



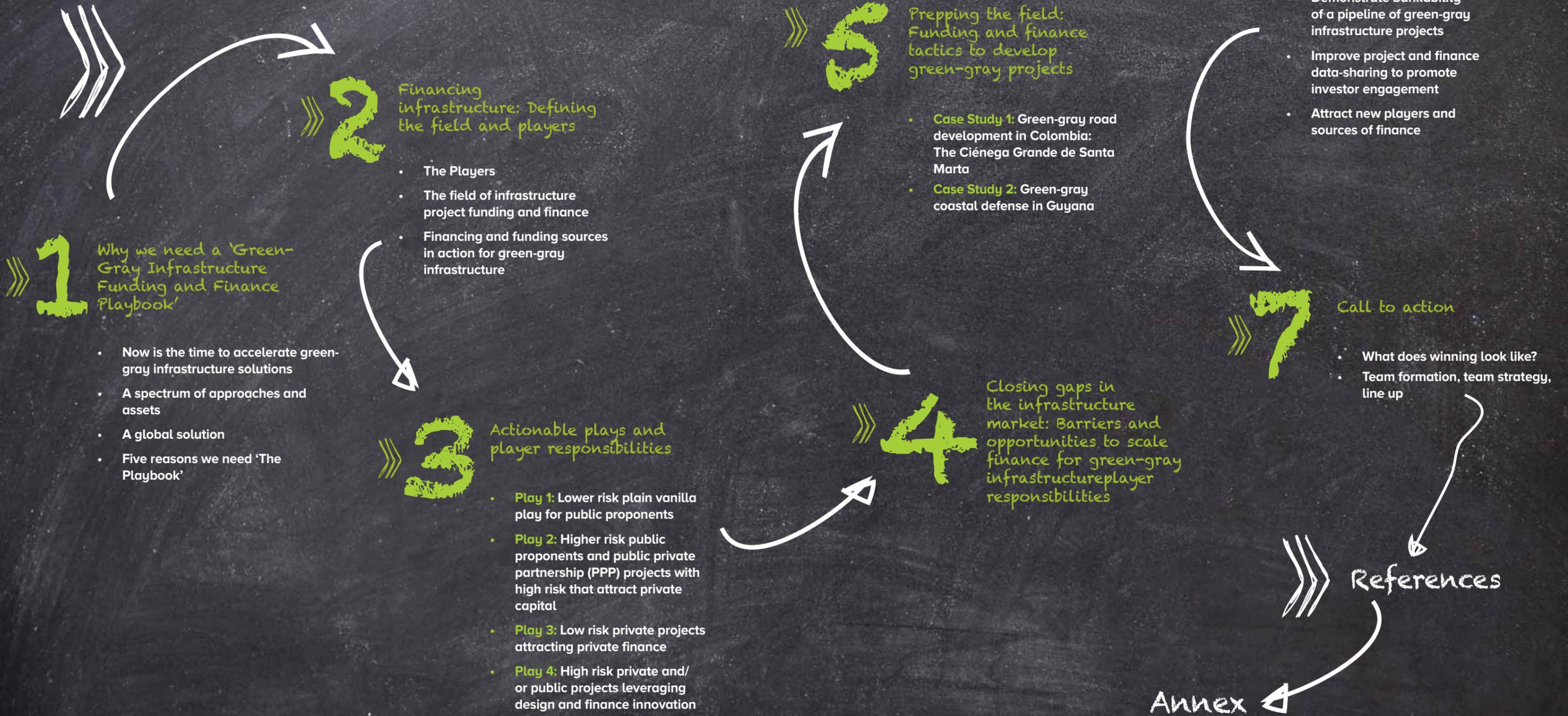
**GREEN
GRAY**
Community of Practice

GREEN-GRAY INFRASTRUCTURE FUNDING AND FINANCE PLAYBOOK

**A HYBRID APPROACH COMBINING
“GREEN” ECOSYSTEM RESTORATION AND
CONSERVATION WITH CONVENTIONAL
“GRAY” INFRASTRUCTURE SOLUTIONS**

A call to action for players designing, implementing, and investing in innovative infrastructure solutions to accelerate sustainable development, while cost-effectively optimizing service delivery

THIS PLAYBOOK GUIDES PLAYERS AND DEFINES THE PLAYS AND STRATEGIES TO ACCELERATE GREEN-GRAY INFRASTRUCTURE IMPLEMENTATION.



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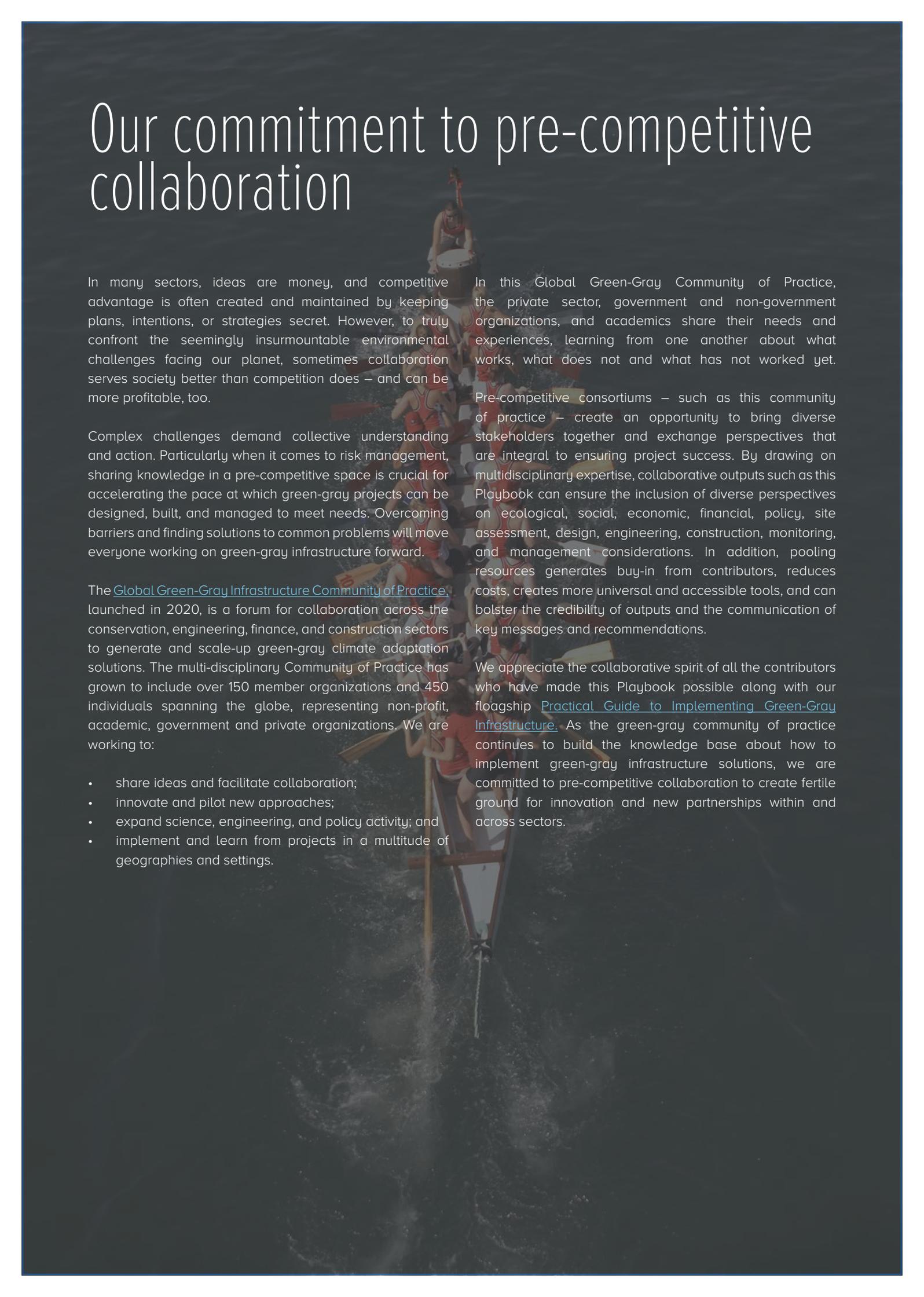
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Our commitment to pre-competitive collaboration



In many sectors, ideas are money, and competitive advantage is often created and maintained by keeping plans, intentions, or strategies secret. However, to truly confront the seemingly insurmountable environmental challenges facing our planet, sometimes collaboration serves society better than competition does – and can be more profitable, too.

Complex challenges demand collective understanding and action. Particularly when it comes to risk management, sharing knowledge in a pre-competitive space is crucial for accelerating the pace at which green-gray projects can be designed, built, and managed to meet needs. Overcoming barriers and finding solutions to common problems will move everyone working on green-gray infrastructure forward.

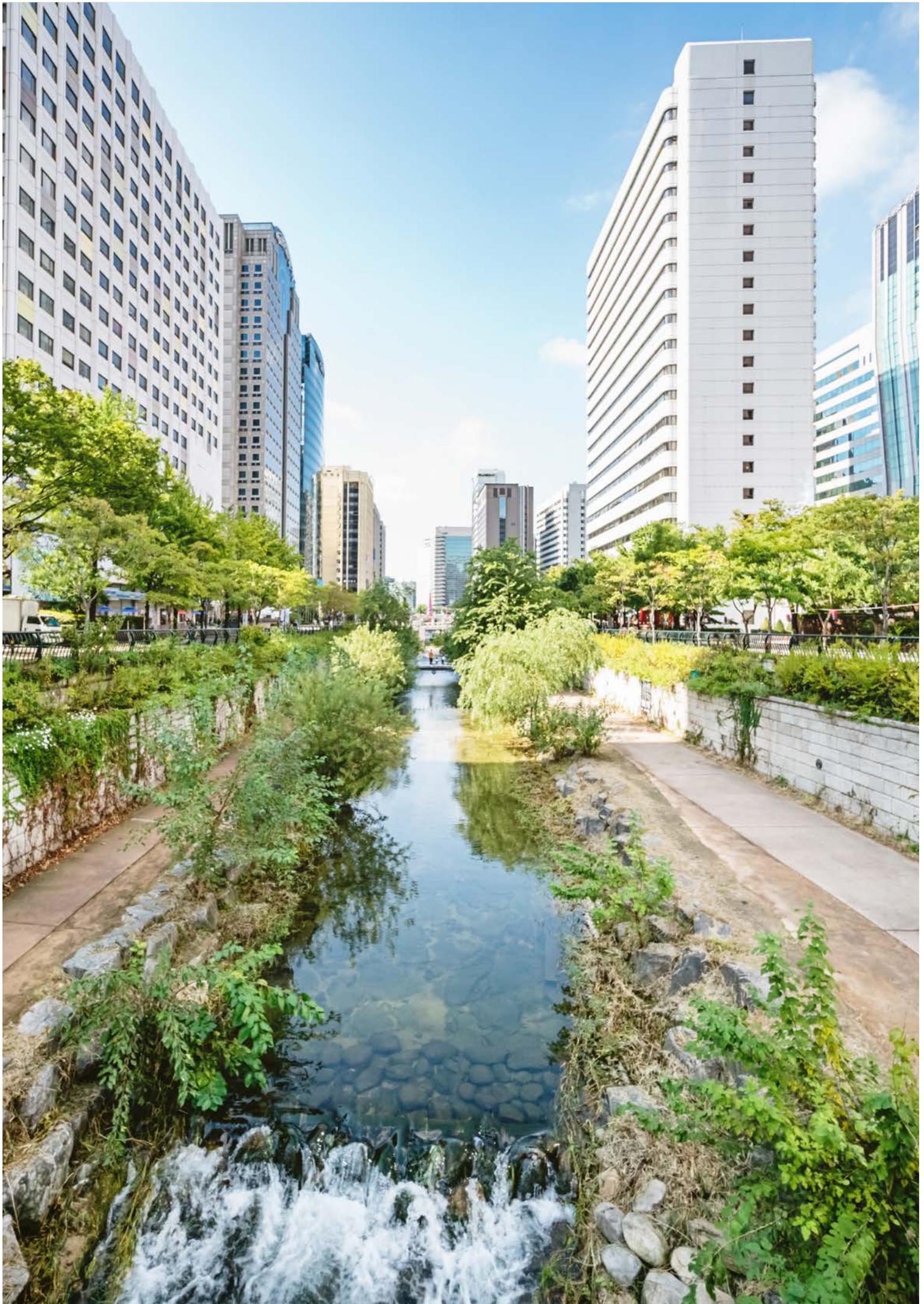
The [Global Green-Gray Infrastructure Community of Practice](#), launched in 2020, is a forum for collaboration across the conservation, engineering, finance, and construction sectors to generate and scale-up green-gray climate adaptation solutions. The multi-disciplinary Community of Practice has grown to include over 150 member organizations and 450 individuals spanning the globe, representing non-profit, academic, government and private organizations. We are working to:

- share ideas and facilitate collaboration;
- innovate and pilot new approaches;
- expand science, engineering, and policy activity; and
- implement and learn from projects in a multitude of geographies and settings.

In this Global Green-Gray Community of Practice, the private sector, government and non-government organizations, and academics share their needs and experiences, learning from one another about what works, what does not and what has not worked yet.

Pre-competitive consortiums – such as this community of practice – create an opportunity to bring diverse stakeholders together and exchange perspectives that are integral to ensuring project success. By drawing on multidisciplinary expertise, collaborative outputs such as this Playbook can ensure the inclusion of diverse perspectives on ecological, social, economic, financial, policy, site assessment, design, engineering, construction, monitoring, and management considerations. In addition, pooling resources generates buy-in from contributors, reduces costs, creates more universal and accessible tools, and can bolster the credibility of outputs and the communication of key messages and recommendations.

We appreciate the collaborative spirit of all the contributors who have made this Playbook possible along with our flagship [Practical Guide to Implementing Green-Gray Infrastructure](#). As the green-gray community of practice continues to build the knowledge base about how to implement green-gray infrastructure solutions, we are committed to pre-competitive collaboration to create fertile ground for innovation and new partnerships within and across sectors.





Why we need a 'Green-Gray Infrastructure Funding and Finance Playbook'

Infrastructure is the lifeblood of the global economy and development. However, conventional 'gray' infrastructure is responsible for over 60% of global emissions, is inflexible in its ability to adapt to changing climatic conditions, and exacerbates species and habitat loss. Infrastructure that integrates nature, such as complementing sea walls with mangroves or restoring riparian habitats alongside stormwater infrastructure, makes sense for the health, safety, and livelihoods of local communities. The evidence is also mounting that it makes financial sense for infrastructure developers and investors, providing more cost-effective and adaptable solutions for increasingly uncertain conditions.

However, today, these solutions remain niche and poorly understood in the conventional engineering and infrastructure finance world. In 2020, Conservation International and the Green-Gray Infrastructure Community of Practice released the [Practical Guide to Implementing Green-Gray Infrastructure](#) to provide the tools for project proponents and engineers to identify, design, construct and monitor green-gray infrastructure projects. It underscored green-gray infrastructure as a preemptive, innovative, and scalable climate adaptation solution that protects, manages, and restores nature.

The Playbook now builds from this, to provide a guide for public and private sector project proponents and investors on the infrastructure funding and financing models that can be used for green-grey infrastructure projects. It clarifies how to tailor funding and finance models for specific project contexts and enabling environments, and then sets out strategies to engage more mainstream infrastructure proponents and investors to consider green-grey infrastructure projects. The Playbook is a resource for local and national governments, environmental practitioners in non-government organizations, project developers (contractors, engineers, designers, and planners in the public and private sector), and financial institutions looking to better understand how to accelerate the growth of green-gray infrastructure development and investment.

NOW IS THE TIME TO ACCELERATE GREEN-GRAY INFRASTRUCTURE SOLUTIONS

The need for a new generation of sustainable and resilient infrastructure is urgent and growing.

By 2050, nearly 20% of the world's population will be at risk of floods, and up to 5.7 billion people will live in water-scarce areas.¹ Approximately USD 9.1 trillion in coastal assets are vulnerable to climate change.^{2,3} As adaptation needs mount, infrastructure costs are expected to account for up to 80% of total climate change adaptation spending globally – potentially up to USD 450 billion per year in 2050.⁴ The demand for new infrastructure is also significant. An estimated USD 94 trillion in global infrastructure investment is needed by 2040.⁵ Ensuring this development has a lower footprint and is more resilient in the face of changing climate conditions is key - it is estimated that about 70% of the increase in future greenhouse gas emissions will come from infrastructure that is yet to be built.⁶ Much of this will be required in emerging economies, countries where adaptation needs and the infrastructure gap is highest. For example, the African Development Bank estimates the African infrastructure financing gap is between USD 68 and USD 108 billion.⁷

In a context of growing uncertainty, the next decade of global infrastructure growth must be more resilient and align with climate and biodiversity goals.

The global infrastructure investment gap is estimated at USD 2.5-3.7 trillion annually, while an estimated USD 6.3 trillion in total infrastructure investment is needed by 2030. Of this amount, USD 4 trillion will be required in developing and emerging economies. The stresses of climate change and impetus to align infrastructure with the goals of the Paris Agreement is expected to add an additional 10% per annum to these costs but could in turn generate USD 4.1 trillion in net benefits by 2030.⁸ To meet these needs as well as global climate and biodiversity goals, future infrastructure growth will need to shift from the conventional model that is dominated by an energy-intensive and high impact approach – to a fundamental transformation of the engineering and construction industry to design and build with nature for increased human well-being, resilience to changing environmental and climate conditions, and reduced impacts on biodiversity. It also makes economic and financial sense. Building infrastructure in tandem with nature can be up to 50% cheaper than traditional gray infrastructure and provide 28% better value for money⁹.

Investments in nature-based sustainable and resilient infrastructure need to better address current disparities in infrastructure finance.

Three-quarters of private investment in sustainable infrastructure projects occurs in high-income countries.¹⁰ In developing countries, infrastructure needs are driven by the growing population, economic growth, urbanization and industrialization and the need to respond to increasing natural hazards. Emerging markets are expected to invest an average of USD 2.2 trillion - 3.9% of GDP - annually in infrastructure between 2020 and 2040, almost double the aggregate spend in advanced markets.¹¹ Private investment in infrastructure projects in middle- and low-income countries represents only a quarter of the total global private investment in infrastructure projects, and it declined by 28% in 2020. Most of this investment occurs in non-renewable sectors and transport.¹² In developing countries, domestic resources for infrastructure investors still far outweighs external development finance.¹³ As such, domestic sources of capital, both public and private, remain particularly important for sustainable infrastructure investment, which in turn highlights the need to get domestic policies right, which are so often a key barrier to investment.¹⁴

Private sector investment will be critical to addressing the infrastructure investment gap in emerging markets and must be aligned with green growth.

Data from 2017 shows that public sector investments, including investment by government entities and state-owned enterprises (SOEs), accounted for 83% of the USD 0.5 trillion of infrastructure project investment commitments in emerging markets and developing economies – a percentage mirrored in our own mapping of green-gray infrastructure projects. Private sources accounted for only 17% of investments, whereby 1,806 new projects were wholly, or majority sponsored by the public sector, compared to 305 projects majority private-sector owned.¹⁵ At the same time, countries with emerging economies have the greatest adaptation needs along with the highest infrastructure gap. Public finance will not be enough to cover this infrastructure and climate finance investment gap. New sources of private infrastructure finance will therefore be critical to ramping up investment in emerging markets and developing economies. These infrastructure and financing needs should drive green growth investments to maximize resilience, adaptation and mitigation, given how climate vulnerable these countries are.

Investing in nature as part of green-gray infrastructure faces significant challenges that must be addressed to enable the sector to grow.

The nature-finance gap is estimated at USD 4.1 trillion by 2050. Currently, 85% of all financing for nature comes from governments, while private capital accounts for 14%.¹⁶ Public official development aid - provided by donors and development finance institutions (DFI) - account for just 2% of overall financing.¹⁷ Private finance and development finance will be key to plug this gap – but face key constraints.¹⁸ Traditional assessments of infrastructure projects often overlook the additional, often intangible, value creation from ecosystem services. Like nature-based solutions¹⁹, green-gray infrastructure projects often lack a well-established track record on performance. At the same time, valuations that do not take account of social and ecological costs and benefits favor gray infrastructure as the default option.²⁰ However, the body of evidence for green-gray infrastructure is growing. Addressing the issues of information asymmetries, risk-return profiles, permitting, technical guidance, and clear revenue streams will be key to the sector's growth.^{21,22}

A SPECTRUM OF APPROACHES AND ASSETS

Green-gray infrastructure is a powerful and cost-effective tool to adapt to climate change and decrease the carbon footprint of infrastructure.

Green-gray infrastructure encompasses a hybrid approach by combining ecosystem restoration and conservation with conventional infrastructure solutions. It capitalizes on the infrastructure-like services provided by ecosystems to reinforce service delivery or protect the infrastructure

asset itself. It also has numerous financial, social, and environmental and biodiversity benefits to traditional gray approaches that can improve a project's risk profile and cost-effectiveness to reduce infrastructure investment costs, while maintaining flexibility to avoid maladaptation.²³ The evidence of these benefits is mounting. In a review of 30 'nature-based infrastructure' (NBI) projects, the International Institute for Sustainable Development (IISD) calculated that NBI can be up to 50% cheaper than traditional gray infrastructure and provide 28% better value for money. 11% of current global infrastructure needs could be replaced with NBI, potentially saving USD 248 billion each year.²⁴ For example, US coastal wetlands provide storm protection worth an estimated USD 23.2 billion per year.

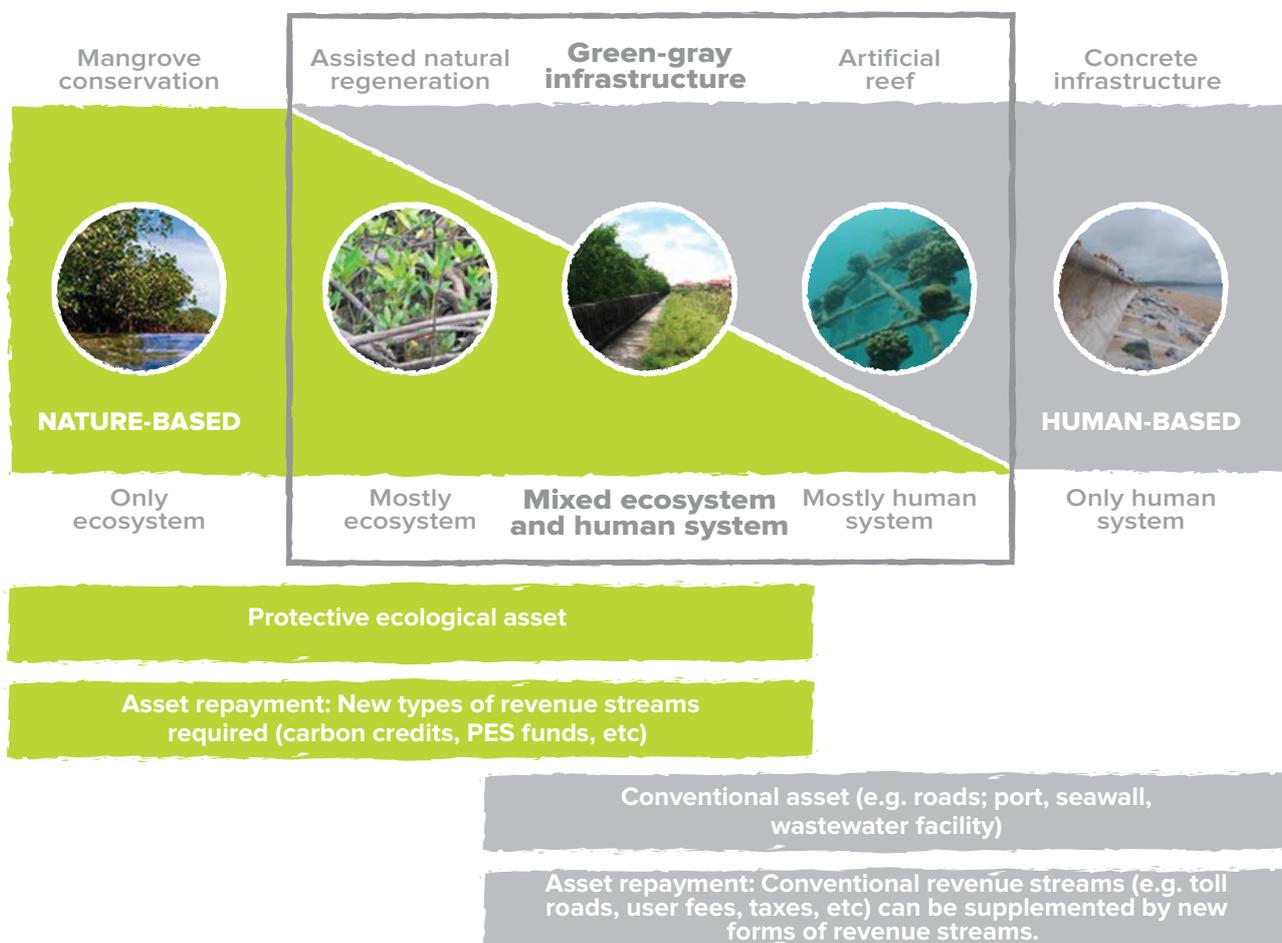


Figure 1. A spectrum of green-gray infrastructure assets.²⁵

Green-Gray Infrastructure work at Conservation International: Over the next five years Conservation International's [Green-Gray Infrastructure Program](#) aims to:

- Implement a portfolio of projects at sites in Guyana, Indonesia, the Philippines, Mexico, Brazil and other countries;
- Develop and facilitate global adoption of standard engineering techniques for green-gray infrastructure to reduce coastal climate impacts (led by the [Green-Gray Community of Practice](#));
- Work with champion governments to develop national policies that incentivize green-gray infrastructure; and
- Integrate green-gray approaches into at least 5% of the estimated USD 1.8 trillion²⁶ spent annually on coastal infrastructure development — more than half of it in emerging markets.

The team's goal is to increase climate resilience for 52 million of the world's most vulnerable coastal people through high-impact green-gray infrastructure solutions that benefit climate, biodiversity, community well-being, and national economies.

A word on terminology: There are a plethora of different terms to describe nature-related project interventions that have subtle nuances or differences between them, but that have very similar or overlapping intent. In this report we use green-gray infrastructure, but recognize that other organisations may apply different terms.

Green-gray infrastructure has high potential in five key sectors. In 2020, the Green-Gray Infrastructure Community of Practice drew on a climate-risk analysis of infrastructure sectors by McKinsey to establish a set of priority sectors for green-gray infrastructure. Five infrastructure sectors were prioritized as being highly vulnerable to climate change and where green-gray approaches have high potential. This report has taken these sectors as its key focus, namely: roads, seaports, water supply and sanitation, coastal and urban flood protection, and energy.

Green-gray infrastructure combines a range of different green and gray components to enhance the protection of an infrastructure asset or optimize service delivery of infrastructure services.

A GLOBAL SOLUTION

Green-gray infrastructure is emerging as a global solution to optimizing infrastructure service delivery and protecting infrastructure assets.

A review of the leading databases and publications on green-gray and nature-based infrastructure provides a comprehensive, if not exhaustive, snapshot of 100 infrastructure projects that integrate green-gray solutions in operation and construction globally. The diversity of projects reveals the global applicability of green-gray solutions across regions, countries, sectors and project goals. It also shows the dominance of green-gray applications for water and storm protection as coastal flood protection accounted for 35% of all projects, urban flood protection for 34%, and water supply and sanitation for 21%, with the remaining 10% spread across other infrastructure types including transport and energy. No projects were identified yet for Seaports. Coastal and freshwater ecosystems accounted for the primary 'nature components' in over 60% of all projects.

Funding and finance data is difficult to access. Project-level investment information was publicly available for 75% of projects and a break-down of finance for green versus gray components was not available. All 100 projects represent USD 9.3 billion in investment – although green-gray components may only represent a portion of this total. While difficult to compare, total infrastructure investment across 57 high-income countries in energy, transport and water sectors reached USD 2.7 trillion in 2021, but indicates the size differential between conventional infrastructure and projects integrating green-gray.²⁷ Urban flood protection accounted for the largest portion of investment, at 53% (almost 5 billion USD) of investment.

Table 1. Taxonomy of green-gray infrastructure.^{28,29}

Infrastructure Type	Gray infrastructure assets	Green infrastructure assets	Examples of ecosystem services provided
Water supply and sanitation 	Water treatment plants	Natural and constructed wetlands and reed beds, and soil infiltration systems.	United States: The Portland Water District assessed that it would be more cost-effective to invest in the natural provision of filtration services provided by an estimated 16,000 hectares of forests and riparian buffers surrounding the water supply in Portland, Maine. Investing in the natural infrastructure surround Lake Sebago substituted the need for a water filtration plant, saving the city an estimated USD 97 to USD 155 million over 20 years. ³⁰
	Dams, reservoirs	Forests, natural and constructed wetlands and reed beds	South Africa: Cape Town came just a few days from running out of water during an historic 3-year drought (2015-2018). The city is adopting a mix of green-gray solutions to optimize supply. This includes the removal of alien plant species in three sub-catchments covering 54,300 hectares that is expected to generate annual water gains of 50 billion liters within 5 years, supplying water at one-tenth the unit cost of gray-only options. ³¹
Coastal flood protection 	Embankments, breakwaters, sluice gates, seawalls, breakwaters, rock revetments	Mangrove fringes, coral reefs, wetlands, sea grass, sand dunes, coastal marshes, beach grasses	United States: TNC has worked with Jacobs Engineering to design a green-gray structure that could generate over USD 3 million in avoided losses in the 12 hectare Morningside Park in Miami, Florida. The concept includes an enhanced waterfront with living shoreline and an earthen berm planted with native trees and shrubs to mitigate erosion, increase biodiversity and mangrove extent. ³² The project is expected to be partly funded through the USD 400 million Miami Forever Bond with matching grants from the City of Miami. ³³
Urban flood management & stormwater management 	Storm drains, pumps, tanks	Bioswales, vegetated roadsides, forests, urban gardens, green roofs, permeable pavements	Mozambique: After the deadly Cyclone Idai hit the municipality of Beira in 2019, the city was financed by the World Bank's Cities and Climate Change Project (3CP) – in coordination with Mozambique's Administration for Water and Sanitation Infrastructure – to rehabilitate the stormwater drainage system and restore the Chiveve River's capacity to mitigate floods. The nature-component was supported under 3CP with financing from the Pilot Program for Climate Resilience and Germany, transforming the formerly degraded river and surrounding area into 17-hectare, multi-functional urban green park. The project reduced future encroachment and generated a funding source for the continued operation and maintenance of the park. ³⁴
Transportation 	Roads, Rail 	Bioswales, permeable pavements, vegetated roadsides, living seawalls, mangroves.	Singapore: Singapore has developed a new system of integrating nature into road design, implementing a system of roads called 'Nature Ways' that feature native trees and shrub and mimic the structure of its native rainforest. Currently, the eight Nature Ways cover 43.3 km, and have improved drainage and reduced flood risk, reduced ambient air temperature, and improved ecological connectivity. Singapore National Parks aims to create 180km of Nature Ways by 2030. ³⁵
	Seaports 	Mangroves, coral reefs, wetlands, sea grass, sand dunes, coastal marshes, beach grasses, biomimetic concrete	Guadeloupe: The harbor of Deshaies in Guadeloupe installed an eco-designed mooring system to reduce the negative ecological impacts of conventional anchoring systems. The system avoided the destruction of seagrasses and coral reefs in the bay, but in addition enhanced coral colonization through the use of biomimetic concrete weight, improving shelter for fish juveniles. ³⁶
Energy 	Wind power Solar power Hydroelectric plants	Forest, upland watershed, mangroves	Colombia: Conservation International and TNC are developing the Cloud Forest Blue Energy Mechanism to mobilize domestic commercial finance to reforest and conserve cloud forests in Latin America to improve erosion control and reduce sedimentation for hydropower companies. ³⁷

Investment size of projects ranged widely, from USD 20,000 to USD 1.3 billion, with the majority of projects ranging between USD 8 million and USD 135 million. The six largest projects range between USD 370 million and USD 1.3 billion, all representing landscape or basin level water and coastal flood management projects financed by the World Bank. Overall, 88% of the projects mapped were initiated by national and local governments, suggesting that there is significant room for increased participation of private proponents and investors in the sector. The World Bank will naturally emphasize government and municipal projects which are likely to be financed through concessional loans and the publicly available data in this analysis reflects that. It is likely that there are more private deals and that data is not accessible, but it is safe to say that today, the majority will be government instigated projects.

Government and municipal funds accounts for the largest share (almost 40%) of project funding, while concessional loans represented 35%. Grants on the other hand were the primary instrument for 13% of the mapped projects, but represented just 2% of total funding, suggesting that grants focused on smaller sized projects and underlining the limitations of this form of capital. Notably, just 1% of the total finance was directed through bond structures.

FIVE REASONS WE NEED 'THE PLAYBOOK'

Green-gray infrastructure offers project proponents, developers, and investors innovative solutions to accelerate sustainable and resilient development, while optimizing service delivery cost-effectively.

The moment is now to fundamentally transform the engineering and construction industry to design and build with nature. Green-gray infrastructure needs to be mainstreamed into the USD 90 trillion worth of infrastructure investment that will last for decades to come. This integration has the potential to reduce upfront costs, generate long-term financial savings, create local economic and social benefits, increase resilience in the face of growing climate risks and uncertainty while reducing negative impacts on biodiversity.³⁸ Five trends make this the perfect moment to focus the sector's attention on accelerating the implementation of green-gray infrastructure.

1. Infrastructure asset exposure to climate change and nature loss will accelerate over the coming two decades.

The risks and global economic costs of climate change are set to grow exponentially over the coming two decades. By 2030, adapting to climate change and coping with damages is expected to cost developing countries alone USD 140-300 billion per year.³⁹ By 2050, global economic costs from rising seas and inland flooding could amount to USD 1 trillion a year.⁴⁰ As the costs of increasingly volatile weather patterns and nature-loss rise, financial intermediaries will be increasingly exposed to their impacts and dependencies on nature and climate. This will also have direct impacts on infrastructure assets, requiring project and infrastructure asset managers to increasingly invest in resilience and build flexibility into their operations - resilience and flexibility that green-gray approaches can provide.⁴¹ For investors – who channeled an estimated USD 730 billion into new projects in 2020 - these risks will need to be increasingly factored in and comprehensively addressed.⁴²

2. Post-COVID infrastructure spending is an unprecedented opportunity for infrastructure investment.

USD 17 trillion of global stimulus packages have been initiated in response to the COVID-19 crisis – with infrastructure investment at the heart of many post-covid recovery packages.⁴³ While this will help to address aging infrastructure in developed economies and rapid growth in emerging ones, the pandemic has also created greater infrastructure needs and new challenges around funding models as user rates changed.⁴⁴ This increased spending should be an opportunity to catalyze more cost-effective, resilient, sustainable and multi-faceted solutions, such as green-gray infrastructure. However, a recent study revealed that just 2.5% of this post-COVID fiscal spending in the 50 largest economies was directed to green initiatives. To not let the moment slip away, increased collaboration between public and private sector investors – facilitated by enabling policies and regulations - is needed to develop these solutions and innovative financial models at the scale required to attract larger investors.⁴⁵

3. A more robust set of global frameworks for ESG and sustainability are emerging that will facilitate the integration of climate- and nature-related factors into investment decisions.

These include the Task Force on Climate-related Financial Disclosures (TCFD), Task Force on Nature-related Financial Disclosures (TNFD), the European Commission Sustainability Taxonomy and Disclosure Regulations, and the SEC climate change disclosure rules.⁴⁶ This will drive companies and investors to measure and address financially material risks derived from climate and biodiversity loss, in order to redirect financial flows into climate resilient and nature positive investments.⁴⁷ Infrastructure investors are already leaders in ESG integration given the exposure of long-term assets

to climate risks. Growing investment in green infrastructure also demonstrates that more sustainable infrastructure as a strategy for infrastructure is seen as financially sound. Since 2014, private investment in sustainable infrastructure projects has risen from USD 58 billion to USD 87 billion in 2020 – but remains concentrated in renewable energy projects, namely wind and solar.⁴⁸ As investors look to grow their exposure to the sustainable infrastructure market, private sector demand for ESG outcomes could help to mobilize investment in green-gray infrastructure.⁴⁹

4. Nature-based infrastructure investment is set to grow as net-zero and nature-positive commitments from countries, finance and business companies are implemented. More than a fifth of the world's 2,000 biggest publicly traded firms - with combined sales of nearly USD 14 trillion per year—have set net-zero targets.⁵⁰ The world of finance is also committing increasing amounts of capital to achieve net-zero, such as the Glasgow Financial Alliance for Net Zero (GFANZ) USD 130 trillion commitment by 2050.⁵¹ At the same time, more than 1,000 companies with revenues of USD 4.7 trillion have signed the Business for Nature 'Call to Action' asking governments to adopt policies to reverse nature loss by 2030. Although these pledges need to be met with healthy skepticism, it indicates that companies and investors are searching for practicable solutions for how they make good on these promises. For construction companies and infrastructure developers, these commitments can manifest into both more aggressive

targets to better account for climate risk, reduce emissions and harmful techniques as well as increasing investment in alternative solutions such as green-gray infrastructure. For example, as part of the SwissBiz4Nature pledge, Holcim has committed to integrating nature-based solutions across their operations, and to design and benchmark their progress in line with the IUCN Global Standard for NbS™.⁵²

5. Countries' Nationally Determined Contributions (NDCs) are likely to shift public and private investment towards more sustainable climate resilient infrastructure. NDCs publicly outline a country's climate actions under the Paris Agreement of the U.N. Framework Convention on Climate Change (UNFCCC). At the same time, governments are negotiating the Post2020 Global Biodiversity Framework (GBF) to protect nature for the next decade.⁵³ Furthermore, Conservation International is developing a Blue Carbon Policy Framework that will provide countries with a strategic approach for integrating coastal ecosystems across UN Conventions (mainly UNFCCC, CBD, SDGs and Ramsar). Together, these frameworks are expected to drive substantive shifts in the financing landscape as public and private investors align with these new climate and biodiversity goals. For example, as part of the Portfolio Decarbonization Coalition, major institutional investors have pledged to decarbonize their investment portfolio and assess the carbon footprint of their assets.⁵⁴ This will create new opportunities for green-gray infrastructure to drive the decarbonization of the infrastructure asset class.

We need this Playbook to clarify the state of play because green-gray infrastructure projects:

- Are a cost-effective, resilient, and financially viable infrastructure solution, but face several core challenges.
- Are currently not well-recognized and integrated into mainstream infrastructure standards, procurement processes and investment.
- Are supported by a growing body of evidence but lack a well-established track record on the performance that favors gray infrastructure as a default option for development and finance.¹¹⁷
- Require appropriate risk-return profiles, diversified revenue streams, relevant permitting and technical guidance to drive the sector's growth.^{118,119}
- Are affected by the triple gap – the infrastructure finance gap, nature finance gap, and adaptation finance gap and need urgent and coordinated action.

Given the urgent need and growing opportunity for green-gray infrastructure's role in more sustainable and resilient development, The Playbook defines strategies to advance green-gray projects more quickly around the world - starting now. The Playbook defines the roles, responsibilities, and actionable and replicable funding and financing models required to develop green-gray infrastructure at scale.



Global Map of Green-Gray Infrastructure Projects



see Annex for project details

Figure 3. Global Map of Green-Gray Infrastructure Projects¹²⁰



Financing infrastructure: Defining the field and players

The Playbook is a guide for the range of players in the market already designing, implementing and investing in green-gray infrastructure. It provides a set of practicable options for funding and finance and an outline of how to tackle specific challenges to developing a pipeline of green-gray infrastructure projects while attracting a broader range of players.

THE PLAYERS

The 'Players' in this Playbook are stakeholders that develop projects and proponents that drive key sources of financing of green-gray infrastructure, be they from public or private sources.

Project developers



Public entities: Government, municipalities and state-owned enterprises are often both developers and financiers and so the Playbook outlines the importance of policy and regulation to support implementation of green-gray infrastructure solutions.



Private sector entities: For engineering, construction companies and private sector sponsors and developers, the Playbook outlines successful use cases of green-gray infrastructure project funding and finance and recommends a set of strategies in which they could engage to develop more bankable larger scale projects connected directly to conventional gray assets.



NGOs and applied research: The Playbook provides an overview of key modalities of infrastructure funding and finance, and a set of infrastructure finance plays for NGOs and conservation organizations that are suitable to green-gray infrastructure finance. It identifies key sources of funding, stakeholders and partners to engage, and financing needs for developing bankable projects.

Project funders and financiers



Public entities: The Playbook outlines how public green-gray projects can be optimized, for example to attract and leverage commercial capital towards projects that contribute to sustainable development, while providing financial returns to investors ('blended finance'), and to attract private finance; they define the policy and regulation pre-conditions needed, including those needed to attract more private finance, and the collaboration opportunities for public proponents to accelerate the growth of green-gray infrastructure; they define the funding modalities that local authorities and government agencies can develop to improve the sustainable financing of green-gray infrastructure projects, and collaboration opportunities to accelerate its growth.

Catalytic capital providers:



Multilateral Development Banks (MDBs) & Development Finance Institutions (DFIs) and Multilateral Trust Funds: The Playbook highlights the key role played by MDBs and DFIs and other multilateral funds, such as Green Climate Fund and Global Environment Facility to provide concessional corporate, project debt, de-risking, as well as grants and loans in emerging markets for governments and private sponsors. This helps to mobilize private finance and build capacity.



Philanthropy: The Playbook outlines how philanthropic institutions are key to getting green-gray infrastructure projects off the ground through up front grants or blended finance solutions, providing catalytic grant capital to de-risk and accelerate the growth of a bankable pipeline of green-gray infrastructure projects.



Insurance: The Playbook outlines the potential role of insurance improve to improve the risk and cost profile of green-gray infrastructure and outlines the partnerships insurance companies can pursue to accelerate the growth of the market.

Investors:



Commercial investors: For impact investors and commercial banks looking to grow their exposure to nature-related investments, the Playbook identifies successful use cases of financing instruments and structures for green-gray infrastructure and collaboration opportunities to invest in the growth of green-gray infrastructure pipeline.



Institutional investors: For large-scale institutional investors and infrastructure investors, the Playbook recognizes the growing interest in nature-based solutions and sustainable infrastructure pipeline of this group, but equally their restrictive investment criteria. The Playbook therefore outlines green-gray infrastructure as an emerging opportunity area for these investors but establishes key informational needs that must be addressed to fully engage them.

THE FIELD OF INFRASTRUCTURE PROJECT FUNDING AND FINANCE

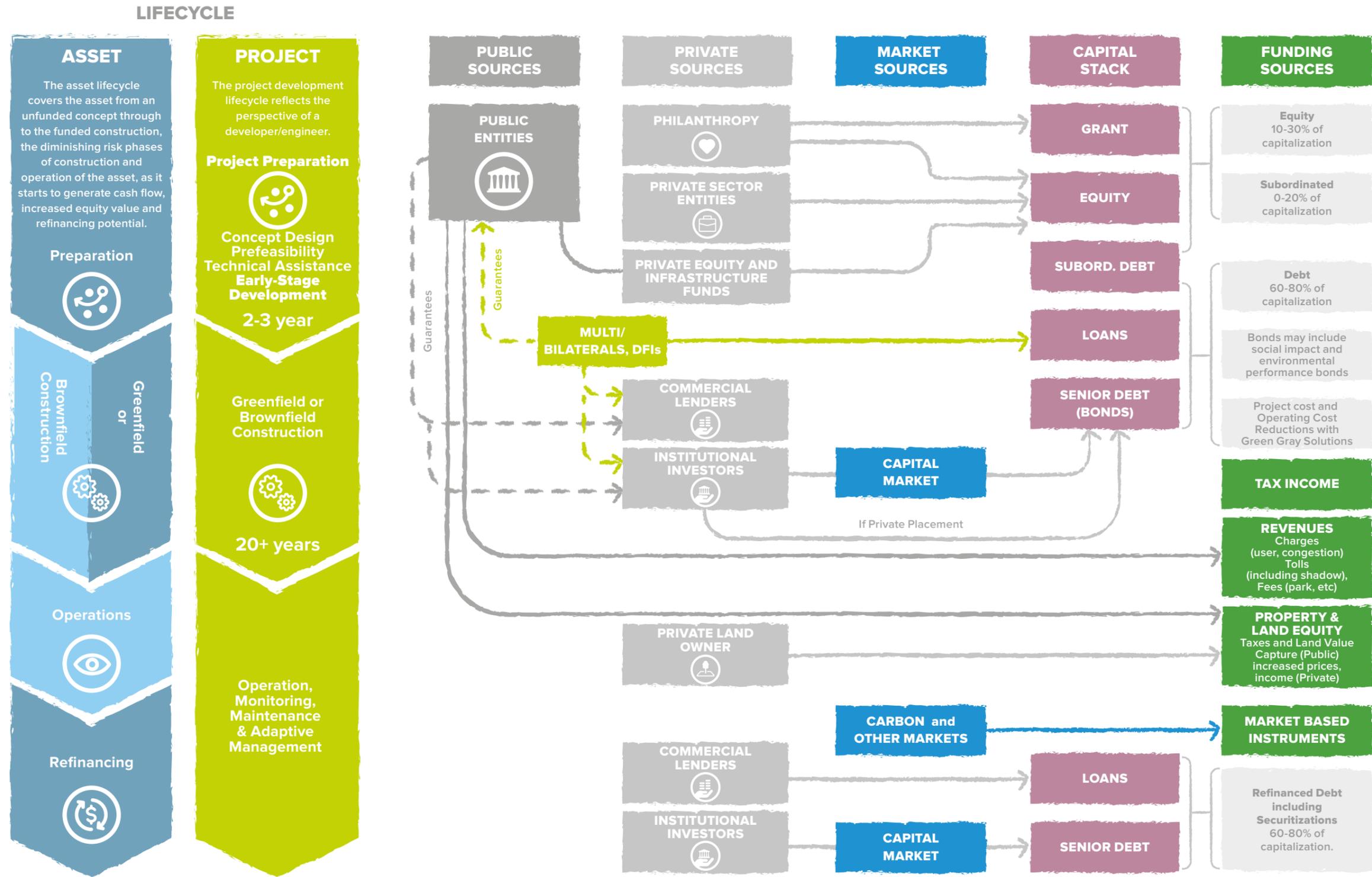
The field of play for green-gray infrastructure represents the funding and financing sources, instruments and stakeholders to design, implement and operate an infrastructure asset along the lifecycle of the **asset** and over the different phases of the **infrastructure project** (development, construction and operation).⁴ Different sources of public and private finance are relevant at these different phases, along with the different instruments they offer, the capital stack required to finance the project, and finally, the sources of funding that will be used to pay for the project.

The 'playing field' is defined by the characteristics of the asset, the project and its proponents, namely:

- Lifecycle of project and asset (e.g., brownfield projects have lower uncertainty and risk since they already have a track record),
- Players, i.e., funding sources and stakeholders,
- The geographic market in which the project is situated,
- The regulatory framework that governs the project or the asset.
- The capacity of local entities to implement and sustain the engineered and natural assets.

Different sources of finance will therefore depend on these project/asset characteristics and influence the types of investors, with different risk/return profiles, that can come to play at different stages of the lifecycle. Government, Philanthropy and Project Sponsors and, in some cases, Multilaterals, tend to actively finance the early stages to get the project going – especially for new asset classes or where there are data constraints - providing up front financing through equity, grants, loans or even concessional financing (i.e., favorable interest rates). At later stages, financing from the private sector and market sources increasingly come into play as the project is built and becomes operational. For the private sector to be engaged and deploy a range of financing instruments - each with different terms and conditions to suit a particular investor type - projects need to secure revenue streams, potentially from different sources, have enough collateral, compelling evidence that it will be successful, a mitigated risk profile, acceptable return on investment for the different players, a clear exit and finally, for refinancing purposes, a clear track record and exit plan.

4 **CLARIFICATION:** While project and asset are often used interchangeably, this Playbook will refer to the 'infrastructure project' to mean the complete project (i.e. from design, construction, implementation, etc.) and the sum of all the related costs (development, construction, operating, financing costs etc.) whereas the asset relates to the infrastructure itself (greenfield or brownfield) its asset life and ability to generate revenue (e.g. a greenfield mangrove forest asset can generate carbon revenue).



ASSET LIFECYCLE:

Note 1. Preparation: Equity and Grants for Preparation and Feasibility designs from project sponsors, government and philanthropy. Investors and Debt providers approached for funding. Deals with significant capital needs often require a multi-source finance solution. Investors do due diligence to evaluate legal aspects, permits, contracts and specific technical issues prior to achieving financial closure, identify risks and mitigation measures.

Note 2. Construction: Credit enhancement packages. Risk insurances. Guarantees. Currency hedging are all put into place to make debt issuance possible. Debt drawdown, bond issuance.

Note 3. Operations: Project becomes operational costs and revenues are certain and stable, Default risk goes down. Ownership can shift from governments and banks and construction companies to investors with specialized expertise in operating and managing the asset.

Note 4. Refinancing: Asset shows operational track record. Can be refinanced to reflect a changed risk profile. Potential for asset to be refinanced or cash flows securitized then ideally recycled back to finance new infrastructure investments.

PROJECT LIFECYCLE:

Note 1. Preparation and Early-Stage Development: Conceptual, pre-feasibility study, development and design, feasibility studies; permits, models cash flows, finances; organizes contracts with partners.

Note 2. Construction: Permitting and construction within the time and cost deadlines. Commissioning (for e.g. energy) to prove it is structurally safe, robust to operate for the project lifetime, operates as designed and performs as expected.

Figure 4. Infrastructure project development and asset lifecycle
 Source: Adapted from: Colenbrander, Sarah & Lindfield, Michael & Lufkin, Joseph. (2018). Financing Low-Carbon, Climate-Resilient Cities.

PUBLIC SOURCES	PRIVATE SOURCES	MARKET SOURCES ⁵⁵	CAPITAL STACK ^{56, 57}	FUNDING SOURCES
<p>FINANCING is the cash required by infrastructure projects to cover front-end investments for their planning, design, construction and early stage operating and monitoring costs. Financing effectively time-shifts costs incurred and is expected to be repaid over time from cash flows derived from the project (or from other sources).</p>				
<p>Public entities are the largest infrastructure finance players. From a finance perspective, an estimated 83% of global infrastructure investment is from public investment. 34% of this is from public entities – namely state and municipal governments - and 66% from state-owned enterprises.</p>	<p>Private infrastructure investors provide finance at market rates through a range of instruments, such as loans, bonds and equity. It accounts for just 17% of global infrastructure finance – but is growing.⁵⁸ It comes predominantly from corporate finance (a company's balance sheet) and from project finance but can be raised and allocated through a variety of instruments, including private equity.</p>	<p>Market Sources are a subset of private sources that refer to any market where the buying and selling of financial securities or commodities takes place. In this context, it includes the bond, insurance and carbon finance market and will be key to driving both innovation (e.g. through carbon credits) and efficient commoditization of financing for green- gray infrastructure projects.</p>	<p>The Capital stack is the structure of all capital (all types of grants, equity and debt) that is invested into a company or project.</p>	<p>Funding is the means by which a project's costs are repaid, namely the sources of cash to cover its implementation and eventual profit. For infrastructure, this generally means identifying the long-term revenue stream necessary to repay the money initially invested plus interest.</p>
<p>Public entities (national, state governments, municipalities, treasuries, ministries, state owned enterprises) provide early-stage public funding through domestic budgets for preparation and design within a typical national or municipal budget cycle, as well as through taxes & subsidies. Government may also fund projects that are difficult to privatize, such as smaller roads. Policy and regulatory incentives can improve local capital markets for sustainable infrastructure. Emerging market governments have less scope to use public finance and public services to leverage private investment.</p> <p>Multilateral Development Banks (MDBs) such as the World Bank Group, African Development Bank and others provide corporate and project debt in emerging markets for governments and private sponsors globally, primarily at concessional rates. Grants or loans can mobilize private finance, as well as building capacity, preparing projects and structuring deals upfront. They also provide risk mitigation for other co-financiers through loan guarantees or other first-loss instruments.⁵⁹ Similar to MDBs, Multilateral Trust Funds such as the GEF, Adaptation Fund also provide catalytic co financing and grants.</p> <p>Public entities and MDBs can provide a range of guarantees to enhance the risk profile of the investment and crowd in private capital.</p> <p>Development finance institutions (DFIs) - despite being public institutions, DFIs often operate commercially with the mandate to support national development plans and policies.</p> <p>Export Credit Agencies (ECAs) can provide debt and risk management solutions to project sponsors if specific conditions are met around the usage of capital and goods from the ECA's home market.⁶⁰</p> <p>Public landowners can capture a proportion of rising land prices to fund large urban infrastructure projects.</p>	<p>Philanthropic foundations are vital sources of early-stage upfront grant finance for initial research and design for green-gray infrastructure. In addition, foundations are increasingly using program-related investments (PRIs) to offer loans or equity stakes at concessional rates to crowd in private capital to riskier pilot phases.</p> <p>Project sponsors are private companies, usually real estate developers or construction companies that develop the project and invest equity into the project upfront.</p> <p>Private equity, infrastructure and unlisted Funds: Seek the highest return (minimum as low as 7% but usually double digit) and will provide equity in projects with strong growth potential, able to invest in new markets and technologies (5-15 years) -their engagement in Green Gray to date has been limited due to return requirements ⁶¹</p> <p>Private landowners can capture the rise in land, property values associated with project outcomes.</p> <p>Commercial lenders include commercial banks, mutual companies, private lending institutions, hard money lenders and other financial groups. They have stringent loan criteria to evaluate potential borrowers and focused on the private market.</p> <p>Institutional investors comprise banks and insurance companies, pension funds and hedge funds, mutual funds, sovereign wealth funds and endowments. They search for investments that provide predictable income streams to meet long-term obligations but need relatively high liquidity.</p>	<p>Capital markets:</p> <p>Bonds that are issued on the open market are debt securities issued by a borrower to one or more parties who lend funds to the Issuer through their bond purchase or subscription. Publicly traded bonds are differentiated from loans in that they may be standardized and issued in capital markets as financial securities. Bond types applicable to green-gray projects include sovereign and municipal bonds, tax increment financing bonds, green, blue, or climate bonds, and environmental impact bonds.</p>	<p>Equity generally makes up 10-30% of the financing source.</p> <p>Investors provide financing to project sponsors in exchange for an ownership interest in the project assets, assuming the risk and reward of the project.</p> <p>Debt products generally make up 70-90% of the financing source, and can come in different forms:</p> <p>Loans Senior & Subordinated, Securitization: In addition to repayment of the principal amount of the loan with interest. Loans can be further differentiated between short-term 'project finance' used to pay the cost of project construction, and longer-term 'permanent finance' for assets during their operational life.</p> <p>Bonds that are issued through a private placement is a sale of debt securities to pre-selected investors and institutions rather than on the open market. Where issued by the public sector, SOE or a company, the bond will be linked to that entity's credit rating.</p> <p>Project bonds are fixed income instruments sold to investors whose proceeds are used to provide debt to an infrastructure project; Project bonds are tradable, rated and directly linked to the cash-flow of individual project.</p>	<p>General taxes and domestic budgets are the funding source for governments and can be used to service public debt incurred for the project.</p> <p>Revenues: income generated specifically from the project in the form of user fees, tolls or charges.</p> <p>Stormwater retention credits: Municipalities (or similar) can introduce standards that require developers to either meet their water retention requirements or purchase stormwater retention credits from others who have voluntarily installed green infrastructure.</p> <p>Payments for ecosystem services (PES): Payments to farmers or landowners who have agreed to take certain actions to manage their land or watersheds to provide an ecological service.</p> <p>Carbon markets: Payment through the issuance of credits in the voluntary or regulatory carbon markets based on the carbon avoided or removed by the project in land or blue carbon ecosystems.</p> <p>Property and land equity: Property taxes & income from land/property projects or portfolio that are predicted to increase economic growth or enhance real property values and tax income, including Land value capture (LVC).</p> <p>Sector-associated revenue generation: Improved fisheries and aquaculture management and catches/ value; livelihood generation; ecosystem tourism services and associated sales.</p> <p>Cost benefit models: Revenue is generated through capturing a portion of reduction in operating, maintenance or capital cost savings over the life of the project to beneficiaries.</p>

FINANCING AND FUNDING SOURCES IN ACTION FOR GREEN-GRAY INFRASTRUCTURE

Infrastructure projects tend to be large scale and long term, with steady revenue stream profiles once they are operational. As such, they need significant patient capital and financing up front with long term repayments from predictable funding sources. Before considering financing and funding, it is key to emphasize that green-gray infrastructure can reduce the up-front construction costs while mitigating climate impact costs over the long term.

Financing sources in the capital stack rely on cash flows that provide repayment of the project over time.

STAGE OF PLAY:



PLAYERS INVOLVED:



Equity & Quasi-Equity: For gray infrastructure, equity would normally be about 10-30% of a project capitalization. While not all equity investors are oriented toward social and environmental returns, those with impact investing mandates or strategies can be an important segment of the market for green-gray project financing. Impact investors look for favorable risk return profiles along with social and environmental impact.

Grants: Grants and convertible grants are fundamental to support green-gray projects at both the project design stage and for financial design. For example, for Atlanta’s Department of Watershed Management ten-year USD 14 million publicly offered environmental impact bond (that financed six green infrastructure projects in the Proctor Creek Watershed to increase green space to manage stormwater impacts), the Rockefeller Foundation covered the design costs of structuring the bond with a grant.⁶²

STAGE OF PLAY:



PLAYERS INVOLVED:



Debt: Debt makes up the lion share (70-80%) of an infrastructure project capitalization because debt products match the profile of infrastructure projects, which churn out long term predictable revenue streams that can service scheduled debt payments. Commercial and investment banks finance the largest share of the investment across all regions and an estimated 80% of private investment in infrastructure projects is financed by debt. While loans represent 87% of debt financing, projects in developed economies are increasingly using debt capital markets – especially for green bonds. Debt instruments that are likely to be particularly interesting for green-gray projects include:

Performance-linked finance, which includes a range of instruments that can tie interest rates/terms of the finance to the achievement of predetermined sustainability performance objectives and outcomes and could be an incentive to incorporate green infrastructure. These can include sustainability linked loans and Environmental Impact Bonds. Investors need clear and homogenous KPIs and need to keep it simple.

Sovereign or municipal bonds are backed by the taxing authority of the issuer, with performance linked to the credit worthiness of the borrower rather than the infrastructure asset. For example, the USD 400 million Miami Forever Bond (2018) which earmarks some of the bond proceeds for green-gray projects – such as Miami Morningside Park- is financed through a General Obligation Bond, a mechanism through which cities finance major infrastructure projects based on their credit rating alone.⁶³ Issuances that focus on more dedicated bonds for specific outcomes for climate resilience could ensure green-gray is not competing with a range of other infrastructure needs. In developing countries, many municipal markets are not investment grade, and would require technical assistance (such as that provided by the United Nations Capital Development Fund’s Municipal Investment Finance Programme) to achieve the ability to raise external finance and secure a credit rating. Where

this is not possible, other forms of debt financing would be required, potentially backed by credit enhancement tools.

Blue, Green or Climate bonds earmark proceeds with climate or other environmental benefits and can be used for green-gray infrastructure. Because of their liquidity, infrastructure bonds can have a lower cost of capital than bank loans, making them effective instruments for refinancing debt once a project becomes operational.⁶⁴ Green and blue bond issuances are expected to continue to have strong growth in the coming years.⁶⁵ However, structuring novel bonds is a lengthy and expensive process and often needs grant finance to cover design costs. In the case of the recent blue bond issuances, such as the Seychelles or Belize, these costs were covered by a mix of grant finance from the Global Environmental Facility and philanthropic organizations.⁶⁶

Private Debt & Equity: Infrastructure and impact investors are increasingly creating unlisted funds, many using blended capital, to invest in infrastructure. This is likely to become more relevant for green-gray infrastructure, given that to date many projects are relatively small-scale investment sizes. Funds can aggregate projects for institutional investment, targeting a larger fund size and diversifying risk. However, this would also require deal volume and pipeline, which is not yet clearly in evidence for green-gray. For example, the Subnational Climate Finance initiative (SCF), is a commercial impact private equity fund that aims to invest in and scale up mid-size climate resilient infrastructure and nature-based solutions. It is a blended finance initiative that aims to invest in and scale mid-sized (USD 5 – 75 million) sub national infrastructure projects in the fields of sustainable energy, waste and sanitation, regenerative agriculture and nature-based solutions in developing countries.

STAGE OF PLAY:



PLAYERS INVOLVED:



De-risking instruments: The risk profile and perception of green-gray infrastructure is higher than conventional gray infrastructure due to the lack of a long-term track record and use of 'novel' technology and therefore projects could benefit from a range of de-risking instruments to improve the risk/return profile for return seeking investors.

Risk-sharing facilities and First Loss Tools: First loss guarantees provide a level of return to improve the comfort levels of commercial investors where there is no track record and limited data. Mirova's Sustainable Ocean Fund has benefited from a risk sharing guarantee through USAID's Development Credit Authority (DCA) that provides loan guarantees directly to portfolio investments made by the Fund.⁶⁷

Insurance: Insurance can de-risk green-gray infrastructure projects to improve the attractiveness of the risk/return profile for investors. This includes the provision of standard insurance covers - such as Construction All Risk cover by Swiss Re for the Prins Hendrik Dyke⁶⁸ – as well as novel covers and political risk insurance. In the case of the Belize Blue Bond for Ocean Conservation (2021), US International Development Finance Corporation issued USD 610 million in political risk insurance that was also tied to the non-performance of environmental outcomes.⁶⁹ Investors have suggested adding the benefit of insurance premium savings to the capital stack on the basis that resilient climate adaptation in brownfield projects should result in a demonstrable reduction in insurance costs. This payment reduction could be similar to an Engineering, Procurement and Construction Contract in building retrofits, but represent a challenge due to investment requirements and the re-evaluation of insurance policies on an annual or maximum three-year basis.

Funding sources need to re-pay costs over time and pay for the longer-term project operation, maintenance, monitoring, and adaptive management.

STAGE OF PLAY:



PLAYERS INVOLVED:



Revenues from service fees & tolls: Service providers can charge a distinct fee for green-gray infrastructure users. For example, some U.S. utilities levy watershed protection fees or surcharges to reinvest in watershed protection measures. A core payment mechanism will transfer commercial risk to the private sponsor of an infrastructure asset enabling the operator to charge customers for services. For example, for the DC Water Bond, the repayment was backed by water rates.⁷⁰ Peru’s drinking water sector made significant policy and financial commitments to contribute to natural infrastructure conservation, complementing conventional funding sources for environmental conservation. In 2017, USD 2.1 million was executed in investments in natural infrastructure for water security and more than USD 30 million of drinking water tariffs collected by water utilities (2014-19) were committed to innovative financing mechanisms for restoring and conserving ecosystem services.⁷¹

STAGE OF PLAY:



PLAYERS INVOLVED:



Property taxes and income from land or property: Where a project, or a portfolio of projects, are predicted to increase economic growth or enhance real property values, cities may increase tax revenue due to the project’s expected economic development benefit. Land value capture includes a range of instruments by which the public sector can capture a proportion of rising land prices to fund large urban infrastructure projects. Investments in water, sanitation and transport infrastructure can lead to increased land and property values nearby. This uplift in value can be used as a source of revenue; but relies on forms of targeted taxation, levies and rates on spatial zones surrounding infrastructure assets in urban locations, including Special District Taxation, Developer Charges and Stamp Duties. For example, in Mexico City, Sistema de Actuación por Cooperación (SAC) Tacubaya utilized the revenues from impact fees and building rights transfers to fund green-gray infrastructure as well as other infrastructure projects such as affordable housing and improved transportation.⁷²

STAGE OF PLAY:



PLAYERS INVOLVED:



High-potential Payment for Ecosystem Services (PES) markets for green-gray include:

Carbon markets: The global voluntary carbon market is expected to grow to USD 20 billion per annum by 2030 compared to under USD 0.3 billion in 2020.⁷³ This remains a nascent and challenging space for green-gray infrastructure projects, but once the market matures and barriers to

entry are reduced, carbon credits could become a more significant and accessible source of funding for longer-term (20-30 year) operating and monitoring costs. However, key challenges for green-gray infrastructure projects will be to generate the scale of carbon credits required to justify the high costs of certification, as well as to adequately distinguish the green-infrastructure from concerns about a project's gray infrastructure component.

Bundled credits: Given these challenges, green-gray infrastructure might be better off exploring the application of new credits that bundle carbon and other ecosystem benefits that are also emerging. For example, the City Forest Credits have developed an 'Impact Certification' that goes beyond carbon benefits to developing science-based metrics and scores for social equity, human health, and environmental impact that is unlocking finance for urban tree-planting programmes.⁷⁴ TNC has partnered with Verra to develop a Blue Carbon and Resilience Credit that is developing the metrics to bundle the carbon and risk reduction of coastal ecosystems.⁷⁵

PES Funds: Fund-based schemes, such as the Latin American water fund (LAWF) schemes (e.g. in Mexico, Colombia, Ecuador, Peru, Dominican Republic, and Brazil), and habitat stamp schemes, (e.g. in US, Canada, and New Zealand) can be financially viable and efficient for large-scale wetland restoration. The US Duck Stamp must be purchased prior to hunting waterfowl, and has restored over 2.4 million hectares of wetlands. Funds are pooled from multiple sources into a trust, managed by trustees tasked with strategically investing in restoration activities that meet the trust's objectives.⁷⁶

Stormwater markets: Credit trading mechanisms (e.g., Washington D.C.'s specific credit for property developer) or mitigation bank (e.g. Maryland State Highway Administration, Delaware Department of Transportation) require runoff retention suppliers and demanders to reduce harmful stormwater runoff according to regulations.⁷⁷ Other examples include incentive creation (not technically open markets) through fees, offsets and layering economic instruments and stormwater taxes. In Washington DC the municipality certifies the stormwater retention credits and sellers are responsible for maintaining the green infrastructure projects, which are subject to inspections. Los Angeles County has instead imposed a USD 0.025 per square foot tax on impervious surface and revenues generated from this tax fund local municipalities, regional watershed areas and program activities⁷⁸.

Wetland-based PES schemes using common asset trusts (CATs) takes the PES bundling schemes one step further and suggest building an investment portfolio of wetlands for overall provision of multiple ecosystem services. While this structure has not been demonstrated to date, CATs can meet the needs of multiple investors, permit bundled payments, and provide flexibility to invest in the restoration of numerous services/values, all using a coordinated, highly collaborative, prioritized, and transparent process. CATs would improve financial viability, facilitate efficiency to reduce administrative burdens, and enable credibility and social license building to restore wetland values and services globally.

Realizing the value of reduced operating and capital expenditures: As the evidence base for the long-term cost reductions that green-gray solutions can provide grows, project developers will be able to quantify that total project cost and related financing costs may be lower than conventional alternatives. Although these are not strictly a funding or financing source, the reduced project cost can decrease both the financing need and longer-term financing costs. In El-Paso, the the International Finance Corporation (IFC) demonstrated the long-term impacts of a green-gray project on reducing ongoing operation and maintenance costs on a road project. The stormwater management project extended repaving needs from every 6 years to every 10 years, thereby significantly reducing operating costs and compounding financing costs over the life of the project.⁷⁹ In the case of the Prins Hendrik Dyke in the Netherlands, the project itself does not generate a cash flow, but the avoided costs of replenishment and reduced maintenance costs of the green-gray solution were high enough to convince the government against the conventional alternative.⁸⁰





Actionable plays and player responsibilities

Green-gray projects represent a widely varying set of characteristics, depending on their size, sector, location and proponents.

Finding the right funding and finance ‘play’ will depend on the policy and regulatory context, level of bankability, risk, project financing structure, and proponents. The ‘plays’ are the tactical maneuvers to structure funding and finance and are determined by the:

- Lifecycle of greenfield or brownfield project and asset type,
- Players - financing and funding sources and stakeholders,
- The geographic market in which the project is situated,
- The regulatory framework that governs the project or the asset.
- The capacity of local entities to implement and sustain the engineered and natural assets.

Infrastructure financing can be either publicly or privately funded or a combination of the two. Starting on the left side of the playing field (Figure 4), balance sheet or budget dependent government funding or grant funding may be the only and most appropriate funding source for projects that are exclusively a public good with limited revenue stacking opportunities, or where it may not lend itself to a public private partnership (PPP) project. Equally, in countries with limited balance sheet capacity and unfavorable enabling environments, both funding and financing options are scarce, making blended and concessional finance crucial.

In countries with a conducive financial enabling environment or in developed country contexts, the options begin to proliferate towards the right of the playing field (Figure 4) with more possibility for private sector players (commercial banks, infrastructure funds), and market sector instruments (e.g., sustainability linked and green bonds, more complex PPP structures, land value capture and insurance products). There are multiple structures and ways to categorize the

project types and many green-gray projects will not fit one clear model, but the plays outlined in this section present a range of options based on the level of risk, innovation and type of proponents and maps these with strategies that generate financial resources and aligned incentives to achieve sustainable outcomes.

The risk profile of a project is impacted by region or by level of innovation risk (Figure 5). For example, there may be a relatively stable regulatory environment, but the project is situated in an emerging market region with latent currency risk, as in Play 2 in Figure 5.

Alternatively, the financial structure may include a new financial instrument which brings innovation risk to the financiers, as in Play 4. Plays in the lower half are riskier to the investor because they are in less mature markets, are testing out new models, new technologies, new financial instruments, etc. and are therefore subjecting investors to increased risk compared to the upper quadrants.

A conducive regulatory and financial enabling environment is key to scale affordable and efficient large scale infrastructure projects.

Markets that are hampered by a lack of experience, shallow financial systems, poor risk rating, lack of regulator preparation for PPPs or concessionaire companies, or that carry significant foreign exchange and political risk cannot foster long term infrastructure project pipelines. Sufficiently mature financial markets are a prerequisite for financial costs to become affordable. Countries that have improved and developed their regulatory and institutional frameworks increase options to meet their need for infrastructure and public services, can draw in private sector, commercial and international banking participation to plug financing gaps, including through public private partnerships. Infrastructure planning and perseverance with regulatory change can allow countries to reach a point where they can obtain low-cost financing in local currency which frees restrictions imposed on foreign financing and reduces foreign exchange risk and costs and can draw in international infrastructure financing banks and increasingly institutional investors (insurance companies and pension funds). Critically for green-gray infrastructure, where PPP models are implemented, the design and evaluation framework defined by the contracting authority must specify or allow for green-gray solutions, and operations and maintenance financing profiles need to also allow for green-gray or nature-based solutions. This may need a new approach to PPP timeframes and debt tenors/maturities/terms to allow for nature-based solutions to really come into play financially.

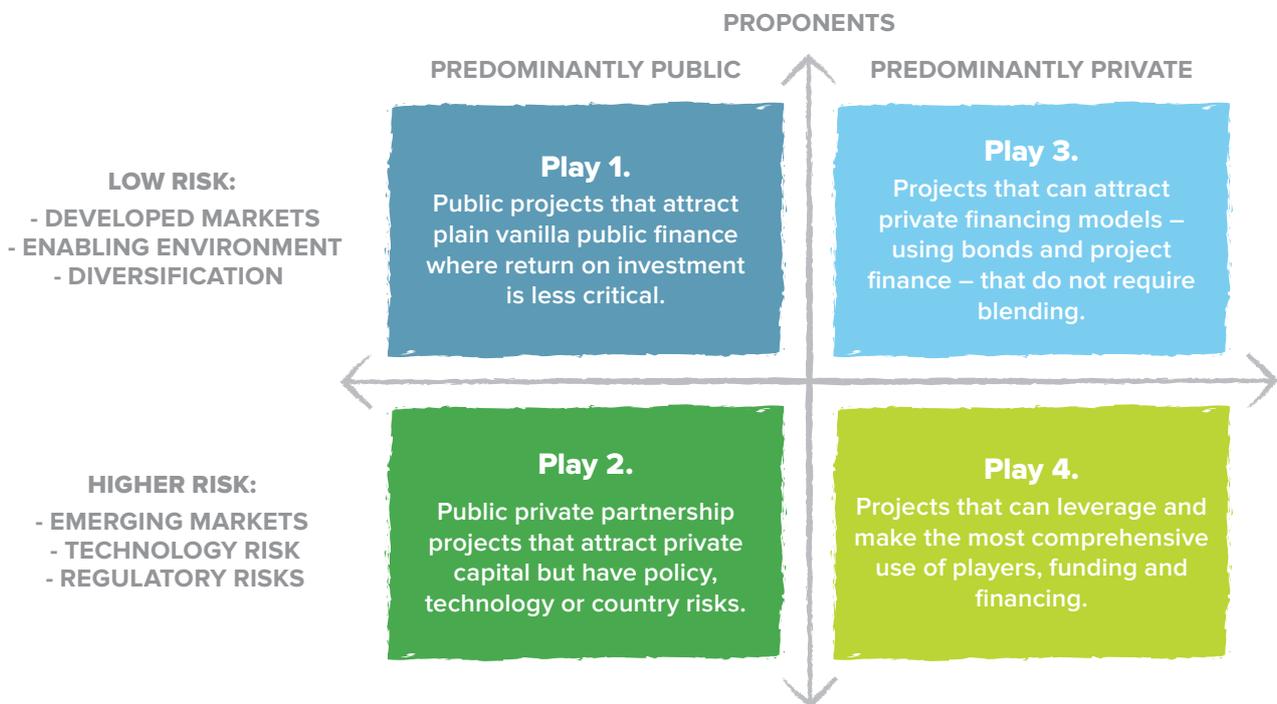


Figure 5: Mapping projects through the lens of risk (low are high) and proponents (public or private) and scale (efficiency, increased capital) as well as incentives for green-gray infrastructure.

Source: Conservation International; and Framework adapted from Conservation Finance Alliance

PLAY 1: LOWER RISK PLAIN VANILLA PLAY FOR PUBLIC PROPONENTS

The 'Plain Vanilla' play is where a project is almost exclusively funded by the public sector (tax revenues, transfers, etc.). They can be financed through existing government budgets, loans or specifically issued bonds (government, municipal, green or other bonds). While the private sector may invest in the municipal bond and bear public sector credit risk, the public sector is ultimately bearing the project risk. Government funding accounts for approximately 85% of all financing for nature and 40% of infrastructure so this will remain a key play. An example of projects directly financed by government budgets include the Miami Morningside Project (through the Miami Forever Bond). This play is not necessarily differentiated for green-gray projects, but public sector entities can (and increasingly do) include incentives for green infrastructure.

When is this play relevant? In large scale infrastructure projects with complex stakeholder engagement in sophisticated markets, characterized by an enabling environment and private sector investor appetite. The project developer is likely to be the public sector, ultimately bearing financing and most other risks.

PLAYERS INVOLVED:



SECTORS:



CHARACTERISTICS THAT DEFINE THE PLAY: Public good projects, developed by public sector players where project return requirements are not key drivers, or where the project must be paid for from government, grant and/or concessional funds (not bankable on a purely project financing basis).

PLAY 1 CASE STUDY. The Netherlands sovereign green bond financed green-gray infrastructure for climate adaptation.⁸¹

- **Green-Gray Infrastructure:** The proceeds of the bond were allocated to climate-related expenditures of which 29% was for climate adaptation water infrastructure, including USD 250 million green-gray infrastructure projects combining sea walls, dikes, wetland riparian buffers and coastal flood defenses. Here, percentage achievement incentives targets were included to increase the implementation of green-gray infrastructure projects.
- **Financing:** USD 6.7 billion in May 2019 20-year AAA rated bond with a 0.50% coupon and ultimate 0.557% maturity rate of return (issuance yield) to a broad range of investors.
- **Funding:** Government tax revenues.
- **Innovation & scalability:** The bond was auctioned-off to pre-qualified institutional and commercial investors who met green criteria. As public sector project developers, the government innovated by ensuring that a portfolio of green-gray projects would be integrated in the construction, implementation, and operational maintenance design and meet the eligibility criteria for certified green bonds. To scale, the Dutch government reopened its bond, raising an additional USD 2 billion in 2021.

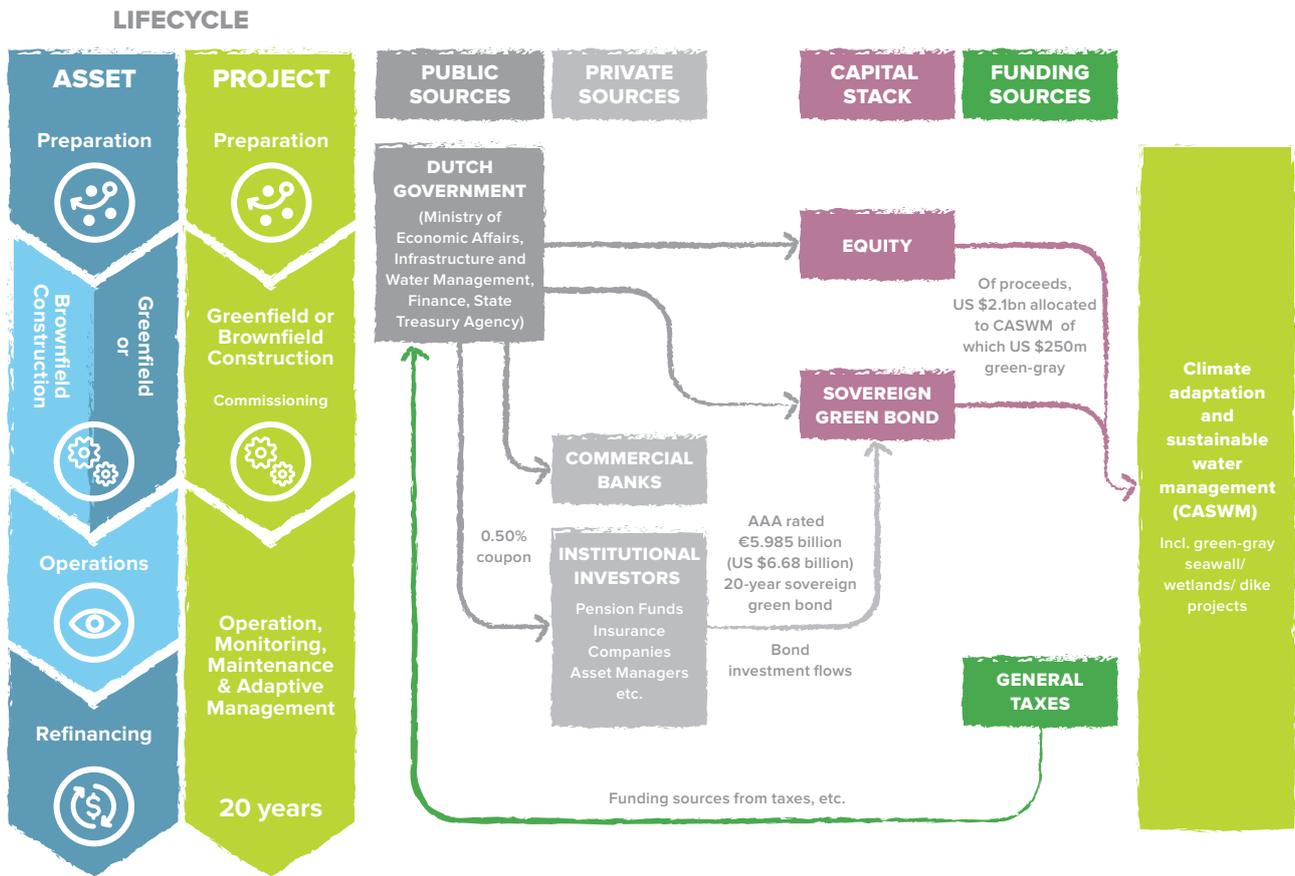


Figure 6: Investment structure for Play 1, lower risk plain vanilla play for public proponents.

PLAY 2: HIGHER RISK PUBLIC PROPONENTS AND PUBLIC PRIVATE PARTNERSHIP (PPP) PROJECTS WITH HIGH RISK THAT ATTRACT PRIVATE CAPITAL

Projects that can attract private finance, need to demonstrate solid revenue stacking and be large enough with adequate risk adjusted returns. Financing is through the project financing structure designed to allocate risk between public and private parties, whereby a special purpose vehicle (SPV) is created, in which the project sponsor invests equity and raises debt from commercial or institutional investors to pay for construction and operation. This is then repaid through ring-fenced (i.e. protected, fully allocated) future cash flows from the project that might derive from toll roads, park fees, user fees, land value capture or even potentially from the sale of carbon credits. These cash flows need to be supported by contractual agreements, such as concessions or offtake agreements.^{82,83}

In this play, private equity financing is leveraged with debt, and private risk allocation – including financing, implementation, and upside risk - is considered from the outset. PPP models are usually chosen based on the cheapest bid. As a result, the green-gray project design would either need to be priced competitively to win outright or the need for a green-gray solution would need to be defined in the request for proposal (RFP) by the contracting authority and reflected in the evaluation framework upfront. Otherwise, the RFP may limit design collaboration and the bidder's ability to push ecological innovation or differentiated green-gray operating/maintenance models in design may be stymied. For example, where the operations and maintenance cost profiles are higher or back-ended,

then this will be reflected adversely in the project returns and net present values compared to a purely gray solution that may need minimal maintenance costs over the life of the project.

When is this play relevant? This play is appropriate where projects are bankable and can attract private capital, and where public proponents want to leverage private capital and allocate and share project risk (technology, etc.). The enabling environment must allow for PPP and similar projects (contractual, regulation, financial) in which case this play can be used across emerging markets.

PLAYERS INVOLVED:



SECTORS:



CHARACTERISTICS THAT DEFINE THE PLAY: Project-financing structures designed to attract private capital in bankable projects (i.e., with expected return on investment) with a public good element, allocating risk between public and private entities. Where green-gray infrastructure introduces technology risks, the public sector support needs to adequately compensate the private sector for sharing this risk.

PLAY 2 CASE STUDY. Public-private partnerships to finance green-gray urban water and waste -water infrastructure in Xiamen Sponge City, China.

- **Green-Gray infrastructure:** Xiamen is improving the filtration, storage, and purification capacity of the drainage pipe network, river channels, and natural water systems to reduce flooding, urban sewage discharge, seawater intrusion, soil salinization, and coastal erosion.⁸⁴

- Funding:** In Xiamen, the central and local government invested a combined 57%, and the private sector – using commercial loans and land value capture from property developers - invested 43% of the total financing across projects. The central and local governments provided a subsidy for design and start-up costs and paid for technical assistance, planning, implementation of a PPP process and for some of the infrastructure (green roofs, permeable pavements, and wetland restoration). This government and grant support was critical in plugging financing and risk gaps to allow for green-gray infrastructure solutions to be demonstrated, replicated and scaled in this scenario.
- Financing:** Through the project financing structure, namely the creation of the special purpose vehicle (SPV), the municipality invests equity into the SPV and raises debt from commercial and institutional investors to pay for construction and operation. This debt is repaid from cash flows into the SPV from the project, namely sponge city purchase service fees. The private sector developer and operator is responsible for the construction and operation of the project and for the financing through the SPV. The ‘Sponge City’ per se is the SPV or the aggregate SPV projects across the Chinese cities that implemented this.
- Innovation & scalability:** The sponge city concept was replicated in 30 cities across China (small, medium, mega cities) in 2014-16.⁸⁵ The scale of the project at USD 21.2 billion total cost, the rapid replication, combined with central government efforts in creating PPP capacity makes this sponge cities project innovative. However, the context (less mature commercial PPP market with significant central and local government funding) is particular to China. While this model could be replicated elsewhere, it would require strong financial government support (technical, financial grants, regulatory approvals, etc.) to implement at the speed and scale that China was successfully able to do.

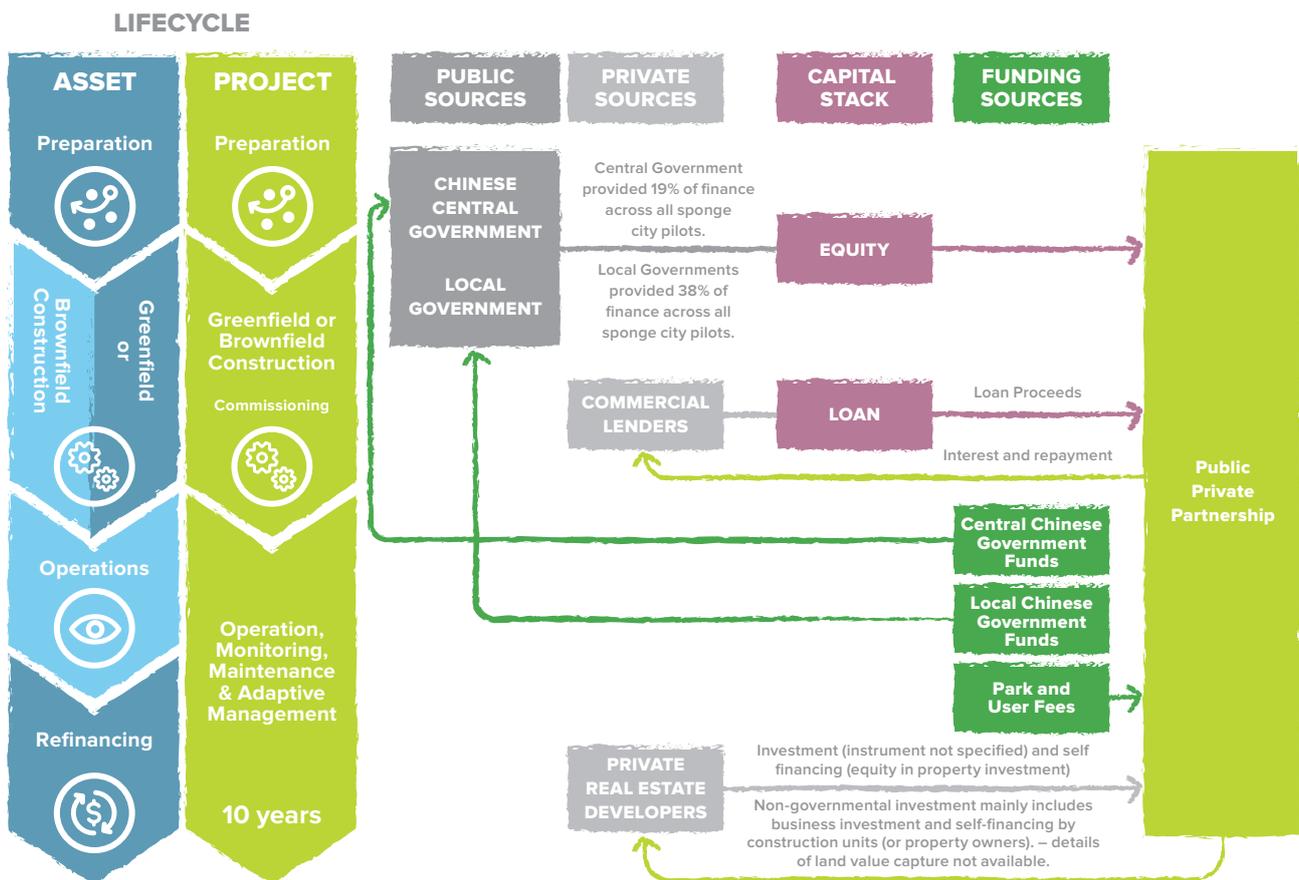


Figure 7: Investment structure for Play 2, higher risk public proponents and public private partnership (PPP) projects with high risk that attract private capital.

PLAY 3: LOW RISK PRIVATE PROJECTS ATTRACTING PRIVATE FINANCE

Projects that are wholly initiated by the private sector and can attract private finance need to demonstrate solid revenue stacking and adequate risk adjusted returns including with - but not necessarily always with blended finance. The difference between Play 3 and the previous Play 2 is that this is wholly private sector driven play, although public sector support in the form of regulatory approval is crucial. The delivery of environmental performance, including emission reduction and climate resilience through green-gray infrastructure can attract philanthropic players that provide design grants or equity for the crucial early stages of feasibility and design work. Revenue and funding streams may include relevant carbon or other credits and cost savings and/or Private Landowners may benefit from land value capture from the project.

When is this play relevant? The Private Sector Developer initiates the project, is responsible for implementation and construction and financing and for repayment.

PLAYERS INVOLVED:



SECTORS:



CHARACTERISTICS THAT DEFINE THE PLAY: Private sector lead project, design and implementation and predominantly private sector; can partly be supported with philanthropic capital.

PLAY 3 CASE STUDY. Anglian Water's Green Bond for rehabilitated wetlands as part of a water infrastructure package.⁸⁶

- **Green-Gray Infrastructure:** The project created a natural wetland to filter the water downstream from the privately held Anglian water utility plant to remove toxic ammonia and other chemicals to protect wildlife habitat and on-site ecosystems and included improvements to the plant and equipment at the water recycling center.
- **Funding model:** Philanthropic grant funding from the Norfolk Rivers Trust funded the early- stage work - feasibility and the design work. Anglian Water financed the project from the green bond proceeds and the company benefitted from future cost savings because of infrastructure improvements and wetlands reducing water and power savings and chemical usage savings. Norfolk Rivers Trust built the wetland and holds the lease on the site and is responsible for the maintenance under a 20-year agreement.
- **Financing model:** The project accounted for GBP 500,000 (USD 625,000) financed out of Anglian Water's GBP 250 million (USD 312 million) 8-year green bond with an annual fixed-rate yield of 1.6% to Commercial Banks and Institutional Investors.
- **Innovation & scalability:** This 2020 financing was part of the first water utility green bond in Europe, financing the implementation of green-gray activities that lower production costs to the utility through infrastructure improvements and the construction of the wetland. It was scaled in mid-2021, when Anglian launched a framework to issue net-zero based green bonds aligned to new carbon targets. While the green bonds are not exclusively nor explicitly ear-marked for green-gray infrastructure, the company has committed to continue to invest the proceeds into capital investment that will ensure future in the face of climate change.

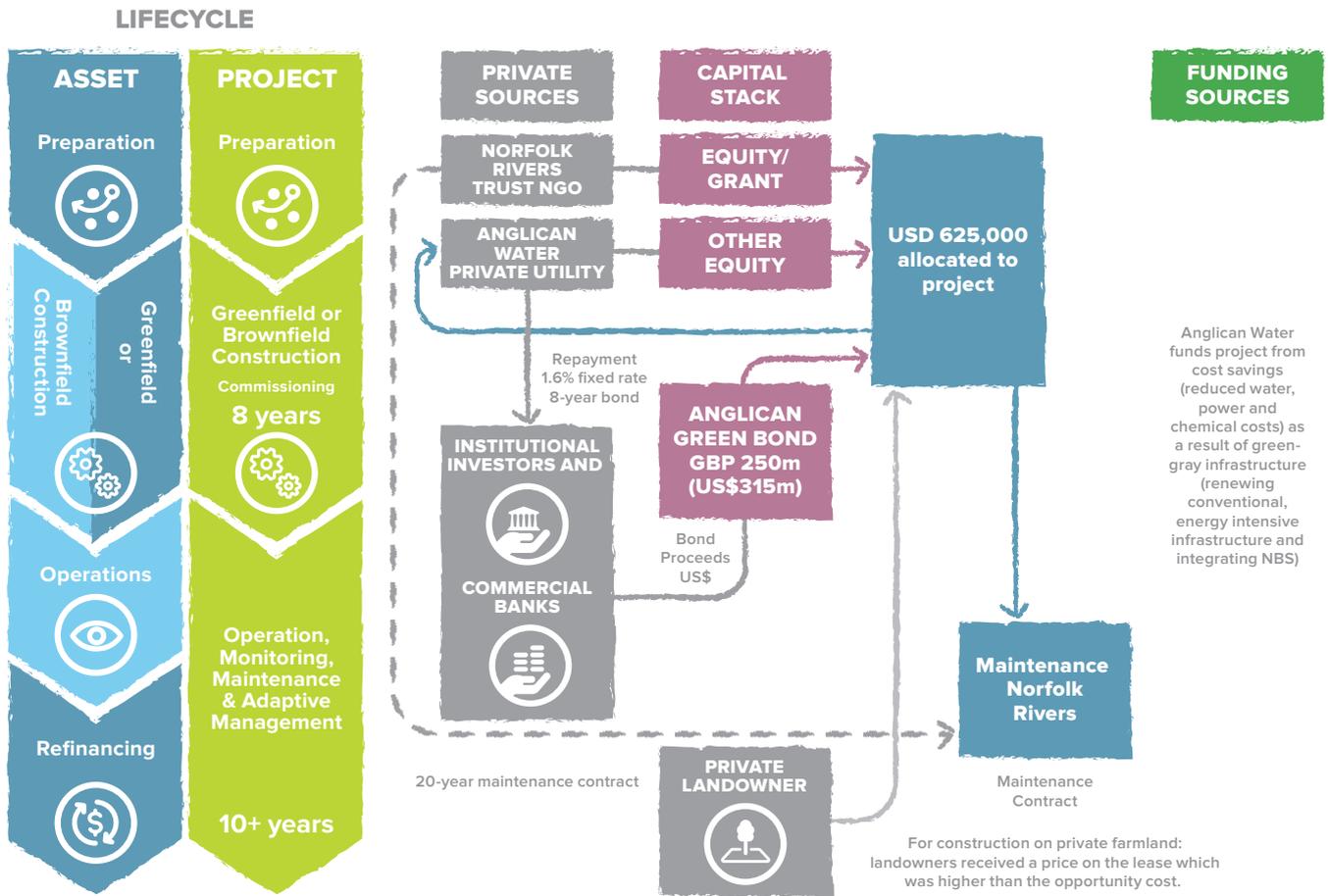


Figure 8: Investment structure for Play 3, low risk private projects attracting private finance.

PLAY 4. HIGH RISK PRIVATE AND/OR PUBLIC PROJECTS LEVERAGING DESIGN AND FINANCE INNOVATION

Like in the previous Play 3, Projects in Play 4 is in a deal conducive enabling environment, can be initiated by the private sector, can attract private finance and needs to demonstrate revenue stacking and adequate risk adjusted returns including with - but not necessarily always with blended finance. Equally, revenue and financing can be stacked with environmental performance, emission reduction and climate resilience through green-gray infrastructure to attract philanthropic grants for the design work and revenue can include carbon or other credits and cost savings and/or land value capture. The difference between this Play 4 and all others is that Play 4 pushes the boundaries by introducing innovation risk to financiers in the form of the financing deal structure, experimental financial instruments, and structuring this around a green-gray infrastructure project. While Play 4 drives financial efficiency and scale, it has to be balanced by the increased complexity that novelty and innovation introduces, and this may be compounded by the fact that today, green-gray infrastructure may still be considered innovative to the un-initiated investor. As green-gray becomes more prevalent over time, this Play 4 is likely to increase across other sectors, but is currently well tested in municipal utility and stormwater deals.

When is this play relevant? Projects in established markets should consider this play, where they can utilize the full range of players and instruments to optimize financing. Novel funding streams, which introduce innovation risk

to the financiers could be tested, including carbon credits and land value capture. This play can also integrate blended finance that can demonstrate adequate returns to private sector players where policy technology and other risks are higher. This play can be relevant where projects have enabling environments that allow for innovation with financial instruments as well as the sophistication and capacity to implement, monitor and maintain the financing terms. For example, outcome-based instruments could help to drive higher transparency and effectiveness to project participants.

PLAYERS INVOLVED:



SECTORS:



CHARACTERISTICS THAT DEFINE THE PLAY: Most comprehensive use of players, instruments and financing across the playing field in enabling environments conducive to innovation; can attract grants through innovations, range of debt instruments and leverage capital markets and private players to innovate on instruments. This Play 4 maximizes capital available to be deployed across the board and increases efficiency in the financing by leveraging the cheapest instruments.

PLAY 4 CASE STUDY. DC Water, Environmental Impact Bond for green-gray stormwater infrastructure.⁸⁷

- **Green-gray infrastructure:** Introduction of nature-based solution projects replaced the performance gains of the originally planned pipeline to channel stormwater runoff to the water treatment facility. It improved water quality, reduced burden on water treatment, and mitigated flooding among other benefits.
- **Funding model:** The project costs and bond are repaid from DC Water utility water fees.

- Financing model:** DC Water issued a 30-year, USD 25 million municipal environmental impact bond in 2016 with an initial 3.43% coupon (semi-annually for 5 years) after which, a USD 3.3 million contingent results-based payment is made to either investors or DC Water based on performance. Specifically, investors received a premium for overperformance and received less for underperformance, thus partially shifting the risk of the new nature-based approaches from DC Water to the investors. In 2021 at the 5-year mark, DC Water made mandatory tender and full repayment of the Environmental Impact Bond (EIB), following a robust evaluation of the project outcomes that confirmed the green-gray projects had reduced runoff into Rock Creek by nearly 20%.⁸⁸
- Innovation & scalability:** This project also created a funding model for other water authorities allowing for scale and to attract private capital to finance innovative stormwater management solution – to date was replicated in the US cities (Atlanta, Georgia and Hampton, Virginia) and has not yet been replicated outside the US, although it could be, subject to regulatory alignment. The model provides investors with a clear financial stake in the performance of the project and improves the sustainability of finance over the duration of the project while demonstrating the business case for innovative water management solutions. To scale, a further green-gray approach will be implemented in DC which lowers capital costs as compared to the all-gray or all-green alternatives and will be implemented by 2030.⁸⁹

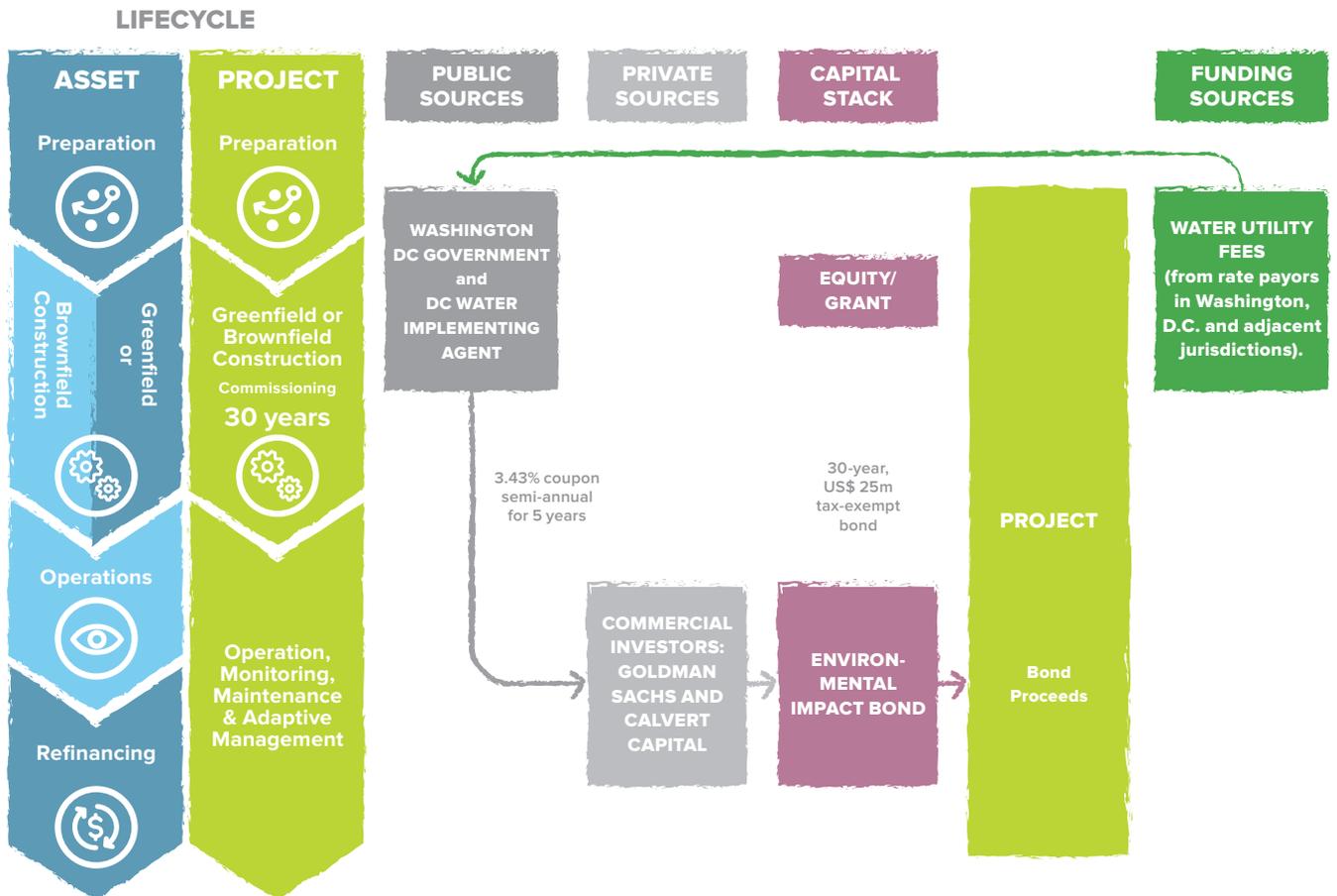


Figure 9. Investment structure for Play 4, high risk private and/or public projects leveraging design and finance innovation.



Closing gaps in the infrastructure market: Barriers and opportunities to scale finance for green-gray infrastructure

Compared to the larger infrastructure market, a relatively small number of green-gray projects have been financed and reached construction and implementation phases. Integrating green into gray infrastructure and scaling green-gray infrastructure will require project developers and investors to overcome key policy, technical and finance challenges.⁹⁰

A survey and engagement stakeholders with first-hand experience in developing and implementing green-gray infrastructure was conducted to identify where practitioners see the key barriers and needs in relation to funding and finance. Out of a total of 23 respondents, more than three-quarters of had direct experience implementing

infrastructure projects, with the majority in the water and wastewater sector, underlining the dominance of this sector for green-gray solutions. The survey was supplemented with the engagement of over 50 key green-gray infrastructure stakeholders to understand the full suite of challenges and opportunities for scaling green-gray infrastructure.

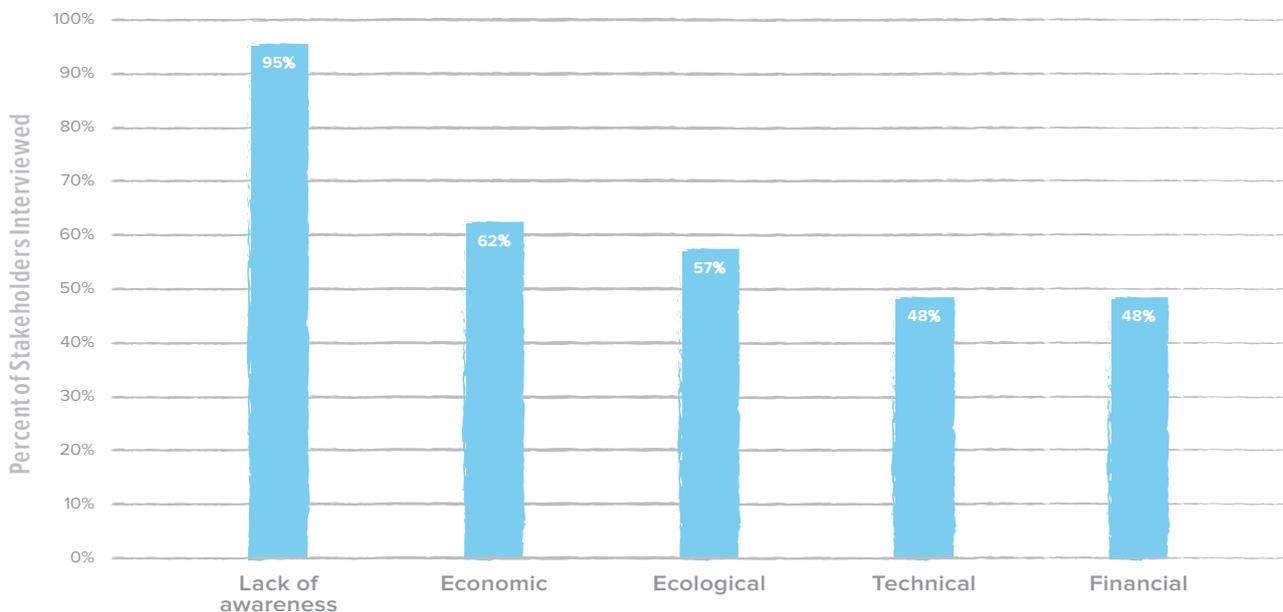


Figure 10. Barriers to bankable green-gray projects, according to green-gray infrastructure practitioners and other stakeholders.



Green-gray and nature-based engineering approaches are still sometimes seen as ‘unproven’ and ‘novel’ methods. A lack of awareness, knowledge, and capacity across developers and financial institutions was cited as the key barrier to scaling green-gray infrastructure. Despite a growing number of projects, the integration of green infrastructure components and their benefits into conventional hard engineering approaches are still seen as riskier and lacking an evidence-base. Furthermore, existing engineering standards do not generally reflect the growing body of evidence from green-gray projects, hampering uptake of these designs in the mainstream.⁹¹ More knowledge of green-gray infrastructure solutions as well as the opportunity to rethink existing conventional gray infrastructure from a green-gray perspective is a priority. The integration of ecological components also adds complexity and uncertainty, leading to perceived technology risks. For example, a number of stakeholders highlighted the need for engineering guidance to be adapted for green-gray for the highly conservative and regulated construction sector. The green-gray life-cycle cost is also perceived as being less certain, despite an increasing body of evidence demonstrating reduced capital and operating expenditure over the lifetime of the asset.^{92,93}



Economic barriers remain considerable, both to assess relative cost-benefit of green-gray and identify revenue-generation. Building the business case for green-gray solutions requires the accurate pricing of services provided and that engineers move from traditional cost-benefit analyses to approaches that integrate a wide range of social and environmental co-benefits (e.g., technical-economic analysis, financial appraisal, environmental valuation, and triple-bottom-line cost-benefit analysis).⁹⁴ However, developers might be required to use more conventional analyses by the government or project proponent. Where wider analyses are permitted, there may still be challenges in linking green-gray project beneficiaries and benefits to specific funding sources or accruing additional co-benefits to the project implementer in the absence of appropriate regulatory frameworks.⁹⁵ Identifying parties who benefit from the relevant ecosystem services and are willing to pay is time-consuming and requires broad stakeholder engagement. Many of these benefits, such as climate resilience in flood defense systems, are also challenging for revenue generation.⁹⁶

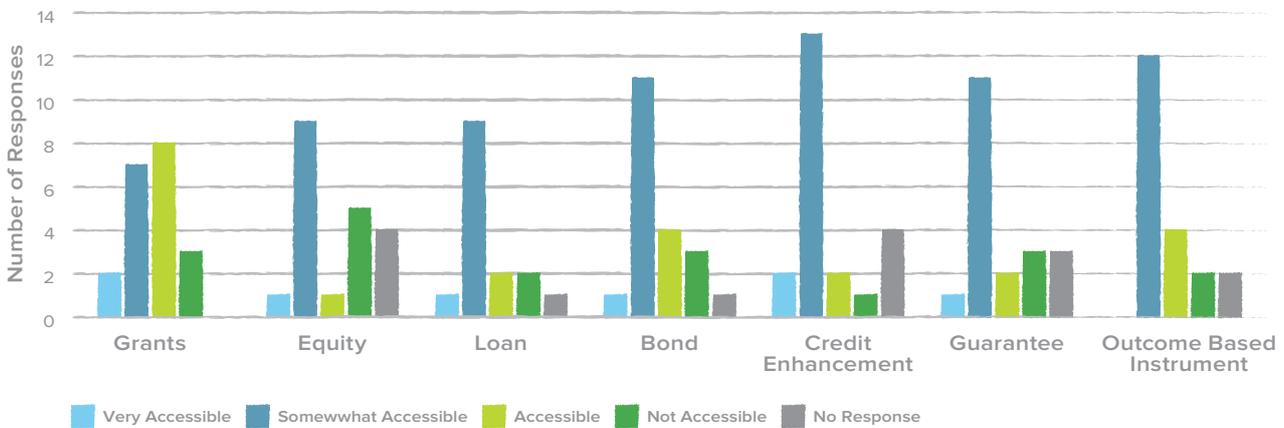


Figure 11: Access to green-gray finance by instrument.⁵

5 **EXPLANATION:** Grants (philanthropic grants, development grants, government grants); Equity and Mezzanine Capital (e.g. shares, convertible loans, sub-ordinated loans); Loans (e.g. concessional loans, commercial loans, syndicated project loans, securitized loans); Bonds (e.g. project bonds, corporate bonds, municipal bonds, sub-sovereign bonds); Credit enhancements by government/agency/development bank (e.g. in case of refinancing, default, exchange rate and political risk guarantees); Guarantees and Warranties by commercial parties (e.g. wrap insurance, warranties, commercial risk insurance); Outcomes-based instruments (Environmental Impact Bonds, Sustainability-linked loans).



Catalytic financing at the early stages is hardest to access, but crucial. Financial barriers that included risks (off take, counterparty, currency, or liquidity), user demand, and ability to pay were acknowledged, but not prioritized as a main barrier. This suggests that financing per se is not seen as an insurmountable obstacle to scaling green-gray infrastructure, but that many of the other challenges cited limit the ability to attract the type of finance that is needed. 93% of respondents stated that the planning and design/early stages were the hardest to access financing for, followed by early operations (36%). Greenfield construction

projects are considered more difficult to finance due to the increased risks and greater unknowns, which are somewhat mitigated in brownfield projects. In terms of specific instruments, respondents stated that most instruments are accessible, although equity and mezzanine debt were considered the most difficult to access. Grant finance is seen as instrumental to cover technical assistance for robust project preparation (technical studies, site selection, even pilot projects for proof of concept) and vital de-risking when conventional investors deem the risk to be too high, by increasing returns, crowding in investors, and plugging the gap in government funds. However, grants are naturally limited in scope and a much smaller source of finance than is needed to kick-start large-scale infrastructure projects.

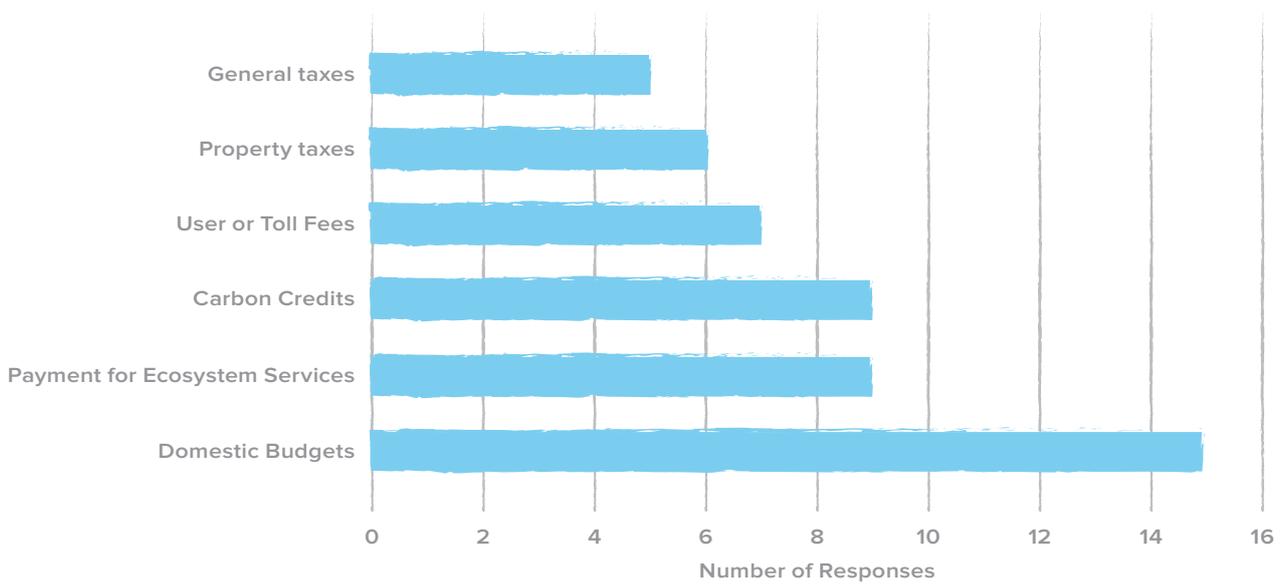


Figure 12: Sources used to fund successful bankable green-gray infrastructure projects



Perceived risks remain high and as a result most projects rely on grants and public resources to get off the ground.

Given the challenges listed, green-gray projects may not carry high enough risk-adjusted rates of returns to attract private-sector equity or debt, or the costs and risks are likely to be insufficiently allocated across investors or not quantified at an acceptable level to build investor confidence. There has been growing interest in the role that carbon credits could provide for meeting long-term operating and maintenance costs for green infrastructure components – but these can also take a long time to kick in and require additional budget to certify and verify. In addition, green-gray benefits are characterized by inherent ecological uncertainty, are not easily predicted, and sometimes require more time to reach full functionality than gray infrastructure. This can affect setting an iron-clad payment schedule among beneficiaries and can also take years for benefits to accrue.⁹⁷

Green-gray projects require additional dialogue and collaboration across specialists, communities, municipal departments, sectors and jurisdictions – driving up transaction costs.

This added complexity increases costs and the need for additional capacity to develop partnerships prior to the project being ‘shovel ready’. Interacting with multiple local landowners and communities is more time intensive and can require specialist skills that sit in the non-governmental or community organization domain. It can also require government departments and agencies to apply for different department’s budgets, or plan and spend money outside their jurisdictions in line with ecological rather than jurisdictional boundaries.⁹⁸ At the same time, pilots are fundamental to building confidence within the financial sector, as they are evidence of the technical feasibility and cost-effectiveness of green-gray approaches. However, many green-gray pilots are not yet at sufficient investment size to generate economies of scale (unless bundled together) or require specific tailored financing structures that also increases transaction times and costs for investors providing finance.⁹⁹



Policy and institutional gaps in emerging markets limit the ability to diversify finance in regions where it is most needed.

This includes the absence of coherent and trusted legal frameworks; higher political and regulatory risk in countries with unstable regimes and/or high corruption levels; and limited institutional capacities and inadequate governance mechanisms – increase country and political risk. This can drive up costs as investors seek higher returns to compensate for the risks. Investors that are willing to take on increased perceived risk are therefore more likely to want higher returns as compensation. The lack of systematic data collection and data sharing on green-gray projects at regional and national levels does not address the risk perception and inhibits planning and investment.¹⁰⁰



Prepping the field: Funding and finance tactics to develop green-gray projects

Catalyzing a green-gray infrastructure project pipeline is at the core of Conservation International’s mission to accelerate uptake globally. Projects in development range from eleven green-gray project concept designs for coastal municipalities in the Philippines, to the planning and piloting of mangrove restoration coupled with the sustainable intensification of aquaculture in Indonesia, Ecuador, and the Philippines.

These projects all represent different levels of risk, potential funding sources, locations, and sizes. In cases where a project could be bankable, there are considerable benefits to diversifying the capital stack for a project’s long-term financing needs. Here we explore the development of a hypothetical model for two projects from Conservation International’s green-gray infrastructure portfolio, in Colombia and Guyana, to reflect on the enabling conditions necessary for catalyzing green-gray infrastructure projects and to highlight barriers covered elsewhere throughout this Playbook.

Guyana is in early-design and scoping phases and Colombia’s government has transport concessions issued that are not aligned in scope with the study presented here. These studies here have been created for illustrative purposes to apply this playbook’s capital stacking process to specific scenarios. Running through this process helps to demonstrate how the Plays can be applied, model what the capital stack could be, and highlight potential funding gaps that would be required grants and concessional finance.



“Gray” coastal protection efforts on the Barranquilla-Santa Marta Highway, Colombia (source: Conservation International)

Table 2. Cost categories and quantifiable values and metrics for green-gray infrastructure.

Cost & value category	Description	Green-Gray Infrastructure		
		Potential additional costs / time	Quantifiable value areas	Metric (e.g., to track & build into financial model)
Project preparation	Cost of planning, engineering, permitting, E&S assessments.	Additional analysis, design work - First costing / life-cycle costs / mainstream off-takers that will buy up potential future income streams - transfer risks.	- Goodwill value / brand IP - Improved stakeholder engagement to reduce land conflict / reduce opportunity cost	- Reduced costs from local community conflicts (USD/year) - Reduced regulatory costs (permitting, fines) (USD/year) - Reduced remediation costs (cost benefit ratio of mangrove restoration v other remediation options) (USD/year)
Capital	Cost of civil works, equipment, land, other capital up-front investments	Higher land costs, increased insurance costs. (higher upfront, but efficiencies down the road); opportunity costs of greater land take	- Reduced CAPEX (Project Proponent) Lower civil works and equipment costs (upfront CAPEX). - More land involved also means potential greater Value Capture from land development / tourism/ concession revenue	- Reduced CAPEX infrastructure construction (USD) - Increase in land value (USD)
Financing	Service charges, interest payments due to borrowed funds	Additional cost to quantify Environmental & Social performance metrics	- Increased pipeline of projects - Improved financing terms and rates linked to sustainability performance. - Lower cost of finance - Improved access to green finance markets - Increase in mitigated damages (insurance costs)	- Pipeline project number and USD aggregate size (greening of portfolio) - Improved access to international capital (by meeting international investment E&S performance standards) - Terms of finance (interest rates)
Operation & Maintenance	Labor, fuel, equipment, civil works maintenance	Different expertise (ecological systems) Recurrent payments to landowners Restoration / maintenance costs of ecosystems.	- Reduced operational and maintenance costs over the project life & extended project lifespan (e.g. reduced erosion and damage repair, reduce siltation, improved water quality). - Increased jobs and local income. - Carbon sequestration. - Improved air quality, human health, temperatures, food security, water security. Improved stock and yields (fish, agro-forestry products, etc). - Mainstream off-takers - Cost reductions from technology adoption, both hard tech, and data-driven and software-driven cost reduction in implementation	- Reduced OPEX infrastructure maintenance (USD/year) - CO ₂ emissions avoided, reduced, removed (MgCO ₂ /year) - Value of carbon offsets generated (USD) - Increase in sustainable production premium (USD/year) - Increase in local community income and value of product (No. of people / income growth) Number of local jobs and enterprises created

CASE STUDY 1: GREEN-GRAY ROAD DEVELOPMENT IN COLOMBIA: THE CIÉNEGA GRANDE DE SANTA MARTA

The Barranquilla-Santa Marta highway is one of the most economically and culturally significant transportation corridors along the Caribbean coast of Colombia. The highway crosses the Ciénega Grande de Santa Marta, the largest coastal wetland system in the Colombian Caribbean, where mangrove forests are the dominant vegetation and

home to a variety of fauna and flora, including commercial fish species on which more than 3,500 fishers depend.¹⁰¹ Between 1956 and 1996 mangrove coverage in the Ciénega Grande de Santa Marta reduced from 500 km² to 226 km² due in part to the construction of the highway. The Colombian government is publicly tendering several projects through concessions to refurbish and expand the highway in response to increased traffic demands and coastal erosion. Conventional ‘gray’ infrastructure approaches are being proposed, including the use of road widening, seawalls, and breakwaters.⁶ Conservation International worked with Invemar, Padilla Engineers, Autocase, and other local partners to compare a conventional gray design to a green-gray design alternative.



Figure 13. The Barranquilla-Santa Marta in the Ciénega Grande de Santa Marta (Source: Conservation International).

6 **CLARIFICATION:** Sections of this highway is in the process of being tendered by Colombia and that this analysis was done without any reference to the winning bidder for any of the concessions (status June 2022).

Key stakeholders: National Ministry of Transportation, National Institute of Concessions (INCO), National Roads Institute (INVIAS), National Department of Planning (DNP), Ministries of Transportation, Finance and Public Credit and Environment.



Existing financial and regulatory environment: Since 2010, the Colombian government has made institutional changes and regulatory reforms which have led to achieving

OECD membership in April 2020,¹⁰² and stimulating more ambitious growth in the infrastructure sector with multiple (PPP) road concessions.¹⁰³ Colombia has the most conducive PPP enabling environments for infrastructure financing in Latin America, placing it in the mature, private sector poised quadrant of the playing field. The Rumichaca-Pasto Highway concession, for example, is due to be financed by a broad range of local and international financial institutions in both US and Colombian currency and includes a social bond of over USD 250 million. Colombia also has a track record of green-gray infrastructure projects. Nonetheless, as the outputs of this analysis will show, while the current environment is conducive to PPPs, there are still improvements to be made to procurement, framework, structure and tenor of procured projects to be conducive to green-gray infrastructure projects ([see map](#)).

Table 3. Financial Model Assumptions, comparing Green-Gray and Gray Only Solution Values for Developing a Road in the Ciénaga Grande de Santa Marta, Colombia.

Categories	Green-Gray Solution Values	Gray Only Solution Values
Project Scope	The green-gray infrastructure alternative covers 43km of road, but calls for the use of both conventional and porous embankments, additional short viaducts located where historic channels existed, and wildlife crossings. Coastal erosion issues are addressed with a road alignment modification, the restoration of the protective mangrove belt, and specific coastal protection elements (engineered sand dunes)	The gray design is based exclusively on conventional civil engineering practices and plans for the same stretch of road improvements over 43 km of roadway using conventional embankments as well as the use of viaducts, rock revetments, and other built infrastructure in sensitive areas to reduce coastal erosion
Capital Expenditure	USD 218 million	USD 404 million
Project development. Including carbon project development costs (design document, verification and certification costs) and up-front financing costs	USD 5.8 million	USD 5.8 million
Total	USD 220 million	USD 410 million
Operating and Maintenance Expenditure	USD 8,7 million per annum (4% of Capex)	USD 16 million per annum (4% of Capex)
Concession Term	25 years	25 years
Equity and Grant	30% of financing USD 66 million	30% of financing USD 123 million
Debt	70 % of financing USD 154 million	70 % of financing USD 287 million
Senior Debt Interest Rate	6%	6%
Senior Debt Term	20 Years, equal annual repayments	20 Years, equal annual repayments
Project IRR Target, calculated based on Toll Revenues generated	12%	12%
Inflation	3.5%	3.5%
Net Present Value	USD 7.6 million (discounted by inflation)	USD 18 million (discounted by inflation)
Annual shadow toll ⁷ from government required to cover costs (nominal 2022)	USD 20.5 million	USD 38,7 million

7 A shadow toll is a per car fee payment made by a government to the private operator based on traffic (projections and actual counts). These fees are paid directly to the company without any fees collected from the drivers (users) of the road

Financial model assumptions: The analysis builds on the original model built by Autocase, to simulate a very simple PPP project financing model based on the revenues and costs related to the green-gray infrastructure project proposed. **In this, the green-gray capital and annual operating cost assumptions were approximately half the cost of that estimated for the purely gray solution.** The model assumes that most funding will come from a hypothetical shadow toll⁸ revenue from the Colombia Toll Road PPP Programs (the 4G and 5G Toll Road Programs). In addition, it explores potential ecosystem service revenues such as revenues from mangrove carbon credits, fishery fees, shellfishery fees, apiculture fees, and eco-tourism park fees, all with potential to reduce the potential toll.

Revenue streams: 99.9% of the revenues derive from the toll fees, while the revenues from ecosystem services are negligible. Mangrove carbon credits, for example, based on regeneration and growth of the 35,000 hectares of mangroves only provide significant financial benefits well after the concession agreement of 25 years is over, and therefore cannot materially contribute to funding streams for the concession itself. This is partially because active mangrove replating is not permitted in Colombia and mangrove rehabilitation is based solely on natural regeneration. Revenues from other ecosystem services are financially negligible in the context of a PPP scenario.

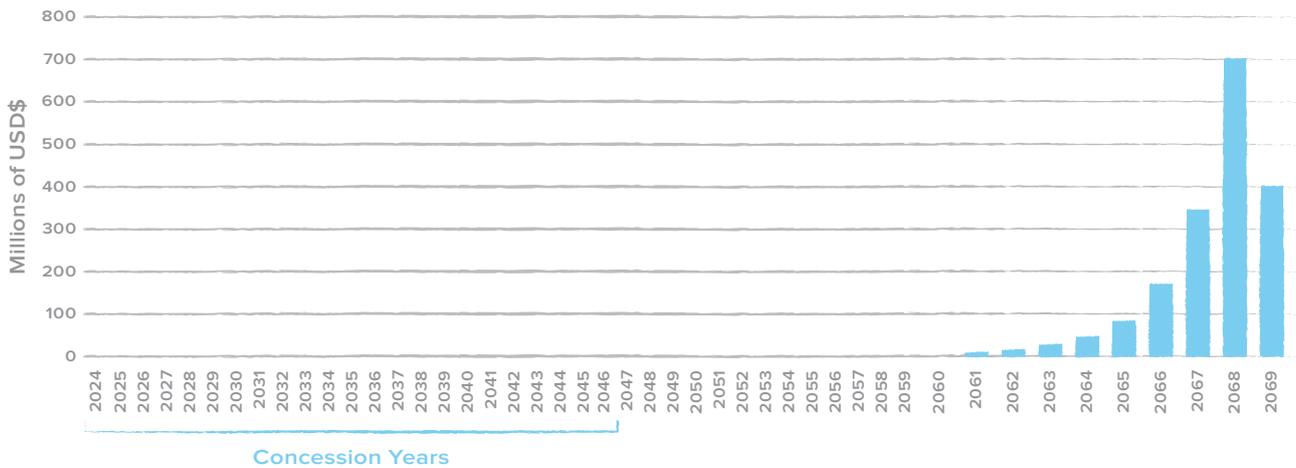


Figure 14. Development of cash flows from mangrove credits in the Ciénaga Grande de Santa Marta.

Financing and funding structure: Equity (30% of financing) is assumed to be project sponsor equity and a notional slice of philanthropy capital to support a green-gray design where these design costs are larger than a purely gray solution. Debt (70% of financing) is assumed to be raised from commercial financing institutions at competitive market rates and can draw broad syndicated participation. MDBs could also offer both risk and currency guarantee instruments to a project of this profile and magnitude. The repayment of debt and equity return requirements in the model is almost exclusively from the toll revenues with negligible revenue from ecosystem services. There is a mismatch in the timing of when additional ecosystem revenues can drive revenues and the tenor of debt and concession period. This scenario highlights a real-case option for green-gray infrastructure, even where the structural PPP environment does not accommodate and promote this solution explicitly.

8 See shadow toll road

Challenges of this scenario: In this scenario, the green-gray solution is substantially cheaper than the gray only design in both capex and opex and therefore also in cumulative financing costs over the period of the concession. However, the tendering process and structure (e.g. timelines, design solutions, evaluation criteria) are not currently conducive to, prioritizing, or incentivizing the use of green-gray solutions, despite the clear cost-effectives, let alone other climate, social and environmental benefits. The challenges is exacerbated by a lack of awareness among developers and RFP evaluators, a perceived lack of evidence and data to support a green-gray design solution, and preference for a gray only solution based on the developer’s expertise and incentives. Addressing these gaps and barriers is possible but requires further regulatory and institutional changes and better alignment between Players.

1. The singular focus on market-based valuations for the PPP, such as price of goods or services, that does not allow for avoided cost of damages from future climate change, replacement or substitute costs, restoration costs, nor allow for appropriate ecosystem pricing (e.g. biodiversity) or any other positive externalities that cannot be monetized. An overhaul of the bidding and negotiation processes and design criteria is needed to include incentives to improve the longer-term sustainability and climate smart adaptation principles.
2. The evaluation criteria of PPP and similar public-private constructs needs to not be based primarily on cost/price, which drives a culture of a race to the bottom both in cost but potentially also in innovation of design by the bidding partners. Predefined design scopes and financial evaluation design criteria should also be amended to accommodate projects with lower capex but higher, flexible operation and maintenance costs (Internal rate of returns (IRR) calculations that discount high upfront capex costs but where later maintenance costs impact Net Present Values (NPVs) and IRRs).
3. Designing the physical scope of a concession to relate to the environment and climate challenges a green-gray solution can solve for, instead of scoping the concession according to jurisdiction, maps and boundaries alone. Here, the key is scoping a concession for the income generating asset but also for example for an appropriate scale for a mangrove forest, to maximize coastal protection.
4. An incongruence between concession timelines and the time required to maximize the returns from quantifiable and marketable ecosystem services (e.g., mangrove carbon credits) to drive financial profitability. Extending the concession period could help to account for the avoided cost of damages from future floods, storm surges, or hurricanes provided by ecosystems like mangroves, in addition to providing a carbon sequestration sink over time.
5. Improved alignment in objectives, budgets and priorities between government and institutional bodies (e.g. environment, regional, transport, etc.).



“Gray” coastal protection efforts in Danzig, Guyana (source: Conservation International)

CASE STUDY 2: GREEN-GRAY COASTAL DEFENSE IN GUYANA

90% of Guyana's 800,000 population live along the 459 km (285 mile) long Atlantic coastline. In 2005, flooding devastated Guyana and in 2010 Guyana's Forestry Commission (GFC) issued a National Mangrove Plan to assure the protection of the country's 20,000 hectares of mangrove forest.¹⁰⁴ To protect the country from climate-change related flooding Conservation International has explored green-gray infrastructure solutions combining mangrove planting, restoration, sediment trapping, breakwaters, and concrete seawalls, and with Deltares in 2022 developed [Engineering Guidance for combined Mangrove and Seawall coastal protection projects](#) in the country.

The financial enabling environment in Guyana is immature compared to the previous example in Colombia. Interest rates on capital loans are high, typically 15% and foreign investors require ministerial permission to borrow more than USD 10,000 from a local bank. The government funds itself primarily with short-term (1 year) debt instruments, limiting the private sector to price longer-term debt for non-government entities. There is no private bond market in Guyana. Given the lack of commercial finance at scale for infrastructure projects in a public-private play in this scenario, it means that financing will rely heavily on MDB concessional debt. Guyana may soon graduate from eligibility for concessional financing owing to rising income levels linked to oil discoveries, and MDBs working with the government see deepening the domestic credit market by expanding the scope of instruments. Further, Guyana has developed

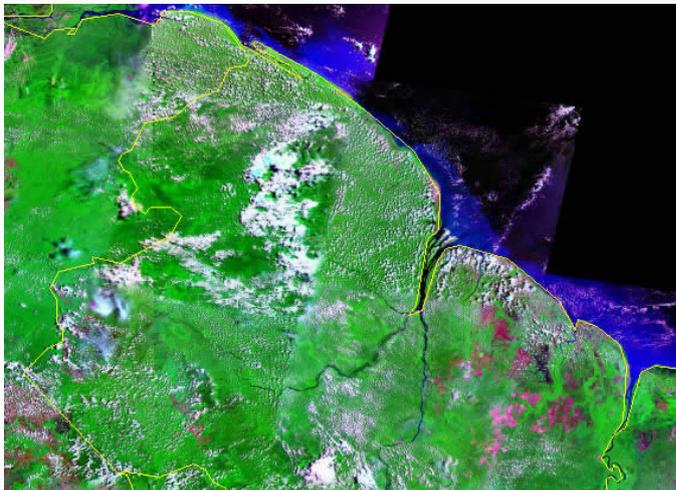


Figure 15: Satellite Image of Guyana's 460km Atlantic Coastline. Source: Geology.com

In this scenario, for a country-wide green-gray coastal protection strategy we assumed USD 80 million for capex and development and an annual operating cost of USD 4.5 million per annum (6% of capex), financed with equity (25% from philanthropy, MDBs and government grants) and concessional debt (75%). Of the debt, only 5% can be assumed to be from local commercial debt funding; 70% from MDB concessional debt, given the financial enabling environment.

The funding to repay debt of any major project in Guyana would need to come from either purely government pockets (budget, taxes, etc.) or in combination with sources such as philanthropy and multilateral finance. Guyana has seen a track-record of mangrove or forest restoration projects funded by development partners (e.g. the European Investment Bank USD 5.5 million, Norwegian Government USD 100 million) and strong NGO support and it is likely that these would be the first key sources. Revenue stacking strategies such as commercial toll revenues cannot be structured to cover project costs given the affordability gap of local road users and additional revenue streams from ecosystem services (such as fishing etc.) are likely to be low, albeit provide important and positive externalities such as increased and sustained fishing stocks, improved survival or a healthy biodiversity, fishery revenues, increased income for local livelihoods and promotion of local nature based industries are ignored.¹⁰⁵ This scenario highlights where the need for and suitability of green-gray solutions is high and ecosystem incremental benefits are likely, but where revenue stacking is challenging, made more difficult due to a lack of financing options.

a Low Carbon Development Strategy, which takes the environment into account in its plans and includes restoration of mangroves and social projects. Green bonds are acknowledged as a suitable potential source of financing further down the line, consistent with both financial sector development and a socially, environmentally responsible development strategy. Before these financing instruments can be considered, the enabling environment will need to be addressed and this takes time. For example, the transformation of the financial enabling environment in Colombia took course over ten years.





Strategies to accelerate the growth of green-gray infrastructure finance

As green-gray infrastructure projects demonstrate their cost-effectiveness, resilience, and diversify revenue streams, projects will gradually shift from grant and public finance to commercial finance that expect a greater focus on risk-adjusted returns. Achieving this transition will require improvements to the enabling environment, proving the case of individual projects, and gradually building project developer and investor confidence in order to mainstream green-gray infrastructure into the engineering and infrastructure finance world.

At the country and project level, solutions are needed to improve the enabling environment, capacity, business case and finance for specific project in order to move from the demonstration and individual ‘pilot’ phase of green-gray infrastructure. Today, the green-gray market is characterized by a lack of long-term track record, a range of unique pilot projects, a limited set of financing solutions, and a lack of consistent KPIs and data that could improve transaction times and confidence in the investor community. Engineers, developers, industry, and governments lack experience, familiarity and, consequently, confidence in the reliability and application of green-gray approaches.

At the same time, technical knowledge and data needed to standardize reliable green-gray solutions is not broadly available or accessible. As appetite grows to direct capital to green-gray and nature-based infrastructure solutions, a more accessible and consolidated hub on investment-relevant data must emerge to build investor knowledge and confidence in the sector. This will require the generation of data and information to support investors to assess the market, its risks and growth trajectory, business models, and compare performance of different projects and financing vehicles for investing in them. In turn, this will also open up new opportunities for attracting new players and sources of finance for mainstreaming nature-based infrastructure into conventional solutions and for green-gray infrastructure projects.

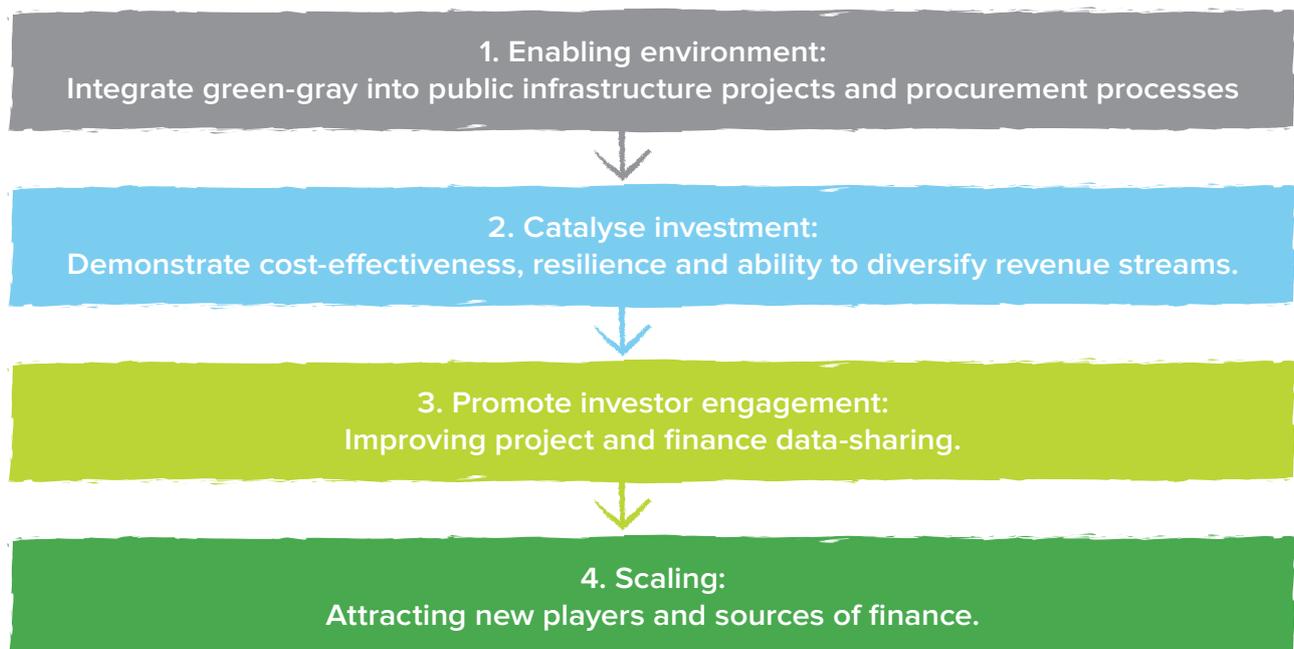


Figure 16: Strategies to accelerate green-gray infrastructure development and investment.

MAINSTREAM GREEN-GRAY INFRASTRUCTURE INTO PUBLIC INFRASTRUCTURE PROJECTS AND PROCUREMENT PROCESSES.

STAGE OF PLAY:



PLAYERS INVOLVED:



The public sector – federal and local governments and agencies – have a key role to play as the largest set of financiers of infrastructure projects, developers, and standard setters for the procurement of infrastructure. Governments are able to utilise regulatory and incentive-based approaches to encourage the uptake and integration of green-gray infrastructure solutions within the infrastructure procurement process, standards and local and national planning processes. They can also lead the way by integrating green-gray infrastructure into the projects they develop and finance. This can also serve to build market capacity to design, evaluate, implement such projects. However, today, most infrastructure policies and regulations do not currently incentivize green-gray solutions.

As the RFP process is so heavily focused on achieving the lowest possible costs, it is critical that governments embed requirements for full cost and benefit accounting for a range of economic, social, climate, environmental and biodiversity factors. This would enable green-gray projects to strengthen their individual business with regards to conventional solutions. A range of existing methods and tools – triple bottom line cost-benefit analysis (an evidenced-based

economic framework that combines Cost Benefit Analysis (CBA) and LifeCycle Cost Analysis (LCCA) across the triple bottom line - financial, social, and environmental), ecosystem environmental valuation, incremental cost benefit analysis, multiple account cost-benefit – exist to achieve this, and to define the range of co-benefits that could derive sources of funding.¹⁰⁶ However, many of these tools are not readily adapted to specific user needs, or may require additional data, technical, and financial capacity to implement.¹⁰⁷ Moreover, clearer incentives, requirements, and guidance are needed to adopt these holistic assessments into public tendering processes and RFPs for these approaches to become mainstream practice.

Strategy 1. Local and regional climate vulnerability assessments to mainstream identification of green-gray solutions.

A critical area for multi-lateral and bilateral development banks to focus is to work with governments on regional and local climate vulnerability assessments and climate adaptation planning. These processes then lend themselves integrate and mainstream screening criteria to identify infrastructure projects that are suitable for green-gray solutions, or even pure nature-based infrastructure solutions, and where these approaches are more cost-effective than conventional solutions. Once a set of projects have been identified through this process, these can then potentially be bundled into a bigger infrastructure financing package rather than seeking individual smaller pots of money for unique projects. This process should be accompanied by an engagement of country-level engineering standard setting bodies, such as national societies of civil engineers and build on the existing guides and resources on nature-based engineering approaches (e.g. Green Stormwater Infrastructure Design Guidebook, International Guidelines on Natural and Nature-Based Features for Flood Risk Management, the Practical Guide to Implementing Nature-based Infrastructure). This is needed to improve local understanding and acceptance of green-gray infrastructure solutions and update relevant local engineering standards for an age of increased uncertainty and climate risk.

Climate risk screening and mainstreaming to accelerate green-gray infrastructure. The African Development Bank and the Global Center on Adaptation launched the Africa Adaptation Acceleration Program (AAP) in 2021. Backed by the African Union, the program aims to mobilize USD 25 billion of investments in adaptation and through the Africa Climate Resilient Investment Facility, integrate climate resilience in approximately USD 7 billion worth of infrastructure investments. The program will provide guidelines, training, advisory services, and data and other tools to attract funding from various sources of development and climate finance to meet the incremental cost of climate-proofing Africa's infrastructure. As part of this, the Global Center on Adaptation is providing advisory services for climate risk screening at the landscape level, the identification of adaptation needs, and specific role of nature-based solutions within specific project needs.¹⁰⁸

DEMONSTRATE BANKABILITY OF A PIPELINE OF GREEN-GRAY INFRASTRUCTURE PROJECTS.

STAGE OF PLAY:



PLAYERS INVOLVED:



Identifying and structuring revenue streams is critical to bankability and requires project developers to identify off-takers for the full range of positive externalities to diversify funding sources with contractual obligations. Projects can also stack revenue sources relating to new forms of coastal and nature-based insurance, carbon credit payments, and more explicitly realize the value of project savings and cost reductions, land value capture and appreciation, and performance-based financing.¹⁰⁹ Developing these structures is time consuming and requires increased technical capacity of investors to assess risk-adjusted returns of green-gray infrastructure projects with appropriate risk-mitigation and sharing instruments. Technical capacity is also required to address local public policy and planning challenges to ensure the right conditions for developing and investing in green-gray infrastructure. The adoption of impact measurements and novel accounting frameworks listed above for the addition of green components can increase costs and affect the commerciality of the project. Supporting projects to develop these analysis and models, stakeholder engagement processes, packaging this up for investors, and then ensuring that the project is sufficiently de-risked is a key area of focus for catalytic finance at the project level.

Strategy 2. Create country-specific facilities to co-develop and structure bankable green-gray infrastructure projects in partnership with local and development banks.

Catalytic finance and support facilities are needed to cover the additional time and expertise to enable projects to become bankable. A handful of green-gray projects have benefitted from incubators such as the Climate Finance Lab or Convergence Funding, but more dedicated country-level approaches are needed to provide technical assistance to improve the capacity of project developers and financiers, local enabling conditions, and provide guarantees and first-loss capital for specific transactions. This package of blended finance can either be provided through a specific transaction, or through a dedicated fund or facility. For a specific transaction, conservation organizations and project developers can identify relevant pilot projects with potential for scale, while a catalytic finance partner can provide the long-term debt as well as the valuation models, risk valuation, guarantees, technical assistance for critical policy work and developing a financial model that can be replicated and scaled.

A facility on the other hand could earmark funds for green-gray projects to help project developers (private companies, municipalities, conservation NGOs) develop suitable green-gray infrastructure solutions - as Conservation International did with AECOM in the Philippines¹¹⁰ - then to structure bankable projects from initial phases to quantify revenue streams, long-term costs and risks, and build the capacity of the banks to appraise the risk-reward profiles. This could improve expertise needed by public and private proponents of green-gray infrastructure and foster increased capacity within the banks to structure projects and financing for individual projects and grow the market. Bringing in insurance and reinsurance partners to a transaction or facility, would also enable the identification of key de-risking needs (e.g., engineering liability, construction all risk, parametric insurance cover from natural hazards, etc.) to improve the risk-return profile of individual projects and demonstrate their potential application to the broader market.

Blended finance approaches to demonstrate bankability. In the Philippines, IFC partnered with the Bank of the Philippines Islands (BPI) in 2008 to build a sustainable energy financing loan portfolio, enabling BPI to build a track record and client base for energy efficiency and renewable energy clients. IFC established a risk-sharing facility for a portfolio of USD 106 million, transferring a portion of the risk associated with BPI's energy efficiency and renewable energy loans to IFC and providing advisory services to improve the risk assessment of new financial products. The facility itself has enabled BPI to issue loans amounting to USD 82 million but has also enabled BPI to build a sustainable energy portfolio amounting to USD 706 million for 184 projects.¹¹¹



IMPROVE PROJECT AND FINANCE DATA-SHARING TO PROMOTE INVESTOR ENGAGEMENT.

STAGE OF PLAY:



PLAYERS INVOLVED:



Project developers require clear and robust financial metrics and key performance indicators (KPIs) for green-gray projects that are easily understood by a range of investors.⁹ Beyond these financial metrics on the immediate project cost, catalytic funding should be made available to also quantify

the cost savings realized post project of disasters avoided/mitigated as a direct result of the green-gray project. While there is a growing body of evidence on cost-benefit analysis tools and results, there remains a lack of standardized set of metrics over time against which investors can benchmark the status quo of project costs and performance. Setting financial KPIs, collecting data, and generating benchmarks will reduce due diligence timelines for investors and allow for better pricing as different projects can be benchmarked against existing projects, thus tightening risk related cost margins.

A lack of a transparent global marketplace or data-sharing platform for green-gray infrastructure is hindering the ability to move beyond project, country or sector specific information and build investor confidence as the body of knowledge on green-gray infrastructure increases. A number of country specific pre-competitive platforms are emerging to build greater understanding and uptake of green-gray. For example, EcoShape in the Netherlands is a pre-competitive consortium of dredgers, investors, environmental organisations, that are co-developing and co-financing green-gray projects, while building a platform to showcase green-gray infrastructure projects. On the financing side, The Canadian Impact Infrastructure Exchange, led by Carlton University, aims to develop a marketplace for infrastructure investors to find information on sustainable infrastructure projects in a consistent manner and streamline the deal finding process.

Creating marketplaces and data-sharing platforms to harmonize data and drive investment

The Global Environment Facility has funded the MAVA Foundation, the International Institute for Sustainable Development (IISD), and the United Nations Industrial Development Organization (UNIDO) to develop comprehensive valuations of natural assets that integrate capital and operating costs, co-benefits (e.g., carbon sequestration, air purification, climate change adaptation), and compare costs to gray infrastructure alternatives. This will enable investors and government officials to build the business case for investing in nature-based solutions in infrastructure spending decisions. An online database will eventually share information on the valuation and performance of nature-based infrastructure to of project partners and stakeholders. IISD has already been working to improve the evidence for financial performance of nature-based infrastructure assets through the development of SAVI assessments – aiming to make NbS infrastructure an asset class.¹¹²

The [Microfinance Information Exchange](#) (MIX) - hosted on World Bank Group Database Data - was created to develop a database and marketplace to drive investment into the micro-finance market and allows investors to compare and analyze the self-reported data performance of financial service providers and MFIs in more than 100 developing markets¹¹³. When it was created in 2002 this type of information was inaccessible. The database covers financial service providers, targeting the unbanked in developing markets and includes data on financial statements, operations, financial products, end clients, and social performance in accordance with recognized standards within the microfinance and inclusive finance sectors through free and subscription products. Over time, the database grew deeper, to capture data on credit, loans, and other resources to establish itself as a local market for MFI data.

⁹ **GUIDANCE:** Metrics include: % value increase in real estate value, value of carbon credits, percent value reduction of operating & maintenance costs over 20 years, reduced flood risk; access to green space increasing local property value and encouraging new investing; water for parks and agriculture; improved water quality and road runoff; improved biodiversity; improved public health and well-being through access to green spaces; improved local multimodal transport; improved air quality.

Strategy 3. Develop a ‘green-gray infrastructure investor hub’ to improve transparency on green-gray infrastructure, the business models, size and growth of the market.

For infrastructure financing, the capital is there, and investors are actively looking for a pipeline of greener projects, but doing this on their own and project by project limits the appetite and speed of growth. A critical use of grant funding and technical assistance would be to fund an independent 3rd party to define financial metrics and KPIs with investors and project developers, aggregate these – as well as social and environmental co-benefits - and develop standards for monitoring and collection of data. This requires developing a set of easily understood and accepted metrics as well as developing a forward-looking monitoring tool over and above the cost benefit analysis. This would be valuable to investors who want to understand how to measure asset performance, how those assets then perform according to the pre-defined metrics, and eventually to benchmark projects against each other and develop public information on market trends.

This data could eventually be aggregated beyond the project level to establish an acceptable benchmark managed by a third party, and develop investor information, such as financial data and trends, models for projects - to demonstrate the market opportunity, value and returns to mainstream investors. The hub could provide crucial information for engineers such as performance data, design details, specifications, costs, as well as case studies and a more transparent and consolidated project pipeline for investors and funders. This should build on existing efforts by the Community of Practice and IISD – but potentially link to an existing mainstream infrastructure knowledge and data hub such as the [Global Infrastructure Hub](#) (GI Hub) or the [FAST-Infra Platform](#) that are infrastructure data platforms – FAST-Infra also includes a project finance loan exchange/marketplace - but currently lack a strong integration of nature-based infrastructure solutions or green-gray infrastructure. Partnering with an existing and trusted infrastructure platform would reduce information asymmetry for mainstream investors, and catalyze the market through regular market intelligence updates and market trend reports.

Regularly aggregated data by a trusted third party, such as a research institute or MDB, on deals, project costs and savings would drive change both at the project developer and investor level and thus help to spark the sector. Individual project developers and investors do not have funds required to procure or produce market intelligence of that depth, but rather there should be a programmatic effort to catalyze a nascent market by a trusted 3rd party, such as the GI Hub. This approach has been proven to work in a number of sectors, including the off-grid sector¹⁰, microfinance¹¹, and green buildings¹². As a first step, this would require building on existing data initiatives on nature-based infrastructure, the identification of the critical informational gaps and steps required to build interest amongst more mainstream investors, including project developers, corporates, banks and institutional investors.

10 GOGLA [Deal Database](#) and GOGLA, International Finance Corporation and Berenschot [Sales Data](#) and Impact Metrics <https://www.gogla.org/impact/gogla-impact-metrics>

11 Microfinance Database, MixMarket hosted on [WBG Data](#)

12 International Finance Corporation [Edge Green Buildings Marketplace](#)

ATTRACT NEW PLAYERS AND SOURCES OF FINANCE

STAGE OF PLAY:



PLAYERS INVOLVED:



However, the growth in net-zero and nature-positive commitments by governments, investors and companies is set to transform the appetite and investment for green-gray infrastructure projects. Furthermore, infrastructure companies themselves are increasingly looking to reduce their impact on biodiversity and incorporate natural infrastructure into projects.¹¹⁴ As appetite grows to direct capital to green-gray and nature-based infrastructure solutions, the green-gray infrastructure sector needs to attract a wider range of project proponents and investors. This will be supported by the advancement of technologies, implementation of policy reforms, maturation of new markets for carbon and biodiversity, and increasing capability amongst stakeholders.

Today, green-gray approaches may not be able to monetize the full range and diversity of climate resilient, environmental, social, and economic co-benefits. However, these 'non-market related' benefits are set to unlock additional revenue streams as they are identified and priced, and could offset future costs, thereby enabling more green-gray projects to attract capital from market sources. As these options grow, green-gray projects will also gradually to shift from grant and public finance to commercial finance that expect a greater focus on risk-adjusted returns. Accelerating this transition will require dedicated engagement of leading infrastructure companies and investors.

Strategy 4. Develop a corporate-backed 'Green-gray infrastructure generation fund' to accelerate the pipeline of green-gray infrastructure globally.

Increasingly, corporates are partnering with impact investors to set up their own funds to invest in nature-based solutions and carbon markets or seeking out potential investments that align with their supply chain and operations. For example, Unilever launched its USD 1 billion Climate and Nature Fund in 2020 that will focus on land restoration, reforestation, carbon sequestration, wildlife protection and water preservation. L'Oréal has also launched a USD 176 million social and environmental fund (earmarking USD 59 million for restoring 1 million ha of marine and forest ecosystems to capture 15-20 million tons CO₂) that is managed by Mirova Natural Capital.

Conservation NGOs should engage with the biggest infrastructure multi-nationals that have set net-zero and nature-positive commitments – such as Holcim, Bechtel, Veolia, amongst others - to develop similar funds focused on developing their own internal and external pipelines of green-gray infrastructure. A different tactic may be a sectoral approach for such investment funds, for example by working with the International Maritime Organization – which has set a 50% carbon reduction target by 2050 – and the container shipping companies on green-gray infrastructure in critical port infrastructure that is relied on for core business.¹¹⁵ These types of corporate investment funds can not only take on higher levels of risk, but can support the companies themselves to address their own climate exposure, while delivering on their net-zero and nature-positive commitments.





Call to action

WHAT DOES WINNING LOOK LIKE?

The fight for increased climate resilience, restored biodiversity and sustainable economic growth is one that humanity cannot lose. Green-gray infrastructure has a vital role to play, by channeling a key driver of economic growth – namely infrastructure – to chart a more sustainable, climate, and nature-positive path. To do this, we need more financing for green-gray infrastructure, more projects in the pipeline, and to bring new private sector financing players into the space.

Conservation International aims to integrate green-gray approaches into at least 5% of the estimated USD 1.8 trillion spent annually on coastal infrastructure development – more than half of it in emerging markets.¹¹⁶ This would equate to USD 90 billion – just for coastal assets. Achieving this growth through our own efforts and for the broader sector will require all the players on the field to pull together to advance the strategies for winning.

LINE UP TO WIN THE GAME

Public entities



Public sector project proponents have been at the forefront of developing green-gray infrastructure projects, accounting for most existing projects.

To build on this leading position, more work is needed to mainstream and integrate requirements for green-gray across policies, regulations, departments, and budgets.

- Governments must play a supporting role across all the strategies, namely by improving the enabling environment to allow the full suite of plays to be implemented. At the **national level**, a focus should be on reducing the barriers from financial policy, allowing direct investment into green-gray projects, more efficient financing instruments through local banks, and improving the enabling environment for longer-term financing and for local governments to raise external finance for financing green-gray infrastructure.

- Specifically for Strategy 1 (Green-gray integration), **local governments** should ensure that requirements for assessing green-gray opportunities should be integrated into project tendering documents. For example, requesting that assessments are undertaken of the relative costs and benefits of green-gray and nature-based infrastructure in comparison to conventional solutions and in relation to climate risk screening. This would develop the needed mechanisms and signal for project developers and engineering consultancies to mainstream the consideration of green-gray across any new infrastructure projects. Furthermore, governments should consider a new approach to PPP timeframes and debt tenors, maturities, and terms to allow for nature-based solutions to really come into play financially.
- Local, regional, and/or state governments should also consider establishing a network of new positions to act as 'Nature-based Solutions Champions', similar to the [Engineering with Nature Practice Leads](#) within the United States Army Corps of Engineers. These advocates would be familiar with local and regional priorities, partners, and environmental constraints and opportunities. They would serve as trusted community partners to identify and steward green-gray projects from inception through permitting to construction, monitoring, and adaptive management.

NGOs



NGOs and conservation organisations will continue to play an important role in identifying and developing green-gray infrastructure projects and initiatives.

To accelerate the growth of a bankable pipeline of projects, NGOs should better leverage the existing projects and programmes to work more closely with new players, such as DFIs, banks, and private sector infrastructure companies, to develop projects based on financial as well as technical feasibility.

- For Strategy 2 (Green-gray country-specific facilities), international and local NGOs should initiate the dialogue with multi-lateral and national DFIs and banks to identify the blended finance facilities that could identify, develop, and finance green-gray infrastructure projects.
- For Strategy 3 (Green-gray investor hub) this would include working closely with investors to identify and define the metrics and data that investors require from projects to better assess risks and opportunities at the project and market level. International NGOs also have the capacity, networks and fundraising capabilities to attract the multi-lateral and philanthropic grant finance and stakeholder coordination required to get these strategies in motion.
- For Strategy 4 (Green-gray funds), NGO coordination of pre-competitive platforms, such as the Green-Gray Community of Practice, would be the ideal place to bring in more infrastructure companies to initiate a dialogue on the development of corporate green-gray infrastructure development funds and screen for relevant projects.

Inter-governmental agencies and research institutions



Inter-governmental agencies and research institutions have been leaders in providing applied scientific research and guidance to develop the body of evidence on green-gray infrastructure.

To continue to grow the sector, the organizations should continue to build the evidence base in a more coordinated manner, mainstream guidance into conventional engineering practice and fora, and increase their focus on professional training.

- For strategy 1 (Green-gray integration), inter-governmental agencies and research institutions have a key role to play in working more closely with public and private engineers and contractors that develop, design and implement these projects to provide professional training on the implementation of climate risk reduction measures for infrastructure resilience and the role of green-gray infrastructure solutions. Developing this skill among planners, engineers and contractors will also be key to ensure that green-gray infrastructure is more widely adopted and applied.
- Inter-governmental agencies and research institutions also can work with engineering standards and project developers to develop more tailored lifecycle operating and maintenance costs of engineering green infrastructure within widely accepted engineering guidance and standards to mainstream these approaches beyond a niche set of conservation organisations and advanced engineering companies.

Private sector entities



Private sector developers, namely infrastructure, construction and engineering companies, account for a relatively small portion of green-gray project development but are poised to play a bigger role in future growth as more companies commit to ambitious emissions reductions and reducing their negative impacts on biodiversity.

- For strategy 3 (Green-gray investor hub), private developers have an important role in co-defining the metrics and KPIs to improve the uniformity and transparency of project and market information for green-gray infrastructure.
- Private sector project developers should also work more closely with engineering standard setting bodies to develop guidance, define acceptable project risk profiles, and encourage the uptake of appropriate green-gray solutions.

Concessional capital providers



Concessional capital providers have been instrumental in catalyzing individual transactions and projects, as well as the growth of the green-gray sector.

Grants and concessional finance provided by these organizations form the backbone of the existing green-gray financing landscape. Further action by these stakeholders should focus on:

- **Multilaterals & DFIS** play a critical role in supporting countries and sub-national governments to develop projects and improve the enabling conditions to finance infrastructure broadly. Just as DFIS, such as the IFC, have successfully mainstreamed gender and climate risk screens across their portfolios, so too should there be a check-point on infrastructure projects to ensure they have been screened for relevant nature-based and green-gray opportunities and a cost-benefit analysis has been conducted to compare green-gray versus conventional gray approaches. MDBs and DFIS have a key role to play in Strategy 1 (Green-gray integration), Strategy 2 (Green-gray country-specific facilities) and Strategy 3 (Green-gray investor hub). For Strategy 2, they can work closely with NGOs and local banks to develop blended finance facilities focused on infrastructure investment where technical assistance is provided to screen projects for climate risks and green-gray solutions are identified where appropriate.
- **Philanthropy:** Grant funding from philanthropic foundations is instrumental to catalyzing some of the most novel financing vehicles for green-gray infrastructure, as well as nature-based solutions more broadly. Other forms of catalytic finance needed for green-gray that foundations could provide includes the provision of risk capital such as first-loss capital in particular. Furthermore, philanthropy is well positioned to prove the case for individual pilots and also to provide broader system-level support described in Strategy 3 (Green-gray investor hub). Philanthropic funding is key to catalyze the development of a more transparent marketplace, to bring down opportunity and transaction costs for project developers and investors alike.

Insurance



Insurance solutions have had a catalytic effect in some of the landmark green-gray projects.

However, the deep knowledge and granular data that insurance and reinsurance companies have on climate risk could be leveraged to advise on where green-gray could be an appropriate risk management solution. This is particularly relevant to strategy 1 (Green-gray integration), where insurance companies can establish risk advisory and data partnerships with local and regional governments to encourage advanced climate risk screening and adaptation planning that integrates green-gray solutions. In addition, insurers can also consider how to better incentivize and advisory solutions to their banking and infrastructure clients to encourage the adoption of green-gray solutions earlier on in the project development and asset financing stages. In particular, insurance companies could build on existing cooperation with multilateral partnerships, such as the Disaster Risk Reduction Private Sector Partnership, to work with DFIs and conservation NGOs to structure the full range of de-risking solutions required to develop Strategy 2 (Green-gray country-specific facilities). This would also position insurance companies to access and shape infrastructure projects at an earlier phase in their development and strengthen insurance markets in countries with traditionally low penetration rates.

Investors



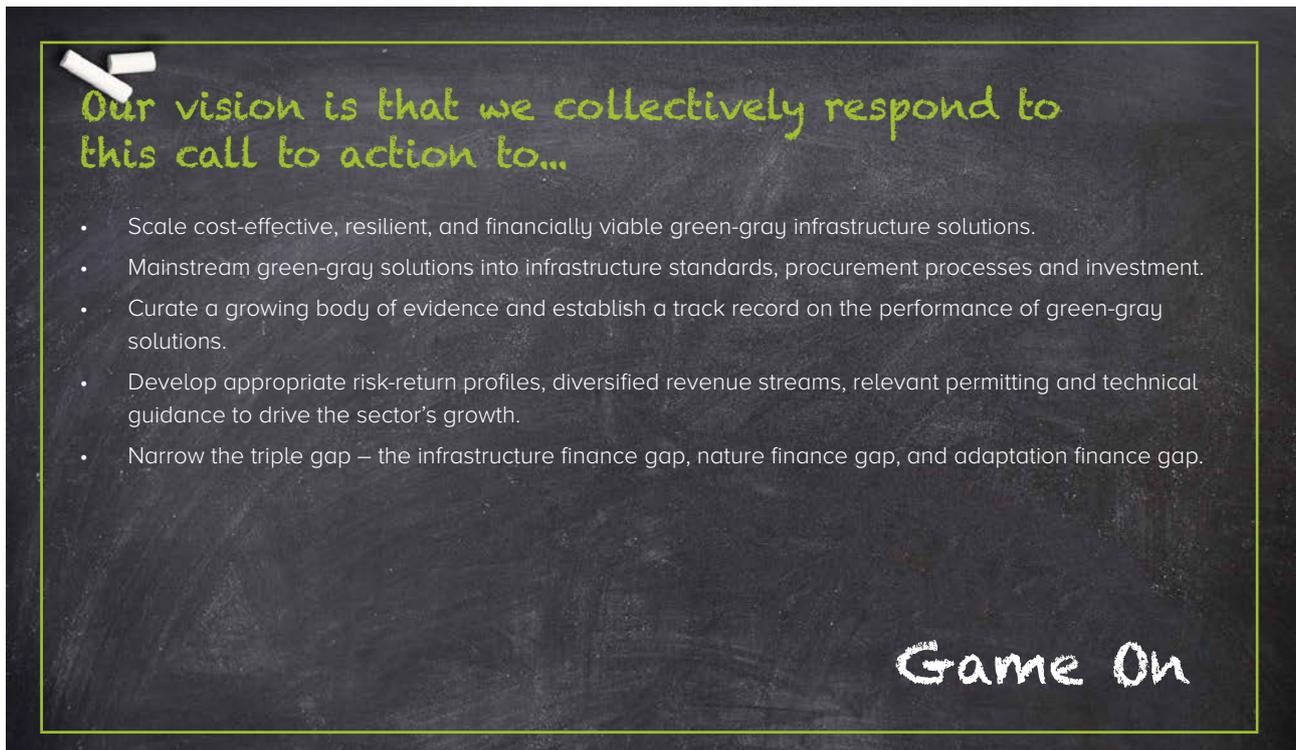
Investors and banks have a critical role to play in accelerating growth in green-gray infrastructure finance as the market matures and recognition grows of the financing case for green-gray.

Impact investors have led innovation at the project deal level for a few green-gray transactions, but more broadly for nature-based solutions. A next phase of their engagement in this sector should focus on driving the innovation needed at the asset class and sector level. Impact investors should build on their experience and understanding of both financial and impact data to spearhead the market-level innovation proposed in Strategy 3 (Green-gray investor hub), working closely with DFIs and project developers to define the financial metrics, performance data and market information needed to spark investor interest and comfort levels in green-gray.

Banks have a key role to play in accelerating the growth of green-gray infrastructure in the future. Firstly, national development and commercial banks should consider partnering with DFIs and conservation organizations to spearhead country-level facilities and transactions outlined in Strategy 2 (Green-gray country-specific facilities). This would provide them with first-mover advantage in a new market and advance their own portfolio decarbonization and nature-positive goals. Secondly, banks have played an important role launching innovative blue and green bonds or sustainability linked loans, that could be more directly targeted to finance green-gray infrastructure for corporate, sovereign, and sub-sovereign clients.

Thirdly, banks can advance their use of climate risk screening combined with an analysis of project lifecycle costs and benefits on infrastructure project loans and refinancing to assess climate risk exposure. This screening should ideally show the potential climate risk and associated costs (catastrophe, income loss, etc.) from purely conventional projects and the relative cost-benefit of integrating adaptive green-gray solutions, thus allowing investment decision markets a holistic assessment of the true cost and benefit over a project lifecycle while highlighting potential opportunities to allocate capital efficiently for the longer term. Over time, this risk assessment could be reflected in country and company credit ratings, signaling true market risk.

Institutional investors have so far been the least engaged investors in financing green-gray infrastructure but are increasingly invested in illiquid projects that would enable them to consider green-gray as part of their broader infrastructure investment portfolio. Asset managers that are part of leading net zero and nature-positive commitments should be engaged to take part in strategy 3 (Green-gray investor hub), to shape market data and information, and future deals, to better match their investment needs.



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Annex

	Name	Country	Infrastructure Type	Size (USD)	Primary Instrument
1	Espirito Santo Integrated Sustainable Water Management	Brazil	Water & Wastewater	\$323,100,000.00	Bonds
2	Teresina Enhancing Municipal Governance and Quality of Life	Brazil	Water & Wastewater	\$44,470,000.00	Market-rate loans
3	BR Sergipe Water	Brazil	Water & Wastewater	\$108,120,000.00	Market-rate loans
4	Managing water supply for hydroelectric power through restoration in Nor-Yauyos-Cochas Lanscape Reserve	Peru	Water & Wastewater	Not available	Not available
5	Watershed forest restoration to support functioning of the Itaipu Dam	Brazil	Water & Wastewater	\$11,500,000.00	Utility/company contributions
6	Climate Change Adaptation and Risk Reduction Technology and Strategies to Improve Community Resilience (CARTS) Project, Westmoreland	Jamaica	Coastal defence	\$943,135.00	Grants
7	Trinityville Area Integrated Land Management and Disaster Risk Reduction Project, St. Thomas	Jamaica	Water & Wastewater	\$663,641.00	Grants
8	Building Resilience and Adaptation to Climate Change and Reducing Disaster Risk in Peckham and Surrounding Communities, Clarendon	Jamaica	Renewable energy	\$783,850.00	Grants
9	Establishing Flood-Resilient Smart Communities through Non-Governmental Organisation Partnerships	British Virgin Islands	Coastal defence	\$1,194,045.00	Grants
10	Rio Bogota Environmental Recuperation and Flood Control Project	Colombia	Water & Wastewater	\$487,000,000.00	Market-rate loans
11	Water Security and Resilience for the Valley of Mexico (PROSEGHIR)	Mexico	Water & Wastewater	\$296,000,000.00	Market-rate loans
12	Microcuencia Anillo de Cenotes de Yucatan	Mexico	Other	\$20,000,000.00	Utility/private contributions
13	Santa Fe, Stormwater Management Project	Argentina	Water & Wastewater	\$8,868,516.00	Govt. / municipal funding
14	Climate-resilient Coastal Management and Infrastructure Program	Bahamas	Coastal defence	\$35,000,000.00	Market-rate loans
15	Bolivia resilient to climate risks	Bolivia	Water & Wastewater	\$40,000,000.00	Market-rate loans
16	Pilot Action Plan for Adaptation to Climate Change in highland areas	Bolivia	Water & Wastewater	\$82,250,000.00	Grants
17	Comprehensive Storm Drainage Program in Priority Cities in Peru	Peru	Water & Wastewater	\$123,592,575.00	Market-rate loans
18	Coastal Protection for Climate Change Adaptation for Small Island States in the Caribbean (CPCCA) Project	Saint Vincent and the Grenadines	Coastal defence	\$13,945,944.00	Grants
19	Building climate Resilience through Innovative Financing Mechanisms for Climate Change Adaptation	Antigua and Barbuda	Water & Wastewater	\$18,000,000.00	Concessional loans
20	At the Water's Edge: Enhancing Coastal Resilience	Grenada	Water & Wastewater	Not available	Not available
21	Border Integration Project	Ecuador	Roads	\$144,784,000.00	Market-rate loans
22	Renovation of the Francisco Morazan Hydropower Plant to Facilitate the Integration of Renewable Energy	Honduras	Energy	\$36,800,000.00	Concessional loans
23	Saramacca Canal System Rehabilitation Project	Suriname	Water & Wastewater	\$35,000,000.00	Market-rate loans
24	Cap-Haïtien Urban Development Project	Haiti	Water & Wastewater	\$56,000,000.00	Grants
25	Bolivia Urban Resilience	Bolivia	Water & Wastewater	\$70,000,000.00	Concessional loans
26	Lo-ong and Bacjawan Norte living breakwater	Philippines	Coastal defence	Not available	Not available

	Name	Country	Infrastructure Type	Size (USD)	Primary Instrument
27	Stratford Point living shoreline: restoring coastal habitats to maintain resiliency and function	United States of America	Water & Wastewater	\$455,000.00	Govt. / municipal funding
28	Sabine to Galveston coastal storm risk mitigation study	United States of America	Coastal defence	Not available	Not available
29	Oro Loma horizontal levee	United States of America	Coastal defence	\$9,100,000.00	Govt. / municipal funding
30	Lightning Point shoreline restoration	United States of America	Water & Wastewater	Not available	Not available
31	Rose Larisa Park living shoreline project	United States of America	Water & Wastewater	\$232,000.00	Govt. / municipal funding
32	Katwijk Aan Zee sea defense	Netherlands	Water & Wastewater	Not available	Not available
33	Bishan Ang Mo Kio Park	Singapore	Water & Wastewater	Not available	Not available
34	Meishe River Greenway and Fengxiang Park	China	Water & Wastewater	Not available	Not available
35	Xiamen Sponge City	China	Water & Wastewater	Not available	Not available
36	Chulalongkorn Centenary Park	Thailand	Water & Wastewater	Not available	Not available
37	Sydney Park stormwater reuse project	Australia	Water & Wastewater	\$8,285,760.00	Govt. / municipal funding
38	Promoting water and food security and environmental restoration through the construction of sand dams	Kenya	Water & Wastewater		Not available
39	Medellin green corridors	Colombia	Roads	\$16,300,000.00	Govt. / municipal funding
40	Bio-Engineering for eco-safe roadsides in Nepal	Nepal	Roads	Not available	Not available
41	Rotterdam Urban Water Buffer Project	Netherlands	Water & Wastewater	Not available	Not available
42	Climate Smart Shrimp West Java, Indonesia	Indonesia	Other	Not available	Not available
43	MillionTreesNYC designed experiments model	United States of America	Water & Wastewater	Not available	Not available
44	Bagongon, Iloilo, Philippines	Philippines	Coastal defence	Not available	Not available
45	Community-based water stewardship in the Dongjiang basin	China	Water & Wastewater	Not available	Grants
46	Prins Hendrikzandijk Reinforcement: Insuring a nature-based solution, designed to protect against rising sea levels	Netherlands	Water & Wastewater	\$34,285,096.00	Govt. / municipal funding
47	Hamilton Wetland Restoration Project	United States of America	Coastal defence	\$286,219,000.00	Govt. / municipal funding
48	Kelp Blue Namibia	Namibia	Other	\$2,400,000.00	Utility/private contributions
49	Adaptation of Nicaragua's Water Supplies to Climate Change	Nicaragua	Coastal defence	\$6,000,000.00	Grants
50	Agriculture and Natural Resources Landscape Management	Mozambique	Other	\$40,000,000.00	Concessional loans
51	Andhra Pradesh Disaster Recovery	India	Coastal defence	\$370,000,000.00	Concessional loans
52	Bihar Rural Roads Project	India	Roads	\$335,000,000.00	Concessional loans
53	Cities and Climate Change Project	Mozambique	Water & Wastewater	\$120,000,000.00	Concessional loans
54	Coastal Embankment Improvement Project - Phase I (CEIP-I)	Bangladesh	Coastal defence	\$400,000,000.00	Concessional loans
55	Coastal Region Water Security and Climate Resilience	Kenya	Water & Wastewater	\$200,000,000.00	Concessional loans
56	Dar es Salaam Metropolitan Development Project	Tanzania	Water & Wastewater	\$330,300,000.00	Concessional loans
57	Enhancing the Climate Resilience of Coastal Resources and Communities	Samoa	Coastal defence	\$14,600,000.00	Grants
58	Kiribati Adaptation Phase III	Kiribati	Coastal defence	\$10,800,000.00	Grants
59	Ma'anshan Cihu River Basin Improvement	China	Water & Wastewater	\$210,000,000.00	Market-rate loans
60	Madagascar Emergency Food Security and Social Protection Project	Madagascar	Water & Wastewater	\$65,000,000.00	Concessional loans

	Name	Country	Infrastructure Type	Size (USD)	Primary Instrument
61	Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods	Viet Nam	Water & Wastewater	\$387,000,000.00	Concessional loans
62	Metro Colombo Urban Development Project	Sri Lanka	Water & Wastewater	\$320,600,000.00	Market-rate loans
63	Myanmar Flood and Landslide Emergency Recovery	Myanmar	Water & Wastewater	\$200,000,000.00	Concessional loans
64	Niger Disaster Risk Management and Urban Development	Niger	Water & Wastewater	\$106,640,000.00	Concessional loans
65	Nigeria Erosion and Watershed Management	Nigeria	Water & Wastewater	\$908,590,000.00	Concessional loans
66	Ningbo Sustainable Urbanization	China	Water & Wastewater	\$317,500,000.00	Market-rate loans
67	Odra-Vistula Flood Management Project	Poland	Water & Wastewater	\$1,317,800,000.00	Market-rate loans
68	Resilient Natural Resource Management for Tourism and Growth Project (REGROW)	Tanzania	Water & Wastewater	\$150,000,000.00	Concessional loans
69	Stormwater Management and Climate Change Adaptation	Senegal	Water & Wastewater	\$55,600,000.00	Concessional loans
70	Seoul's Cheonggyecheon river restoration project	Korea	Water & Wastewater	\$323,000,000.00	Govt. / municipal funding
71	Philidelphia Green City, Clean Waters initiative	United States of America	Water & Wastewater	\$125,000,000.00	Utility/private contributions
72	Union Carbide Corporation's Constructed Wetlands for Wastewater Treatment	United States of America	Water & Wastewater	\$1,400,000.00	Utility/private contributions
73	Houtrib Dike Pilot Project	Netherlands	Coastal defence	\$100,000,000.00	Govt. / municipal funding
74	Coastal Pipeline Erosion Control using Oyster Reefs	United States of America	Energy	\$1,000,000.00	Utility/private contributions
75	Oyster Reef Building & Restoration for Coastal Protection	United States of America	Coastal defence	\$28,000,000.00	Govt. / municipal funding
76	Shell: Produced Water Treatment using Reed Beds, Nimr, Oman	Oman	Water & Wastewater	Not available	Not available
77	Chicago City Hall Green Roof	United States of America	Other	\$2,500,000.00	Govt. / municipal funding
78	Upgraded stormwater infrastructure	South Africa	Water & Wastewater	\$122,679,944.00	Govt. / municipal funding
79	Taumanu Reserve Onehunga Foreshore Restoration	New Zealand	Coastal defence	\$28,000,000.00	Govt. / municipal funding
80	Galveston Beach Nourishment at 61st Street	United States of America	Coastal defence	\$18,670,000.00	Govt. / municipal funding
81	Cat Island Chain Restoration	United States of America	Coastal defence	\$18,700,000.00	Govt. / municipal funding
82	Redistribution and Impacts of Nearshore Berm Sediment	United States of America	Coastal defence	Not available	Not available
83	MacDill Oyster Reef Shoreline Stabilization	United States of America	Coastal defence	Not available	Not available
84	Coffee Island Oyster Reefs	United States of America	Coastal defence	\$1,689,000.00	Govt. / municipal funding
85	Oesterdam Sand Nourishment Project	Netherlands	Coastal defence	Not available	Not available
86	Swift Tract Oyster Reef Breakwaters	United States of America	Coastal defence	\$549,341.00	Govt. / municipal funding
87	Slowing the Flow at Pickering	United Kingdom	Water & Wastewater	Not available	Not available
88	River Glaven Restoration Project	United Kingdom	Water & Wastewater	\$20,000.00	Govt. / municipal funding
89	Belford Natural Flood Management Scheme	United Kingdom	Water & Wastewater	\$700,000.00	Govt. / municipal funding
90	Missouri River Levee Setbacks	United States of America	Water & Wastewater	\$100,000,000.00	Govt. / municipal funding
91	Kalkense Meersen Cluster	Belgium	Water & Wastewater	\$3,867,242.24	Govt. / municipal funding
92	The Polders of Kruikebe	Belgium	Water & Wastewater	\$107,898,140.00	Govt. / municipal funding
93	Chocolate Bayou Channel Management Plan	United States of America	Water & Wastewater	\$31,226,000.00	Govt. / municipal funding

	Name	Country	Infrastructure Type	Size (USD)	Primary Instrument
94	Ashtabula Harbor Breakwater Tern Nesting Habitat	United States of America	Water & Wastewater		Not available
95	MilwaUnited Kingdomee Harbor Breakwater Fish Habitat Demonstration Project	United States of America	Water & Wastewater	Not available	Not available
96	Cleveland Harbor East Arrowhead Breakwater Demonstration Project	United States of America	Water & Wastewater	Not available	Govt. / municipal funding
97	Fowl River Private Living Shorelines	United States of America	Water & Wastewater	\$125,000.00	Utility/private contributions
98	Rich Revetments: Enhancing Hard Substrates for Ecology	Netherlands	Coastal defence	Not available	Not available
99	Soo Locks Fish Habitat Restoration	United States of America	Water & Wastewater	\$9,400,000.00	Govt. / municipal funding
100	Mud Mountain Fish Passage	United States of America	Water & Wastewater	\$112,000,000.00	Govt. / municipal funding

