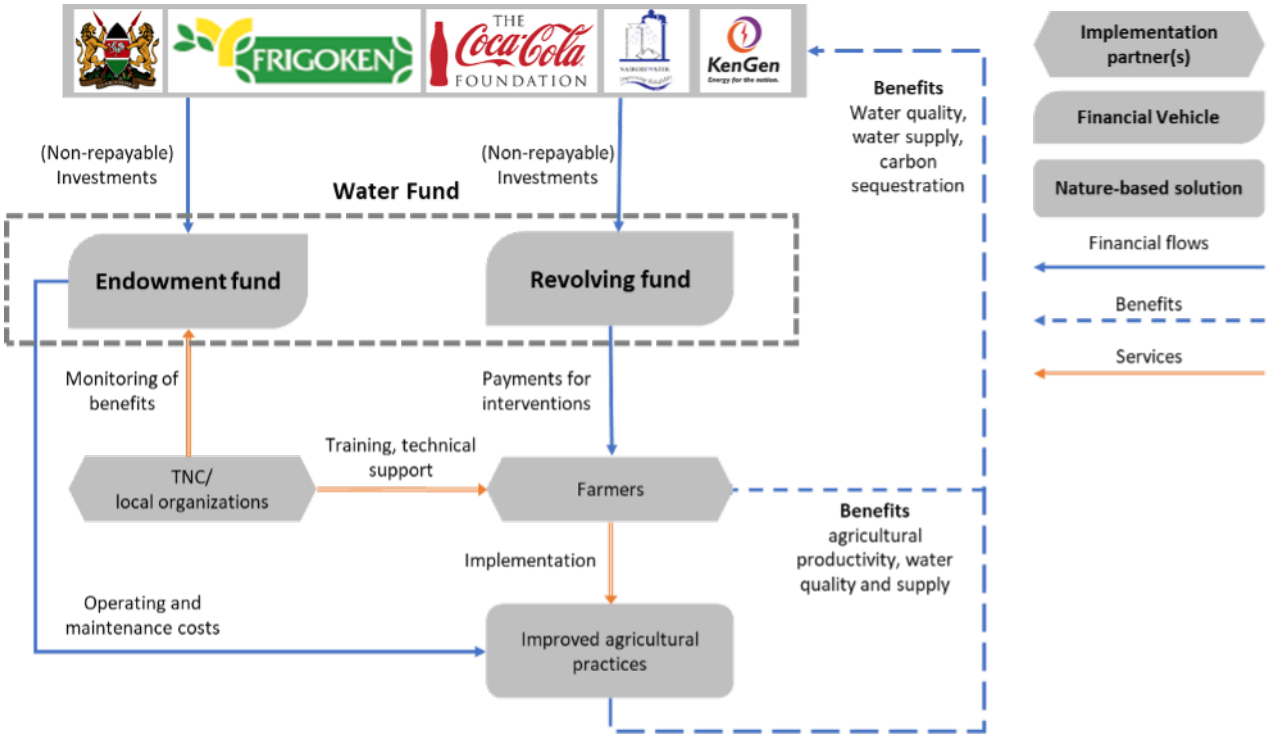
Kenyan farmer participating in the UTNWF. Photo courtesy of TNC.

Funding Structure

The UTNWF channels funding to farmers in the Upper Tana watershed to implement sustainable agricultural practices. A key feature of UTNWF is that funds committed by private and public sources are non-repayable and non-contingent on outcomes, and instead based on the projected benefits generated from the proposed interventions. This allowed the UTNWF to collect initial contributions into two different funds: a revolving fund to support agricultural interventions that is expected to be periodically replenished through fees and/or donations; and an endowment fund with a capitalisation target of US$5 million to support the long-term operating and maintenance costs of the interventions, as well as education for farmers on evolving techniques and technologies.

The UTNWF initially raised US$4 million of funds from local water-dependent utilities and organisations including Nairobi City Water and Sewerage Company ("NCWSC"); Kenya Electricity Generating Company ("KenGen"); Coca-Cola, Frigoken Limited and East Africa Breweries Limited. The Kenyan government declared the UTNWF a national priority in 2016. In the same year, TNC was able to establish UTNWF as a charitable Trust, with the goal of maintaining its activities indefinitely (Schmitz and Kihara, 2020).

Figure 10: Upper Tana Nairobi Water Fund structure



Source: Authors

Revenue source(s)

Around US$1 million annually for ten years is required to fund the adoption of sustainable land and water management practices in the region. To meet this funding need, beneficiaries agreed to share the benefits expected to be generated by the proposed interventions. UTNWF identified significant cost savings over a 30-year period for three key stakeholders: KenGen, NCWSC and the farmers. KenGen is expected to realise US$6 million in benefits from avoided interruptions and greater power generation as a result of increased water supply; NCWSC is expected to save US$3 million in water treatment costs from reduced sediment load; and participating farmers are anticipated to receive net benefits of US$12 million from higher yields (TNC, 2015). In addition to the initial private contributions of US$4 million from KenGen, NCWSC, Coca-Cola and others, the Kenyan Government provided match funding of US$4 million, with the Global Environmental Facility ("GEF") providing a further US$4 million in grant funding to the programme.

Table 12: Challenges and Success factors for the UTNWF

Challenges	Solutions/Success factors
Building the commercial case for beneficiaries Uncertainty around the evidence quantifying the water quality, supply and agricultural productivity benefits from interventions in the medium to long term presented barriers to funders' and farmers' participation.	• The Kenyan Government's cost-share of 33% was instrumental in improving the financial viability of the water fund model to attract additional non-repaybale private funds. • TNC's technical expertise supported the development of an evidence-based commercial proposition for beneficiaries. • Partnerships with scientific institutions (World Agroforestry, National Museums of Kenya and Jomo Kenyatta University of Agriculture and Technology) were established to support baseline studies used to strengthen the commercial case. • The access to non-public data secured through non-disclosure agreements between TNC and beneficiaries enabled the in-depth cost-benefit analysis to quantify benefits.
Execution and delivery at scale Ensuring on-the-ground execution of conservation activities is delivered effectively and efficiently presented logistical challenges given the large number of farmers involved.	• The joint collaboration between TNC, local NGOs and the public sector provided the capacity and expertise to deliver activities. UTNWF partners provided training, technical support and resources needed to deliver the targeted interventions. • The UTNWF established a mobile SMS platform to communicate with farmers in remote areas, which facilitated education and data collection.
Multi-stakeholder engagement across private and public sectors Conducting the multi-party stakeholder engagement process was particularly challenging given the UTNWF is a collective of private and public bodies with different requirements, objectives and incentives.	• TNC engaged with senior management of key stakeholders and beneficiaries and encouraged their involvement as members of the UTNWF steering committee to create more ownership and to help drive its success. • A robust governance framework and structure was established that gave decision-making authority and accountability to the UTNWF Committee members.
Lack of familiarity within agricultural communities Local communities and farmers needed to be convinced by the long-term economic benefits of the proposed interventions.	• TNC's role as the developer of the UTNWF and global eNGO with local representation facilitated engagement and negotiations with multiple stakeholders including farmers. • TNC employed a referral system for farmers already enrolled in conservation activities to refer peers via a mobile SMS platform, accelerating recruitment. • The UTNWF worked with 92 secondary schools in the region to establish environmental programs, introducing 35,000 youths into conservation and building community support for the programme and its wider benefits. • Benefits and lessons learned of the water fund model are shared among the community and stakeholders through seminars, workshops, discussions and peer-learning groups.
Ensuring the longevity of benefits To ensure benefits are generated sustainably and for the long term, the programme needs to generate sufficient income to cover ongoing operating expenses.	The UTNWF established an endowment fund at the outset to generate annual returns sufficient to cover the ongoing maintenance and operating costs of the programme. The benefit of an endowment fund is that it provides a perpetual income stream independent of stakeholders.

Sources: interviews conducted by Authors; UTNWF Key achievements (2021); Leisher, C. et al (2018)

2.4. MANAGED AQUIFER RECHARGE

Aquifers are key water reserves but are sometimes over-exploited, which means water extraction is higher than the natural rate of recharge through water infiltration. Supporting the sustainable management of aquifers and investing in actions that stimulate their natural recharge is key to ensuring resilience of water systems, both for people and nature.

Groundwater is found underground in spaces between and among soil, sand and rock. It forms an integral part of the global water cycle. Most groundwater comes from aquifers, which are bodies of porous rock formations and/or sedimentary deposits where surface water has infiltrated the soil and collected in empty spaces. Aquifers can be an attractive alternative to lakes for water storage and supply as they typically require less land, avoid water losses from evaporation, and act as natural filters to improve water quality (American Geosciences Institute, 2021). Aquifers contain nearly 96% of the planet's freshwater, provide 40% of the water used in agriculture and around 33% of water used for industry (UN-IGRAC, 2021; Earth Security Group, 2016). However, despite the attractive features of aquifers, groundwater aquifers are often poorly managed and inadequately replenished or "recharged", leading to aquifer depletion in many regions around the world (Famiglietti, 2014).

Aquifers are naturally recharged through water infiltration from rainwater. Managed Aquifer Recharge ("MAR") or groundwater banking, consists of artificial recharge techniques and water management methods to increase groundwater availability via the infiltration of external water to aquifers using surface or underground recharge practices. Beyond replenishing groundwater, MAR approaches can deliver benefits such as improved water quality, healthier soil and prevention of land subsidence (Casanova et al., 2016). Managed aquifer recharge can be supported in two main ways: firstly, grey infrastructure such as soakaways, infiltration basins and subsurface installation of wells can be used to replenish groundwater; secondly, several NbS-WS such as habitat protection and restoration, agricultural and ranching best management practices or creation and restoration of wetlands, can contribute to groundwater recharge by supporting and enhancing natural processes (Trémolet et al., 2019). A third way is the artificial recharge by means of treated wastewater, as demonstrated in El Paso, Texas and other cities across the world.

A range of aquifer recharge techniques have been deployed around the world. In Central Spain in 2018, as part of a multi-stakeholder EU-funded project to promote NbS to mitigate flood and drought risks, the Duero River Basin authority and regional government introduced aquifer recharge measures. These included soil and water conservation practices to restore the water supply and recover degraded surface ecosystems across the Medina del Campo aquifer which spans 370,000 hectares (914,290 acres). This aquifer is one of the most important groundwater bodies of the Duero River Basin region but has been severely impacted by droughts and groundwater exploitation for agriculture. This multi-stakeholder collaboration process was undertaken as part of Nature Insurance value: Assessment and Demonstration ("NAIAD"), an EU funded project to promote the use of NbS in response to flood and drought risks, and included scientific advisors, businesses and farmers (Altamirano et al. 2021; NAIAD, 2020).
In the United States, the City of San Antonio, Texas, established the Edwards Aquifer Protection Programme (EAPP) to protect and preserve the Edwards aquifer, which spans over a million hectares (2.5 million acres) and provides drinking water for nearly two million people. As of spring 2021, US$315 million has been raised locally for the protection of the aquifer from bonds issued by the city-owned San Antonio Water System ("SAWS") and repaid through revenues raised from local sales-tax revenue the city collects from SAWS, a structure that was approved through local ballots of city residents. This financing structure provides the city with upfront capital to protect the Edwards Aquifer from development impacts, while generating wider benefits including habitat protection, climate change mitigation and recreational opportunities (Abell et al., 2017).

What are the benefits, beneficiaries and potential revenue streams?

Increased groundwater storage can contribute to the baseflow and surface water availability in rivers and wetlands connected to aquifers, which can support both biodiversity and provide water to communities local to groundwater-dependent ecosystems (Moench et al., 2002). Aquifers can also provide vital habitats for subterranean biodiversity such as microbes and other organisms that serve to clean water supplies for human consumption by removing contaminants, pathogens and viruses (Schmidt and Hahn, 2012). Higher groundwater levels can support agricultural production, drinking water consumption and resilience by reducing vulnerability to droughts and rainfall fluctuations. Aquifer recharge can also mitigate the risk of groundwater salinisation and dilute salinity and/or pollution by mixing different water resources, which can reduce water treatment costs where groundwater is extracted for supply (Trémolet et al., 2019). It can also mitigate the risk of land subsidence, as has been demonstrated in Mexico City.

Revenue streams can be generated through the sustainable supply of water for domestic, agricultural and industrial use, the sale of related water rights where such markets exist, and local taxes and tariffs. There are also opportunities to monetise benefits associated with improving water quality and increasing agricultural production.

Table 13: Benefits, beneficiaries and monetisation opportunities from aquifer recharge

Benefits	Monetisation opportunity	Beneficiaries
Water supply		Water utilities Water dependent companies Farmers/Landowners Local communities Water end users
Water quality		Water utilities Water dependent companies Local/Public Authorities Farmers/Landowners Local communities Water end users
Hazard mitigation (reduced risk of land subsidence – avoided future cost)		Farmers/Landowners Insurance Companies Local communities
Biodiversity and local environment		

Established track record of monetisation and accessible market for selling ecosystem services

Limited track record of monetisation or hard-to-access market for selling ecosystem services

No market for selling ecosystem services in short term although market may develop in future

What are the key barriers to investment and potential funding and financing solutions?

The success of implementing aquifer or groundwater recharge systems is highly dependent to on site conditions, including current land use, soil type and geological properties such as the density of the aquifer. It can be technically challenging to identify the appropriate location for water recharge and MAR techniques requires careful implementation due to the risk of accidental pollution causing irreparable damage to the aquifers. Hydrological modelling and analytical tools such as the Aquifer Recharge Financial Calculator developed by WRI can support the case for aquifer recharge interventions (Morales, Ozment and Gray, 2019). Outcome-payment mechanisms such as those deployed in impact bonds have the potential to address technical uncertainties (see Section 2.1 case study).

Water supply and extraction is typically regulated by local and/or national laws. Implementing groundwater recharge systems presents governance challenges as it often requires collaboration between multiple stakeholders including local regulators, water utilities, public authorities, irrigation boards, farmers and local communities. A transparent governance structure involving a private-public partnership such as the water fund model (see Section 2.3 case study) could potentially help to mobilise multiple beneficiaries and facilitate joint investment for the replenishment of aquifers.

Another potential barrier to implementing aquifer recharge facilities can be the securing of land rights, potentially spanning across multiple properties, communities or even jurisdictions. Securing access to land and supporting appropriate land management can generate significant upfront and ongoing costs. Damage caused by poorly applied recharge techniques can also be irreparable, amplifying risks to private investors. Blended finance approaches are useful in securing private investment whereby development finance is used to fund project development costs and adjust the risk-return profile.

Groundwater recharge basin creating a temporary wetland for birds. Photo courtesy of Ryann Graye.

CASE STUDY
THE SUSTAINABLE WATER IMPACT FUND ("SWIF" or "the FUND")

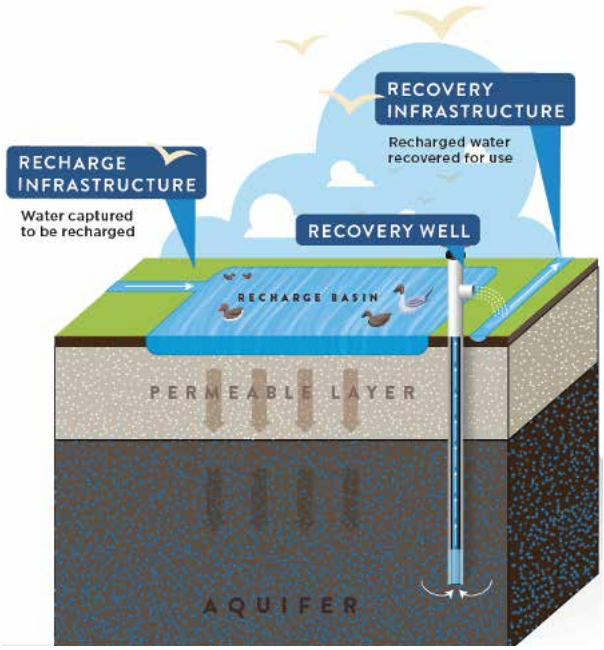
Overview

In 2019, TNC and RRG Capital Management LLC ("RRGCM") an impact-focused asset management firm, launched the Sustainable Water Impact Fund ("SWIF") to invest in land and water assets to generate environmental and social impact alongside competitive financial returns. By 2020, SWIF raised US$927 million from family offices and institutional investors. SWIF identifies and invests in land and water to deliver improved water management and sustainable agricultural practices. For example, by investing in groundwater recharge infrastructure, the Fund aims to improve land and water management, increase the reliability of water supplies, and mitigate the negative impacts of regional groundwater overdraft while creating habitat for wildlife (RRGCM and TNC, 2020).

Most of California's Central Valley has been designated as 'critically overdrafted,' which means it is at risk of land subsidence, ecosystem loss, and aridification due to unsustainable groundwater extractions. As a result, in 2014, California introduced the Sustainable Groundwater Management Act to regulate and limit groundwater extraction while protecting the water rights of landowners (CDWR, 2022). Extraction limits are determined and enforced by local enforcement bodies in each jurisdiction, including Groundwater Sustainability Agencies and the State Water Resources Control Board. These public bodies are also responsible for monitoring the groundwater quantities that are recharged and extracted from aquifers to ensure regulatory compliance.

In 2019, SWIF invested in Capinero Creek, its first acquisition, formerly an active dairy and feed crop farm, and established a pilot-scale groundwater recharge facility with the intent of informing the development of larger-scale groundwater recharge basins in the future. This consists of an above-ground basin filled with surface water from irrigation district deliveries, which then percolates into the groundwater aquifer to be stored for the short- or long-term. When filled, the 56-hectare (140-acre) recharge basin was managed in a way that replicated the ecological conditions of a temporary wetland, providing habitat for migratory birds including 23 species of conservation importance (Figure 11). Since its launch, SWIF has made further investments in California as well as internationally in Australia, Chile, and Peru, where it works to deploy sustainable farming practices and conservation approaches (RRGCM and TNC, 2020).

Figure 11: Aquifer recharge in Capinero Creek

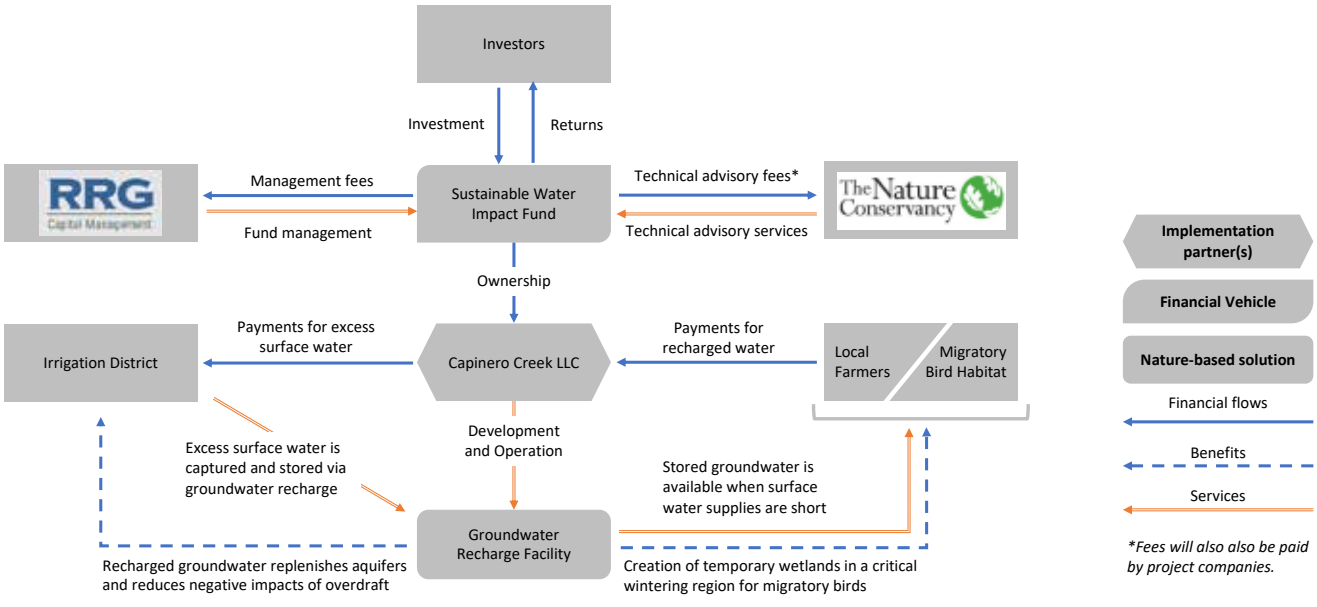


Source: SWIF 2020 Impact Report

Funding Structure

SWIF is an impact fund managed by RRGCM. RRGCM owns, manages, and develops water, agriculture, land, and renewable energy assets in the US and internationally. TNC serves as technical advisor to the Fund, including ecological evaluation of and conservation-related guidance for the selection and management of SWIF's assets. TNC also leads the implementation and ongoing monitoring of conservation-related activities and outcomes that are pursued on SWIF assets. SWIF has a 10-year investment horizon and acquires properties based on stringent investment criteria seeking to deliver impact and commercial returns (RRGCM and TNC, 2020).

Figure 12: Capinero Creek investment structure



Source: Authors, RRG and TNC

Table 14: Challenges and success factors for select assets of the Sustainable Water Impact Fund

Challenges	Solutions/Success factors
Site identification and technical case creation Identifying suitable projects where benefits can be quantified reliably presents technical challenges.	• SWIF mobilises both key scientific and technical experience from project partners to build robust technical cases. Together with RRGCM's expertise in water management, TNC's conservation expertise supports the site identification process and development of evidence-based technical cases for beneficiaries.
Achieving impact alongside financial returns SWIF's objectives include delivering social and environmental outcomes as well as market-rate financial returns. Identifying approaches to land and water management that maximize returns while simultaneously delivering social and environmental impact requires a new way of doing business.	• SWIF aims to deliver co-benefits (environmental and social benefits alongisde typical investment activities) through novel approaches to asset management, such as creating wetland habitat through groundwater recharge activities described here for Capinero Creek. Other examples include increasing water security through watershed protection, and conducting water transfers in ways that provide environmental benefits in-stream while moving water downstream to market. Some forms of impact are accretive to deal financials, such as conservation transactions (e.g. fee simple or conservation easement sales to land trusts or resource agencies) that bring in revenue for portions of properties that have low commercial value. • Ecological and financial outcomes are embedded in the Fund's governance model. RRGCM and TNC expertise are integrated within an Investment Committee and a separate Technical Advisory Committee, which is chaired by TNC and evaluates habitat and biodiversity needs for each project.
Ensuring regulatory compliance Water infrastructure construction is typically governed by a range of regulatory bodies depending on the jurisdiction, which presents compliance challenges and material costs.	• Having an expert partner with an understanding of and experience in managing the local regulatory environment is key to successful project implementation. RRGCM provides long standing experience in developing and managing water infrastructure projects, including the permitting and development of water infrastructure.
Ensuring longevity of environmental benefits Monitoring and maintaining interventions is required to ensure environmental impact continues to be delivered sustainably in the long term.	• Where possible, SWIF aims to secure longevity of benefits via formal contracts using existing legal mechanisms such as conservation easements. These are legal agreements that permanently restrict land use in order to protect its conservation value.

Sources: SWIF Impact Report 2020, the Authors

2.5. WETLAND CREATION AND RESTORATION

Wetlands are areas where the water table is near or at the surface of the land, or where the surface is covered by water. The Ramsar Convention, an international treaty for wetlands conservation, defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or saline, including areas of marine water the depth of which at low tide does not exceed six metres". Wetlands occur in different forms, from marine, riverine to inland water bodies, covering over 12 million km^2 globally, an area larger than Canada (Ramsar Convention on Wetlands, 2018). Wetlands, often referred to as the "earth's kidneys" (UNEP, 2020), provide a range of critical functions including access to freshwater, groundwater recharge, water purification, flood regulation and storm surge protection, as well as capturing carbon, supporting biodiversity and human livelihoods through food provision and ecotourism.

Despite this long list of ecosystem services provided by wetlands, their value has remained largely overlooked by policy and decision makers. 35% of natural wetlands have been lost since the 1970s, at a rate three times greater than that of forest loss, mainly driven by human activities including drainage for agriculture and urban expansion; extraction for industry; pollution and unsustainable land use (Ramsar Convention on Wetlands, 2018). Large-scale wetland conservation and restoration would support multiple SDGs by providing a critical buffer against climate change while addressing water security challenges and generating wider environmental and social benefits for society.

Wetland creation, conservation and restoration can also play an important role in reducing flood risk, especially in urban environments. For example, cities in Laos are vulnerable to annual flooding causing economic damage equivalent to around 3% of the country's Gross Domestic Product. Supported by a US$10 million grant from the Green Climate Fund, the Laos Government has launched a five-year pilot programme promoting NbS-WS interventions across four cities. These include the restoration of urban wetlands and stream ecosystems to complement traditional engineered infrastructure solutions in addressing flood risk challenges and vulnerability (GCF, 2021).

Constructed wetlands may also provide a solution for the treatment of wastewater and have been recognised as an effective technology for removing phosphorus and nitrogen. In France, approximately 3,500 constructed wetlands have been built over the last decade providing raw wastewater treatment for small rural communities. Similarly, in the UK, Severn Trent was the first UK water company to deploy constructed wetlands for full primary wastewater treatment to replace its ageing conventional treatment works. The Hull and Ward Treatment Works relies on vertical flow reed beds to serve a population of c.900 people and has significantly lowered maintenance and energy requirements for the utility while providing new habitat for local biodiversity (Arm Group, 2014, Morvannou, A. et al. 2015).

What are the benefits, beneficiaries and potential revenue streams?

Wetlands provide US$47 trillion of ecosystem services each year globally (Canning et al., 2021). Through their ability to store rainwater, wetlands can act as important seasonal suppliers of water to population centres, agriculture and industry, benefiting water utilities, water end users and farmers. Storage and sequestration of carbon by coastal wetlands, saltmarshes, mangroves and peatlands plays an important role in regulating the global climate. Wetlands also offer important habitats for aquatic life, which in turn provides a food source for local communities (TNC, 2019c).

The ability of natural and artificial wetlands to maintain and improve water quality can benefit not only water dependent companies and utilities, but also farmers and local communities. Wetlands can also provide NFM benefits by regulating stormwater and peak flows before they enter rivers, streams and sewers, or by retaining water in upper catchment areas, reducing the risk of damaging floods for local authorities, insurance companies, farmers and communities (Ramsar, 2018). Revenue streams can be generated through the sale of environmental credits, such as carbon, biodiversity units where markets are established enabling the monetisation of ecosystem services through PES schemes with beneficiaries.

Table 15: Benefits, beneficiaries and monetisation opportunities from wetland creation and restoration

Benefits	Monetisation opportunity	Beneficiaries
Water supply Water quality		Water and sewerage utilities Water dependent companies Public authorities Farmers/Landowners Local communities Water end users
Carbon sequestration		GHG emitters
Recreation and eco-tourism		Local communities
Natural Flood Management		Public authorities Insurance Companies Farmers/Landowners Local communities
Biodiversity and local environment		Developers
Health and wellbeing		Local communities

Established track record of monetisation and accessible market for selling ecosystem services

Limited track record of monetisation or hard-to-access market for selling ecosystem services

No market for selling ecosystem services in short term although market may develop in future

What are the key barriers to investment and potential funding and financing solutions?

Wetlands can cover large landscapes potentially spanning multiple communities or jurisdictions and generate benefits for a range of stakeholders. In these cases, the success of implementing wetland conservation and restoration projects depends on achieving strategic agreement between multiple stakeholders, including public sector bodies, property developers, public and private corporates, landowners and local communities. A private-public partnership governance structure such as the water fund model (see Section 2.32.3 case study) can help to align incentives across these stakeholders, including local communities and wetland users that are often needed to manage the assets. The Latin America Water Fund partnership demonstrates the success of this structure in mobilising eNGOs, utilities, private companies and public authorities to mobilise and pool funding for implementing wetlands restoration at scale across South America. Cities such as Lima and Quito have established water funds to restore degraded wetlands and address urban water security risks (LAWF, 2022; TNC, 2022b).

A frequent challenge for procuring investment into wetlands is in building a robust business case underpinned by technical evidence with clear attribution of outcomes to beneficiaries, so that benefits can be monetised. The benefits of treating water pollution at source are often overlooked by public authorities and water companies, which traditionally rely primarily on grey infrastructure to address water security issues. In the UK, Anglian Water, a regional utility, opted to invest in wetlands downstream of its sewerage plant to address water quality concerns, instead of more expensive engineered treatment facility upgrades. Working with a local eNGO, local public authority and landowner, the Ingoldesthorpe wetland project provided a relatively low cost and sustainable method in providing water quality improvements and benefits for wildlife (Norfolk Rivers Trust; n.d.).

In the absence of a suitable investment market for wetlands, the appropriate regulatory framework can create a clear need for investment and facilitate financing models that can draw in private capital, such as the emerging “biodiversity net gain” market in the UK, underpinned by the 2021 Environment Act. One of the most mature offset markets is the US Wetland and Stream Mitigation Programme, introduced by the 1972 Clean Water Act to preserve national wetlands from negative environmental impact (Trémolet et al, 2021b). The size of the market has grown significantly, transacting US$3.3 billion in credits in 2016 (Trémolet et al, 2021a). Like with any offsetting market, this mechanism introduces environmental risks and is open to abuse by developers not following the “mitigation hierarchy”, especially in jurisdictions where governance frameworks, oversight and enforcement maybe under resourced. According to the mitigation hierarchy, efforts should be made to prevent or avoid environmental impacts, then minimise and reduce, and then repair or restore adverse effects. Only after these steps should any residual effects be addressed via an offset. A recent paper prepared by TNC explores and discusses approaches to developing an effective biodiversity net gain market (Trémolet et al., 2021b).

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CASE STUDY
PETERSEN RANCH MITIGATION BANK

Overview

Established by the US Environmental Protection Agency ("EPA"), the Clean Water Act of 1972 prohibits the discharge of pollutants into the wetlands, streams and other water bodies unless a permit issued by the US Army Corps of Engineers ("USACE") or an approved State authorises such discharge. The introduction of the US Wetland and Stream Mitigation Programme aims to minimise the pollution of wetlands and streams caused by infrastructure development and to ensure "no overall net loss" of these water bodies. This legal framework creates a requirement for project developers, or permittees, to mitigate and compensate any unavoidable environmental impacts by purchasing credits issued by approved mitigation banks. A mitigation bank is a wetland or stream that has been restored or preserved for providing compensation for negative impacts to water bodies and resources permitted under Section 404 of the Clean Water Act (EPA, 2014). By purchasing mitigation credits, permittees transfer their mitigation requirements to mitigation banks, which are responsible for the design, implementation and monitoring of compensatory habitat sites. The US Wetland and Stream Mitigation Programme has developed into one of the most mature and successful biodiversity offsetting schemes globally.

The Petersen Ranch Mitigation Bank ("PRMB"), encompassing 1,714 hectares (4,236 acres) in Los Angeles County, is currently the largest wetland mitigation bank in California and one of the largest in the USA. The PRMB is located at the headwaters of two different watersheds, the Santa Clara River and the Antelope Valley. Mitigation credits from the PRMB include wetlands, riparian, stream and various habitats for special status species and native plant communities.

Land Veritas, a Californian based mitigation bank owner, purchased the land for the PRMB in 2012 and worked with an environmental consultancy and mitigation bank developer, WRA, to develop the habitat bank. In 2016, the PRMB received approval for selling mitigation credits from several public and regulatory authorities including the EPA, the Los Angeles district of the USACE and the local water quality control board.

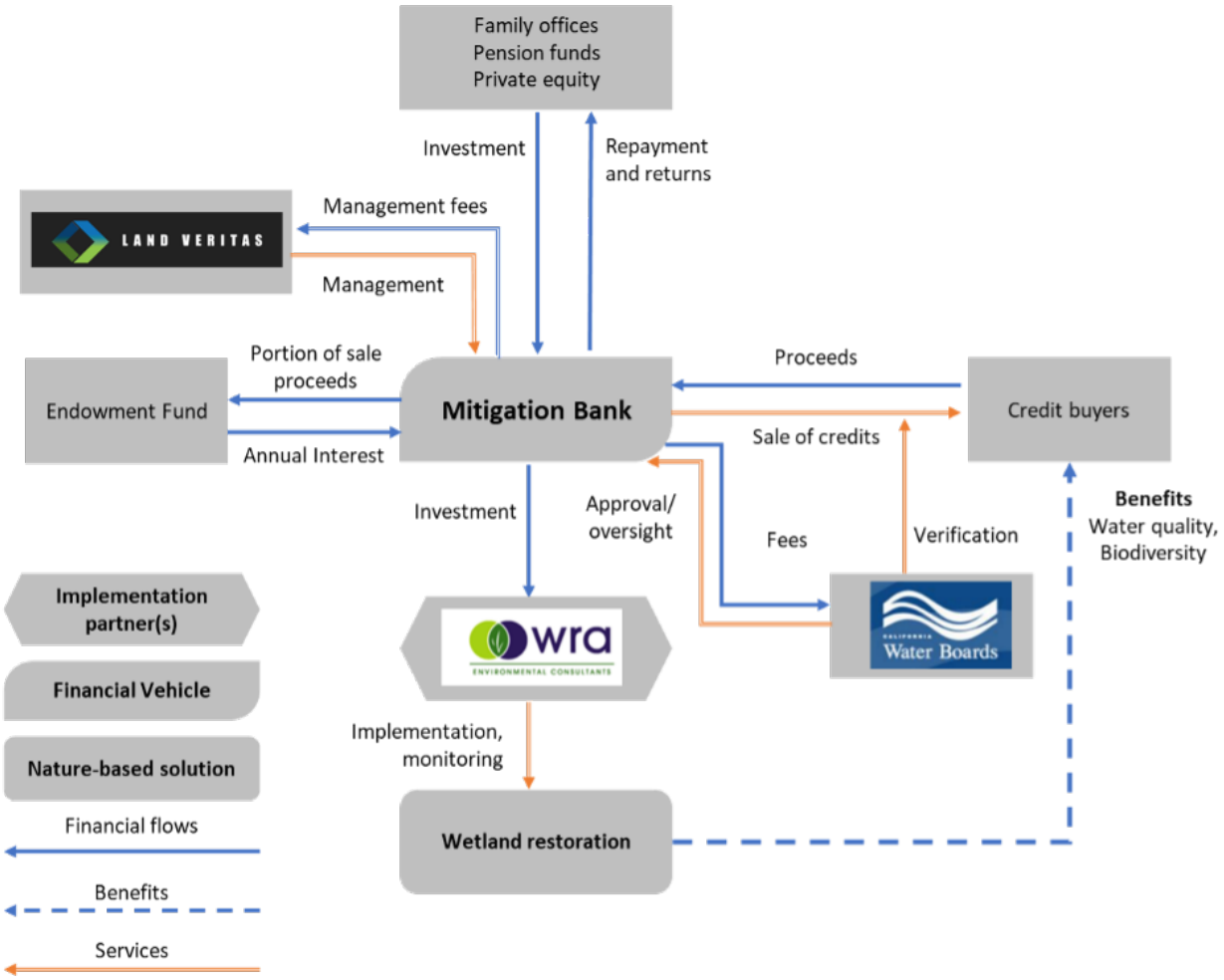
Financing Structure

Land Veritas provided the upfront investment. The total capital raised amounted to more than US$20 million over the operating period of over 10 years, covering the full development process, including technical design, approval process, overhead costs and restoration works. Since the completion of the initial restoration works in 2017, approximately 80 hectares (200 acres) worth of credits have been issued and sold to both public authorities and private developers. As credits are sold, a portion of the proceeds are transferred to an endowment fund to support the long-term management costs of the PRMB. The surplus interest generated through the endowment fund provides a perpetual revenue stream to support the long-term operating costs of the PRMB. Following the local mitigation market standards, 15% of projected lifetime credits are made available for sale prior to restoration, with the remaining being released over time when restoration is completed and ecological milestones met.

Revenue Source(s)

The revenue sources are generated through the sale of mitigation credits to project developers and public authorities. Different credit types are being offered based on their interventions ranging from preservation of lakes, re-establishing floodplains and riparian buffers, so-called Open water, Stream, Riparian credits as well as a number of habitat and species credits. Approximately 3,600 credits were predicted to be generated over the lifetime of the mitigation bank, this includes planned future development phases that will generate additional credits for sale.

Figure 13: Petersen Ranch Mitigation Bank Structure



Source: Authors

Devil's Gate Mitigation Area immediately after planting. Photo courtesy of WRA, Inc

Table 16: Challenges and success factors for the Petersen Ranch Mitigation Bank

Challenges	Solutions/Success factors
Access to appropriate habitat banking sites Identification of sites of suitable size with favourable hydrological conditions that were technically and financially viable was challenging.	• A specialist environmental consultancy firm (WRA) with experience in the planning and approval of mitigation banks assisted in the identification of appropriate sites. • Site due diligence and ecological assessments were performed to test the feasibility of a mitigation bank and to ensure the site was able to meet targeted financial and ecological outcomes.
Regulatory and governance framework The sophistification of the mitigation banking market requires specialist expertise and resources to meet the regulatory requirements for setting up a mitigation bank.	• Regulatory compliance requirements and feasibility was included as part of due diligence activities on the site. • Coordination and outreach to approval agencies and engagement with agency staff was instrumental in developing the final project design and programme requirements. • A local consultant familiar with the regulatory process facilitated negotiations with the approval agencies.
Evidencing the risk adjusted return profile for investors Market demand for mitigation credits needed to be demonstrated to provide confidence in return on investment.	• An assessment of the regional mitigation credit demand was conducted by WRA using a range of data sources to determine the appropriate credit price. • Periodic re-evaluation of credit pricing after bank approval is conducted to ensure appropriate credit pricing. • Land Veritas utilises a credit marketing and sales programme to conduct outreach and maintain a high rate of credit sales.
Longevity of the mitigation bank Funding needed to be ringfenced for the ongoing operating and maintenance costs of the mitigation bank to ensure long term benefits.	• An endowment fund was established where proceeds from credit sales were capitalised for three years. Surplus interest generated by the endowment fund supports long-term management costs, with no capital drawdown allowed. • The PRMB employs full-time maintenance staff to provide dedicated support operations and habitat management to ensure high-quality service and to maximise long-term operational benefits.
Obtaining community buy-in Local communities needed to be persuaded by the economic and social value of the proposed solution given multiple land use alternatives.	• The habitat bank conducted regular community outreach programmes on the conservation of land and benefits for biodiversity, and demonstrated the progress and results of the restoration work to local communities to secure long-term support.

Source: interviews conducted by the Authors

2.6. NATURAL FLOOD MANAGEMENT

Flooding is among the most common and destructive natural hazards globally. Fluvial flooding causes damages to infrastructure including supply chains and transportation networks and has resulted in global economic losses of approximately US$720 billion between 1970 and 2019 (WMO, 2021). Climate change increases the frequency and impact of storms and flash floods with detrimental consequences, especially in cities where fluvial flooding currently causes US$157 billion of damages to properties annually, a cost that is expected to more than triple by 2030 (Kuzma and Luo, 2020).

Natural Flood Management ("NFM") approaches deploy NbS to mitigate the risk of flooding whilst providing co-benefits for the environment and communities. Measures include water retention and attenuation techniques such as leaky dams to slow down the overland flow of rainwaters; flood bypasses, and actions to reconnect rivers to their floodplains to create more space for water; and restoration of habitats including wetlands and riparian woodlands. Often, these measures can be combined with traditional grey infrastructure to optimise flood protection. Restored river floodplains, wetlands and flood bypasses can support river flood management alongside traditional techniques such as embankments, sluice gates and pump stations (UN-Water, 2018).

Table 17: Overview of common NFM approaches

NFM technique	Increasing storage capacity	Regulating waterflow
Floodplain restoration	✓	✓
Revegetation		✓
Riparian restoration		✓
Protection of targeted habitat	✓	✓
Wetland creation and restoration	✓	✓

Source: adapted from TNC (2022a)

NFM approaches can be cost-effective alongside grey infrastructure and are increasingly considered a sustainable solution for public investment. In Singapore, the Kallang River was channelised over decades into a concrete canal to manage flooding and stormwater. When the canal needed repair, the city instead opted to restore the river's natural floodplain which improved flood risk management, water quality and recreational value for the city's residents. This NbS represented 46% of the estimated costs of renewing the existing grey infrastructure and delivered savings of US$44 million (Beyer and Anderson, 2020). In North Yorkshire, England, as part of Working with Natural Processes, a national research project gathering evidence for NFM's effectiveness in restoring the natural functions of floodplains, rivers and canals, the UK Government invested £3.4 million (US$4.4 million) on implementing leaky dams. The project reduced peak flows by 15-20%, leading to a risk reduction of local flooding from 25% to less than 4% in any year, and generated a benefit-cost ratio of 1.25 to 1 based on estimates of cumulative NFM benefits generated and associated costs over a 50-year period (Burgess-Gamble et al., 2018).

The Netherlands have realised the benefits of natural infrastructure solutions over decades and have integrated these alongside traditional grey infrastructure development within their national policy for flood management. In 2006, the Dutch government launched the Room for the River programme, a €2.3 billion multistakeholder programme to implement NFM techniques such as lowering floodplains, relocating dykes and increasing water retention capacity (Trémolet et al. 2019). To fund these interventions, the Dutch government has issued green

bonds. In 2019, the Dutch ministry issued one of the largest green bonds of €6.0 billion (US$6.8 billion) to finance low-carbon projects as well as sustainable water management including natural infrastructure solutions (Anderson et al.,, 2019). The recent exponential growth of the green bond market represents an important opportunity for water utilities to access mainstream commercial capital to fund green infrastructure where stable revenues can be generated from the project. In 2017, Anglian Water became the first public water utility in the UK to issue a green bond. The £250 million (US$322 million) issuance funded eligible projects in sustainable water recycling, management and projects to support climate transition. By 2020, the utility company has issued more than £800 million (US$1.1 billion) in green bonds and had used a small proportion of proceeds to finance NbS to address water pollution (Trémolet et al., 2019).

Riparian woodland can provide NFM benefits. Photo courtesy of TNC.

What are the benefits, beneficiaries and potential revenue streams?

By reconnecting rivers to floodplains and allowing them to naturally meander, the river's capacity to carry water increases and so reduces the risk of riverbank erosion and bursting during fluvial flooding events. River restoration can also restore the river's natural cleansing ability, increasing its resilience to pollutants. Flood bypasses provide conveyance and storage capacity for flood water while maintaining the connection between the river and its floodplain and providing habitat for fish and other wildlife. These benefits can create cost saving opportunities for local authorities, water utilities and national agencies by avoiding or reducing the costs of upgrading, maintaining existing and/or installing new traditional flood defences. Water utilities benefit further as reductions in sedimentation can generate savings in water treatment costs downstream. Potential revenue streams can be created through monetising these potential cost savings through PES made by water utilities and local authorities (UNEP-DHI, 2014).

Reduced risk of flood damage to infrastructure and properties can generate benefits for insurers and especially reinsurers, creating significant potential cost savings in the form of reduced pay-outs from insurance claims. A 2021 study by TNC and Munich Re US of a levee setback project completed on the Missouri River found that flood risk insurance premia could be lowered as a result of implementing NFM solutions, and explored a community-based business case that captured insurance premium savings to support project financing (Munich Re US and TNC, 2021).

People and nature can benefit from improved vegetation and wildlife habitat, generating potential economic opportunities for local communities. The increase in green spaces and wildlife can generate additional health and wellbeing benefits for the communities (Vouk et al., 2021).

Table 18: Benefits, beneficiaries and monetisation opportunities from natural flood management

Benefits	Monetisation opportunity	Beneficiaries
Reduced flood risk		Local authorities Insurance companies Water utilities Farmers
Water quality		Water utilities Public authorities Local communities Farmers
Biodiversity and local environment		Developers
Health and wellbeing		Local communities

Established track record of monetisation and accessible market for selling ecosystem services

Limited track record of monetisation or hard-to-access market for selling ecosystem services

No market for selling ecosystem services in short term although market may develop in future

What are the key barriers to investment and potential funding and financing solutions?

NFM approaches may need to be undertaken across multiple communities and jurisdictional authorities. This spatial scale can complicate the planning and implementation of NFM projects, as it often involves multiple stakeholders including flood risk authorities, water managers, landowners, infrastructure developers and agricultural interests (WWF, 2017). A cross-sector collaborative approach in the form of public-private partnerships and governance frameworks is often needed to fund and deliver NFM solutions; water funds (see Section 2.3 case study) can provide an effective governance structure to bring together a range of stakeholders to implement NFM solutions and mobilise multiple revenue streams.

One of the typical barriers for NFM investment is developing a viable business case based on identified revenue streams. Implementing NFM on a landscape scale may require significant upfront capital investment prior to revenue stream models being established. Whilst this can be met through blended finance approaches, potential co-benefits can be monetised to expand revenue streams and improve the investment case over time. For example, in the Wyre catchment in Lancashire, UK, a £1.5 million (US$2 million) NFM project has raised private finance based on revenue streams generated from the sale of ecosystem services, including the sale of carbon credits arising from the tree planting elements of the scheme. This was a cross-sector partnership between Esmée Fairbairn Foundation, the UK environmental regulator the Environment Agency, local water utility United Utilities, and Triodos Bank. The project also demonstrates a blended finance approach for NFM, as around 35% of the capital requirement is being funded via grants from the Woodland Trust (The Rivers Trust, 2021).

Private equity funds (see Section 2.4 case study) can raise commercial capital to invest in individual projects, including NFM solutions, provided the benefits from investments can be monetised to meet the financial return requirements for investors. Green bonds can provide an effective instrument in attracting private capital at scale and are used to raise finance for projects that include green and grey infrastructure solutions. The sourcing of large-scale investment can be an enabler for green infrastructure projects including NFM, provided these projects can generate stable revenue streams for servicing regular payments to the bond holders. This approach is exemplified through the 2019 Dutch Green bond to fund renewable energy projects, clean transportation as well as sustainable water management including NFM approaches (Trémolet et al., 2021a).

CASE STUDY
THE NETHERLANDS' SOVEREIGN GREEN BOND

Overview

Approximately 59% of the Netherlands' land surface area is prone to flood risk (PBL, n.d). Vulnerability assessments conducted in the 2000s identified that many of the existing flood defences were not sufficient to mitigate this flood risk. In order to fund the large-scale infrastructure projects required, the Netherlands issued a 20-year sovereign bond for $6.68 billion in 2019 (IDB and WRI, 2021). To reward and incentivise sustainability commitments from financial institutions, preference and early access was given to "green investors", leading to 28% of the total issuance being provided to those institutions able to substantiate their green credentials. In just two hours, investors including asset managers, pension funds and insurance companies, placed bids worth over $23.6 billion for $6.68 billion worth of certificates. This highlights the growing appetite from the financial sector for green projects.

Upon issuance, a Green Bond Working Group, with representatives from the Ministry of Finance, Ministry of Economic Affairs and Climate, and Ministry of Infrastructure and Water Management, was established to coordinate project selection, with all proceeds allocated in under two years. Approximately 29% of the proceeds ($2.1 billion) were earmarked for climate adaptation and sustainable water management, with the remainder used to fund clean transportation, renewable energy and energy efficiency improvements.

The entire portfolio of green-grey water management infrastructure projects meets the eligibility criteria for certified green bonds, and, whilst not specified in the funding allocations, NbS-WS projects are also prioritised. A hybrid approach combining NbS-WS with traditional grey infrastructure schemes was viewed as a strategy to diversify risk and ensure environmental and social benefits. As a result, at least €208 million (US$248 million) has been provided to projects that incorporate NbS into flood risk mitigation projects. These include the Zandmaas and Grensmaas projects which are harnessing 1,635 hectares (4,040 acres) of natural land to capture and retain excess water during flood events, protecting downstream communities (IDB and WRI, 2021).

With this success, the Dutch government extended its green bond programme to issue further offerings in 2021, raising an additional US$2.1 billion.

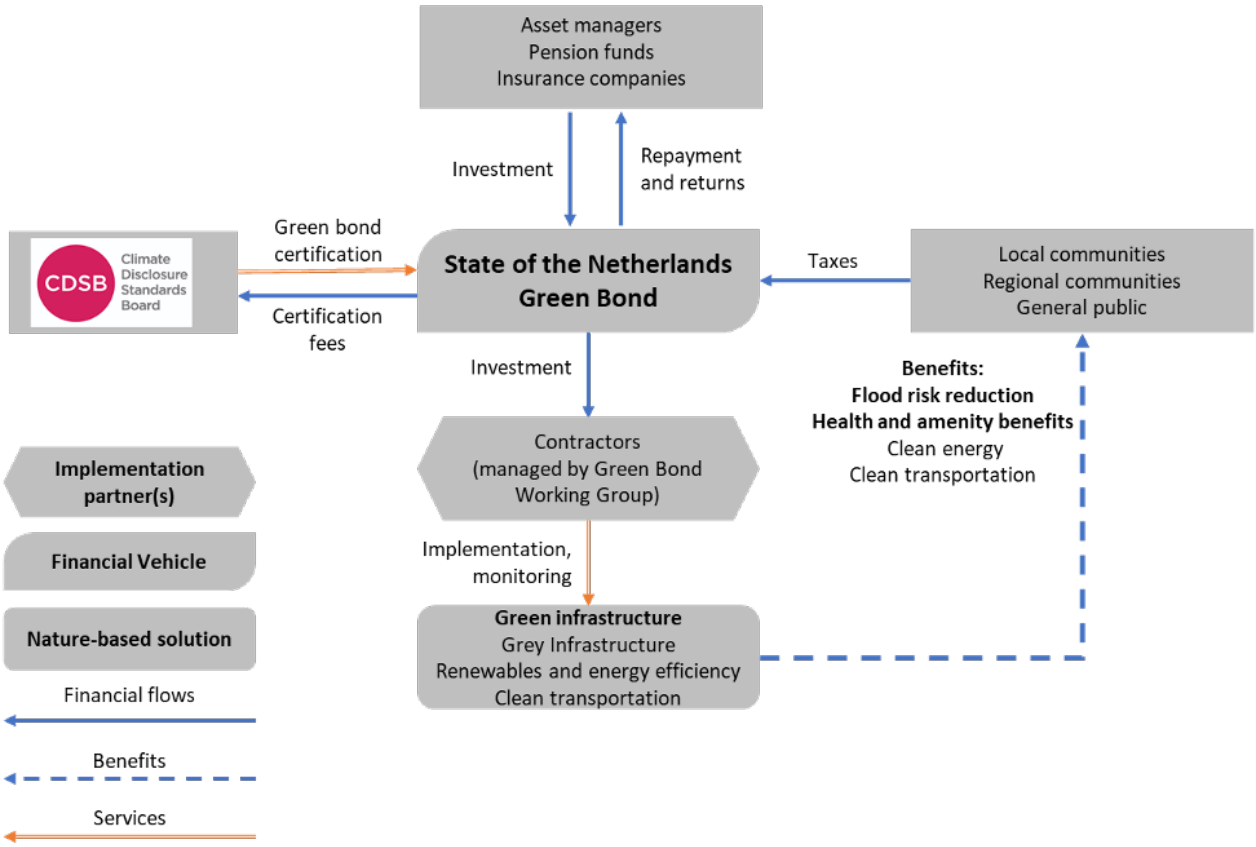
Financing Structure

The Netherlands was the first country with a triple-A rating to issue a sovereign green bond. Private investors, including asset managers, pension funds and insurance companies invested in the bond, with the Dutch government using tax revenues to repay the investors. The bond was issued in compliance with the ICMA's Green Bond Principles, which set a global standard around project eligibility and disclosure. It was also certified by the Climate Bonds Initiative.

Revenue Source(s)

The Dutch government uses tax revenues to repay the bond's investors. Projects financed through bonds should ideally generate a return, either in the form of a direct revenue stream or in cost savings equivalent to, or more than, the interest paid to investors. The majority of proceeds earmarked for sustainable water management is allocated to the Delta Fund, a government fund established by the 2012 Delta Act to finance the national Delta Programme which manages flood risk, freshwater supply, and the long-term impact of rising sea levels. One of the Delta Fund's main aims is to mitigate the risk of climate change related disasters and damage, and the heavy costs they incur, by ensuring that high-water protection, freshwater supply and spatial planning take climate change into account, systematically identifying and addressing weaknesses in the country's high-water protection system. The long term savings in avoided damages from flooding outweigh the coupon payment on the bonds.

Figure 14: The Netherlands' Sovereign Green Bond Structure



Coastal farmland in the Netherlands. Photo courtesy of Unsplash.

Table 19: Challenges and success factors for sovereign green bonds

Challenges	Solutions/Success factors
Infrastructure asset risk While well-established as an asset class, infrastructure assets (green and grey) typically require long investment periods given the long-term nature of the targeted benefits, so investors require assurances in the quality of the projects and underlying income streams.	• The Netherlands has a AAA sovereign credit rating which means that the Netherlands is considered a low investment risk. • Many countries in the Global South do not have favourable sovereign credit which substantially increases the costs of borrowing on international capital markets. Technical assistance from Multilateral Development Banks (MDBs) and Development Financial Institutions (DFIs) to prepare the pipeline of underlying infrastructure assets can help to reassure investors about the quality of projects to be funded via a bond issuance. These actors can also provide additional project financing on concessionary terms.
Institutional investors' lack of familiarity with NbS-WS NbS-WS is not yet an established asset class, in contrast to traditional infrastructure assets.	• The Dutch strategy of investing across a diversified portfolio of projects, including established infrastructure asset classes such as grey infrastructure, renewables and transportation reduced exposure to the less established NbS-WS sector. • Adherence to globally-recognised green bond principles assured investors that the proceeds were being used for sustainable and financially sound projects.
Governance around the allocation of expenditure A systematic approach was required to identify and prioritise eligible projects including NbS-WS that provide the public with value for money, while also delivering environmental and social objectives.	• The creation of a cross-departmental working group to decide on investment allocations was important in providing multi-party oversight to ensure appropriate projects were supported. The working group assessed green expenditures proposed by the Dutch State Treasury Agency to determine whether they met the criteria and definitions in the Green Bond Principles before providing formal approval. • The Dutch government invested significant time and resources into clearly identifying future water security risks and exploring potential green and grey solutions to generate a pipeline of projects appropriate for its green bond programme.

Source: Authors

LESSONS LEARNED AND CONCLUSIONS

This study sought to develop an understanding of how nature-based solutions for water security ("NbS-WS") can be implemented as an alternative or complement to traditional grey infrastructure in helping to address global water security risks. The report highlights the important role that private investment can play in accelerating the deployment of NbS-WS, exploring key barriers and success factors in mobilising private investment in NbS WS, and showcasing successful examples from around the world.

This chapter summarises key learnings and puts forward recommendations to accelerate the uptake of NbS-WS approaches in the future.

Opportunities for NbS in managing water security risks

Global demand for clean water is growing at around 1% each year, driven primarily by population growth and economic development. This development is also placing increasing strain on conventional water-related infrastructure, while increasing exposure to flooding events. Systemic risks within global water management are exacerbated by climate change and unsustainable water practices, which reduce the quantity and quality of water available for domestic, industrial and agricultural use. These risks are further enhanced by economic development models that often fail to appropriately value clean water supplies and the habitats upon which they depend. This has led to the destruction of many critical ecosystems and the loss of the services they provide to people, that include not only the preservation of clean water supplies and flood protection, but also wider co-benefits such as climate regulation and supporting sustainable livelihoods.

The most common techniques to managing these water risks are through traditional forms of 'grey' infrastructure. These engineered solutions typically have large capital investment needs and high energy requirements both in construction and over their operational lifetimes. In comparison, NbS-WS utilise natural systems, often resulting in lower costs and lower energy requirements in both construction and operation while providing wider social and environmental benefits. NbS-WS can provide significant benefits when implemented in a complimentary way or as an alternative to engineered solutions, especially where grey infrastructure solutions may not be as cost-efficient for dealing with distributed risks such as urban stormwater run-off or catchment-scale water quality issues.

NbS-WS approaches have been evidenced as providing cost effective and impactful solutions to mitigate water security risks while offering multiple co-benefits, including biodiversity, carbon sequestration, and health and wellbeing for local communities. Despite these wider benefits, there has been limited deployment of NbS-WS to date compared with grey infrastructure. Furthermore, the majority of NbS-WS projects have been funded almost exclusively through public funding initiatives, suggesting that there is considerable opportunity to mobilise private investment to significantly increase the level of funding for and deployment of NbS-WS.

Promising areas for NbS-WS investment

This report identifies six key NbS-WS types, or 'business lines', which appear to present the most promising opportunities to mobilise private investment:

- Sustainable urban drainage schemes (SuDs);
- Woodland creation, restoration and management;
- Improved agricultural practices;
- Aquifer recharge;
- Wetland creation and restoration; and
- Natural flood management ("NFM") interventions.

These business lines can be characterised across a spectrum of passive interventions (such as natural reforestation) through to active management systems (such as adopting minimum soil cultivation agricultural systems) and vary from relatively low-cost activities (such as 'leaky dams') to capital intensive major projects (such as wetland creation). The scale and form of projects also varies significantly compared to grey infrastructure solutions, which are typified by large singular interventions, in contrast to NbS-WS that often utilise a high number of distributed interventions or impact a large spatial area.

Key benefits and revenue models to support finance

The report showed that the distributed approach and often large spatial nature of NbS-WS projects helps to create a wide range of social and environmental benefits. Where benefits can be clearly attributed to a specific intervention and beneficiaries are willing to pay for targeted outcomes, it may be possible to monetise these benefits to create revenue streams capable of attracting private investment.

NbS-WS projects deliver a wide array of benefits, including water and air quality, biodiversity, soil health, recreation and health and wellbeing, impacting a range of beneficiaries across the public and private sectors, including water-dependent companies, utilities and local communities. Despite these myriad positive benefits, their distributed nature combined with multiple stakeholders and beneficiaries presents challenges in transaction structuring and stakeholder alignment.

Despite these complexities, there are multiple potential revenue streams for NbS-WS projects, albeit with no single dominant method of monetising benefits. Revenue streams range from ecosystem-derived income models such payments for ecosystem services ("PES"), whereby specific natural capital benefits are measured and paid for; charging tariffs and taxes on water usage for the implicit use of a particular supporting ecosystem; and cost saving models whereby NbS-WS create savings compared to business-as-usual, which are shared with investors to repay project finance. Enterprise models can also be generated through NbS-WS, which seek to create commodities or services to sell into established markets, such as the sale of timber or ecotourism activities. The report identified opportunities whereby different revenue streams can be combined, an approach known as revenue 'stacking'. This is demonstrated in the Upper Tana Nairobi Water Fund (Section 2.3 case study), which procured private investment into the adoption of sustainable agricultural practices by farmers in the region. It succeeded in part by identifying commercial revenues arising from the expected reduction in sediment loads downstream, including increased hydropower sales for the local electricity utility, and water treatment cost savings for the local water utility.

Many of the ecosystem-service based revenue models, such as mitigation credits, rely on local regulation and supportive policy frameworks to stimulate market demand and set clear parameters over minimum levels of credit quality. Defining these baselines helps to ensure an open and fair market for project developers. Where regulation or interpretation of legislation is clear and standardised market infrastructure has been established, NbS-WS markets have developed that are attracting significant levels of private investment, as seen in the US wetland mitigation banking market.

Public funding is typically under significant competing demands, and if used in isolation without crowding in private finance, will be unable to meet the scale of financing needs for NbS WS. To date, the majority of NbS-WS projects have been funded through public resources, whereby capital investment is ultimately recovered through taxes or levees often charged on services irrespective of project performance. Because public and philanthropic funders have to-date played such an important role in market-building, there is a major opportunity for private investors and project developers to work with them to help build investment cases and co-design quality projects.

Barriers and solutions to scaling investment

The report identified multiple barriers which need to be overcome to scale private investment in NbS-WS. Several tools and approaches that have been deployed successfully to overcome these barriers have the potential to be replicated and scaled. These include: the need to develop simple, measurable and understandable performance metrics; collaboration with conservation experts and scientific institutions; close cooperation with regulators and regulatory experts; on the importance of professional advice and trusted financial intermediaries to facilitate stakeholder engagement, negotiations and transaction structuring; establishing inclusive governance mechanisms and linking fund management performance fees to environmental outcomes to ensure projects fund and deliver impact alongside financial returns; utilising legal mechanisms such as conservation easements and endowment funds to secure long term social and environmental impact, and; securing community support through early-stage local engagement and employment opportunities. Some of the proposed solutions such as the development of technical metrics and legal mechanisms may require national-level engagement and collaboration. The solutions are covered in more detail below.

Building technical cases for investment through robust data on performance

Technical evidence and the ability to reasonably predict NbS-WS performance is fundamental to creating a viable business case. There are several global initiatives to collate and disseminate NbS performance data, such as the European Commission's ThinkNature and UNaLab projects, the International Institute for Sustainable Development (IISD) and the MAVA Foundation's Nature-based Infrastructure Global Resource Centre, the United Nation's CEO Water Mandate and the UK Government's Enabling a Natural Capital Approach resource. However, to-date there is limited real world data on the performance and track record of NbS-WS projects which acts to increase the relative costs and complexities of project technical modelling. Models are often bespoke taking into account very localised biophysical processes and datasets which hinders their replicability in other contexts. Measuring and proving the attribution of outcomes to a given intervention, in a cost-efficient way, is key to ensuring services can be monetised. At the same time, a growing number of technologies and tools are being developed to identify potential NbS-WS and quantify impacts. Successful solutions often seek simple metrics and proxies to measure performance which are easily understood by investors and other stakeholders. Projects also benefit from close collaboration with organisations such as eNGOs with experience in on-the-ground delivery, technical performance appraisals and natural capital approaches, all of which can help to build investor confidence. There would be significant value in the creation of a centre of excellence or dedicated programme to engage and advocate NbS-WS application within the water sector and its investment community.

Building financial cases for investment through robust data on costs

There is a lack of data on capital and operational costs associated with NbS-WS projects. This serves to decrease investor confidence in financing models. Given the wide range of NbS-WS project types, sizes and locations, there is a broad spectrum of costs which can be difficult to interpret or compare across projects. Additionally, there is currently no global comprehensive NbS-WS project data platform through which water sector infrastructure project developers can share costing and performance information. Specialist technical advisers can provide a level of cost guidance and due diligence, and there are increasing numbers of technical specialists operating in the NbS market. The report has shown that blended finance structures provide some scope for mitigating inaccurate costing information, while providing opportunities to access concessionary capital to alter the risk-return profile of the investment to attract mainstream investors.

Overcoming performance uncertainty through risk-sharing financing models

Investors are often reluctant to engage in new asset classes, where performance and risk profiles are unfamiliar and challenging to compare to existing asset classes. Investors will typically seek to utilise industry technical standards where available to mitigate concerns around asset performance. However, in the NbS-WS market, there is a lack of technical standards and transaction data readily available. Investors will then tend to classify such projects as carrying higher perceived risk. The report has pointed to the opportunities presented by financial mechanisms designed to overcome such uncertainty in performance and risk profile by sharing the risks of underperformance

and the rewards for overperformance between investors and investees. These include impact bonds and NbS bonds, a bespoke forms of green bond with a flexible repayment profile.

Overcoming regulatory barriers through capacity development of regulators in NbS-WS
Regulatory frameworks for water security actors can restrict the ability of utilities and other water system operators from trialling new techniques. These regulations are generally framed as protecting the utility bill payer, and NbS-WS approaches have been viewed as lacking sufficient technical evidence to demonstrate they can deliver equivalent outputs as traditional grey infrastructure, and are therefore considered higher risk investments. This regulatory backdrop impacts much of the culture throughout many water system operators which often under-invest in their NbS technical capacity and knowhow as a result. The lack of internal technical NbS-WS capacity exacerbates, in turn, the impact of unsupportive regulatory frameworks, limiting the number of opportunities identified as suitable for NbS-WS. Working closely with regulators and regulatory experts to facilitate regulatory "sandbox" environments where NbS-WS models can be pioneered and tested would accelerate the collation of NbS-WS performance data and enhance project comparability, and over time shift industry perceptions.

Overcoming complexity in financial models through increased standardisation
The wide range of revenue models and lack of common approaches makes assessment and development of business cases complex. The lack of standardised revenue models for NbS-WS acts to limit market demand as potential buyers struggle to assess and compare services and products from similar nature-based interventions. The development of internationally standardised revenue models, associated standards and proxy technical performance metrics could significantly aid the development of NbS-WS markets. Collaboration with legal and financial experts to develop investment cases, transaction structures and related documentation is especially important for markets in embryonic stage of development such as NbS, to accelerate industry growth. In the impact investment sector, there can be opportunities for such experts to provide services for below market rates, or for philanthropic bodies to support such activities. With impact investment structures, there is also often a balance to be struck between social and/or environmental impact and financial return, which adds a further layer of complexity. The report shows that successful fund structures set minimum investment criteria on social and environmental outcomes to ensure investments are made that meet the requirements of diverse stakeholders.

Overcoming governance barriers by developing best practices in governance models
NbS-WS projects often impact a wide range of beneficiaries and stakeholders which are critical to successful projects outcomes. Given the wide range of NbS-WS project types and locations, there are currently limited standardised governance models with proven steps to implementation. The TNC Water Fund structure is a proven multi-party governance model and provides valuable insights for governance of upstream water assets, including on the effective alignment of public and private sector interests and the use of independent steering and technical advisory committees. Investors and project developers would benefit from the collation of best practices in governance models which can then be tailored to the specific NbS-WS projects. Robust governance models are also important in ensuring projects are aligned with the interests of local communities to secure their buy-in, which is vital to support project outcomes and their longevity.. This is particularly important when NbS-WS projects are delivered in remote or expansive areas requiring the support of multiple community groups. Finally, to ensure potential trade-offs or conflicts between generating financial returns and social and/or environmental impact are minimised, investment management performance fees can be tied to the achievement of pre-agreed impact outcomes in addition to financial return thresholds.

Overcoming barriers caused by small scale nature of projects through aggregation
Some forms of NbS-WS consist of multiple small-scale interventions potentially spread over a large spatial area. These multi-site interventions create logistical challenges that include securing site access, managing operational costs and multiple stakeholders, and necessitating complex transaction structures. Aggregation vehicles can help to mitigate high transaction costs by aligning multiple small investments into a single portfolio, enabling investors to finance multiple interventions through a single investment. This can also be useful from a risk management perspective.

Overcoming market hesitancy by creating and shaping the NbS WS market through blended finance
The structure and timing of NbS-WS cashflows over a project lifetime, from setup through to revenue generation, can be uncertain which presents material risks to developing and implementing a given business model. NbS-WS projects often need some form of capital to fund project development costs and bridge the gap until revenues can be generated. However, given the nascent stage of many NbS-WS revenue streams and limited proven investment models, projects often struggle to deliver risk-adjusted return profiles that will attract commercial sources of finance. To help overcome this, the strategic use of donor and/or philanthropic capital through blended finance approaches can help to reduce project risks and lower the cost of finance, enabling private investment to be 'crowded in'. Technical assistance from the non-profit sector, development partners and other actors into project development can also help to build the investment case, ensure robust impact measurement frameworks are in developed, relevant stakeholders are included, and that adequate monitoring and evaluation processes are in place. These can help to strengthen investor confidence in project quality and the capacity to deliver. Whilst blended finance approaches do help to make some projects commercially viable, it is important to recognise that there is limited pool of concessionary funding currently available. Donors and philanthropists could do more to move concessionary funding away from relatively mature sectors, like renewables, towards more nascent markets like nature-based solutions. Learning and insights from past projects also needs to be shared more widely, despite commercial sensitivities. This will help to build and accelerate the market over time.

Ensuring the longevity of projects through inclusive multi-stakeholder engagement processes
Inclusive and early-stage consultation is important in aligning key stakeholders including local communities, which may be required to play an important role in ensuring the site remains in good condition and generating benefits in the long term. The collation of best practices in stakeholder engagement from successful NbS-WS projects, particularly where local communities have played a role, would act as a helpful resource for project developers and investors who are often unfamiliar with the local context. This would be especially useful for those seeking to deliver projects in the Global South, where local communities often stand to benefit the most from projects that are environmentally sustainable and create jobs-, but where the principle of informed consent is not necessarily always followed by developers. There is a role for the international donor community to play in disseminating lessons learned and best practices in local stakeholder engagement.

Further information on the funding and financing instruments discussed in this report is provided in the Annex.

ANNEX: FUNDING AND FINANCING MODELS COVERED IN THIS REPORT

Seven distinct funding and financing models have been identified and explored in this report, as detailed below. All of these models are intended or have the potential to raise finance and could be applied in a range of situations. It is important that designers of projects consider what is the appropriate type of capital for the project, which will be determined in part by the project risks and projected cashflow profile.

Green Bonds

Where NbS-WS projects are being developed as part of a wider portfolio of initiatives, which have commercially proven revenue models (such as renewable energy, or traditional water infrastructure being developed by a utility), it may be suitable to utilise a green bond to raise project finance. Green bonds in themselves do not have specific NbS-WS features, however it could be attractive to investors to develop a dedicated NbS subset of the green bond framework, to help differentiate how proceeds will be used from the majority of green bonds in the market. See 2.6 case study for further discussion.

NbS bonds

NbS bonds are not a common financing instrument, but the authors felt it is important to distinguish the differences with other bond instruments, specifically where proceeds are used exclusively for NbS interventions. Given the limited volume and scale of suitable NbS-WS pipelines NbS bonds are yet to become a standalone institutional asset class; however, it may be possible to utilise the Green Bond framework to create a segmented 'NbS bond code' which could be evolved overtime until there is sufficient demand for a standalone NbS bond framework. See 2.2 case study for further discussion.

Environmental Impact Bonds ("EIBs")

The limited technical evidence and performance data combined with the inherent risks of newly established revenue models often means that 'vanilla' debt instruments, which require predictable and consistent underlying cashflows, are not appropriate for the majority of NbS-WS projects currently. EIBs can help to mitigate performance risks by sharing risks and rewards with third-party investors. These models require an outcome payer such as a water utility that is willing to share in both the financial upside and downside with investors in the event of NbS-WS performance exceeding or falling short of expectations respectively. EIBs still require a requisite base level of technical evidence to give investors' confidence of the risk return profile across different performance scenarios. The EIB structure can be complex and expensive to design and implement contracting between multiple parties. Similarly to blended finance models, EIBs should be pursued as a bridging tool to facilitate project development and evidence building on technical performance. This overtime can enable the application more standard financing models such as bonds and equity funds, which typically have lower transaction and intermediary costs in comparison to EIB structures. See 2.1 case study for further discussion.

Sustainability linked loans

Debt instruments can also be structured to incentivise behaviour by lowering financing costs in the event of specific targets being achieved, as is the case with sustainability-linked loans. These loan products have grown in popularity among investors and borrowers, although are generally only appropriate where there is strong evidence that a given intervention will achieve a targeted outcome. Furthermore, there are limited examples to suggest these loans have been used exclusively for NbS-WS project finance. Instead, they are normally applied to a portfolio of more traditional activities with more proven revenue models, with the NbS-WS activity being a small proportion of the overall loan proceeds. Subject to lenders' risk appetite, lenders could explore how these products can be utilised to provide a level of performance risk transfer similar to EIBs and this may help to stimulate further uptake of NbS-WS models.

Water Funds

Although the water fund model is primarily focused on enabling a suitable governance structure to create implicit valuation of a given water resource, bring together suppliers of ecosystem services with beneficiaries of those services, and help pull multiple revenue streams into one investment vehicle, by doing so they provide a suitable mechanism through which to bring together public and philanthropic funding and potentially leverage in private finance. For example, a Water Fund could issue a bond instrument against the forecasted payments from the Water Fund's participants. See 2.3 case study for further discussion.

Habitat banks

Where there is established market demand for ecosystem services from a given habitat, whether voluntary or regulated, habitat banks provide a suitable mechanism to facilitate upfront investment to create NbS-WS projects. Supportive policy to encourage buyer demand underpins the core business model, however, these can still operate in voluntary markets, as seen with the growth of the voluntary carbon offset market. In unregulated markets, blended finance approaches may be required to help bridge risk-return requirements of private investors. However, in regulated markets with clear business models, there appears to be strong investor demand, with projects capable of meeting investor risk-return requirements. See 2.5 case study for further discussion.

Impact-focused private equity funds

Impact focussed private equity funds are a common instrument for investors seeking to finance NbS projects. They can incorporate blended finance approaches and supporting technical assistance programmes to aid investee projects with non-financial needs. Private equity fund investors typically seek commercial returns, and this can create tension with impact objectives requiring careful fund governance and management. Given the relatively immature NbS market, impact funds often have very broad spatial, sometimes global mandates. This is to help investment funds increase their scope and ability to source attractive NbS-WS investments, however the disparate approach limits the extent to which a given supply chain can be mobilised in a target area. Furthermore, where there is a limited local presence from a fund manager, this can create difficulties in ensuring projects are appropriately managed, delivered to high quality and unintended consequences are robustly mitigated. See 2.4 case study for further discussion.

GLOSSARY

Afforestation	Establishing forests in areas that have not been forested before.
Aggregation vehicle	A pooled investment entity built by aggregating relatively small investments within an asset class to provide an opportunity for investors to gain exposure to asset classes that on an individual project level may be too small and/or undiversified to meet investment criteria.
Aquifer Recharge	Replenishing groundwater resources in an aquifer through artificial or natural processes.
Biodiversity Unit	A unit of trade used to offset losses in biodiversity. Habitat is used as a proxy for wider biodiversity, with habitat types scored according to their relative biodiversity value. The location and condition of the habitat are then used to calculate the number of biodiversity units for a particular project.
Blended Finance	Use of development finance sources to leverage commercial investment (either state-owned or private) in sustainable development.
Bond	A repayable debt instrument issued by an entity to private or public investors to fund balance sheet/operating activities, which can be traded in international or local markets.
Carbon Credit	A tradeable permit that corresponds to emissions of 1 ton of CO2 equivalent (tCo2e) and can be purchased on local or international carbon markets.
Conservation Easement	A legal agreement by a landowner to preserve land in perpetuity through restricting or conditioning certain uses. Conservation easements are typically sold or donated to qualified conservation organisations, which ensure the conservation through stewardship.
Coupon	The interest payment on a bond made to investors on a regular basis.
Ecosystem	The complex of living organisms, their physical environment, and all their interrelationships within a particular geographic area.
Ecosystem Services	The benefits that can be obtained from ecosystems, including provisioning, regulating, cultural and supporting services.
eNGO	A Non-Governmental Organisation in the field of environmentalism, e.g. WWF, Greenpeace, Conservation International and The Nature Conservancy.
Environmental Impact Bond ("EIB")	An innovative financing model using a pay-for-success approach to attract private investment for environmental projects, with bond repayments linked to agreed outcomes.
Fluvial Flooding	Results from water in a river or drainage channel that cannot be constrained within its stream channel.

Green bond	A fixed-income instrument designed specifically to support specific climate-related or environmental projects.
Green Infrastructure	A subset of nature-based solutions that preserves, enhances or restores elements of a natural system with the aim to produce more resilient and lower cost infrastructure services.
Habitat Banking	A market where credits from actions with beneficial biodiversity outcomes can be purchased to offset the debit from environmental damage.
ICMA	International Capital Market Association
Improved Agricultural Practices	Approaches to support sustainable agricultural production with a range of on- and off-farm benefits.
Investment-Ready	Capable of raising and supporting repayable investment.
Managed Aquifer Recharge ("MAR")	MAR or Groundwater banking consists of artificial recharge techniques and water management methods to increase groundwater availability through infiltration to aquifers using either surface or underground techniques.
Natural Flood Management ("NFM")	The use of nature-based or nature-centred structures and techniques to reduce the risk of flooding or the impact of flood events.
Outcome-Payment Mechanism	Investment mechanism where payments depend on project performance pre-defined outcomes or targets, transferring the risk of project delivery from the outcome buyer(s) to investors. Utilised in EIBs (see above definition).
Payments for Ecosystem Services ("PES")	Incentive payments from a beneficiary/user of an ecosystem service to the provider of that service.
Reforestation	Restoration of forests where they have been lost due to human intervention.
Risk-Adjusted Return	A return on investment adjusted by the investment risk taken by the investor, used as a measure to compare different investment opportunities.
Stacking	The use of multiple income streams to increase investment returns.
Stormwater Retention Credits	A tradeable permit corresponding to one gallon of Off-Site Retention Volume for one year. These credits are privately negotiated and a market price has not been set.
Sustainability-linked loan	Form of lending product that incentivises the borrower's achievement of pre-determined sustainability performance objectives by linking their to loan terms. For example, the margin under the relevant loan agreement may be reduced where the borrower satisfies a pre-determined sustainability target.

Sustainable Development Goals ("SDGs")	Set of targets adopted by the United Nations in 2015, intended to be achieved by 2030. SDGs comprises 17 interlinked goals, aimed at ending poverty and achieving sustainable development.
Sustainable Drainage Systems ("SuDS")	Water management practices that are designed to align modern drainage systems with natural water processes. Examples include bioswales, green roofs, permeable pavements, sediment traps and rainwater harvesting.
Water Fund	Organisations that design and promote financial and governance mechanisms, engaging public, private, and civil society stakeholders in order to contribute to water security through solutions grounded on nature-based infrastructure and sustainable management of watersheds.
Water Quality Credit	A tradeable permit corresponding to a unit of pollutant reduction (e.g. phosphates, sediments) that can be traded bilaterally or through an exchange.
Water Quality Trading	The buying and selling of water quality credits to offset the discharge of pollutants into waterbodies (e.g. the Pennsylvania Water Quality Trading Programme and the Long Island Sound Nitrogen Credit Exchange Programme).
Wetland Mitigation Credits	A unit of trade used to offset ecological losses that occur in waters of the United States, which are regulated by the USACE and USEPA.

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