TECHNICAL ASSESSMENT

KARNATAKA WATER SECURITY AND RESILIENCE PROGRAM

MARCH 2025

FINAL VERSION

Contents

1. Country and Sector Context

Water Security, Sustainability, and Resilience Challenges

1. **The Bengaluru Municipal Corporation is the fourth largest in India**, and the capital of the southern state of Karnataka. It is the third most populous city in India, with a population of more than 8 million,[1] and a decadal growth rate of 47 percent[2]. It is administratively managed by the Bruhat Bengaluru Mahanagara Palike (BBMP). BBMP was created in 2007 by merging the erstwhile Bangalore Mahanagar Palike, along with seven city municipal councils, one town municipal council, and 110 villages around Bangalore covering an area of 712 sq. km. The temporal analysis of land use in Bengaluru shows that there has been a 466 percent increase in built-up area leading to water scarcity and frequent flood in the vulnerable areas.

2. **As a result of the rapid expansion in the city boundaries, Bengaluru faces several water security challenges that can be characterized by the adage 'too much, too little, too polluted'.** These include water supply shortages[3] with daily deficits amounting to 20 percent of demand[4], groundwater depletion[5], contamination of water bodies and lakes, frequent flooding of low-lying settlements, and encroachment of lakebeds and stormwater drains (SWD). Bengaluru has 633 sub-drainage catchments with a network of 860 km of primary and secondary Storm Water Drains (SWD). All SWDs in the city are gravity drained, and each primary drain has a unique identification number and known catchment area. The unchecked encroachment of the SWDs, solid waste disposal in SWDs, and lack of maintenance lies at the heart of the city's persistent flooding issues. Additionally, hundreds of dilapidated and leaking machine-holes[6] on sewage trunk lines are located in SWDs, which leads to contamination of lake water where these SWDs discharge to.

3. **Bengaluru's vast lake system consisting of 204 cascading lakes is now polluted and disconnected, and thus, unable to perform their water balancing functions.** The problem is mainly caused by discharges of untreated wastewaters and industrial effluents. Sand mining in the lakes, uncontrolled disposal of solid waste, and possibly seepage of groundwater into those lakes negatively affected by fertilizer use, may also be contributing their share. The result is not only an environmental problem, but also increasingly a public health concern. Twenty-one of these have been reclaimed for infrastructure such as a stadium and a bus terminal. However, the remaining 183 lakes hold great potential for reintegration into a system where lakes serve as balancing reservoirs during floods and droughts. Desludging of existing lakes and upgrading of Bengaluru's SWD network (860 km of which one-third needs reinforcement or strengthening) can create the basis for a rejuvenated lake system and increase the flood discharge capacity of the city.

4. **The city's water security is also influenced by the water management context of its surrounding (and expanded) areas.** Many of Bengaluru's neighboring districts like Tumkuru, Bengaluru Rural, Bengaluru Urban, Chikkaballapura, and Kolar do not have perennial rivers. Hence, agricultural, domestic,

[1] https://www.census2011.co.in/data/town/803162-bbmp-karnataka.html
[2] https://bengaluruurban.nic.in/en/demography/
[3] https://www.downtoearth.org.in/water/dte-coverage-bengaluru-water-crisis-2024-95072
[4] https://www.waterdiplomat.org/story/2024/05/bangalore-indias-high-tech-capital-experiencing-serious-water-shortages
[5] https://www.theweek.in/news/india/2024/03/12/bengaluru-water-crisis-how-over-exploitation-of-groundwater-caused-scarcity.html#:~:text=According%20to%20the%20Central%20government's,more%20than%20they%20are%20recharged
[6] Previously known as manholes.

and industrial water requirements are fulfilled by groundwater. However, 10,443.17 sq. km. of groundwater area was declared critical in 2023, up from 6,580.96 sq. km. in 2022, and increase of almost 60 percent.[7] The main sources of recharge are rainfall and applied irrigation. Due to the complex geological formation of the state, the groundwater recharge process is slow compared to the extraction rate.

5. **Despite long-standing city and state-level institutions, capabilities for delivering resilient municipal water services and disaster risk governance in the context of climate change are limited.** Responsibilities for managing situations of "too much, too little, too polluted" water are spread across different institutions at the city and state levels. This includes the municipal corporation -Bruhat Bengaluru Mahanagara Palike (BBMP); the city's water utility - Bangalore Water Supply and Sewerage Board (BWSSB); the state's disaster risk management agency – Karnataka State Disaster Management Authority (KSDMA), amongst others such as the state's pollution board and water management departments. The sections below highlight the technical, operational and financial improvements that can enhance the capabilities of the key institutions in delivering results for water security and resilience.

6. **BBMP and BBMP's responsibilities include provision of civic amenities in the Greater Bengaluru metropolitan area such as municipal solid waste, the maintenance of stormwater drains, and lake development and maintenance.** BBMP's two departments responsible for SWD and lakes largely work in silos and lack an integrated approach. With a rapidly growing population, especially in the added areas merged into it in 2007, enhancing civic service delivery and sustaining investment in urban infrastructure is crucial for maintaining the quality of life for its residents. BBMP needs to significantly enhance institutional capacity to deliver on investment commitments and meet its service delivery obligations.

7. **BBMP's is one of the richest municipal corporations in India** and could ideally borrow from the capital markets to finance investments, as other Indian municipalities have done. BBMP's own source revenues (OSR) consisting of property taxes (85%) and fees (15%) are strong and growing, contributing an average of 80 percent to total revenue in the last five years. Strengthening OSR will improve the creditworthiness of BBMP, allowing it to raise commercial financing to fulfil its mandate and improve services to citizens.

8. **BBMP's OSR has increased from Rs.3,438 crores (~US$430 million) in 2019-20** to Rs.4,194 crore (~US$524 million) in 2022-23 and to Rs.5,047 crore (~US$630 million) in 2023-24. The O&M expenditures have also increased at same compounded annual growth rate of 7.9 percent from Rs.2,897 crore (~US$349 million) in 2019-20 to Rs.4,228 crore (~US$528 million) in 2023-24. The five-year average O&M cost coverage from OSR is 109 percent. It has negligible amount of debt and hence no debt servicing costs.

Table 1: BBMP OSR revenue and cost coverage trends & proposed baseline and target

BBMP Actuals in INR Crores	Actual 2019-20	Actual 2020-21	Actual 2021-22	Actual 2022-23	Actual (RE) 2023-24
Municipal Own Total Source Revenue Income (Actual Receipts)	**3,438**	**3,464**	**3,793**	**4,194**	**5,047**
Revenue growth		**0.8%**	**9.5%**	**10.6%**	**20.3%**
5-year Compound annual growth rate (CAGR)					**7.9%**
Revenue Expenditure (O&M costs)	**2,897**	**3,495**	**3,932**	**3,787**	**4,228**
O&M cost coverage ratio from OSR (actual receipts/actual expenditures)	**119%**	**99%**	**96%**	**111%**	**119%**
5-year Average O&M cost coverage from OSR					**109%**

[7] https://bangaloremirror.indiatimes.com/bangalore/others/alarming-rise-in-critical-groundwater-areas-in-karanataka/articleshow/112023450.cms

BWSSB

9. **Alongside water shortage in Bengaluru, the quality of water supply and sanitation services is declining**. Rapid urban agglomeration along with significant multi-fold expansion in the service area of Bangalore Water Supply and Sewerage Board (BWSSB) from the core area of 245 sq. km to 712 sq. km of the entire BBMP area, has put a huge strain on WSS services.

10. **The current water demand is 2,100 MLD. Until the recent commissioning of the Cauvery V Stage Project, BWSSB used to provide 1,450MLD[8] of water to the core area, sourced 300 m from the Cauvery River, leaving a deficit of 650MLD.** Water supply has now increased to 2,225MLD to include the peripheral 110-village area. However, this is still not enough to bridge the gap between demand and supply, as the city's demand stands at 2,632 MLD according to some estimates. The high reliance on surface water makes Bengaluru particularly vulnerable to the impacts of climate change. Moreover, much of the 4,800 km of pipeline network serving 5.5 lakh connections is corroded and leaking, resulting in 27 percent loss to non-revenue water (NRW).

11. **Implementing circular economy principles – including sewage treatment, reduction of water losses, and water reuse – hold great potential for addressing water scarcity.** However, currently only 15 MLD is reused for industrial and commercial use. Investment in water reuse technologies would provide additional revenue for BWSSB, increase the total available water to the city during droughts, and help rejuvenate city lakes with the additional benefit of increased groundwater recharge.

12. **Bengaluru now generates 2,000 MLD of wastewater, while the 36 Sewage Treatment Plants provide a sewage treatment capacity of 1,372.5 MLD.** This leaves a deficit in the treatment capacity of wastewater treatment. Additionally, the mandate of BWSSB for sewerage coverage does not extend to apartment complexes with more than 120 apartments in the 110 villages around Bangalore. Thus, due to ageing sewer pipelines, some of which were laid 40-50 years ago, and direct discharges from the houses and apartments into SWDs, in addition to encroachment and damages in the sewerage system, some part of wastewater flows through SWDs and enters lakes, causing them to be polluted.

13. **BWSSB has block pricing for water supply, with sewerage fee charged at a flat rate of Rs. 14 for water consumption up to 8,000 liters.** It last revised its tariff in 2014. Since then, cumulative inflation (CPI) in India has been 41 percent (2015-2023), while revenue potential is stagnant. Collection of current dues was at 78 percent for the one-year period to July 2024, but including collection of arrears takes BWSSB's collection to 100 percent of current billing. BWSSB's financial position has steadily declined over the last 7 years as illustrated by its declining operating cost coverage ratio (total income / operating expenses excluding depreciation & provisions), which declined from 1.6 in 2016 to 0.97 in 2023. Neither depreciation nor financed costs are covered, increasing the state's burden for financing all major repairs and capital works and increasing BWSSB's debt burden, as there is no capacity to pay interest or principal on outstanding debt from government institutions. With its aging water supply and sewer pipelines, inadequate asset planning on its part will require massive rehabilitation works. BWSSB's net losses have grown from INR 342 million in 2016-17 to INR 12.5 billion in 2023-24, resulting in cumulative losses of over INR 42 billion. While there is some room for cost optimization and improvement in collections, BWSSB will have to increase tariffs to cover operating costs, gradually recover some finance costs and build its creditworthiness.

[8] Arup India. 2024. Biogas Utilization for GHG Mitigation and Revenue Generation. Option Assessment Report for Bangalore Water Supply and Sewerage Board

14. **Adequate incentives to improve the quality of services are missing.** Performance-based financing mechanism that would reward good and penalize poor performance is not in place. Lack of adherence to bylaws on industrial and residential wastewater. There is a basic monitoring and evaluation system with limited use of digital technologies. Citizen report cards are not published.

KSDMA

15. **Despite being mandated by the Disaster Management Act 2005, Karnataka is yet to have an operational State Disaster Management Authority (SDMA).** KSDMA was constituted officially in 2008 but is yet to become operational. The DM Act mandates that SDMAs lay down plans and policies, coordinate the implementation of disaster management plans, examine state vulnerability, specify mitigation measures, recommend mitigation and preparedness funds, monitor implementation of guidelines and incorporation of risk in development plans. Some of these functions are currently being undertaken by Revenue Department (RD) or the Karnataka State Natural Disaster Monitoring Center (KSNDMC). For example, RD anchors the development of plans and policies such as the State Disaster Management Plan and KSNDMC supports with functions related to risk assessments, post disaster assessments and memorandum preparation, risk communication and public engagement. However, in the absence of a functional SDMA, the operational linkages needed to translate risk information into integrated planning do not exist and the decision-support potential of the risk information is sub-optimally utilised. This is also the case with operational linkages for risk information related to Bengaluru.

2. Program Description

2.1 Government Program

16. With resilience as its key organizing principle, the Karnataka State Action Plan on Climate Change (KSAPCC) 2024 will serve as the overarching government program ('p', the government program) with an estimated[9] expenditure of US $ 1.4 billion ('p') on sectors relevant to this Program. Given the cross-cutting nature of resilience actions, GoK's commitments towards water security and resilience in Bengaluru are realized through initiatives and institutions at the city, sector, and state-levels. This includes the Bengaluru Climate Action and Resilience Plan (BCAP), the Water Policy Implementation Program 2022, and the State Disaster Management Plan. The KSAPCC integrates such different levels of action by bringing together adaptive and mitigative strategies for the entire state through key priority sectors viz. agriculture, animal husbandry, water resources, forest and biodiversity, coastal zone, and energy, at the district level between 2025 and 2030. The BCAP (2023-2030) was launched by BBMP to develop an actionable roadmap to mitigate and adapt to climate change, and to build better resilience. It targets emission reduction and climate change risk and vulnerability reduction across sectors through collaboration and is aligned with the KSAPCC. The Water Policy Implementation Roadmap is a 10-year plan (2022-2023) at the state, district, and technical support level, which aims to monitor policy goals related to efficiency of water use, sustainable water management, healthy watersheds etc. BWSSB is a core agency responsible for provisions relating to urban drinking water, recycling, reuse of treated wastewater and rainwater harvesting, and water resource planning and development, under this policy. The State Disaster Management Plan is a comprehensive plan mandated by the Disaster Management Act and developed by GoK to identify mitigation, preparedness, response, and recovery actions for managing disasters. The responsibility framework, outlined in Volume II of this plan, outlines action areas for different state agencies in this regard.

[9] GoK (2021) Karnatak State Action Plan on Climate Change Version 2.0 (based on expenditure estimates for the relevant sectors till 2030.

17. The proposed Program-for-Result (PforR) Program ('P', the Program) will support a subset of GoK initiatives on climate resilience and DRM, to address water security and resilience issues in the city of Bengaluru. The Program will apply the circular economy principles of reduce, reuse, and recycle with financial allocation and climate change adaptation over department wise schemes and programs as outlined in the KSAPCC and supported by the BCAP, GoK's Water Policy, and the state DRM Plan. The Program will cover institutional reforms and capability enhancement for improved delivery of sanitation, water security planning, and drainage services as well as flood and DRM. The Program budget is US$670 million and prioritizes Bengaluru due to its economic salience to the state of Karnataka, population concentration, and climate vulnerability. The proposed Program will include activities to be undertaken by the four implementation agencies. Following are the key programs and activities of the GoK for water security and climate resilience.

18. ***Program for treatment of sewage and reuse:*** With the goal of achieving 95 percent wastewater treatment through a combination of networked and decentralized systems, of which 60 percent would be through adoption of low carbon wastewater treatment technologies by 2050, BWSSB is expanding its sewage treatment capacity. With support from the Japan International Cooperation Agency (JICA), the Government of Karnataka (GoK) is currently constructing 14 sewage treatment plants (STPs) in the expanded area with a capacity of 721 MLD[10], but an additional 9 STPs with a secondary treatment capacity of 148 MLD are needed to prevent sewage from entering the SWDs and lakes. Additionally, the GoK also aims to achieve reuse of treated wastewater to a minimum of 50 percent by 2030 and 90 percent by 2050.

19. ***Program for improving the health of watersheds and water bodies:*** The government aims to restore and enhance sponge spaces to increase groundwater recharge and decrease storm water runoff through green infrastructure technologies. Towards this, the government is planning to have 40 percent of city's surface area become permeable by 2040 by reclaiming ecologically sensitive spaces and adopting nature-based solutions (NBS).

20. ***Program for NRW monitoring:*** BWSSB has started to implement projects to improve NRW management for addressing the water availability issues in line with the BCAP goal of reducing NRW to 15 percent by 2050. To tackle NRW in 132.50 sq km. of the core area, where average NRW was as high as 50 percent, 635 km of pipelines less than 100mm diameter were replaced under JICA funding. The project was executed using performance-based construction contract with five years of O&M for a total cost of the contracts was 635.4 crores over a period of 9 years. The project led to a total savings of 170 MLD of water, or Rs. 261 crores (~US$33 million) per year at Rs.42 per KL of water. At this rate of savings, the payback period for BWSSB is three years. As a result of this project, the NRW is reduced to 23 percent, consumers get increased supply of water and improved pressure and water quality, which translates to improved revenue. Pipe replacement in an additional 20 sq. km. is under progress and nearing completion. However, pipes need to be replaced in an additional 70 sq.km. of the core area.

21. **Groundwater Recharge Program:** The Government of Karnataka has taken up Lake Filling Schemes with Secondary Treated Sewage water to augment ground water table in overexploited taluks around Bengaluru City. The state intends to fill 308MLD of secondary treated sewage water to 259 lakes in Bengaluru Urban, Bengaluru Rural, Tumkur, and Chickballapura districts with treated water from Vrushabhavathi valley STP at an estimated cost of Rs. 2240.00 crore (approx. US$270 million). The first phase with a cost of Rs. 1081.00 crore (approx. US$130 million) for filling 70 lakes is approved and in progress.

[10] https://bwssb.karnataka.gov.in/info-1/About+BWSSB/en

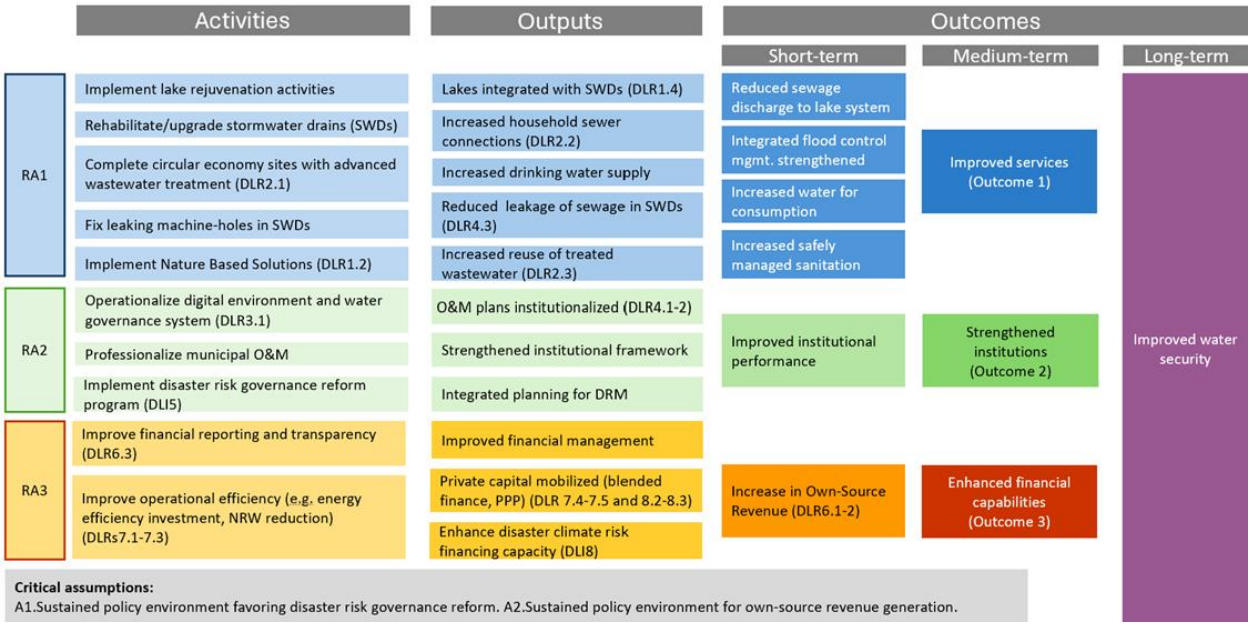
2.2 Theory of Change

22. **The proposed KWSRP supports the Government of Karnataka in operationalizing the Karnataka State Action Plan on Climate Change.** Specifically, the Program adopts a framework with three interlinked results areas to enable a transition to higher-quality, sustainable and resilient services: (i) improving infrastructure and services; (ii) strengthening institutions; and (iii) improving financial sustainability of service agencies.

23. **In the absence of fully empowered ULBs that can deliver integrated urban management to ensure climate resilience, the Program creates mechanisms for better coordinating planning, management, and service delivery in the greater Bengaluru area**. Agency-level reforms are expected to restore the links between service performance, accountability, governance and finance to ensure water security. Key reasons for the current state of affairs is the gap in infrastructure and service delivery, fragmentation of services resulting in lack of accountability, and stagnant own source revenue receipts. The PforR aims to bring the focus of the implementing agencies on water security and climate resilience by financially incentivizing service delivery performance, helping the agencies improve their own-source revenues and overall financial performance, and supporting mechanisms for enhancing governance, including the governance of risk.

24. **Results areas under the KWSRP**. The first results area focuses on activities that will bridge the service delivery gap and by rehabilitating and expanding infrastructure services such as sewage treatment, integrating stormwater drains with lakes, lake rejuvenation, and implementing nature-based solutions. The second results area on strengthening institutions supports activities such as coordinating O&M plans across zones and institutions and strengthening the institutional framework through benchmarking of services; the third results area on financial sustainability requires service delivery agencies to improve own-source revenue, transparency, and creditworthiness. The PforR aims to facilitate medium-term outcomes under these results areas, and the DLIs are generally concentrated at the activities and output level. With this approach, the Theory of Change is presented below.

Figure 1: Theory of Change



2.3 PforR Program Scope and Design

25. The proposed PforR would support interventions under an umbrella of water security, climate resilience, and Disaster Risk Management (DRM), with infrastructure investments focused on Bengaluru, support institutional reforms, integrated planning, and enhanced coordination among BWSSB, BBMP, the Karnataka State Disaster Management Authority (KSDMA), and reduce the financing gap required for climate resilience. As a subset of the Government program, the PforR Program boundaries are defined as follows:

- **Services.** The Program will cover selected service sectors under the government program for integrated flood control management, improved water quality and increased safely managed sanitation. The services include water, sanitation, stormwater drainage, lake rejuvenation, groundwater recharge, and nature-based solutions.

- **Institutions and state capability.** The Program will undertake institutional reforms and capability enhancement for improved delivery of sanitation and drainage services as well as flood and DRM.

- **Duration.** The Program will be implemented over a period of five years (2025-2030).

- **Financing.** The program budget is US$670 million, with US$426 million from IBRD, US$239 million from GoK/GoI, and US$5 million from commercial financing.

- **Implementation responsibility.** The Program will be coordinated and managed by the Revenue Department at the state level. The main implementing agencies will be BWSSB, BBMP, KSDMA, and Minor Irrigation and Groundwater Development (MI) Department.

- **Geographical boundary.** The Program will cover the state of Karnataka with focus on the greater Bengaluru area.

26. The Program will support the state government in achieving water security and resilience through three results areas.

27. **RA1: Improving infrastructure and services for enhanced water security and resilience**. RA1 will focus on water, sanitation, drainage and DRM infrastructure and service that directly improve safely managed water supply and sanitation (WSS) services and enhance resilience to floods and droughts. It will incentivize BWSSB to expand sewage treatment, ideally through an open technology bidding process and with the following key amenities: tertiary treatment to increase the reuse of treated wastewater; methane capture and biogas generation; and solar sludge dryers. In addition, RA1 will incentivize BBMP and BWSSB to collaborate on fully integrating SWDs and lakes and creating climate-resilient balancing reservoirs to dynamically retain and release water for groundwater recharge, recreation, and green zones along with storm flood management. BWSSB will support this integration by sealing leaking machine-holes in the sewer truck lines in the SWDs. Additionally, the MI Department will undertake groundwater recharge investments wherein it will fill 40 lakes in the greater Bengaluru areas under the ongoing Vrishabhavati Valley Project, which conveys treated sewage from Bangalore city to surrounding drought=-prone districts.

28. **RA2: Strengthening water security institutions.** To transform the institutional approach to SWDs, the Program seeks to institutionalize a coordinated multi-agency approach for SWD that will develop joint O&M implementation plans, with citizen engagement, behavior change campaigns. A new digital water and environmental governance system will be developed to monitor, track critical sector indicators such as effluent from STPs, STP utilization rate, water reuse, residential wastewater effluent, and a lake health index.

29. **The institutional structures related to (DRM) will be reformed** through the enhancement of KSDMA's capabilities and the establishment of functional units such as Mitigation and Disaster Risk Financing (DRF) units. These new units will facilitate the development and implementation of a wide array of DRM activities tailored to address the specific challenges posed by multiple hazards. Central to this reform effort will be the Karnataka State Natural Disaster Management Centre (KSNDMC), which will be scaled into a Centre of Excellence (CoE) focused on proactive climate actions and strategies for managing extreme weather conditions. This CoE will serve as a vital hub for research, innovation, and offer services to mainstream DRM across sectors. A key feature of the CoE will be a new comprehensive data model – the Karnataka Climate and Multi-Hazard Risk Information System (KCHRIS). This cutting-edge, one-stop risk management tool will function as a comprehensive decision-support platform. It will strengthen emergency preparedness, streamline response efforts, enhance mitigation planning, and promote resilience-building initiatives—all crucial for safeguarding communities and ensuring risk informed development considering climate-related challenges.

30. **RA3. Enhancing financial capabilities and resources of key institutions.** RA3 seeks to strengthen the financing sustainability of BWSSB and BBMP. It will incentivize the improvement of BWSSB's cost recovery through both enhanced operational efficiency and revenue generation, including energy efficiency, NRW, and water tariff adjustments. The Program seeks to increase BWSSB's revenues by at least 30 percent and advance the first PPP in BWSSB's history. The PPPs will bring in innovation, enhance operational efficiency, and ensure adequate O&M to enhance asset quality and longevity. Life cycle cost evaluations will be used to evaluate the PPP versus engineering, procurement, and construction approaches. BBMP will be supported to strengthen capital investment planning and financial management (FM) systems enhancement. Lastly, RA3 will incentivize the establishment of a DRF Unit at KSDMA and development of the state DRF strategy including the operationalization of a blended finance facility expected to enable at least US$50 million private capital investments for DRM. This will include identifying, securing, and channeling financial resources from various sources—government budgets, private investments, international aid, and innovative mechanisms such as climate finance and insurance tools—to enable the implementation of DRM strategies.

2.4 Program Development Objective (PDO) and PDO Level Results Indicators

31. The PDO is to improve water security related municipal services, institutions, and financing in Karnataka.

32. The PDO indicators by outcomes are the following:

Outcome 1: Improving infrastructure and services for enhanced water security and resilience
PDO indicator 1: People with enhanced resilience to climate risks (Corporate, gender disaggregated)

PDO indicator 2: People provided with safely managed sanitation (Corporate, gender disaggregated)

Outcome 2: Strengthening institutions and integrated planning
PDO indicator 3: Disaster risk governance institutional reform program implemented

Outcome 3: Enhancing financial capabilities and resources of key institutions
PDO indicator 4: Own source revenue increased

2.5 Disbursement Linked Indicators and Verification Protocols

33. **Program resources will be disbursed based on the achievement of each of the eight DLIs.** These DLIs have been selected to incentivize the important policy reforms, infrastructure, and service quality interventions. The incentive amount across different DLIs reflects their importance toward achieving the Program results. Table 3 details the DLIs and the justification for their inclusion.

34. **The achievement of all DLIs will be reviewed and confirmed by the independent verification agency (IVA) to be hired by the Revenue Department, the nodal agency for the Program.** The respective Program Management Units for each of the DLIs will be responsible for reporting on achievement of the Program DLIs, each of which includes several disbursement-linked results (DLRs). The DLIs will be verified through a combination of desk review of available data and physical verification in accordance with an agreed verification protocol. All disbursement requests to the World Bank will be submitted with the results of the independent verification.

35. **Disbursement modality:** There are eight DLIs with sub-DLIs, called Disbursement Linked Results (DLRs). Most of the DLRs are scalable, - DLI1(all DLRs), DLI2 (all DLRs), DLI4 (all DLRs), DLI5 (DLR5.4), DLI6(all DLRs) and DLI 8 (DLR8.2, DLR8.3) are scalable, meaning that partial loan disbursements are allowed, and they will be proportional to the progress towards achieving the targeted DLI. Some of these will disburse against incremental percentage improvement - DLR6.1 and DLR6.2, which will disburse against the incremental increase in own source revenue receipts with a target of 45 percent increase for BBMP, and 30 percent increase for BWSSB over the baseline. This means for each percentage increase in own-source revenue compared to 2023-24 baseline, the implementing agencies will be paid a pro-rated amount for a total of US$45 million and US$30 million respectively. If the achievement consistently outperforms the targets, the corresponding loan amount can be fully disbursed before the end of the operation. A few like DLI3(all DLRs), DLI 5(DLR5.1-5.3), DLI7(all DLRs) are disbursed one time upon completion of the activity. If the action is not achieved in any particular year/period, the allocated amount is carried over to the subsequent year. Yearly disbursements will be against progressive achievement of the annual action plan under DLR4.1 and DLI4.2. If the action is not achieved in any year, the undisbursed amounts cannot be rolled over to the subsequent years. If the target is under-achieved in any period, pro-rata disbursements will be reduced for that particular period.

Table 2: DLIs and Justification for Selection

Rationale for DLI	DLI Description	Amount (JPY) and (US$ indicative)
RA 1: Improving infrastructure and services for enhanced water security and resilience		
Strengthening and integrating SWDs, lakes, and NBS in a flood management system will improve resilience to floods.	**DLI 1: Integrated flood management system strengthened** This DLI includes four disbursement linked results (DLRs): DLR 1.1 disburses upon the city's 8 zones having achieved institutional enhancement of social and environmental management; DLR 1.2 disburses upon completion of scaled NBS in each of the city's eight zones; DLR 1.3 involves 40 MI lakes able to receive treated water from Bengaluru; and DLR 1.4 disburses upon completion by BBMP of 16 integrated flood management systems. This includes SDW improvements and integration and rejuvenation of in-city	12,019,140,000 (US$84 million)

	cascading lakes, including sensors for depth and water quality.	
Operationalizing scaled circular economy investments and removing raw sewage from SWDs will improve water availability and public health outcomes.	**DLI 2: Circular economy operationalized** DLI 2 supports the construction of nine new STPs in the expanded area and one advanced water treatment plant that will produce drinking water from in-city lakes. For the STPs, reuse of tertiary treated wastewater, methane capture and biogas generation, solar sludge dryers, and long O&M design-build-operate contracts will be operationalized at scale. The DLI's three scalable DLRs will disburse upon: completion by BSWSSB of 10 circular economy sites (DLR 2.1); establishment by BSWSSB of 100,000 household sewer connections (DLR 2.2); and a 100 percent increase in volume of wastewater reuse over baseline (DLR 2.3).	5,723,401,000 (US$40 million)
RA 2: Strengthening water security institutions		
Enhancing scientific understanding and systems for integrated flood management.	**DLI 3: Water security system enhanced** DLI 3 disburses against: (i) the operationalization by BBMP of a digital environment and water governance system (DLR 3.1) that includes: (a) streamlining environment and water procedures, such as monitoring, permitting and inspections; (b) industrial wastewater pollution monitoring; and (c) implementation of a public-facing lake health index; and (ii) operationalization and integration of advanced stormwater modelling (DLR 3.2).	5,141,760,000 (US$36 million)
Institutionalizing a coordinated O&M approach for all SWDs in Bengaluru will increase water availability and climate resilience.	**DLI 4: Municipal O&M institutions integrated and professionalized** This DLI applies to all of BBMP's SWDs (860 km) and all 183 lakes and seeks to systematically improve and modernize municipal O&M institutions through a periodic performance score. It includes maintaining annual flood management professional score at 50 (DLR 4.1), fixing leaking machine-holes in the SWDs by BWSSB (DLR 4.3), and achievement of utility enhancement program score of 100 (DLR 4.2). The DLI tracks city-wide sector performance across the eight zones of Bengaluru.	9,014,355,000 (US$63 million)
Implementing reform and operationalizing DRM institutions in alignment with legal mandates and global best practice.	**DLI 5: Disaster risk governance institutional reform program implemented** The DLI disburses against achievements within the Program's disaster risk governance reform program. Disbursements will be made against the establishment of KSDMA's operational program (DLR 5.1), launch of the KCHRIS data model by KSDMA (DLR 5.2), establishment of CoE (DLR 5.3), establishment of the mitigation unit and creation of mitigation project pipeline by KSDMA (DLR 5.4), and achievement of energy efficiency performance	11,017,603,250 (US$77 million)

	enhancement score of 100 (DLR 5.5). The reform program is detailed in the Program Operational Manual (POM).	
RA 3: Enhancing financial capabilities and resources of key institutions		
Increasing OSR and meeting the 2021 FBM Rules promulgated by GoK.	**DLI 6: Own source revenues, financial reporting, and transparency improved** DLRs 6.1-6.2 disburse against pro-rated OSR growth with a target of 45 and 30 percent increase over baseline for BBMP and BWSSB, respectively. DLR 6.3 disburses against achievement of municipal financial reporting and transparency score of 100 per GoK's 2021 Fiscal and Budgetary Management (FBM) rules 6 and 8.	12,877,655,000 (US$90 million)
Strengthening the financial foundation for a climate-resilient water-secure city by moving BWSSB toward creditworthiness.	**DLI 7: BWSSB's financial and operational efficiency improved** To be eligible for disbursement under this DLI, BWSSB will demonstrate achievements towards improved financial and operational efficiency. Disbursements will be made against execution of performance-based contracts for NRW reduction (DLR 7.1), execution of energy efficiency investment at river Cauvery (DLR 7.2), ISO 50001 certification on energy management (DLR 7.3), completion of PPP transaction advisor's project feasibility report (DLR 7.4), and signing of a PPP contract (DLR 7.5).	3,577,140,000 (US$25 million)
Enabling risk and resilience financing through strategic and market-based mechanisms.	**DLI 8: Financing for addressing disaster and climate risks enhanced** To be eligible for disbursement under DLI 8, KSDMA will establish an institutional mechanism for financing disaster and climate risks (DLR 8.1), mobilize capital using market-based DRF instruments (DLR 8.2), and mobilize capital from non-GoK sources to the blended finance facility (DLR 8.3). The three DLRs are further detailed in the POM.	1,431,860,000 (US$10 million)
Front end fee		152,385,750 (US$1 million)
Total		60,954,300,000 (US$426 million)

2.6 Institutional Arrangements

36. **The implementation of the program will be undertaken by existing government institutions.** The Program will have a Program Steering Committee (PSC). The PSC, chaired by the Chief Secretary, and comprising the Revenue Department, MI Department, BBMP, BWSSB, and KSDMA will provide policy guidance, oversight, and strategic direction including inter-ministries, departments, and agencies.

37. The main implementing agencies along with the fiduciary responsibilities will fall under RD, BWSSB, and BBMP. The Program will be implemented following the Government's fiduciary and environmental and social (E&S) legal framework. The IAs under the Program are:

38. **The Revenue Department** is the nodal agency for the Program and a PMU will be established at the RD and will have the overall responsibility for compliance, monitoring, and supervision of the Program and providing strategic advice. The RD will hire the IVA for verifying the results achieved under the DLI. The PMU will include specialized technical personnel as well as environmental, social, FM, and procurement experts. The staff may either be brought in on deputation or hired from the private market. KSNDMC and the ACIWRM are executing agencies tasked with specific responsibilities under the Program but without any fiduciary power.

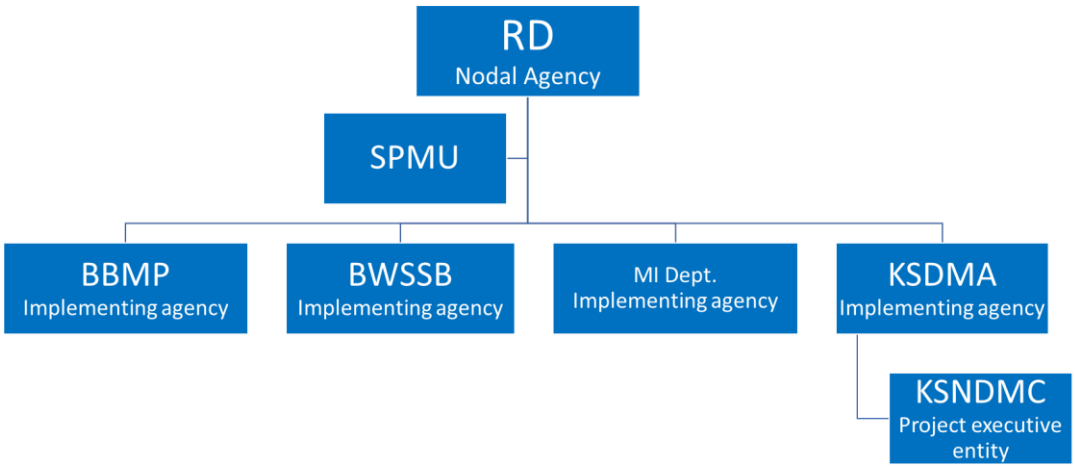
39. **BBMP** will be responsible for the construction of SWDs, rehabilitation of lakes, and integrated flood management under the Program. Readiness: More than 30 percent of the BBMP contracts for civil works have been tendered.

40. **BWSSB** will lead the implementation on STPs, NRW, energy efficiency, and PPPs under the Program. Readiness: More than 30 percent of the BWSSB contracts for civil works are ready for tendering.

41. **KSDMA** facilitates, coordinates, reviews, and monitors all disaster-related activities in the state including capacity building. KSNDMC provides proactive and innovative science and technology inputs. It will lead the DRM activities and institutional reforms including the establishment of the blended financing mechanism under the Program.

42. **MI Department** has jurisdiction over minor irrigation projects that have a command area of up to 2,000 hectares. The department oversees planning, designing, investigation, construction and maintenance of minor irrigation projects in the state.

Figure 2. The four Implementing Agencies supported by a State-level PMU



2.7 Description and Assessment of Program Results Framework and M&E

43. **The Program will be monitored using Government systems.** The results framework provides the basis on which the implementing agencies will measure and report on the progress of program implementation. DLIs selected as indicators in the Results Framework reflect critical elements of performance required to achieve the PDO. The DLIs were selected to ensure that they: (i) reflect foundational 'first step' actions for each implementing agency, (ii) are measurable and independently verifiable and (iii) incentivize needed action or reforms during Program implementation. The Revenue Department will prepare an Annual Program Report (APR), which will include evidence of progress on all results indicators included in the Results Framework, results related to DLIs and DLRs and evidence of compliance with requirements under the Program Action Plan (PAP). The APR will build on the monitoring and evaluation systems of the different implementing entities as further to be detailed in the Program Operation Manual.

44. In addition, the Program will support three M&E systems enhancements: (i) a sector-wide M&E system to monitor operations and management (O&M) of the 850 km of SWDs with cross-agency collaboration ; (ii) a digital environment and water governance system for effluent monitoring, adherence to city bylaws that facilitates cross-agency coordination and verification for BWSSB and the Karnataka Pollution Control Board, among others; and (iii) an M&E systems under BWSSB for energy efficiency. While these M&E system enhancements are being developed, the respective agencies will provide paper-based annual Program reports on the status of Program implementation and results achieved.

3. Description and Assessment of Program Strategic Relevance and Technical Soundness

3.1 Strategic Relevance

45. **This Program has high relevance because it directly responds to service delivery challenges in Bengaluru amidst increasing urbanization and a looming water crisis fueled by fragmented institutional landscape and climate change.** The Program has identified a critical set of urban services in Bengaluru including water supply, sewerage, drainage, and Disaster Risk Management (DRM) infrastructure and service, which will improve the city's service performance while tackling the effects of climate change, resilience and sustainability related challenges that the city is facing in the context of rapid urban expansion. The focus of the Program is not only to improve the service levels in these sectors but also enhance the efficiency and sustainability of the systems that need to address the rapidly increasing service demands of the city.

46. **The Program objective of improving services, and institutional and financial capacities to enhance resilience to water and climate stress in Karnataka is consistent with the World Bank's FY18-22 Country Partnership Framework,** which emphasizes the need for resource efficient growth approaches to managing India's urban areas. It is also consistent with India's Long-Term Strategy,[11] which promotes "low-carbon municipal service delivery through resource efficiency, management of water, solid, and liquid waste" and highlights the need for "strengthening basic infrastructure such as sanitation systems, […] as well as institutional infrastructures such as disaster response teams" for building climate resilience. The Program focuses on climate mitigation activities critical for fostering low-carbon growth in the city such as methane capture and biogas generation from the STPs, reduction in NRW, and in-city advanced water treatment that will reduce the need of lifting water from the Cauvery River, and reduction in energy consumption by improving energy efficiency. These mitigation actions enhance the resource efficiency and lead to cost reduction for the service delivery agency, namely, BWSSB. It also responds to the stated

[11] MoEFCC (Ministry of Environment, Forest and Climate Change). 2022. *India's long-term low-carbon development strategy.* Government of India.

goals of the Government of Karnataka's (GoK) Water Policy, which is to facilitate water security, and the optimal utilization of the State's water resources for health, food, energy, environment, and other societal purposes.

47. **The Program is strategic because it seeks to build on the World Bank's long-term engagement with Karnataka and facilitate convergence between eight water-related operations and technical assistance in Karnataka.** The closed, current, and pipeline operations include the Second Dam Rehabilitation and Improvement Project (P170873), National Groundwater Management Improvement (P158119), Rejuvenating Watershed for Agriculture Resilience through Innovative Development (P172187), Karnataka Urban Water Supply Modernization Project Additional Financing (P176107), National Hydrology Project (P152698), Karnataka Sustainable Rural Water Supply Program (P179039), National Cyclone Risk Mitigation Project (P144726), and Strengthening Coastal Resilience and Economy (P180932). The broad water security, resilience, and DRM focus of the Program provide an opportunity to link and form synergies across the current water operations in Karnataka. However, the expenditures under these operations are excluded from this PforR, and there is clear demarcation in scope and coverage between these PforRs. Additionally, Bangalore is one of the 10 priority cities in the 100 Cities Water Supply, Sanitation and Solid Waste Management Program across India to reimagine urban infrastructure, and services operated and maintained out of user charges. This operation, by prioritizing financing reform of BBMP and BWSSB to ensure an increase in own-source revenue, synergizes with the broader reform agenda.

48. **The Program will help build institutions by supporting institutional strengthening of key service agencies through institutional reforms, integrated planning, and enhanced coordination between the four critically interlinked institutions**, Bengaluru Water Supply and Sewerage Board (BWSSB), Bruhat Bengaluru Mahanagara Palike (BBMP), the Karnataka State Natural Disaster Monitoring Center (KSNDMC), and Karnataka State Disaster Management Authority (KSDMA) to reduce fragmentation across these agencies for improved resilience to climate change.

49. **The Program seeks to improve the financial capacity of key institutions to ensure that they are able to fulfill their responsibilities and improve the service delivery experience for their customers.** The Program will do so through a twofold approach: (i) through an increase in revenues, and (ii) by advancing PPP investments and implementing performance-based contracts (PBCs). These PPPs will help leverage finance and private sector technology and expertise to improve overall operational efficiency. The PBCs will enable cost savings by optimizing operations and minimizing waste in addition to bringing in improved efficiency and quality.

50. **The program builds on strong government ownership and the activities have strong support and buy in from the implementing entities, state line departments and finance department.** Activities complement government policy and existing investment interventions in urban water and sanitation services, storm water drainage, and lake rejuvenation.

3.2 Technical Soundness

51. **The technical soundness of the Program is reflected in the results it prioritizes to tackle the problem of water security and resilience to climate change.** The sectors—wastewater treatment, stormwater drains, disaster risk management—have economies of scale and spillover effects. Because of this, public sector providers are uniquely positioned to deliver these services, but they will require improvements to their technical capacities and operational modalities, including citizen interface, to

ensure longer term sustainability. Although the role of the government in provision of services is crucial, there are several areas in the sector where private sector can participate, due to their technological and project management superiority. The Program will, thus, incentivize the agencies to leverage private sector expertise to lead resource efficiency measures through long performance-based contracts. The Program is designed to help the municipal agencies in Bengaluru address water security through three results areas: (i) improving infrastructure and services for enhanced water security and resilience; (ii) strengthening water security institutions; and (iii) enhancing financial capabilities and resources of key institutions - by incentivizing actions and outputs in these areas.

52. **The water stress in Bangalore felt in the city is partly attributable to inadequate management of water, and especially the management of wastewater and its disposal.** Strengthening BWSSB's capability, service performance, and finances are necessary to achieve a water supply and sewerage system that can keep up with the growth of the city. Similarly, BBMP is a relatively well-performing municipal corporation compared with other cities in India, but like BWSSB faces a few key constraints such as service delivery, operational efficiency and financial sustainability. To steadily move BWSSB and BBMP up the ladder of improved service performance, increased corporatization, and improved financial sustainability the Program will include various activities under the three results areas as follows:

3.2.1 RA1: Improving infrastructure and services for enhanced water security and resilience

53. **As a step towards improving service delivery, BWSSB will operationalize circular economy** through the construction of wastewater treatment plants to improve treatment capacity, connection of households, and reuse of treated water. The Program will support BBMP in implementing integrated flood management system through rehabilitating SWDs that are fully integrated with Bengaluru's lakes.

Wastewater Treatment

54. **Under the Program, 400 km of sewer network and nine STPs with a total capacity of 148 million liters per day (MLD) will be constructed to complement the existing sanitation infrastructure.** About 100,000 households in the Program area will be connected to the sewer network, and the collected sewage will be treated to secondary[12] levels, as requested by National Green Tribunal (NGT) 2019. Such treated waters shall be fit for discharge directly or indirectly into lakes and should render the recipient lake waters fit for reuse in agriculture and, in parallel, permit for a rejuvenation of lakes and some infiltration into groundwater. Five out of 9 STPs shall be equipped with an improved "tertiary treatment" stage, replacing the disc filters typically by Ultra Filtration (UF), final chlorination and phosphorus precipitation, thereby reducing pathogens to zero levels and thus permitting for safe non-potable reuse options. Such water is usable for vehicle exterior washing, construction, non-potable uses such as toilet flushing or fire protection in commercial / high-rise buildings, gardening, landscaping, recreation centers, horticulture and agriculture purposes, as well as in various industrial applications like manufacturing, various processes, cooling, boiler water, cleaning, etc., with adequate treatment as per industrial water quality requirement. These discharge standards for "tertiary treatment" are based on CPHEEO Manual Table 7.19 and have been adjusted further by BWSSB. The GoK reuse policy targets 25 percent reuse by 2025, and the BWSSB is targeting about 60-70 percent reuse of treated water from the newly constructed STPs.

[12] Secondary - Treatment up to requirements as defined by NGT (2019), i.e., including enhanced Biological Nutrient Removal (BNR), chemical precipitation, disc filter and disinfection.

55. Table 4 summarizes the secondary and tertiary treatment targets, as defined by BWSSB.

Table 4: Secondary and Tertiary Treatment Targets

Parameter		Secondary treatment (NGT 2019)	Tertiary treatment for reuse (DPRs, 2024)**
BOD_5	mg/L	≤ 10	≤ 5
COD	mg/L	≤ 50	≤ 30
TSS	mg/L	≤ 20*	(as arising)
TN	mg/L	≤ 10	≤ 5
NH4-N	mg/L	---	---
TP	mg/L	≤ 1.0	≤ 1.0
FC	MPN/100mL	Desirable: ≤ 100 Permissible: ≤ 230	Nil

* To meet required BOD5 ≤ 10mg/L, TSS ≤ 10 mg/L is needed in practice.

** Standard as defined by BWSSB, tentatively based on CPHEEO Table 7.19.

56. **Strong interest among potential recipients exists, including the willingness to pay for the reused water.** This income will quickly recover the extra cost for investment and Operations and Maintenance (O&M) and will thus provide a reliable source of net income to BWSSB, which is urgently needed to partially cover operating expenditures (OPEX) of the new facilities. Innovations like solar sludge drying, photovoltaic solar panels, and sludge digestion and biogas generation and use are included in three STPs. Detailed Project Reports (DPRs) for the STPs have been prepared and submitted to the World Bank for review. Five contract packages, each with sewer network, STP(s), and O&M for ten years are planned. BWSSB shall go for "open process technology" bidding, life cycle assessment, and a 10-year O&M contract. This should permit the benefit of up-to-date market know-how and lead to increased competition among potential contractors.

57. **Clear land titles for 8 STPs are with BWSSB, and land transfer for one STP (UM Kaval) is being processed.** The land parcels are free of encroachments. All STPs shall be located at an elevation of about 1.5 m above the 100-years high flood level. Thus, flooding should not be an issue at any of those sites.

58. **Large parts of the required sewer network already exist.** The envisaged works thus mainly serve to complete the existing sewer network by constructing an additional ≈460 km of pipes and about 10 pumping/lifting stations, permitting almost 100% connection of all legal domestic and commercial properties. BWSSB levies a connection charge based on the property plinth area. Households with plinth areas less than 600 sq.ft will get a free connection, which should benefit the poor. A total of about 100,000 house service connections are expected under this Program in all 110 villages.

59. **Solar sludge drying:** No comprehensive sludge management masterplan exists yet. Consequently, the Program's envisaged sludge strategy for the 9 STPs is to continue with the same practice, as employed at the existing STPs. That is, sludge will be dewatered mechanically to about 20% dry solids (DS), and then transported by trucks to nearby farmers, where the sludge is frequently stored for some weeks / months until it is eventually used as manure in agriculture. Although it permits resource/nutrient recovery, the sludge still has high pathogen count. This may negatively affect the health of farmers and consumers of

agricultural produce. The option to employ Solar Sludge Drying was arrived at as the most economically viable option. In this process the 80 percent water content still present in dewatered sludge is significantly evaporated with the help of energy contained in solar radiation. Given that solar radiation is high in Bangalore, such technology is particularly efficient and well suited for this location. The process is offered on the market by several international manufacturers and is established for about 30 years. Due to the strong reduction of the sludge's moisture during solar drying, the remaining water proves insufficient to sustain life of pathogens, and they die off, as proven by practice and lab results. Consequently, this process is able to deliver hygienically safe sludge, and additionally it reduces sludge volume by about 70% down to just 30% of its prior dewatered volume. CAPEX is not high, and OPEX is rather low. Operation is also simple. The end produced has a grainy structure (grain size of about 0.2 – 1.0 cm), it is de facto free of dust, and it is free of odors. Additionally, due to the low remaining water content it has a substantial calorific value and can be considered as a (renewable) fuel. This renders alternative applications attractive, such as use in large incinerators (e.g. in cement kilns), where they can replace fossil fuels and provide a reduction of the carbon footprint of such incinerators. Particularly, using dried sludge in the cement industry is an established strategy globally. The only moderate disadvantage is its footprint of roughly 1000 m^2 for a 10 MLD STP and appears feasible at some STP sites.

60. **With its numerous small/medium sized STPs, the BWSSB will pilot the technology in STP Chikkabegur designed for 15 MLD.** The expectation is that the practical experience / benefits gained from this solar sludge drying may greatly contribute to an improved future sludge management in Bangalore. Improving health-related parameters and opening up new pathways for sludge management may be an important factor in increasing the sector's resilience against climate-induced changes.

61. **Renewable energy from photovoltaic (PV) panels:** Additionally, the STP in Soulkere, with a capacity of 28 MLD, will examine the use of photovoltaic (PV) panels for power generation and will allow the Program to gain important practical experience to permit the future scaling up of such activities.

Integrated Flood Control Management Services

62. **The incomplete and inadequately maintained SWD network,** poor solid waste management, together with the deterioration of Bengaluru's extensive lake system and the deliberate disconnection between lakes and SWDs due to the continuous presence of raw sewage in SWDs which would otherwise contaminate the lake is a large cause of the flood management problem in Bengaluru. The integration of SWDs with natural lakes is a key climate adaption strategy to manage increased surface water runoff during climate-induced extreme rainfall events, thereby reducing flood risks and improving groundwater recharge through water retention in city lakes. The Program through RA1 will incentivize BBMP to strengthen and fully integrate SWDs with lakes to create climate-resilient balancing reservoirs to dynamically retain and release water for groundwater recharge, recreation, and green zones along with storm flood management.

63. A total of 491 km of SWDs was lined between 2005 and 2012 with funding from state government and Government of India (GoI) and lining of 195 km is ongoing. A total of 174 km of SWDs, mostly at the outskirts of the metro area, require lining. Only few drains in the core area have remaining need for limited lining interventions. Lining of the remaining 173 km is proposed under the Program at an estimated cost of Rs. 1,600 Cr. In addition, about 80 km of SWDs with deteriorated lining will require new lining estimated at Rs. 400 Cr. The Program incentivizes the rehabilitation of each section of the 173 km of newly lined SWD and/or 80km of newly rehabilitated SWDs in a watershed[17] that must be fully integrated with lakes, including flood management control measures such as diversion structures, sluice gates, and sensors.

Nature Based Solutions

64. NBS can be effective around lakes and other green zones in the city. For example, many underneath tree covers have bare impermeable top layers, causing most of the water to run off rather than percolate. These areas could be vegetated to allow for more percolation. NBS such as swales and small retention ponds may be particularly interesting in parks in the city and around relatively clean areas such as universities and tech campuses, in combination with tertiary drains.

65. It is unclear how the various components and domains associated with SWD and beyond (sewage, solid waste) interact. For instance, insight is needed into the relative contribution to floods by conveyance capacity, bridges, control structures, junctions, siltation, improper streamlining, etc., and how introduction of additional measures, e.g. NBS, can attenuate large loads on the system. Hence, a hydrological and hydraulic modelling at the level of the city will be developed. Modelling will allow better understanding how the system functions, dynamically, and with evaluation of potential interventions and the generation of state-of-the-art outputs such as flood risk maps. Modelling for flood forecasting and water conservation are important components of the proposed Program. There are considerable advantages in using open water and groundwater modelling to inform flood mitigation and water conservation investments. Modelling is known to reduce costs as it can help optimize infrastructure interventions and Nature Based Solutions. Three options for modeling will be considered:

a. **Wide Scale**: Covers all hydrological catchments relevant to Bengaluru, utilizing climate analysis tools (historical and future scenarios based on IPCC) and large-scale hydrological instruments that address water balances, elevation, rainfall-runoff, river basins, aquifer characteristics, and major control structures.

b. **Medium Scale**: Focuses on sub catchments near Bengaluru with more detail than the wide scale. It includes tools for hydraulic modeling, providing historic and future discharge time-series for integrated water resource management, and groundwater modeling to track pollution spread, groundwater table trends, and water use from extractions.

c. **Urban Scale**: Specific to the Bengaluru urban perimeter, this scale builds on the previous models with added detail. It incorporates hydraulic components for stormwater drainage (SWD) systems, lakes, sewage system interactions, and clogging factors like solid waste and sedimentation.

66. **The Program will incentivize the development of integrated flood management plans for each of the four sub-catchments to cover the 633 valleys of Bengaluru.** The modelling will include hydrologic and hydraulic models with fine-scale datasets obtained from observations and weather research and forecasting simulations, identification of flood vulnerable areas, the development of flood risk maps for Bengaluru City, and a range of additional flood management elements. These integrated flood management plans will inform NBS interventions to be piloted in each of the 8 zones.

Flood mitigation through groundwater recharge investments

67. As a flood prevention and drought resilience initiative, the Minor Irrigation Department, under the second phase of the Vrishabhavati Valley Project (Lift-4), aims to fill a total of 189 lakes at an estimated cost of Rs.1,159 crores (approx.US$140 million). Under the proposed Program, 40 of these lakes in Bangalore Rural District—23 in Doddaballapura and 18 in Nelamangala at an estimated cost of Rs. 250 crores (approximately US$30 million). This Program is expected to enhance the storage capacity of the

lakes by 0.7361 thousand million cubic feet (TMC). The investment will effectively mitigate floods in Bengaluru City by: (i) reducing stormwater runoff by diverting treated sewage away from the city, and (ii) decreasing pressure on the drainage system minimizing the risk of overflow. Additionally, by recharging groundwater it will help alleviate drought, and reduce the city and its surrounding districts' reliance on freshwater sources for irrigation.

3.2.2 RA2: Strengthened water security institutions

68. **To improve operational performance, BWSSB will commence benchmarking of operational quality indicators.** The Program will incentivize BBMP to improve operational efficiency and improved O&M of SWDs through operationalization of a digital system to benchmark zone and ward performance, and the establishment of a joint Zonal O&M Coordination Cell and developing of joint zonal O&M plans. BBMP will also operationalize digital environment and water governance system to improve their O&M partly through improved collaboration with BWSSB. The latter would fix leaking machine-holes in the stormwater drains, thus preventing contamination of lakes with sewage.

Institutional Reforms for Disaster Risk Management

69. **The Program will support reforms to strengthen the disaster risk governance framework in Karnataka, including strengthening/operationalizing/establishing institutions and strengthening their operational relationships.** This includes KSDMA, KSNDMC, and State Institute of Disaster Management (SIDM). Established in 1988 as the Drought Monitoring Cell, KSNDMC has played an important role in hazard monitoring in Karnataka through a network of weather stations, data acquisition partnerships and modelling capabilities developed over the years. It has also contributed to other disaster management functions such as early warning and post disaster needs assessments which are typically to be undertaken by the State Disaster Management Authorities (SDMA) as mandated by the Disaster Management (DM) Act. The Karnataka SDMA (KSDMA) was constituted officially in 2008 but is yet to become operational with many of its mandated functions being undertaken by Department of Revenue or KSNDMC. Increasing extreme weather events and disasters in Karnataka calls for: (1) a fully functional SDMA with state-of-the-art infrastructure and decision support systems; (2) clear roles and operational relationships amongst different agencies with DRM functions; (3) user-oriented climate and disaster monitoring services; and (4) institutionalized capacity building and public engagement platforms. Karnataka is yet to establish and operationalize its State Institute of Disaster Management as mandated by the DM Act. The Program will support the following specific activities:

- Strengthening the overarching Disaster Risk Governance Framework in Karnataka, including development of a draft bill.
- Functional review of KSNDMC including the development of organizational structure, staffing, revenue models for KSDMA and KSNDMC.
- Master-planning and construction of a building for KSDMA and the State Institute of Disaster Management (SIDM) equipped with an Experience Learning Center (ELC).
- Operationalization of the SIDM, including development of a Business Plan and annual training calendars.

70. **The Karnataka Climate Hazard & Risk Information System (KCHRIS):** This activity will consolidate the hazard vulnerability mapping data available with KSNDMC together with local knowledge and need-based vulnerability surveys for development of a decision support system "KCHRIS" to enable future utilization of risk information at multiple levels.

3.2.3 RA3: Enhanced financial capabilities and resources of key institutions

71. As a key step towards improving financial sustainability, BWSSB will steadily improve its user charges or tariffs by 30 percent from the 2024 baseline. It will also replace its pipelines with the goal of reducing NRW, and implement energy efficiency investments, which will lead to cost reduction for the utility. BWSSB will also leverage private investment through public private partnerships (PPPs), a first in its history, for: (i) smart metering for high volume customers, and (ii) upgrading six existing STPs to biogas generation. The PPPs will bring in innovation, enhance operational efficiency, and ensure adequate O&M to enhance asset quality and longevity. Given that its average receipts are below the national average, the Program will incentivize BBMP to increase own source revenue and implement a series of actions to improve financial reporting and transparency. Some of these interventions are discussed in more detail below.

Improvement of BWSSB's financial and operational efficiency

72. The PforR program will incentivize BWSSB to strengthen its operational and financing efficiency and sustainability of BWSSB through improvement in own source revenue and optimize operational efficiencies through measures such as energy efficiency, smart water meters for large volume consumers, and NRW reduction.

a. **Improvement in own source revenue:** Funds will be disbursed to the BWSSB for improvement in its own source revenue, with a target of 30 percent increase over the baseline. The definition of own source revenue will be all operating revenues from water and sewer related charges such as tariffs, including tariff increase and inflation indexation, improved collection of billed revenues, and revenue from sale of treated water.

b. **Reducing Nonrevenue water:** Pipes need to be replaced in an area of 70 sq.km. of which 40 sq. km. are the worst affected with NRW of 33-39 percent. The area where the replacement is proposed faces frequent contamination issues due to leaky pipes. In many places, the existing pipelines are blocked due to encrustation and are a recurring problem in this area. The project in this area would include replacement of the entire pipeline and consumer meters older than seven years, and house connections. The estimated cost is Rs. 647.7 crores (~US$81 million). The project period will be 2-3 years and an additional year maintenance during 'defect liability period' and all leak activity during 'defect liability period' will be carried out by contractor and hand over the system to BWSSB. Under DLI8, the Program aims to help BWSSB advance PPPs, by incentivizing PPP contract for NRW investments.

c. **Energy efficiency:** Based on the energy audit reports carried out for BWSSB, energy efficiency management holds great potential. Capital cost requirements of an estimated US$10.15 million, could realize energy savings of US$4.68 million per year, in order to reduce the current BWSSB energy cost of US$33.14 million per year on these three stages. This may yield a simple payback of 2.2 years, and an IRR in excess of 50 percent.

Improving financial reporting and transparency

73. The Government of Karnataka issued Notification No. FD 18 SAD 2021 on March 10, 2022, making rules for the fiscal and budgetary management of BBMP. BBMP's current reporting in various forms carries out a detailed tracking of income and expenditure, and its annual financial statements are filed in cityfinance.in. However, it is currently using multiple accounting software that is decentralized in 225

wards. For example, there is separate software for salaries (HRMS), direct payments, work bills (contractor payments), bills (electricity, water etc), budgetary control model system, job codes, welfare including direct beneficiary transfers, receipts monitoring: property tax (National informatics center), other receipts such as building licenses etc. The first sub-indicator is a one-off to be based on a functional integrated financial management system being put in place that can monitor finances at all the 225 wards centrally.

74. There is an urgent need to track the asset base – both BBMP assets such as land, buildings and equipment as well as project assets such as roads, drains, streetlights etc. Once an asset register is created, an annual maintenance plan will be developed to track O&M needs.

75. The Medium-Term Fiscal Plan approved by the BBMP Council should follow the format prescribed in the FBM rules. A comprehensive annual report is expected to be prepared that gives the public an overview of BBMP's strategy and vision for the city as well as key trends (MD&A), achievements of the previous year (performance review) and audited financial statements adhering to accounting standards issued by the Institute of Chartered Accountants of India.

76. The Program incentivizes BBMP to meet a series of actions (as laid out in DLR 7.2 as shown in Annex 1) to improve financial reporting and transparency in line with the Fiscal and Budgetary Management rules 6 (Medium term fiscal plan) and 8 (Publication of financial document and annual performance report).

Improving BBMP's own source revenue

77. With a large asset base and continued investments both under the program and otherwise, BBMP needs to increase spending on operations and maintenance (O&M) to maintain asset quality and protect its investments and. In pursuit of this objective, BBMP plans to increase revenues to fund the forthcoming O&M expenditure by increasing OSRs - while transfers from the state and center are fairly predictable, BBMP has huge expenditure need and the city has significant potential to increase revenues from OSRs.

78. The indicator will track increase in BBMP's OSR, allowing it to cover incremental O&M expenditure while maintaining an operating surplus (own source revenue receipts / O&M expenditure), which will contribute to enhanced overall operational sustainability. Disbursement will be against pro-rated OSR growth over the baseline for 2023/24 with an end target of 45 percent increase over the.

Disaster Risk Financing

79. Between 2008 to 2024 funding from GoI, primarily via National Disaster Response Fund (NDRF), was 8 percent of the total estimated losses for droughts, and 6 percent for floods (see Annex 2), meaning the bulk of the financial burden is on the state. Currently, the only ex-ante source of funds that are available to state is the State Disaster Risk Management Fund (SDRMF), which for the period 2021-22 to 2025-26 (15th Finance Commission) is about US$497 million and the majority of the funds have been used for 2023 drought, and floods in 2021 and 2022. Private insurance penetration is very low in the state which is in line with the trend across the country – less than 10 percent of homes are insured, and less than 30 percent of farmers and cropped area are insured. Thus, it is evident that the financial burden following major disasters is primarily on the State. This RA will: (a) establish a dedicated disaster risk financing (DRF) unit within KSDMA; (b) commission a Catastrophe Risk Modeling study to quantify risks from natural hazards; and (c) support the development of financial instruments for risk financing. The study should include possible annual and maximum losses and determine cat risk financing options including cost-benefit of different types of disaster risk financing instruments.

Blended Finance Facility

80. This activity will support the development of a blended finance facility for climate resilience to meet Karnataka's need for substantial climate-smart investments, leveraging both public and private finance. Blended finance, which pools capital from various sources, presents a strategic approach to mobilize climate finance, leveraging private investments to enhance returns and mitigate risks. Specifically, the blended finance facility for Karnataka could mitigate risks and enhance returns through:

a. Enable: identification and resourcing of low-cost climate finance that can catalyze green investments and accelerate implementation.

b. Leverage: use of development finance and philanthropic funds to attract private capital into deals.

c. De-risk, reduce uncertainty: advisory and preparatory services to facilitate private investment in high-impact projects, reduce high initial costs before commissioning of a project helping manage the failure rates and elevated transaction costs associated with high-risk enterprises or projects that are experimenting with, testing and piloting new business approaches.

d. Design of tools: to 'crowd in' private capital including market incentives (and guarantees) to stimulate innovation on equal terms for mature or credible projects by signaling that macro risks can be managed, and that the investment is commercially viable.

4. Description and Assessment of Program Expenditure Framework

The Purpose of the Economic Analysis

81. The purpose of the assessment of the expenditure framework of the Program is primarily to understand whether the government is able to clearly budget, track, and report against those expenditures on an annual and multi-year basis. A typical economic analysis has five components:

i. Assess the implication of the fiscal context on the PforR and any impact of the PforR on the fiscal outlook.
ii. Review the budget structure and classification.
iii. Assess the Program's financial sustainability and funding predictability.
iv. Assess the adherence of the budgeted Program expenditure and its execution to the government's priorities.
v. Assess the efficiency of program expenditures.

Expenditure framework

82. The Program's Expenditure Framework will include GoK and World Bank's financing in disaster mitigation, urban water supply, storm water drains, sewerage system as well as program management. The identified expenditure items will provide financing to BBMP, BWSSP, and KSDMA for undertaking project specific investments, reforms and institutional development activities. An assessment of the expenditure framework found that the fiscal status of the state is satisfactory.

Implication of the fiscal context on the PforR and impact on the fiscal outlook

83. The state of Karnataka has been in the forefront of other Indian states in terms of fiscal discipline and the quality of government expenditures. The state has maintained fiscal prudence as one of its main

policy goals. The fiscal consolidation has ensured all the fiscal parameters are within the stipulated limits of the Karnataka Fiscal Responsibility Act, 2002 (KFRA).

Table 5: Fiscal Indicators for the Government of Karnataka

Category	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24 (RE)	2024-25 (BE)
Fiscal deficit as a % of GSDP	2.37%	2.73%	2.25%	3.72%	2.76%	2.14%	2.67%	2.95%
Revenue deficit as a % of GSDP	0.34%	0.05%	0.07%	1.07%	0.80%	(-)0.60%	0.50%	1.00%
Liabilities as a % of GSDP	18.75%	20.26%	19.87%	22.37%	26.71%	23.97%	22.64%	23.68%
Breakdown of Revenue (Rs. In Crores)								
Revenue receipts	1,47,000	1,64,979	1,75,443	1,69,123	2,13,871	2,29,080	2,26,780	2,63,178
Revenue expenditure	1,42,482	1,64,300	1,74,257	1,76,054	2,09,428	2,15,584	2,40,731	2,90,531

Note: (RE): Revised Estimates; (BE): Budget Estimates

84. In terms of adhering to the fiscal consolidation efforts as mandated by the KFRA, the state had its own Expenditure Reforms Commission (similar to the Centre's Expenditure Management Commission). Based on its recommendations, the state, by and large, has been protecting the targets on the capital outlays even when there are some distresses on the revenue side and not resorting to compression of capital outlays (Table 6).

Table 6: Receipts and expenditures of Karnataka (Rs crore)

Receipts and expenditure of Karnataka (Rs crore)								
Items/ Years	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**
	(A/Cs)	**(A/Cs)**	**(A/Cs)**	**(A/Cs)**	**(A/Cs)**	**(A/Cs)**	**(RE)**	**(BE)**
Revenue receipts	1,47,000	1,64,979	1,75,443	1,69,123	2,13,871	2,29,080	2,26,780	2,63,178
Revenue expenditure	1,42,482	1,64,300	1,74,257	1,76,054	2,09,428	2,15,584	2,40,731	2,90,531
Revenue Deficit	4,517	679	1,185	6,931	(-)4,443	(-)13,496	13,951	27,354
Capital Expenditure	35,759	39,147	39,599	48,075	52,084	60,599	54,664	55,877
Fiscal Deficit	31,101	38,442	38,166	54,691	47,508	46,622	68,505	82,981
GSDP (Current Prices)	13,10,879	14,08,112	16,98,685	18,03,609	17,21,336	21,81,217	25,67,340	28,09,063
% of GSDP								
Revenue receipts	11.21%	11.72%	10.33%	9.38%	12.42%	10.50%	8.83%	9.37%
Revenue expenditure	10.87%	11.67%	10.26%	9.76%	12.17%	9.88%	9.38%	10.34%
Capital Expenditure	2.73%	2.78%	2.33%	2.67%	3.03%	2.78%	2.13%	1.99%
Fiscal Deficit	2.37%	2.73%	2.25%	3.72%	2.76%	2.14%	2.67%	2.95%
Revenue Deficit	0.34%	0.05%	0.07%	1.07%	0.80%	(-)0.60%	0.50%	1.00%

Source: (i) Karnataka Medium Term Fiscal Plan 2020-24 (ii) Medium Term Fiscal Plan 2021-25 (ii) Medium Term Fiscal Plan 2022-26 (iv) Medium Term Fiscal Plan 2023-27 (v) Medium Term Fiscal Plan 2024-28.

85. Though the state has maintained a fiscal deficit within 3 percent of the Gross State Domestic Product (GSDP) (Table 6), it has been gradually increasing in the recent past and is likely to be under stress during the coming years due to several populist welfare announcements made by GoK during past couple of years. These include free electricity to every household (200 units), fixed monthly grant to woman household-head in the Below Poverty Line (BPL) (Rs. 2,000 per month), free rice to each person in the BPL category (10 kilograms per month), grant to unemployed graduates and free bus travel for women in public transport buses etc. Further, GoK will have to factor in seventh pay commission payouts. Interest

payment too have sharply risen in the past few years. Despite these, water supply, storm water drainage and sewerage in the Bengaluru region remains a key priority area for GoK and, thus, is not expected to be affected.

86. The Medium-Term Fiscal Plan outlines the medium-term fiscal objectives of GoK. It also includes a brief evaluation of the key fiscal indicators along with the latest economic trends and prospects for the future growth and development. Overall, the state has a well-defined MTFP for 2022-26 which has been projected with the several assumptions on growth trends in revenues, expenditures and other key parameters (Table 7). The fiscal deficit is well under control at present, but the revenue deficit has been marginally increasing, and it is expected to increase in the next few years. The revenue shortfall and increased expenditure commitments have pushed the state into revenue deficit. With the end of GST compensation from 2022-23, the reduced revenue collection may result in reduction of capital expenditure in future years.

Table 7: Medium Term Fiscal Plan Projections 2022-2026 in Rs crore

Particulars	2020-21 (A/Cs)	2021-22 (BE)	2021-22 (RE)	2022-23 (BE)	2023-24 Proj	2024-25 Proj	2025-26 Proj
Revenue Receipts	1,69,123	1,72,271	1,89,579	1,89,888	1,99,019	2,17,323	2,37,868
Revenue Expenditure	1,76,054	1,87,405	1,95,814	2,04,587	2,39,587	2,62,431	2,88,836
Revenue Surplus	(-)6,931	(-)15,134	(-)6,259	(-)14,699	(-)40,568	(-)45,109	(-)50,968
Capital Receipt (Non-Debt)	315	131	131	89	93	97	101
Capital Expenditure	48,075	44,237	42,366	46,955	20,729	23,776	26,877
Fiscal Deficit	54,691	59,240	48,470	61,564	61,204	68,788	77,745
Outstanding Debt	3,85,099	4,40,835	4,40,713	5,02,432	5,76,043	6,44,831	7,22,576
Total Liabilities	4,03,520	4,57,899	4,58,042	5,18,366	5,91,977	6,60,766	7,38,510
GSDP at current prices	18,03,609	17,21,336	17,21,336	18,85,750	21,10,499	23,72,009	26,80,845
GSDP Growth Rate	6.20%	(-)4.60%	(-)4.60%	9.60%	11.90%	12.40%	13.02%
Revenue Receipts	9.38%	10.01%	11.01%	10.07%	9.43%	9.16%	8.87%
Revenue Expenditure	9.76%	10.89%	11.38%	10.85%	11.35%	11.06%	10.77%
Revenue Surplus	(-)0.38%	(-)0.88%	(-)0.36%	(-)0.78%	(-)1.92%	(-)1.90%	(-)1.90%
Capital Receipt (Non-Debt)	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Capital Expenditure	2.67%	2.57%	2.46%	2.49%	0.98%	1.00%	1.00%
Fiscal Deficit	3.72%	3.44%	2.82%	3.26%	2.90%	2.90%	2.90%
Outstanding Debt	21.35%	25.61%	25.60%	26.64%	27.29%	27.19%	26.95%
Total Liabilities	22.37%	26.60%	26.61%	27.49%	28.05%	27.86%	27.55%
* State Own Tax Revenue is inclusive of GST compensation and GST Loan, # excludes Implicit subsidy.							

Source: Karnataka Medium Term Fiscal Plan 2022-26

87. Expenditure for both BBMP and BWSSB have been showing increasing trend during the last four years (as detailed in table 8 below). BBMP's annual expenditure has grown at a Compound Annual Growth Rate (CAGR) of 7.36 percent from Rs. US$885 million (FY 2019-2020) to US$1,095 million (FY 2022-2023). For BWSSB, the expenditure during last four years has a CAGR of 5.90 percent from US$568 million (FY 2019-2020) to US$674 million (FY 2022-2023). Together the two entities may spend more than US$10 billion over the next five years. The share of capital expenditure as percentage of total expenditure stands at 65 percent for BBMP and 59 percent for BWSSB.

Table 8: Annual Expenditure of BBMP and BWSSB during last 4 years (amount in US$ million)

Year	BBMP			BWSSB		
	Capital Expenditure	Total of Expenditure	Share of Capital Expenditure as % of Total Expenditure	Capital Expenditure	Total of Expenditure	Share of Capital Expenditure as % of Total Expenditure
2020-21	317.61	885.47	**35.87%**	315.06	**568.28**	**55.44%**
2021-22	472.07	947.22	**49.84%**	366.52	**613.84**	**59.71%**
2022-23	714.07	1095.65	**65.17%**	401.56	**674.89**	**59.50%**

Budget Structure and Classification

88. The GoK has an established budget preparation process that is guided by a Budget Manual. It follows a six-tier budget classification system; and budget instructions are issued by the Finance Department (FD) (generally in the month of August) each year to all administrative departments; in turn the departments prepare budget estimate for the current year and advance estimate for the next two years; which are examined by the FD and negotiations ensure that budget allocations are adequate and expenditure commitments are within the fiscal targets set in the Karnataka Fiscal Responsibility and Budget Management Act.

89. Budget preparation process: BBMP prepares its budget in accordance with Bruhat Bengaluru Mahanagara Palike Act, 2020 and in the manner and form specified in therein. BBMP also has notified Bruhat Bengaluru Mahanagara Palike (Fiscal Responsibility and Budget Management) Rules, 2021 which aims to increase transparency in its fiscal management systems and attain budgetary stability. For preparing its budget, BBMP uses budget codes which are a combination of function heads and account heads. Budget is prepared using a bottom-up approach. Budget preparation process starts in December with every zonal committee, in consultation with wards, preparing a budget estimate comprising of the required budgetary support for the implementation of the existing schemes, list of capital expenses, required manpower etc. Public consultation is also invited during the preparation of budget. This budget is submitted to Chief Commissioner, who forwards it to 'standing committee for taxation and finance and appeals'. After review, it submits the draft of budget to the Administrator (generally in the first week of February) for passing.

90. BWSSB prepares its annual budget in accordance with section 17 of the Bengaluru Water Supply and Sewerage Act, 1964, the PWD departmental code and instructions issued by GoK from time to time. The annual budget of BWSSB is required to be submitted to GoK in February. The said statement includes estimates for capital and revenue receipts and expenditure, salaries of members, officers and employees of the Board and other particulars as prescribed. On receipt of the said statement, it is laid on the table of both Houses of the State Legislature and open to discussion therein (though it is not subject to vote). The Board takes into consideration any comments made on the said statement in the State Legislature.

91. KSDMA prepares annual Program budget requirements and submits this to RD as per the state budget schedule so that the requirements can be incorporated in the state budget. KSDMA has very little own expenditure in the past and has mostly been used as a vehicle for distribution of relief under various

state/ national schemes. However, it will be playing a more central role in implementation of the activities relating to the RD under this program.

92. Table 9 below summarizes the Program expenditures or the big 'P'. The identified expenditure items will provide financing to BBMP, BWSSB and KSDMA for undertaking project specific investments and institutional development activities. The expenditure under the Program will be made by each Implementing Agency's (IA) from its own budgetary sources, either through state government allocations, transfers, or its own source revenue.

Table 9: Program Expenditure (in US$ million)

Expenditure Head	Year 1	Year 2	Year 3	Year 4	Year 5	Total
KSDMA						
KSDMA & Key Units	7.29	7.88	7.88	7.88	8.00	**38.93**
Centre of Excellences	1.76	2.00	2.00	2.00	2.12	**9.88**
State Institute of Disaster Management	0.35	0.53	0.53	0.53	0.65	**2.59**
Integrated campus for DRM	2.59	2.59	2.59	2.59	2.94	**13.30**
Total KSDMA(A)	**12.00**	**13.00**	**13.00**	**13.00**	**13.70**	**64.70**
BBMP						
Capital Works	47.06	47.06	47.06	47.06	47.06	**235.29**
Lakes rejuvenation	11.76	11.76	11.76	11.76	11.76	**58.82**
Salaries Public Works*	11.18	15.29	16.20	17.18	18.18	**78.03**
Repair & Maintenance of SWD	4.28	5.14	5.42	5.70	6.03	**26.57**
Total BBMP(B)	**74.28**	**79.25**	**80.44**	**81.71**	**83.03**	**398.71**
BWSSB						
Capital Works	30.12	30.12	30.12	30.12	30.12	**150.59**
Salaries	2.98	5.40	5.72	6.03	6.38	**26.50**
Total BWSSB(C)	**33.10**	**35.52**	**35.83**	**36.15**	**36.49**	**177.09**
Total MI (D)	**3.50**	**4.50**	**5.50**	**7.00**	**9.00**	**29.50**
Grand Total (in US$ mn)						**670.00**

Program's financial sustainability and funding predictability

93. The capacity of BBMP and BWSSB to absorb the allocated funds is shown by the total spending compared to program expenditure. The cash flows during the project life cycle to BBMP and BWSSB are expected to be around US$80 million and US$35 million respectively, which is relatively small compared to their current annual spending of US$1,095 million and US$674 million. In terms of program size, the total expenditure of the implementing entities for the Program period (next five years) assuming a notional growth rate of 6 percent is US$1,408 million. Table 10 below denotes the small 'p'. The World Bank-financed operation is expected to contribute US$426mn.

Table 10: Projected Expenditure during next 5 years (in US$ million)

Implementing Agency	Base Year	Year 1	2	3	4	5	Total
BBMP	114.61	121.48	128.77	136.50	144.69	153.37	**684.81**
BWSSB	45.88	48.64	51.55	54.65	57.93	61.40	**274.16**
KSDMA and MI	75.26	79.78	84.57	89.64	95.02	100.72	**449.73**
Total in US$ mn	**235.75**	**249.90**	**264.89**	**280.79**	**297.63**	**315.49**	**1,408.71**

Adherence of the budgeted Program expenditure and its execution to the government's priorities

94. The Program budget allocations are aligned with the government priorities. Based on these priorities, the financial support needed by BBMP and BWSSB are assessed at the lowest accounting level (i.e. wards in case of BBMP) and divisions (for BWSSB). This is then consolidated to form the annual budgets proposals. With respect to whether budgetary allocations are sufficient to achieve intended results, both BBMP and BWSSB largely depend on GoK grants as their revenue fall short of the budgeted expenditure, especially for capital outlays. GoK, in the past, has made sufficient budgetary allocations. Deviations from the proposed and approved action plans have to be approved again and the necessary additional budgetary needs are met by the available resources.

95. BBMP and BWSSB are dependent on state finances and budget to the extent of annual grants received from GoK for capital works. In BBMP, in two out of the last three years, the receipts from GoK are in excess of capital expenditure. BWSSB tends to invest in the creation of infrastructure for water supply and sewerage. However, the water charges have not been revised since 2014, and collection of bills and arrears needs improvement. As a result, fiscal situation of BWSSB is weak, and it has been unable to pay the interest or repay the principal on the loans received from GoK; this is with tacit approval of the GoK.

Table 11: Total expenditure and Grant Received from GoK (in US$ million)

Year	BBMP*			BWSSB**		
	Capital Expenditure	Grant Received from GoK	GoK Receipts as a % of Capital Expenditure	Capital Expenditure	Grant Received from GoK	GoK Receipts as a % of Capital Expenditure
2019-20	406.02	263.75	**64.96%**	255.04	24.61	**5.45%**
2020-21	317.61	419.77	**132.17%**	315.06	14.15	**3.69%**
2021-22	472.07	571.61	**121.09%**	366.52	29.52	**5.98%**

*Source: BBMP - 5th State Finance Commission Data; BWSSB - Budget documents.

96. The budget outturn for BBMP during FY 2020-21 to 2022-23 for receipts as well as expenditure was around 70 percent. During the year 2022-23, it improved to over 87 percent indicating efficient resource planning. Budget outturn for the BWSSB for receipts for the financial years 2020-21, 2021-22 and 2022-23 was 88 percent, 80 percent, and 71 percent respectively. With regard to the expenditure,

the budget outturn for the same period was 123 percent[13], 81 percent, and 95 percent again reflecting efficient resource and expenditure planning and execution.

Table 12: Budget Outturn

Year	Budget Outturn BBMP		Budget Outturn BWSSB	
	Receipts	Expenditure	Receipts	Expenditure
2020-21	70%	70%	88%	123%[14]
2021-22	86%	77%	80%	82%
2022-23	87%	87%	71%	95%

Focus on Efficiency of Program Expenditure:

97. GoK has made steady budgetary allocations for water supply, storm water drains and sewerage in the past years. Efficient budgetary execution is important for GoK is important when it comes to water supply, storm water drainage and sewerage, underground drainage and development projects because it ensures that allocated funds are used efficiently and effectively to achieve the desired outcomes. It can then create a positive impact on health and quality of life of the fellow citizens.

5. Program Economic Analysis

98. An economic analysis was performed to assess the economic internal rates of return of capital investments in nine sewage treatment plants managed by BWSSB, and 173 km of new and 80 km of rehabilitated storm water drains managed by BBMP. Together these two capital investments consist of 60 percent of the total Program costs. The quantifiable benefits of the STPs were measured by the market value of secondary and tertiary treated water to be discharged from these plants. The benefits of the storm water drains were measured by expected avoided losses to the households from future floods. See the Program economic analysis in chapter 5 for details. Overall, the average EIRR for the Program is 19.0% with the NPV in the range of US$360.9 million to US$844.4 million and BCR in the range of 2.1 to 3.3 for the discount rates of 10 and 5 percents respectively. Based on the Monte Carlo simulations the probability of low economic returns is 17.0% for the overall Program. The absence of data and the high level of uncertainty of the avoided losses from annual floods resulted in the relatively large probability of low EIRR.

Methodology

99. The total project costs are expected to be US$670 million. The economic analysis focused on only the investment parts of components adding up to US$365 million, or about 54% of the total Program costs.

100. The project will have several benefits. The quantifiable benefits of the STPs were measured by the market value of secondary and tertiary treated water to be discharged from these plants. The benefits of the storm water drains were measured by expected avoided losses to the households from future floods.

101. Separate economic analysis was conducted for the sub-components as well as the overall aggregates:

a. Sewage treatment plants managed by BWSSB

[13] This achievement is over 100% because of the surpluses of previous year spent during 2022-23.
[14] See footnote 4 above.

b. Storm water drains managed by BBMP

102. Each analysis included Monte Carlo simulations to consider uncertainties in the benefits calculations.

General Assumptions

a. The project component costs will be equally divided between the five years of the project duration.
b. The infrastructure built by the project will be operated and maintained for the next 15 years after the end of the project. This assumption is in line with the BWSSB's assumption on the productive life of the STPs.
c. Annual operations and maintenance costs is assumed to be 1% of the investment costs.
d. The discount rate is in the range of 5 to 10 percent.

103. The additional assumptions for the benefits calculations are listed below in respective sections.

Costs calculations

104. For the purposes of the economic analysis, the costs of constructions and maintenance of nine sewage treatment plants, and 173 km of new and 80 km of rehabilitated storm water drains were considered. This consists of 60% of the total project costs. The cost is assumed to be equally disbursed in the amounts as described in Table 13 over the five-year period from 2025 to 2029. Following the end of the project the continued operating and maintenance costs of the project is assumed to be between 1.0 percent of the overall costs.

Table 13: Distribution of project costs used for the economic analysis

Additional Financing / Years	2025	2026	2027	2028	2029	Total
Sewage treatment plants	$24.3	$24.3	$24.3	$24.3	$24.3	$121.7
Storm Water Drainage	$48.6	$48.6	$48.6	$48.6	$48.6	$242.9
Total	**$72.9**	**$72.9**	**$72.9**	**$72.9**	**$72.9**	**$364.6**

Counterfactual benefit calculations without the project

105. To understand the counterfactual of continuing discharge of untreated water, and potential losses from the floods, we assume in the absence of the project none of the investments included in the analysis would be undertaken. Thus, there will be no costs and benefits in the absence of the project.

Components benefits calculations and economic analysis

Sewage treatment plants

106. The project is planning nine new sewage treatment plants (STPs). Five of these plants will have tertiary water treatment capability. The remaining four STPs will have secondary water treatment capability. The quantifiable benefits of the STPs were measured by the market value of secondary and

tertiary treated water. The secondary treated water can be potentially used irrigation in the agricultural sector. The tertiary treated water has industrial uses. A range of water prices from these sectors were used to account for uncertainties. The price and other assumptions are listed below.

- The price secondary treated water for agricultural use is assumed to be between Rs 10 and 30 per m3D.
- The price tertiary treated water for industrial use is assumed to be between Rs 40 and 80 per m3D.
- The STPs are expected to work at 80% of their respective capacity on an average.

107. Table 14 shows the results of the Monte Carlo simulations for the new sewage treatment plant infrastructure.

Table 14: Results matrix for new sewage treatment plant infrastructure

	EIRR	**NPV**		**BCR**	
Discount Rate	**NA**	**10.0%**	**5.0%**	**10.0%**	**5.0%**
Expected Value	17.1%	$68.0	$175.6	1.6	2.4
Standard deviation	0.03	28.7	47.9	0.3	0.4
Minimum	10.3%	$0.6	$68.8	1.0	1.6
Maximum	22.5%	$134.6	$286.3	2.2	3.3
Coefficient of Variance	0.15	0.42	0.27	0.16	0.2
Probability of low* outcome	3.5%	0.0%	0.0%	0.0%	0.0%

*low: < 12% EIRR, < 0 NPV, <1 BCR

108. The average economic internal rates of return (EIRR) for the STPs is 17.1% with the net present value (NPV) in the range of US$68.0 million to US$175.6 million and benefit costs ratio (BCR) in the range of 1.6 to 2.4 for the discount rates of 10 and 5 percents respectively. According to the Monte Carlo simulation there is a 3.5% probability of low EIRR for the new sewage treatment plants.

New and rehabilitated storm water drainage systems

109. The new and rehabilitated SWD infrastructure is assumed to mitigate annual flooding in the affected project area. The measured benefits are based on avoided economic losses to the households in the area. Extreme flood events are associated with loss of lives, damages to public infrastructure and private property, and economic losses to the households. However, regular annual urban floods may only be associated with household economic losses.

110. There is no data on household economic losses from floods in Bangaluru. We bench-marked the economic loss data from the extreme flood event of 2015 in Chennai. According to the Chennai Flood 2015 Report published by National institute of Disaster Management in 2021, 30% of the households faced losses between Rs 2 lakhs to 20 lakhs. We assume the losses from annual flooding in the project

area would also affect 30% of the households. However, the extent of the losses would be between 1% to 5% of the 2015 Chennai flood, after taking into account inflation. The assumptions are listed below:

- The avoided economic losses per household is between US$38 and US$1,879.
- The average household size is 3.8.
- 50% of the population of the "110 Villages" area would be in the project area. That is 1.8 million people.
- 30% of 1.8 million potentially suffer economic losses from annual flooding.

111. A Monte Carlo simulation was used to accommodate the uncertainty of the actual avoided losses resulting from new and rehabilitated SWD systems. Table 15 shows the results of the Monte Carlo simulations.

Table 15: Results matrix for new and rehabilitated storm water drainage systems

	EIRR	**NPV**		**BCR**	
Discount Rate	**NA**	**10.0%**	**5.0%**	**10.0%**	**5.0%**
Expected Value	20.0%	$292.9	$668.8	2.3	3.7
Standard deviation	0.13	321.4	588.0	1.5	2.4
Minimum	-188.5%	-$186.4	-$190.5	0.2	0.2
Maximum	45.1%	$1,327.6	$2,434.6	7.0	10.8
Coefficient of Variance	62.6%	1.1	0.9	0.6	0.6
Probability of low* outcome	24.2%	19.8%	8.7%	19.8%	8.7%

*low: < 12% EIRR, < 0 NPV, <1 BCR

112. The average EIRR for the SWD system is 20.0% with the NPV in the range of US$292.9 million to US$668.8 million and BCR in the range of 2.3 to 3.7 for the discount rates of 10 and 5 percents respectively. According to the Monte Carlo simulation there is 24.2 probability of low EIRR for the new and rehabilitated SWD systems. The absence of data and the high level of uncertainty of the avoided losses from annual floods resulted in the relatively large probability of low EIRR.

Overall Results

113. For each of the 1000 Monte Carlo simulations for the three sub-components included in this analysis, cost weighted aggregate EIRR and BCR indicators were calculated along with the respective total overall NPV. Table 16 shows the results of the Monte Carlo simulations for the overall Program.

Table 16: Overall results matrix

	EIRR	NPV		BCR	
Discount Rate	**NA**	**10.0%**	**5.0%**	**10.0%**	**5.0%**
Expected Value	19.0%	$360.9	$844.4	2.1	3.3
Standard deviation	0.08	321.2	590.0	1.0	1.6
Minimum	-120.5%	-$146.1	-$111.2	0.6	0.7
Maximum	36.6%	$1,400.4	$2,611.4	5.2	8.0
Coefficient of Variance	0.45	0.89	0.70	0.46	0.5
Probability of low* outcome	17.0%	10.0%	0.7%	10.0%	0.7%

*low: < 12% EIRR, < 0 NPV, <1 BCR

114. Overall, the average EIRR for the project is 19.0% with the NPV in the range of US$360.9 million to US$844.4 million and BCR in the range of 2.1 to 3.3 for the discount rates of 10 and 5 percent respectively. Based on the Monte Carlo simulations the probability of low economic returns is 17.0% for the overall project.

6. Inputs to the Program Action Plan (PAP) Implementation

Table 17: Program Action Plan

Action Description	Source	Responsibility	Timing	Completion Measurement
Institutional Enhancement for Social & Environmental Management: (i) Hiring at PMU State-Level: Social Specialist and environmental specialist; (ii) Appointing dedicated Environmental Officers within each implementing agency.	Environmental and Social Systems	RD, BBMP, BWSSB, KSDMA, KSNDMC, MI	Before starting sub-project activities.	Staff contracted and joined duties.
Develop and enforce a Construction Zone Management Plan to mitigate E&S risks pertaining to occupational and community health and safety including traffic management.	Environmental and Social Systems	BWSSB, KSDMA, MI	Throughout construction period.	CZM Plan developed and enforced through regular inspections and corrective actions to address any identified risks effectively.

Development and Implementation of Program Specific Comprehensive Water Quality Monitoring Network and Plan: Design and implement a comprehensive, program-specific water quality monitoring network for raw and treated sewage at STPs, SWDs and lakes.	Environmental and Social Systems	BBMP and BWSSB	Develop the Plan within 6 months of program effectiveness; Implement within 2 years of program effectiveness.	Water quality monitoring network and plan, Implementation report.
Receipt of IAs' monitoring reports to comply with E&S provisions included in contract agreements of Program investments— during construction and O&M phase	Environmental and Social Systems	BWSSB, KSDMA, MI	Semi-Annually	Monitoring template for semi-annual reporting. Semi-annual E&S monitoring reports submitted till completion of works.
Include in the Program's Standard tender documents the World Bank's E&S clauses to ensure E&S, OHS, ESHS, GBV, and SEA compliance and risk mitigation, and ACG for PforRs.	Fiduciary Systems	All program implementing agencies	Before tendering for works.	Program-specific STDs prepared and utilized for all procurements under the Program.
Develop ICT platform for monitoring the procurement cycle including contract management and displays procurement KPIs on the dashboard as per the IFSA.	Fiduciary Systems	State PMU	Within six months of the Program's effectiveness and semi-annual report.	Operationalizes the procurement and contract management monitoring system and displays key performance indicators (KPIs) as per IFSA on its dashboard, and discloses necessary information in the public domain.
Submit fiduciary KPIs report as per the IFSA table	Fiduciary Systems	BBMP, BWSSB, KSDMA	Semi-Annually	Submit the semi-annual report as per the agreed format in POM.

Establish a fiduciary complaint-handling mechanism at the Program's agencies to redress procurement, financial management, and corruption-related complaints.	Fiduciary Systems	BBMP, BWSSB and KSDMA	Mechanism established within three months of program effectiveness. Submit semi-annual reports.	Establish fiduciary complaint handling mechanism. Submit semi-annual reports within the two months after the semi-annual reporting using the formats provided in the POM.
BBMP and BWSSB to conduct **studies to assess various fiduciary systems** (including accounting software) and implement recommendations		BBMP and BWSSB	Within 12 months of Program's effectiveness	Conduct study on how various fiduciary systems can be improved and implement the recommendations of the studies within a reasonable timeframe.
Strengthen **internal audits** at BWSSB		BWSSB	Continuous	Internal audit strengthened to: (i) broaden scope, (ii) include qualitative aspects, and (iii) to cover a range of procurement aspects.

7. Technical Risk Rating

Table 18: Program Risk Assessment

Risk -1	**Fragmented approach to tackling water security and disaster risk**
Risk Rating	**Substantial**
Mitigation Actions	The current institutional landscape in Karnataka is highly fragmented with each agency working in silos on its own mandates. However, water security issues and disaster risk management require the agencies to work together to address these challenges which have intensified due to increasing urbanization and climate change. To address this fragmentation: 1. The Program incentivizes an integrated approach to planning, institutional strengthening, and reforms of disaster risk governance through joint efforts of BWSSB and BBMP's SWD, lake and solid waste management divisions. 2. The institutional structures around disaster risk management elements will be reformed through the establishment of the KCHRIS and the operationalization of KSDMA's capacity to formulate and execute DRM projects.
Risk - 2	**PPP transactions do not come to fruition**
Risk Rating	**Moderate**
Mitigation Actions	BWSSB does not have experience with PPP contracts for leveraging private investment, and has only used Design, Build, and Operate (DBO) contracts. However, the Program envisions upgrading of six existing STPs to biogas generation through PPP models along with other large PPP projects on energy efficiency, water reuse, and NRW. Because of this lack of experience, there is some risk that the planned investments may not be realized. To ensure that BWSSB is able to successfully leverage PPPs, the Program will incentivize step-wise achievement of PPP milestones, with separate incentives applied towards appointment of PPP transaction advisors, and signing of PPP contracts.

8. Inputs to the Program Implementation Support Plan

115. During the implementation of the PforR operation technical support is envisaged to be provided, with the support of the World Bank. This support will focus on strengthening the implementation of the Program.

Table 19: Program Implementation Support Plan

Technical Area	Type of support	Skills needed	No. Staff weeks average / year
Field Level Leadership, study tours, and international partnerships	Leadership development, training and capacity building	Institutional integration, water security, human resource,	8
Behavior change promotion for support on water security and resilience	Community development and mobilization	Behavioral design; water scarcity	12
Analytical Studies	Water security strategy, river basin plans, water balance, energy audits as well as field pilots on smart metering	Water resource management, energy efficiency	24
Independent Verification Agency	Training and supervision of verification	Water resource management, evaluation and survey design	52
Financial audits	Supervision	Financial management, accounting	8

9. Annex 1: Verification Protocol Table for Disbursement Linked Indicators

(US$ amounts are indicative)

DLI 1: Integrated flood management system stengthened	
Formula	**DLI 1: Total allocation US$84 million** **DLR 1.1|BBMP|** US$2,750,000 per zone (8) achieving institutional enhancement of social and environmental management **DLR 1.2|BBMP|** US$3,000,000 per zone (8) with completed Nature Based Solutions. **DLR 1.3|MI|** US$250,000 per MI lake (40) able to receive treated water from Bengaluru. **DLR 1.4|BBMP|** US$1,750,000 upon completion of 16 integrated flood management systems.
Description	**Definition of scalable:** The DLI is scalable, meaning disbursements against partial achievement of results are allowed; consequently, the DLI can pay for the achievement against activities in each watershed or each of the eight zones independently. The DLI includes four DLRs: **DLR 1.1|BBMP|US$22 million| Scalable| Institutional Enhancement of Social and Environmental Management**| US$2,750,000 per zone achieving compliance with social and environmental criteria including impacts on livelihood, vulnerable populations, community health and safety, construction zone management plan, and appointment of requisite staff. **DLR 1.2|BBMP|US$24 million|Nature based solutions competed |Scalable|** US$3,000,000 per zone with completed NBS system intervention covering a sub-hydraulic section in each of the 8 zones (scalable). The eight nature based- and other water retention interventions have to be optimized using modelling and contribute to flood management and/or groundwater recharge. The DLR requires that the total investment on the NBS interventions in all eight zones is at least US$12 million. **DLR 1.3|MI|US$10 million|Lakes able to receive treated water from Bengaluru|Scalable|** US$250,000 per lake in Doddaballapura and Nelamangala areas that receives diverted treated water from Bengaluru. A total of 40 lakes are eligible under DLR 1.3. **DLR 1.4|BBMP| US$28 million|Scalable|** US$1,750,000 upon completion of the integrated flood management system across 16 distinct areas of Bengaluru. The integration under DLR 1.4 includes concrete lining of 173 km of SWD and rehabilitation of 80 km SWDs, lakes development and integrated of SWDs and lakes. Lake integration includes flood management control measures such as diversion structures, sluice gates, and sensors.
Data source/ Agency	BBMP and MI
Verification Entity	Externally hired IVA
Procedure	DLR 1.1: The IVA will conduct desk review and field verification where necessary. DLR 1.2: The IVA will conduct field verification in each of the completed NBS schemes. DLR 1.3: The IVA will conduct field verification in each of the completed lakes. DLR 1.4: The IVA will conduct field verification.

DLI 2: Circular economy operationalized	
Formula	**DLI 2: Total allocation US$40 million** **DLR 2.1**|BWSSB|US$500,000 per circular economy site completed. **DLR 2.2**|BWSSB|US$300 per new household sewer connection in the 110-village area. **DLR 2.3**|BWSSB|US$50,000 per percentage point increase in volume (m^3) of reuse of BWSSB's total treated wastewater over baseline (15 million liter per day)
Description	The DLI disburses against circular economy investments which include nine STPs with a combined capacity of 148 MLD and one advanced water treatment plant (5 MLD). Among the STPs, reuse of tertiary treated wastewater, methane capture and biogas generation, solar sludge dryers and long O&M design-build-operate contracts will be demonstrated as stipulated in the verification protocol of the POM. The DLI includes three scalable DLRs: **DLR 2.1**|**Allocation US$5 million|Scalable|**US$500,000 per circular economy site completed as per the planned specifications further detailed in the POM. The completion requires that a sludge management plan is developed for the STPs. There is a total of 10 sites. **DLR 2.2**|**Allocation US$30 million|Scalable|**US$300 per new household sewer connection in the 110-village area. The sewer connection will be connected to an operational STP. Target: 100,000 household connections. **DLR 2.3|Allocation US$5 million|Scalable|**US$50,000 per 1 percent increase in volume of wastewater reuse for commercial and industry purposes over the baseline of 15 MLD as of August 2024. DLR 2.3 targets a 100 percent increase in volume of wastewater reused to 30 MLD.
Data source/ Agency	BWSSB
Verification Entity	Externally hired IVA
Procedure	DLR 2.1: IVA to review available data and conduct sites visits to all 10 sites. DLR 2.2: IVA to conduct field verifiacition of 2-5 percent of the household sewer connections. DLR 2.3: IVA to review wastewater reuse volume and contracts.
DLI 3: Water security system enhanced	
Formula	**DLI 3: Total allocation US$36 million** **DLR 3.1|BBMP|US$16,000,000 (indicative)** upon the operationalization of the digital environment and water governance system. **DLR 3.2|BBMP|US$20,000,000** upon operationalization and integration of advanced stormwater modelling.
Description	**DLR 3.1|BBMP|Allocation US$16 million|Digital environment and water governance system |** US$16,000,000 upon the operationalization of the digital environment and water governance system that includes: (a) streamlining environment and water procedures, such as monitoring, permitting, and inspections; (b) development of industrial wastewater pollution monitoring system; (c) development of a public-facing lake health index; (d) institutionalizing third-party audits and inspections. Required agencies: BBMP, BWSSB, KSPCB. **DLR 3.2|BBMP|Allocation US$20 million|Integrated advanced stormwater modelling |**US$20,000,000 for operationalization and integration of advanced stormwater modelling. The model is considered operationalized and integrated when it meets the following criteria: (a) the model includes hydrologic and hydraulic models with fine-scale datasets obtained from observations and weather research and forecasting simulations, identification of flood vulnerable areas, the development of flood risk maps for Bengaluru, groundwater trends, and additional urban climate resilience elements; and (b) an interagency modelling unit is established with representation from the police department, BBMP, and KSDMA.
Data source	BBMP
Verification Entity	Externally hired IVA

Procedure	DLR 3.1. Desk review of functionality. DLR 3.2: Review of model and modelling unit.
DLI 4: Municipal O&M institutions integrated and professionalized	
Formula	**DLI 4: Total allocation US$63 million** **DLR 4.1|BBMP|US$36,000,0000.** Each of the eight zones will receive an annual zonal flood management professional score between 1 and 100 based on a zonal performance criteria for BBMP. The annual zonal score is equivalent to US$180,000 per point and will be awarded annually for 4 years. **DLR 4.2|BWSSB|Utility enhancement program score|US$20,000,000.** DLR 4.2 disburses against the progressive achievement of the utility enhacement program score. **DLR 4.3|BWSSB|US$7,000,000** upon fixing leaking machine-holes in the SWDs.
Description	This DLI applies to all of 860 km of BBMP's SWDs and 183 lakes. This DLI will disburse against the following three DLRs: **DLR 4.1|BBMP|Total allocation US$36 million| Scalable| Zonal Flood Management Professional Score**| Each zone receives an annual score of between 1 and 100 to rate the zonal performance on the following key factors: (a) zonal action plan developed by staffed joint coordination cell (weighted score 35 percent); (b) SWD asset management system operational (25 percent); (c) SWD solid waste management action plan (15 percent); (d) zonal operationalization of advanced flood modeling (15 percent); and (e) zonal institutionalization and implementation of the lake health index (10 percent). The DLR applies to all 860 km of BBMP's SWDs across the city's eight (8) zones. The annual performance score will pay US$1,125,000 per zone for a score of 50. The annual joint zonal O&M plans will be developed jointly by all concerned agencies and include the planned works linked to available maintenance budgets of BBMP and BWSSB. The scope of the plans includes O&M contracts for solid waste and silt removal in all SWDs and lakes, maintenance of machine-holes and trunklines in the SWDs, and monitoring of wastewater effluent from STPs and industry and residential buildings along with a follow-up action plan. The specific requirements to the zonal O&M plans will be further specified in the POM. **DLR 4.2|BWSSB|US$20 million| Utility enhancement program score| Scalable|** The DLR disburses against progress on the utility enhancement program, which includes joint planning (10 percent), customer satisfaction surveys (10 percent), STP effluence assessment of apartment buildings (20 percent), and wastewater treatment efficiency and monitoring (60 percent). **DLR 4.3|BWSSB|US$7 million| Fixing machine-hole leakages** | US$7,000,000 upon fixing leaking machine-holes located in the 110-village area of the city to stop leakage from machine-holes entering in SWDs in this area. A coordinated O&M approach for all SWDs in Bengaluru is important from a flood management and water scarcity perspective as explained in paragraphs 4, 5 and 7. DLI 4 will institutionalize the O&M approach for SWD for its continued maintenance and upkeep and thus improve the climate adaptation of the city.
Data source	BBMP, BWSSB
Verification Entity	Externally hired IVA

Procedure	DLR 4.1 and DLR 4.2: Desk verification by IVA. DLR 4.3: Field verification by IVA.
DLI 5: Disaster risk governance institutional reform program implemented	
Formula	**DLI 5: Total allocation US$77 million** **DLR 5.1**|**KSDMA|**US$15,000,000 upon establishment of KSDMA operational program. **DLR 5.2**|**KSDMA|**US$20,000,000 upon launch of the KCHRIS data model. **DLR 5.3**|**KSDMA|**US$17,000,000 upon the establishment of the Center of Excellence (CoE). **DLR 5.4**|**KSDMA|**US$100,000 for each US$1,000,000 of mitigation project pipeline created (scalable up to US$5 million). **DLR 5.5|MI|**US$20,000,000 against an energy efficiency performance enhancement score.
Description	To be eligible for disbursement under DLI 5, KSDMA will demonstrate achievements towards the agreed disaster risk governance reform program which contains the following five DLRs: **DLR 5.1|KSDMA|US$15,000,000** upon the establishment of KSDMA's operational program which include organizational policies, staffing, and budget lines. **DLR 5.2|KSDMA|US$20,000,000** upon the launch of the KCHRIS data model. **DLR 5.3|KSDMA|US$17,000,000** upon the establishment of the CoE and allied facilities with infrastructure, organizational policies, staffing, and budget lines. **DLR 5.4|KSDMA|US$5,000,000|Scalable|US$100,000** for each US$1,000,000 of mitigation project pipeline created. Under DLR 5.4, the establishment of the KSDMA Mitigation Unit and the development of mitigation project pipeline for US$50 million are prerequisites for the disbursement which is scalable up to US$5 million. **DLR 5.5|MI|US$20,000,000| Energy efficiency in irrigation|** against the energy efficiency performance score weighted across the following factors: ISO 50001 energy management certification (70 percent), and energy demand flexibility (30 percent).
Data source/ Agency	RD and KSDMA; MID
Verification Entity	Externally hired IVA
Procedure	DLR 5.1, 5.2, and 5.3: Qualitative inspections and quantitative data collection using the verification protocols in the POM. DLR 5.4: Quantitative data collection of the reported results. DLR 5.5. Desk verification by IVA.
DLI 6: Own source revenues, financial reporting and transparency improved	
Formula	**DLI 6: Total allocation US$90 million**

	DLR 6.1|BBMP| US$1,000,000 per percentage point over BBMP's revenue baseline. Target: 45 percent revenue increase. **DLR 6.2|BWSSB|** US$1,000,000 per percentage point over BWSSB revenue baseline (scalable). Target: 30 percent revenue increase. **DLR 6.3|BBMP|** US$15,000,000 against a municipal financial reporting and transparency score.
Description	The GoK issued Notification No. FD 18 SAD 2021 on March 10, 2022, making FBM for BBMP. DLI 6 will incentivize BBMP to comply with certain sections of the rules to improve OSRs, financial reporting, and transparency. The DLI will include three DLRs. **DLR 6.1|BBMP|US$45 million| Scalable| Improved Own Source Revenues|** US$45,000,000 will disburse against the incremental increase in BBMPs OSR receipts. The DLR is scalable up to the targeted 45 percent increase over the FY2023/24 baseline. Definition of BBMP's OSR for the purpose of measuring DLR 6.1 includes: (a) property tax excluding cess payable including interest and penalty, (b) advertisement taxes or fee, (c) entertainment tax, (d) non-tax revenues, and (e) other revenue receipts (excluding any grants or transfers from state and central governments). **DLR 6.2|BWSSB|US$30 million|Scalable|Improved Own Source Revenue|** US$30,000,000 will disburse against the incremental increase in BWSSB's OSR receipts collected *(excluding state and central grants) provided that cost recovery ratio is equal to or greater than 1*. The DLR is scalable up to the targeted 30 percent increase over the FY2023/24 baseline. Definition of BWSSB's OSR for purpose of disbursement will be all operating revenue from water and sewer-related charges such as tariffs, inflation indexation, improved collection, revenue from sale of treated water. **DLR 6.3|BBMP|US$15 million|Scalable|** US$15,000,000 against a financial reporting and transparency score. The DLR is scalable and disburses against BBMP improving financial reporting as per the FBM rules 6 and 8, that is asset register and maintenance plan (40 percent), and publishing annual reports covering management discussion and analysis, annual performance review, and audited financial statements (60 percent).
Data source/ Agency	BBMP and BWSSB financial statements and IVA
Verification Entity	Externally hired IVA
Procedure	Desk review of the reported evidence.
DLI 7: BWSSB's financial and operational efficiency improved	
Formula	**DLI 7: Total allocation US$25 million** distributed across five DLRs. **DLR 7.1|BWSSB|** US$6,000,000 upon executing the Performance Based Contracts for NRW reduction. **DLR 7.2|BWSSB|** US$5,000,000 upon executing the energy efficiency investment at river Cauvery. **DLR 7.3|BWSSB|** US$3,000,000 upon obtaining ISO 50001 certification on energy management.

	DLR 7.4|BWSSB|US$6,000,000 upon completion of the PPP transaction advisor's project feasibility report. **DLR 7.5|BWSSB|**US$5,000,000 upon signing a PPP contract.
Description	DLI 7 includes the following five DLRs: **DLR 7.1|BWSSB|US$6 million|** Disburses against BWSSB executing performance based contracts for NRW reduction. The contracts will cover at least 100 km of pipeline. **DLR 7.2| BWSSB|US$5 million|** Disburses against BWSSB executing energy efficiency investment at river Cauvery. **DLR 7.3| BWSSB|US$3 million|** Disburses against BWSSB obtaining ISO 50001 certification on energy management. BWSSB will be the first in the country to meet the ISO certification. **DLR 7.4| BWSSB|US$6 million|**Disburses against BWSSB official completion of the PPP transaction advisor's project feasibility report. **DLR 7.5| BWSSB|US$5 million|**Disburses against BWSSB signing a PPP contract.
Data source/ Agency	BWSSB
Verification Entity	Externally hired IVA
Procedure	Desk review and field verification of the reported results.
DLI 8: Financing for addressing disaster and climate risks enhanced	
Formula	**DLI 8: Total allocation US$10 million** distributed across three DLRs. **DLR 8.1**|**KSDMA|**US$2,500,000 upon establishment of institutional mechanism for financing disaster and climate risks. **DLR 8.2|KSDMA|**US$200,000 for each US$1,000,000 mobilized using market-based disaster risk financing instruments. **DLR 8.3|KSDMA|**US$200,000 for each US$1,000,000 mobilized from non-GoK sources to the blended finance facility.
Description	DLI 8 includes the following three DLRs: **DLR 8.1|KSDMA|US$2,500,000** will be disbursed when KSDMA has established institutional mechanism for financing disaster and climate risks. **DLR 8.2|KSDMA|US$3,750,000|**US$200,000 for each US$1,000,000 mobilized using market-based disaster risk financing instruments to complement the State Disaster Risk Management Fund. **DLR 8.3|KSDMA|US$3,750,000|**US$200,000 for each US$1,000,000 mobilized from various non-GoK sources to the blended finance facility.
Data source/ Agency	KSDMA
Verification Entity	Externally hired IVA
Procedure	DLR 8.1: Qualitative inspections and quantitative data collection as per the POM's verification protocols. DLR 8.2, 8.3: Quantitative data collection of the reported results.

DLR 4.1\|BBMP\|Total allocation US$36 million \| Zonal Flood Management Performance Score \| Each zone receives an annual performance score of between 1 to 100 following a set methodology that will rate the zones performance based on the following key factors:

#	Zonal performance score	Maximum Points
1.	**Join annual zonal action plan** developed.	**10**
2.	**Training:** Field Level Leadership is implemented at the zone.	**5**
3.	**Asset management system:** SWD asset management system operational and serve as a single source for effective planning and management of SWDs.	**10**
	Periodical inspections and regular maintenance of drains conducted.	**10**
	Integrated contracts covering both desilting and transportation (one contract).	**10**
	Bed level data and high flood levels collected/available.	**10**
4.	**SWD Solid waste management action plan.**	**5**
	Ward level citizen engagement implemented.	**5**
5.	**Storm water modeling operationalized.** Modeling presented at the zonal and ward level.	**15**
6.	**Lake health index active.**	
	Zonal lake health index developed, updated and public facing.	**15**
	Ward level citizen engagement on lakes health implemented.	**5**
	Total	**100**

DLR 4.2|BWSSB|US$20M|Utility Enhancement Program| Annual over 3 years

#	Utility Enhancement Program	Points
1.	**Annual joint ward-level implementation plan** on SWDs developed with BBMP. Three annual plans to be developed.	10
2.	**Annual customer satisfaction surveys (division wise)**	10
3.	**Mapping of apartment buildings sewage discharge/treated water to storm water drains** (larger than 120 flats) conducted. Three annual assessments to be developed. (division wise)	20
4.	**Wastewater monitoring:** Percent of STPs meeting effluent standards. Measured annually over 3 years. Verification: Measured via online monitoring system (flow and effluent)	20
5.	**STP capacity utilization rate:** Proportional to performance. Measured annually over 3 years. Verification: Measured via online monitoring system	20
6.	**Wastewater treatment efficiency:** STP energy (kWh) used per m^3 treated or kWh per kg of BOD removal. (progress from 2024 August baseline for all BWSSB's STPs). Proportional to performance. Target: 10% reduction in energy usage. Measured annually over 3 years. Verification: Measured via online monitoring system	20
	Total	**100**

DLR 5.5|MID|US$20,000,000 against an energy efficiency program weighted across the following factors: ISO 50001 energy management certification (70%), and energy demand flexibility (30%). Each point holds a value of US$200,000.

#	Energy Efficiency Program	Points	Maximum Points

1.	Inventory of MID **larger pumping system** (500HP) completed.	**25**	**40 Cr.**
2.	Electricity bill analysis of larger pumping systems	**25**	**40 Cr.**
3.	Energy efficiency team established and staffed (4 persons)	**20**	**32 Cr.**
4.	ISO 50001 energy management certification completed. Treated wastewater pumping only.	**10**	**16 Cr.**
5.	Energy demand flexibility (load flexibility) study completed	**10**	**16 Cr.**
6.	Demand flexibility with MID demonstrated (small scale)	**10**	**16 Cr.**
	Total	**100 points**	**160 Cr.**

DLR 6.3|BBMP|US$15,000,000 against a financial reporting performance score. Each point holds a value of US$150,000.

#	**Financial reporting performance score**	**Maximum Points**
1.	Asset register (All assets) & maintenance priority plan developed	**20**
2.	Asset register & maintenance plan operationalized	**20**
3.	**First Annual Report published:** covering management discussion & analysis; annual performance review; and audited financial statements adhering to accounting standards issued by the Institute of Chartered Accountants of India.	**15**
4.	**Second Annual Report published:** covering management discussion & analysis; annual performance review; and audited financial statements adhering to accounting standards issued by the Institute of Chartered Accountants of India	**15**
5.	**Third Annual Report published:** covering management discussion & analysis; annual performance review; and audited financial statements adhering to accounting standards issued by the Institute of Chartered Accountants of India	**15**
6.	**Fourth Annual Report published:** covering management discussion & analysis; annual performance review; and audited financial statements adhering to accounting standards issued by the Institute of Chartered Accountants of India	**15**
	Total	**100**