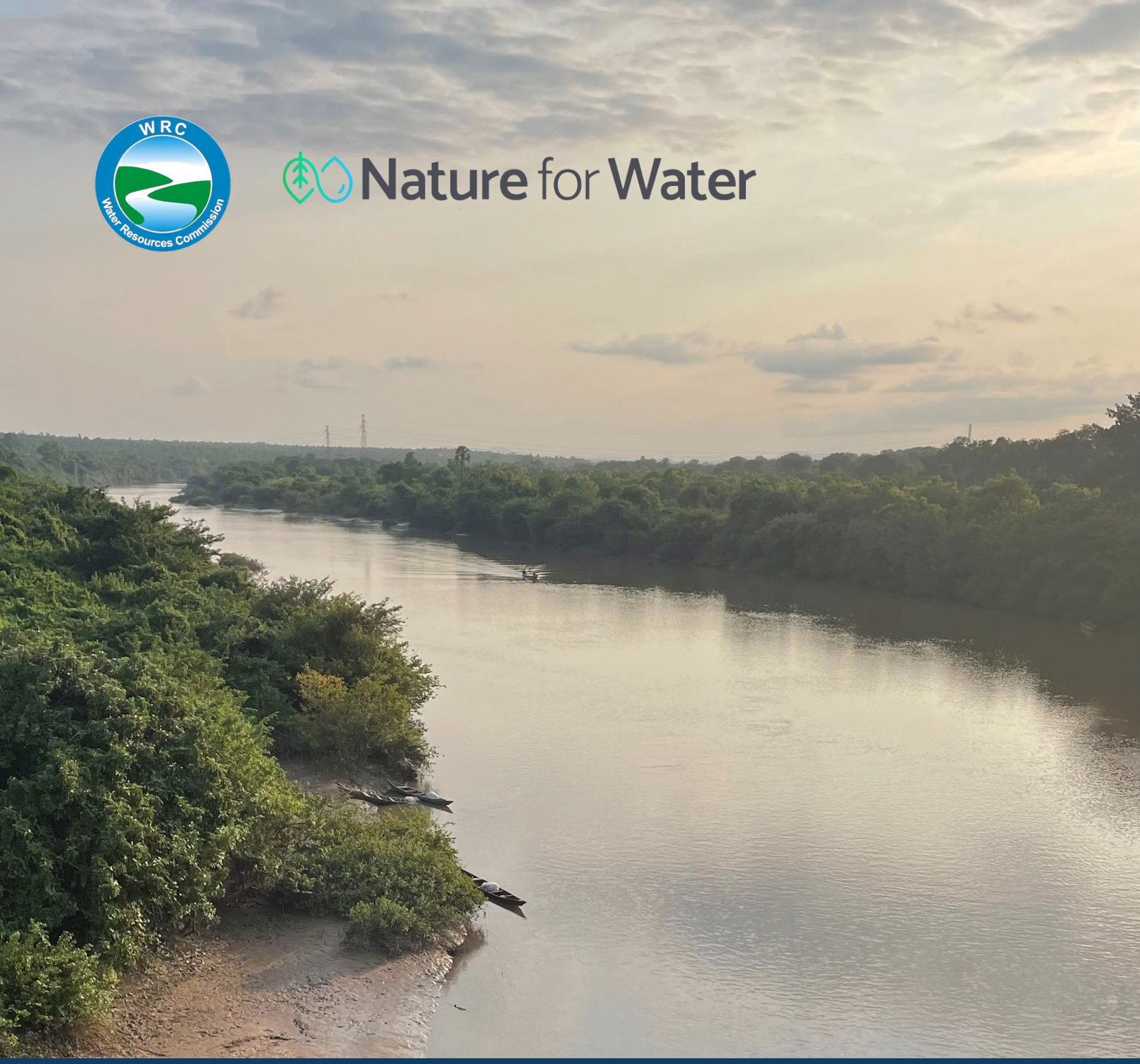

BLACK VOLTA WATERSHED INVESTMENT PROGRAM

BUSINESS CASE: SUMMARY OF FINDINGS

Summary Report **2025**

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Investing in Nature for a Water-Secure Future

This business case demonstrates that investing in the large-scale implementation of nature-based solutions (NbS), such as restoring forests and protecting riparian buffers, can address water security and bring significant economic benefits. In Ghana's part of the Black Volta Basin, every $1 USD invested returns up to $5 USD of economic benefits.

Benefits are derived from better water quality and availability for both people and industries across the watershed. Beyond water, NbS can also help protect wildlife, support farming communities, capture and store carbon, and create jobs - making them a smart, holistic solution for people and the environment, that can deliver system change.

Large-scale implementation of NbS can be effectively coordinated through a Watershed Investment Program (WIP). A WIP is a long-term initiative designed to drive collective action, bringing together partners from both the public and private sectors. It enables diverse stakeholders to pool their resources and align their efforts, directing funding and support to local implementers. In doing so, it helps to secure water resources and restore vital ecosystem services across the watershed.

The Water Resources Commission (WRC), Ghana's government agency responsible for Integrated Water Resources Management, has identified the need to create collective action to ensure long-term water security in the Black Volta watershed. It has partnered with Nature for Water,

which specialises in setting up long-term investment programs, to assess the local impact and return on investment of a WIP on Ghana's side of the Black Volta. The findings from this assessment are presented in this business case.

The assessment that Nature for Water undertook included: a literature review, field visit and in-person stakeholder engagement, a scientific and technical analysis including GIS mapping and water quality modelling (SWAT), as well as a financial and economic analysis following a public Cost-Benefit-Analysis approach. Nature for Water also explored potential governance and funding arrangements, to inform the long-term structures of a potential WIP. Beyond the Black Volta, the WRC is working with the Catholic Relief Services (CRS) to establish a WIP in the White Volta and it also has the ambition to scale NbS-initiatives nationwide.

Therefore, this feasibility assessment serves as a foundational step in building the local evidence base for the effectiveness of NbS, both to improve water security and to justify the mobilisation of national-level resources and long-term backing for WIPs.

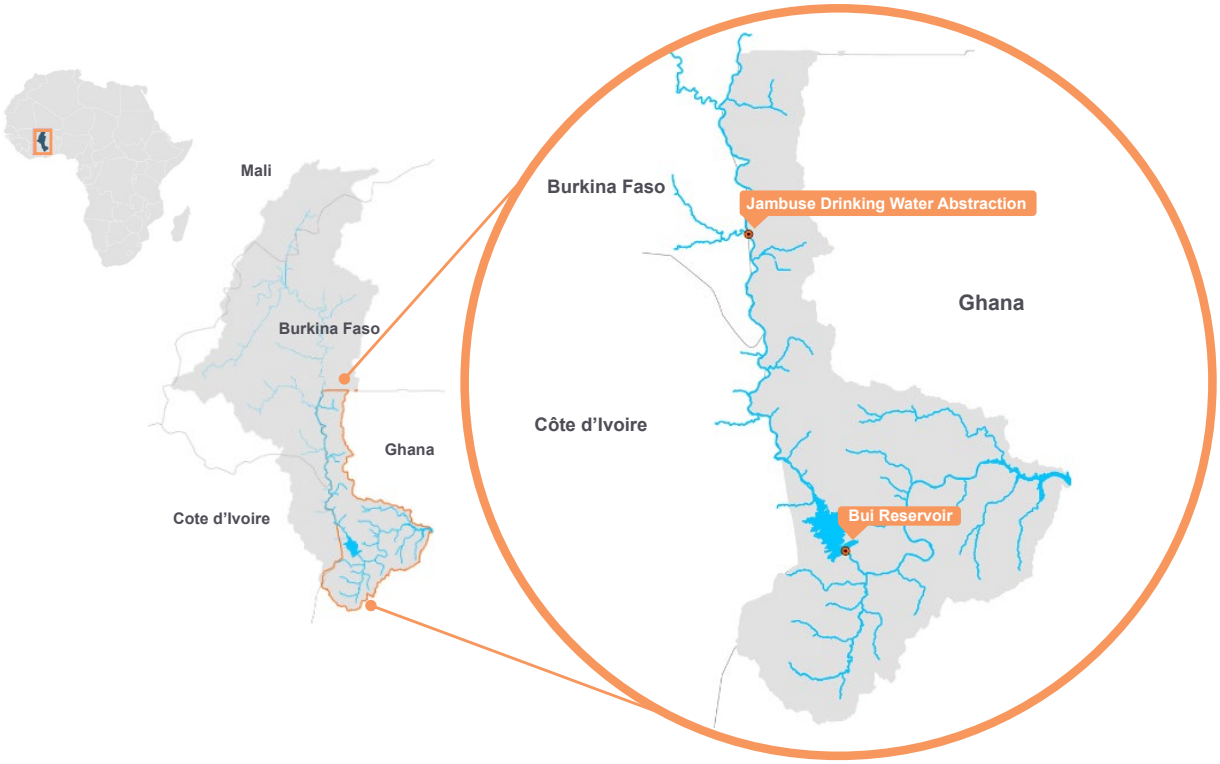


Figure 1: Ghana's side of the Black Volta Basin

The Black Volta Watershed

The Black Volta Basin is a transboundary river system that has four riparian states, namely Burkina Faso, Côte d'Ivoire, Mali, and Ghana.

The whole basin covers approximately 154,988 km². Burkina Faso accounts for the largest portion at 59% (89,913 km²) and only 21% of it (33,888 km²) lies within Ghana, in the most downstream section of the river basin.

This section of the basin is characterised by a tropical savannah climate with distinct wet and dry seasons. The Black Volta is one of Ghana's most important watersheds, supplying water to around 1.6 million people (5% of the country) in numerous towns and rural communities. It also serves the Jambuse drinking water abstraction point near Wa, along with other abstraction points for commercial irrigators, and the Bui Reservoir, which provides about 25% of Ghana's total hydroelectricity capacity.*

The watershed is the main water source for Bui National Park as well as supporting unique wildlife habitats, including rare birds and hippos, giving it high biodiversity value.

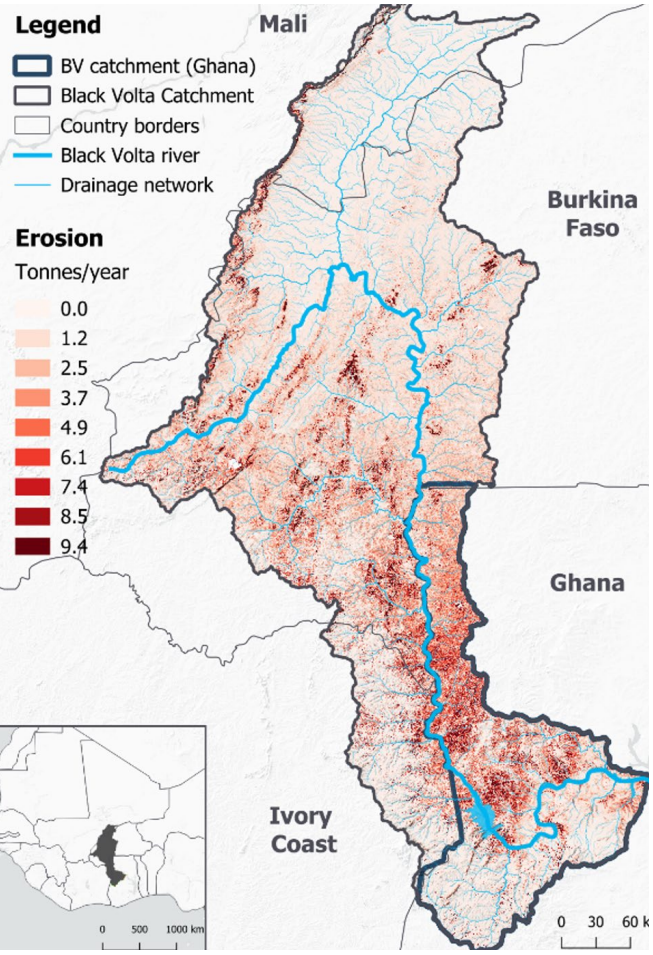


Figure 2: Erosion hotspots in the Black Volta Basin

Supplies 1.6M people

A key source of water

25%

Contributes 25% of Ghana's total hydroelectricity capacity

33,888 km²

Of the basin lies within Ghana

*PDRI/ISSER (2022), Policy Brief 2: Climate change and hydroelectricity shortfalls in Ghana, Penn Development Research Initiative

The Challenges

Water quality

Ghana's side of the Black Volta Basin is experiencing significant sedimentation across its many waterways. Downstream, sediment in the water increases the treatment costs for drinking water. It has caused regular increases in dredging and maintenance costs borne by water utilities and commercial irrigators, in addition to accelerating sedimentation in the Bui Reservoir, shortening its lifespan. Upstream, where the water originates from, erosion depletes nutrients in the soil which reduces yield losses for small-holder farmers.

Nature for Water team inspecting water quality during their field visit.

While some erosion comes from the upstream riparian countries, notably Burkina Faso, most of the land degradation occurs downstream on the Ghanaian side, particularly close to the main channel of the Black Volta River. Each year, approximately 28,000 tons of sediment reach the Jambuse drinking water abstraction point where Ghana Water Company Limited (GWCL) and Community Water and Sanitation Agency (CWSA) abstract, with 19,000 tons originating within Ghana. The primary drivers include:

- **Agricultural encroachment** on riverbanks and poor farming practices.
- **Deforestation** driven by the need for more firewood and agricultural land.
- **Illegal small-scale mining** ("galamsey"), is also a driver of deforestation and direct disturbance of the river beds.

Water Availability

Water availability issues are becoming increasingly critical. As water quality deteriorates, demand for water continues to rise, particularly in fast-growing towns like Wa. In addition, many rural communities rely on rainfed agriculture and do not have access to centralised water supply systems. Furthermore, climate change induced rainfall variability poses significant challenges for local farmers. Prolonged droughts lower agricultural productivity, while heavy rainfall events exacerbate erosion across agricultural lands, causing sustained nutrient losses in soils. These growing challenges have driven farmers to cultivate closer to tributaries and the main river to access fertile soils and water, thereby reinforcing a destructive feedback loop. Downstream, commercial farmers face ongoing disruptions to their irrigation operations, often halting water abstraction for months when their pumps seize due to large amounts of sediment caused by lower water levels. This leads to financial and economic losses.

Water availability issues are becoming increasingly critical in Ghana.

The Solutions

NbS, when implemented at scale, offers a powerful approach to addressing these challenges by enabling systemic change that supports long-term watershed health and water security. Based on stakeholder input, literature review, WRC's local knowledge, and Nature for Water's global experience, **the following priority NbS have been identified as the most effective for addressing the basin's water challenges:**

Riparian Restoration and Protection

The revegetation and protection of riparian areas in line with the Riparian Buffer Zone Policy due to be passed into law (see Box 1. on following page).

Agricultural Best Management

Agricultural Best Management Practices (AgBMP): such as composting, low tillage practices, cover cropping, and rotational / low-impact livestock rearing.

Soil Bunding

Creating soil ridges along sloping ground to reduce erosion.

Water Ponds

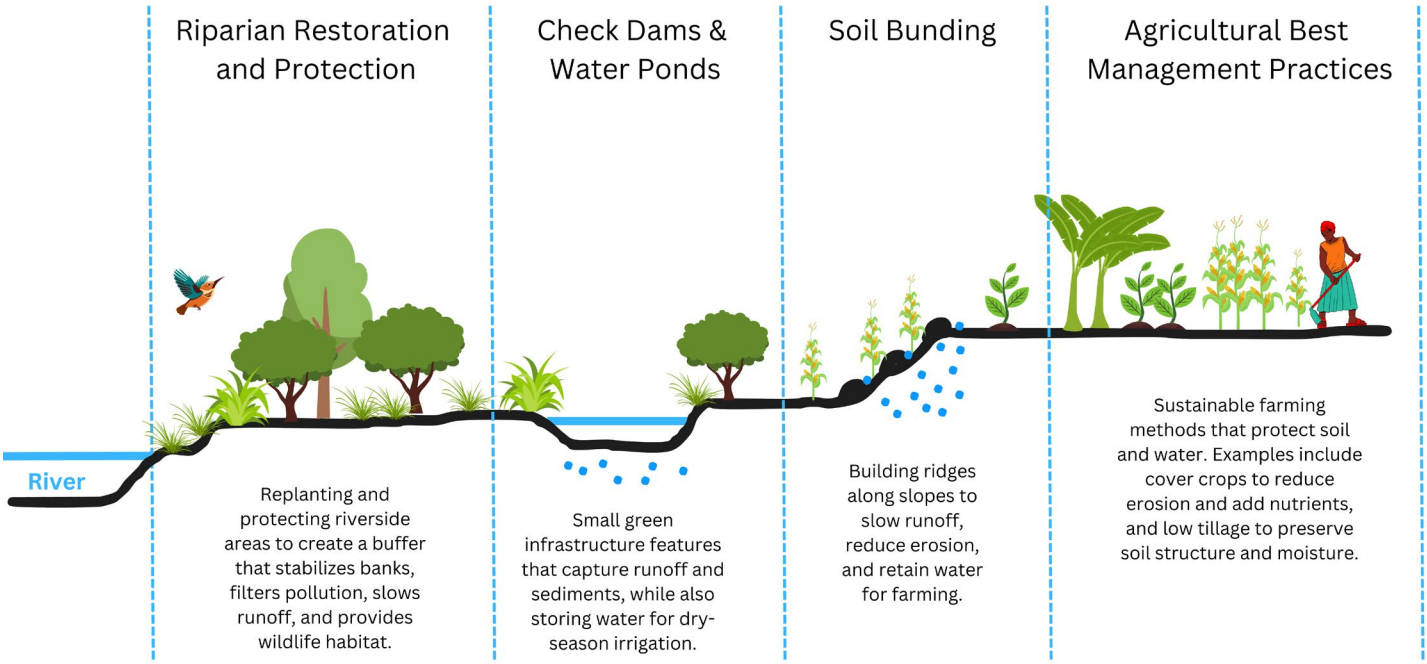
Many local, green infrastructure features to store water in the landscape and capture sediments.

Check Dams

In-channel natural barriers used in tributaries that slow down water speed, which captures sediments.

*See Figure 3 (on following page) for visualisation of these NbS.

Figure 3: Type of NbS recommended



Box 1.

Riparian Buffer Zone Policy

Introduced in 2011, Ghana's Buffer Zone Policy aims to protect watersheds by establishing vegetative buffers around rivers and water bodies to prevent pollution, control erosion, reduce flooding, and enhance biodiversity.

It promotes sustainable land use and community involvement, and is now advancing into law to strengthen enforcement – particularly against illegal mining, a major cause of deforestation of riparian areas and water quality degradation.

For the Water Resources Commission (WRC), riparian restoration is a national priority and a strategic tool for safeguarding water resources and addressing one of Ghana's most critical environmental challenges.

Native tree species planted in riparian buffer zone in 2023 by WRC.

The Need for a Watershed Investment Program

A coordinated, long-term effort is essential to deliver these NbS and restore ecosystem health across the basin. This can be achieved through a Watershed Investment Program (WIP), which would likely be hosted within the WRC.

However, decisions regarding resource allocation will be made by a Steering Committee representing local stakeholders. A dedicated account would be established to manage WIP funding, kept separate from other WRC activities to ensure that resources are directed to communities and local water committees – the key actors in implementing and maintaining the NbS.

The WRC will coordinate with government agencies, including agricultural extension services and the irrigation department to engage, support, and capacitate communities to ensure successful and sustainable delivery.

From Communities for Communities

A key priority of the WIPs is to ensure that the communities restoring the land also directly benefit from the program.

Therefore, the WIP will delivery a comprehensive Alternative Livelihood Program to engage, mobilise, and incentivise local communities.

The program will include the installation of solar-powered irrigation pumps to reduce the need to access to the main river for irrigation, as well as a provision of economically valuable fruit trees, improved sea butter processing equipment, and bee-keeping and aquaculture support.

This WIP should be a program from communities for communities.

Scientific and Technical Analysis

The impact of NbS on water resources and ecosystem health

Our team undertook a scientific analysis, which indicates that implementation of NbS at-scale could significantly reduce sediments in tributaries and the main channel downstream.

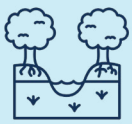
The analysis also showed that at-scale NbS would increase water availability locally at decentralised sources.

To determine the optimal scale of implementation across Ghana's part of the basin, five different options were tested.

Each one represented a different level of implemenatation: 20%, 40%, 60%, 80%, and 100% of the total area where NbS could be used (See Figure 4).

Impact of NbS on the Black Volta's upstream and downstream water sources

Proposed NbS on Ghana's Side of the Black Volta



Riparian Restoration and Protection on **28,114 Ha**

Agricultural BMPs on **12,416 Ha**

Soil Bunding or erosion control on **3,270 Ha**

175 Water Ponds and check dams

Impact: Upstream Sources

- **Up to 15.5% soil erosion**
- **Up to 84% turbidity reduction**
- **~2.6 million m³ additional water stored in the landscape**

Impact: Downstream Main River

- **89% reduction in sediment load at the Jambuse abstraction point, resulting in a 75% decrease in turbidity**
- **83% reduction in sediments reaching the Bui Reservoir**

		Nbs Implementation Scenarios				
NbS	Unit	20%	40%	60%	80%	100%
Check Dams*	#	75	75	75	75	75
Water Ponds*	ha	100	100	100	100	100
Riparian Restoration & Protection	ha	6,095	12,387	19,908	27,700	28,075
Agricultural BMPs	ha	1,000	2,000	3,000	4,000	12,416
Bunding	ha	1,071	2,143	2,336	2,366	3,270
Total Area (Hectares)	ha	8,166	16,529	25,255	34,035	43,761

Figure 4: NbS Implementation Scenarios

*The number of check dams (75) and water ponds (100) was kept at their maximum in all scenarios to trap as much sediment as possible to improve downstream water quality, while also supporting local irrigation. However, implementation can't exceed 75 check dams and 100 ponds – because going beyond that could start to reduce the main river's flow too much, which would have negative effects on downstream users.

Importantly, downstream impacts of sediment loads remain steady across all scenarios as the check dams and water ponds are highly effective at trapping sediments that have reached the water.

However, meaningful erosion control that retains sediment in the landscape only starts to appear once more than the 40% scenario is implemented (Figure 5), indicating that the investment programme should aim to reach near the 60% implementation area to realise meaningful improvements in erosion and ecosystem health.

Addressing soil erosion and retaining soil nutrients across the landscape is crucial for: (i) improving water quality locally, (ii) maintaining and enhancing soil fertility in agricultural areas, and (iii) minimising the burden to communities of sediment removal from check dams and water ponds.

This has a reinforcing effect, because restored soils and naturally vegetated landscapes enhance moisture retention and slows runoff, further reducing flood severity and enhancing local surface water and groundwater resources.

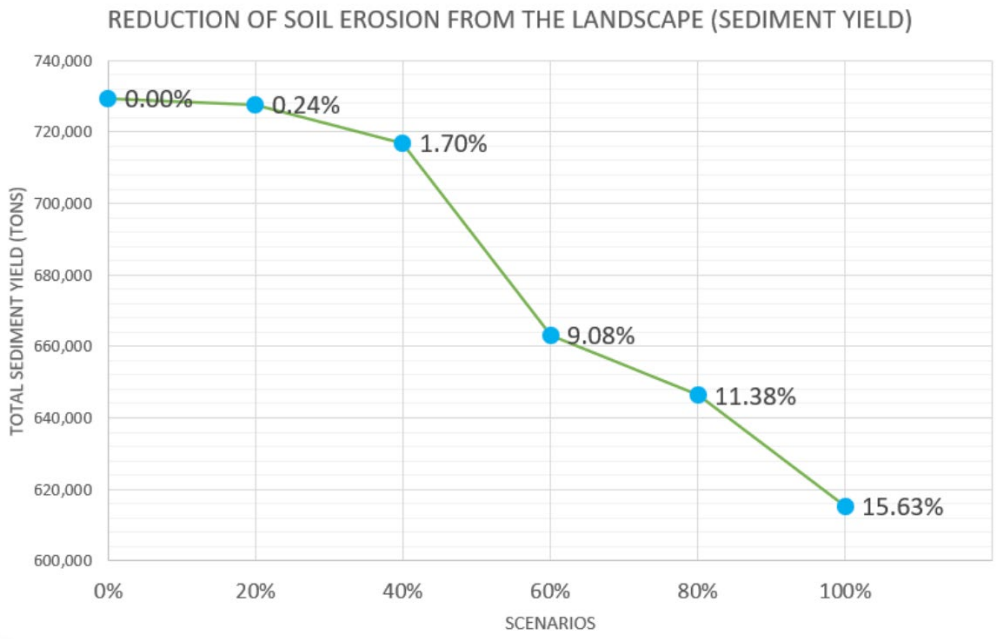


Figure 5: Reduction in soil erosion (sediment yield)

Financial and Economic Analysis

A Cost-Benefit Analysis (CBA) was conducted to assess the financial and economic feasibility of a long-term WIP focusing specifically on the Ghanaian side of the Black Volta Basin. This was undertaken by comparing all the costs to implement the WIP with the anticipated economic, social, and environmental benefits under all five implementation scenarios. The costs and benefits were structured as illustrated in the diagram.

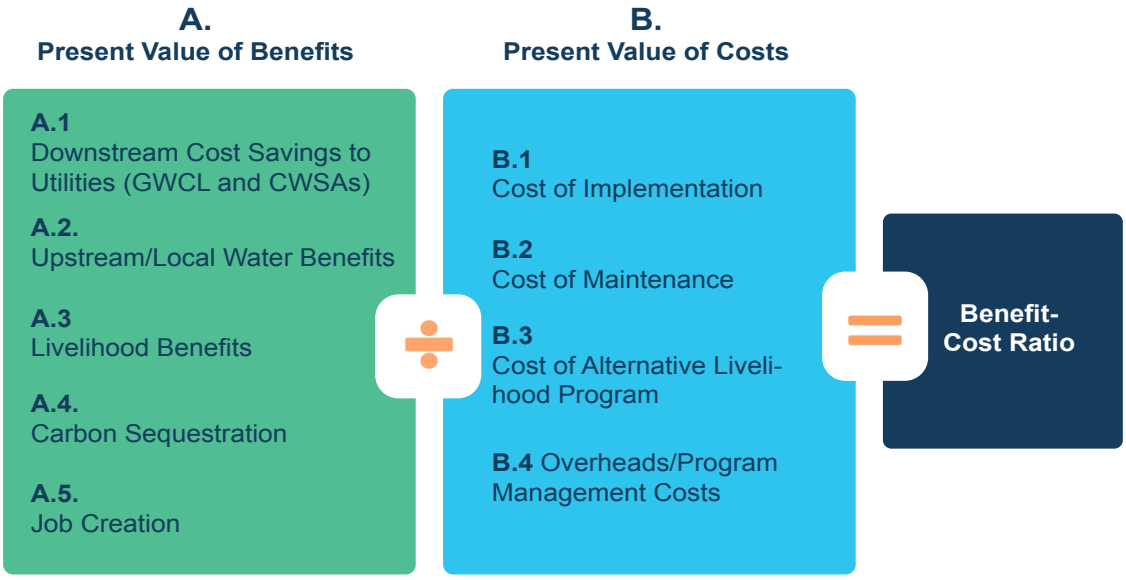


Figure 6: Structure of Cost-Benefit Analysis

Our findings confirm that a WIP is a sound, long-term investment opportunity, demonstrating strong economic viability across all scenarios (see Figure 7).

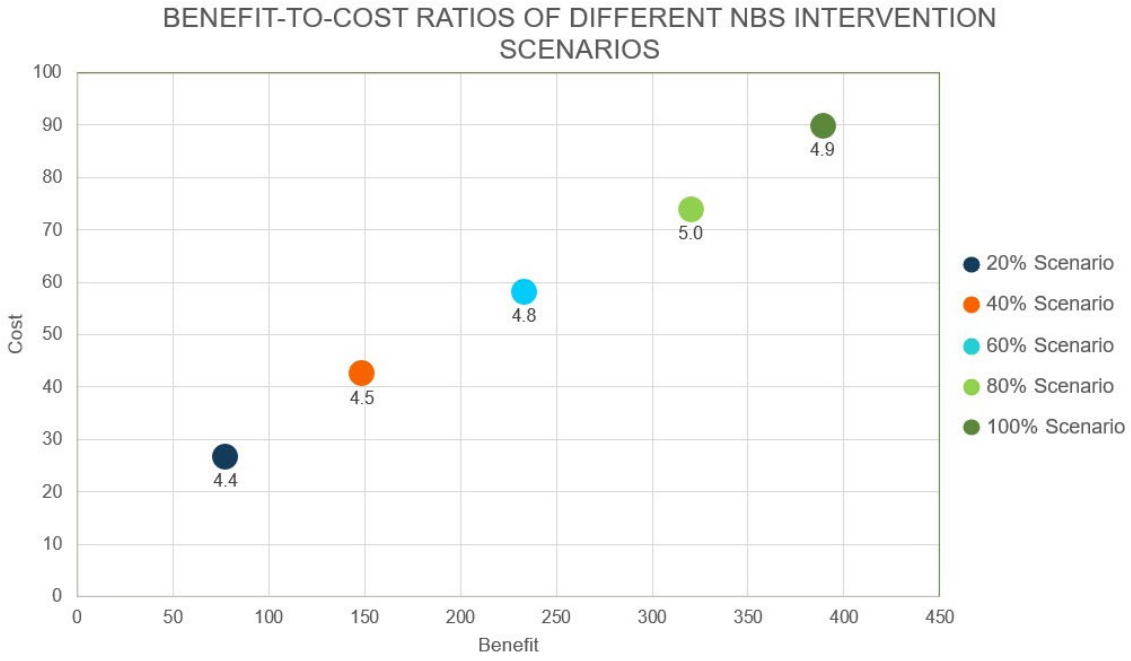
The graph shows that in general, more NbS implementation results in a higher Benefit-Cost Ratio (BCR) due to economies of scale. However, beyond the 80% scenario ($125 million total portfolio cost over 30 years), benefits begin to tail-off, which points to an optimum investment limit at that implementation scenario (80%).

The scientific analysis confirms that achieving meaningful erosion control requires an implementation scale exceeding the 40% scenario, suggesting that the optimum investment range lies between 40% and 80% scenario.

This translates into an investment need of $12.6 - $22.5 million USD over the next 5 years, which further needs to be balanced with the WRC's ability to mobilise these sums of money.

Every $1 USD invested in a WIP could generate economic and financial benefits of $4.4-$5 USD (Benefit-Cost Ratio).

Figure 7: Benefit-Cost Ratio of all five scenarios



A WIP could deliver substantial water benefits – both where it originates at source and downstream – as well as other important benefits such as improved livelihoods, greater carbon sequestration and storage, and new job opportunities.

The Net Benefit of the program would be substantial as demonstrated by Figure 8, comparing the costs and benefits over 30 years.

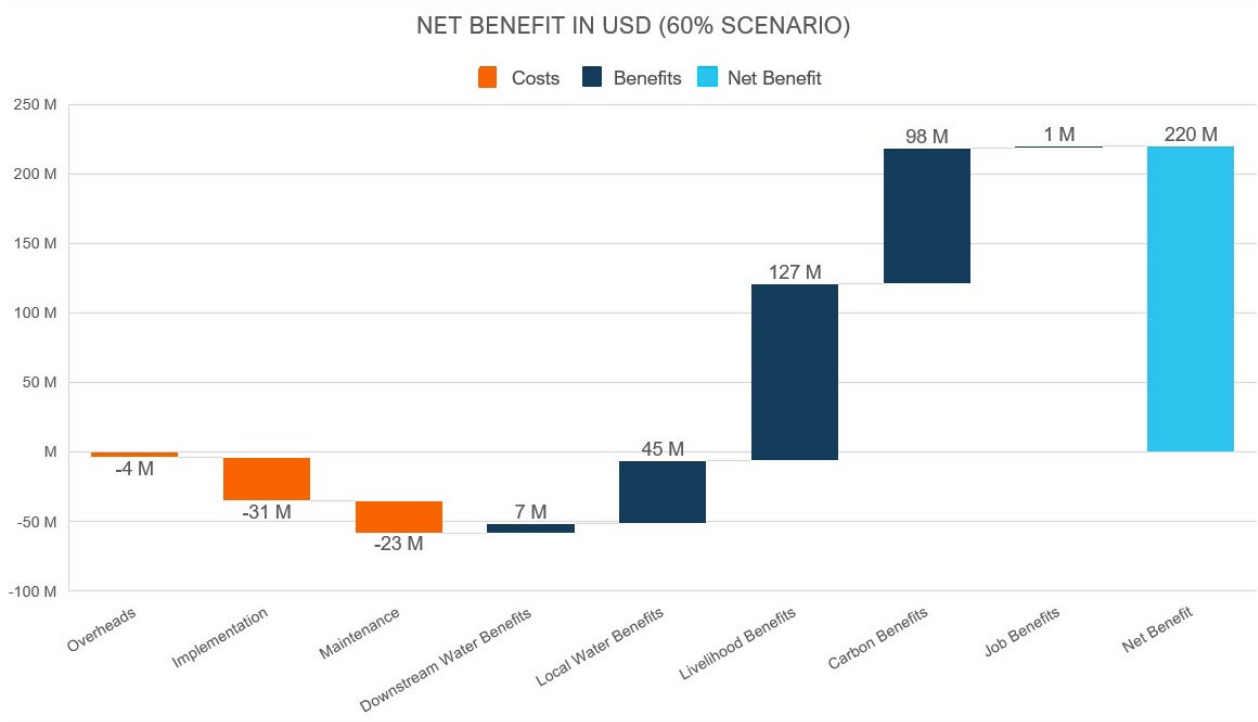


Figure 8: Net Benefit waterfall chart of the 60% scenario

Downstream water benefits	The downstream water benefits translate into significant cost savings to the water utilities across all scenarios: **36% utility cost savings over 30 years. Average annual cost savings to utilities worth $605,759 USD.**
Local water benefits	Local water benefits are derived from the **2.5 million m3 of additional water stored in the landscape**, enhancing groundwater recharge and dry season irrigation, valued at **$45 million USD**.
Livelihood benefits	The Agricultural Best Management Practices can **increase agricultural productivity** valued at up to **$88.6 million USD**, while the **Alternative Livelihood Program** could increase household income delivering economic benefits worth up to **$153.6 million**
Carbon	A WIP could deliver up to **$138 million worth of economic benefits** from increased carbon sequestration and storage.
Jobs	The WIP would directly generate **51 new and permanent full-time job positions**, resulting in up to **$1.5 million USD in economic value**. This does not include the knock-on effects of increased household income and the numerous job opportunities that this could generate across the communities.

* All benefits are discounted figures over 30 years.

A WIP would likely deliver further benefits to other important stakeholders that could, however, not be valued due to the lack of data or viable methodology, including:

- long-term operational and refurbishment cost savings to the Bui Power Authority due to the reductions in sediment deposition in the reservoir.
- cost savings to commercial irrigators struggling to abstract due to sedimentation, particularly during the dry season.
- benefits to biodiversity and opportunities for ecotourism.
- wider economic benefits (e.g. knock-on effects due to increased household incomes).

Shifting Paradigms to Secure Ghana's Water

Our findings underscore the opportunity for Ghana to make a paradigm shift to secure its long-term water future. At the heart of this new paradigm is a shift from a "centralised" to a "decentralised" approach to water resources.

The proposed at-scale NbS enables this shift, by providing benefits both downstream, supporting centralised water supply systems, and locally at the source of the water. By improving water quality and availability, increasing soil moisture and fertility, mitigating drought impacts, and sequestering carbon, at-scale NbS strengthens the resilience of both rural communities and urban centres.

At-scale NbS supports the natural hydrological cycle in a holistic way, the root cause of its imbalance.

Crucially, the proposed long-term investment programme will generate substantial benefits for local communities who are the primary implementers and stewards of the NbS. These benefits include opportunities for alternative livelihoods, economic incentives, and additional job opportunities, which have the dual benefit of restoring land and water across the watershed.

One of the strongest conclusions from this work is that collective watershed management is not just a necessity – it's a strategic investment opportunity – with the potential to deliver significant benefits locally and nationally, and

Erosion Gullies near Dapola, Black Volta Basin

WIPs present high-impact opportunities to drive socio-economic benefits

provide insights for fellow Riparian States at the transboundary level.

Locally

A WIP in the Ghanaian section of the Black Volta presents a high-impact opportunity to drive both socio-economic and environmental benefits. By safeguarding water resources, it strengthens livelihoods and resilience for communities across the basin, from those in source water areas to downstream users.

Nationally

The financial savings, economic growth, and environmental gains from this WIP make a compelling case for scaling the “long-term investment programme logic, nationwide. Although Ghana is downstream in a multi-faceted transboundary river system, this initiative proves that strategic investment in Ghanaian source water areas is beneficial to Ghana – a model for all Ghanaian basins facing similar upstream problems.

Transboundary

On a transboundary level, the demonstrated upstream livelihoods benefits create a strong incentive for other countries to adopt NbS and replicate a WIP. By investing in at-scale NbS, these countries can secure their own water future while contributing to improving downstream water quantity, quality and reliability.

This is a moment of opportunity, to shift the paradigm from reliance and investment in centralised water supply, to the multidimensional benefits and long-term security of decentralised water provisioning.

Paving the Way for Implementation

The next phase of work

The next phase of the Watershed Investment Program is a critical step in transitioning from planning to implementation and securing funding. It is designed to lay the groundwork for a successful large-scale rollout of NbS across the Black Volta watershed in Ghana.

At its core, this long-term investment programme is about uniting key stakeholders – communities and the public and private sectors – around a shared vision for water security.

Addressing the basin's complex challenges will require genuine collective action, and the success of this next phase depends on all stakeholders stepping up, aligning efforts, and committing to long-term collaboration.

Key workstreams in this phase include:

- **Designing an implementation strategy** with clearly prioritised NbS intervention areas.
- **Designing a sustainable long-term funding strategy** to support scale and longevity.
- **Building capacity** within the Water Resources Commission (WRC) and local Water Committees.
- **Implementing pilot projects** to test and refine approaches.
- **Developing a robust monitoring and evaluation strategy** alongside a decision-support system.
- **Defining a governance framework and legal structure** to ensure accountability and coordination.

Dr Joachim Ayiiwe Abungba, Deputy Director of Water Resources Planning and Management is intrumental in leading this WIP effort.

Collaborating with our Generous Supporters

The WRC, Ghana Water Company Limited, the Bui Power Authority, the Conrad N. Hilton Foundation, and Nature for Water have already committed to supporting this critical transition phase, with the intention of bridging the support of others, including the Ghanian local and national governments.

As the program moves toward to implementation, fostering buy-in and ownership among core partners will be essential to turning the vision into real benefits and long-term impact.

Lead Authors: Lola Grundmann and Dr Douglas Nyolei
Contributors: Eng. Michael Vice, Thomas Skurtis, Dr Joachim Ayiiwe Abunga

Black Volta Watershed Investment Program

The Black Volta River Supports

- Drinking water for 1.6 million people
- 25% of Ghana's total hydro power capacity
- Rural communities & livelihoods
- Irrigation for commercial agriculture
- Wildlife habitat & biodiversity

The Challenges

Sedimentation of water ways

Erosion & nutrient loss

Land degradation particularly in riparian areas, driven by agricultural expansion and illegal small-scale mining

Climate vulnerability due to rainfall variability

Watershed Investment Program


Riparian Restoration


Ag BMPs


Water Ponds


Soil Bunds


Check Dams

DOWNSTREAM WATER SECURITY

75% turbidity reduction at the Jambuse drinking water abstraction point.

83% reduction in sediments reaching the Bui Power Dam.

$60,759 USD in average annual cost savings to the water utilities.

UPSTREAM WATER BENEFITS

84% reduction in turbidity in the tributaries.

2.6M m³ additional water stored in the landscape, enhancing groundwater recharge and dry season irrigation valued at **$45M USD**.

RESILIENT LIVELIHOODS

$88.6M USD agricultural productivity gains.

$153.6M USD worth of alternative livelihoods created.

51 permanent full-time jobs up to **$1.5M USD** in economic value.

RESILIENT NATURE

Up to $138M worth of carbon sequestration.

More than 28,075 ha of habitat restored.

**The figures included here assume the 100% implementation scenario.*

Black Volta Summary Report

2025