

Ex-Ante Evaluation (for Japanese ODA Loan)

South Asia Division 1, South Asia Department

Japan International Cooperation Agency

1. Name of the Project

Country: India

Project: Bengaluru Water Supply and Sewerage Project (Phase 3) (II)

Loan Agreement: March 31, 2022

2. Background and Necessity of the Project

(1) Current State and Issues of the Water Supply and Sewerage Sector and the Priority of the Project in India

In India, households supplied with water through pipes or with access to portable water in their premises through unspecified means such as wells account for about 81% of all households in urban areas (based on the Ministry of Statistics and Programme Implementation's 76th National Sample Investigation Report in 2018). However, the development of water sources and water supply as well as sewerage facilities has not kept up with the water demand that has risen along with the country's population and economic growth. The operation and management of the water supply and sewerage facilities in India have faced technical and financial problems, such as high rates of non-revenue water, low payment collection rates, and low level of pricing, resulting in the deterioration of the water supply and sewerage facilities in some areas. The development of sewerage facilities has not kept up with the increase in demand due to population growth either. The percentage of households with access to toilets connected to sewerage has remained about 39% among all households in urban areas (based on the Ministry of Statistics and Programme Implementation's 76th round of National Sample Investigation Report in 2018), which suggests the necessity of developing sanitary sewage treatment facilities.

The Bruhat Bengaluru Mahanagara Palike (Bengaluru metropolitan area, hereinafter referred to as "BBMP") comprises Bengaluru City, which is the capital of Karnataka State in the south of India, urban local bodies (hereinafter referred to the "ULB"), and 110 suburban villages that have been urbanized rapidly along with mass migration into their central parts in recent years. Also known as the Silicon Valley in India, the area around Bengaluru City has rapidly developed into an agglomeration area of software industry, including many Japanese companies (405 companies in total as of October 2020 based on the research by the Japan External Trade Organization (JETRO)). However, infrastructure development,

including water supply and sewerage facilities that have not been able to keep up with the population increase in the area, has been a major constraining factor for the development of BBMP. The water demand in BBMP excluding groundwater utilization was 1,550 million liters per day (MLD) as of 2016. In contrast, the water supply capacity of the Bangalore Water Supply and Sewerage Board (hereinafter referred to as the "BWSSB") has remained at 1,310 MLD. Thus, the water supply in Bengaluru is not enough to meet the increasing water demand. In particular, the 110 suburban villages are expected to see a rapid population increase in the future and the water demand is estimated to increase to 254 MLD by 2024. Considering that the available groundwater supply in the urban district has come close to its limit, there is an urgent need to develop water supply with surface water as water sources. Regarding sewerage, the coverage ratio in Bengaluru City and the ULB is about 60%, but there is no sewerage operated by the BWSSB in 110 suburban villages. Thus, there is a pressing need to improve the sanitary and water environments in these villages.

In order to cope with the water resource problem, the Government of India (hereinafter referred to as the "GOI") established a new ministry, Ministry of Jal Shakti, by integrating existing departments related to water resources (in 2019) and implemented the Jal Jeevan Mission (Urban), which aims to supply water to all households in the urban district (according to the government's policy speech for the 2021 budget in February 2021). Regarding sewerage, the Ministry of Urban Development, the precursor of the Ministry of Housing and Urban Affairs, announced the "National Urban Sanitation Policy in 2009", which included a policy to give people access to safe sanitary facilities by conducting activities to increase the awareness of urban residents about the importance of sanitation such as sewerage. GOI also announced a policy to address the continuous installation of toilets and the development of sewerage facilities in urban districts by establishing Swachh Bharat Mission (Urban) 2.0, which succeeds the Clean India Policy (2014 to 2019) (according to the government's policy speech for the 2021 budget in February 2021).

Furthermore, in the Urban Drinking Water and Sanitation Policy 2003 and the Karnataka State Water Policy 2019, the Karnataka state government set a target to provide water supply and sewerage services to everyone in the state. Under these policies, the BWSSB has promoted the Cauvery Water Supply Scheme (CWSS) from Stage I to Stage IV to develop water supply facilities with capacities of 1,310 MLD as part of its efforts to achieve a water supply of 2,100 MLD

(excluding groundwater utilization) to BBMP by 2034. The project has been further promoted to Stage V so as to develop a water treatment plant, and raw and purified water transmission mains and achieve a water supply capacity of 775 MLD. Water supply and sewerage facilities are also being developed in 110 suburban villages where the population is growing at high rates.

The Bengaluru Water Supply and Sewerage Project (Phase 3) (hereinafter referred to as the "project") aims to assist the water supply and sewerage development projects promoted by the BWSSB for ensuring stable water supply with Cauvery River as a water source and stable sewer treatment. This is consistent with the GOI's development policy in the water supply and sewerage sector.

(2) Japan's and JICA's Cooperation Policy and Operations in the Water Supply and Sewerage Sector

The Country Assistance Policy for India (March 2016) formulated by the Government of Japan establishes "supporting sustainable and inclusive growth" as a priority area and states its support for water supply and sewerage as a part of its "response to environmental problems and climate change." Additionally, the JICA Country Analysis Paper for India (March 2018) mentions importance of basic social services under "supporting sustainable and inclusive growth" and provision of support for sustainable economic development and in the country, sharing its benefit with society equally. In addition to providing support for this, as part of urban development under "water and sewerage, sanitation improvement and pollution control measures program", supporting social sector such as basic social infrastructure development including sewerage and sanitary facilities. Thus, the project is consistent with these policies and analysis results.

The project is also considered to contribute to Goal 6 (ensure availability and sustainable management of water and sanitation for all) of the Sustainable Development Goals. Therefore, it is highly necessary to assist the implementation of the project.

(3) Other Donors' Activities

The World Bank accepted the Karnataka Municipal Reform Project (worth 216 million US dollars) for BBMP in 2006 and extended assistance in the sewerage development in the ULB. In the Country Partnership Strategy (2018 to 2022), the Asian Development Bank has promoted public infrastructure development, including water supply and sewerage facilities, for comprehensive urbanization as one of the priority fields of the cooperation for India and intensively extended

assistance in the promotion of public private partnership (PPP). The US Agency for International Development (USAID) implemented capacity reinforcement project focusing on the financial improvement of project operation agencies in the water supply, sewerage and sanitation sector in 70 cities of 13 states, including Odisha, Karnataka, and Maharashtra States during the period from 1993 to 2011.

3. Project Description

(1) Project Objective

The objective of the Project is to provide safe and stable water supply and sewerage services in BBMP by carrying out construction of water supply and sewerage system utilizing water resource of Cauvery river, thereby improving living conditions of the residents as well as the promoting industrialization in the concerned areas.

(2) Project Site/Target Area

Bengaluru urban district in Karnataka State (population: about 8.5 million (2011))

(3) Project Components

<Water Supply Facilities>

- a) Installation of raw water transmission pipes (about 10 km)
- b) Construction of a treatment plant (treatment capacity of 775 MLD in terms of raw water) and transmission pump stations (3 locations), as well as installation of transmission pipes between pump stations (about 70 km) and transmission mains in the urban district (about 114 km)
- c) Installation of connecting pipes from new transmission facilities to existing and new distribution reservoirs in BBMP
- d) Construction of new distribution reservoirs (7 locations)
- e) Construction of overhead water tanks (135 locations) and transmission pumps (61 locations), as well as installation of connecting pipes from distribution reservoirs to overhead water tanks (about 200 km in 5 zones)
- f) Installation of water transmission networks in 110 suburban villages (5 zones)
- g) Installation of SCADA (central monitoring) system (common to water supply and sewerage facilities)

<Sewerage Facilities>

- a) Construction of sewage treatment plants in 110 suburban villages (14 locations with a treatment capacity of 114 MLD in total) and relay pump stations, as well as installation of sewer mains
- b) Installation of terminal sewer pipes in 110 suburban villages (5 zones)

<Consulting Service>

Design review, schematic design, detail design, tendering assistance, construction supervision, capability building in the operation and maintenance of facilities and in the reduction in non-revenue water, resident enlightening activities, implementation and supervision of the environmental management plan and environmental monitoring, etc.

(4) Estimated Project Cost

128,352 million Yen (Japanese ODA loan (for the tranche II): 37,068 million Yen)

(5) Schedule

January 2021-June 2027 (114 months)

Project Completion is defined as that all facilities are installed and become in use.

(6) Project Implementation Structure

1) Borrower: President of India

2) Guarantor: None

3) Executing Agency: BWSSB

4) Operation and Maintenance Agency: BWSSB

(7) Collaboration and Sharing of Roles with Other Donors

1) Japan's Activity: N/A

2) Other Donors' Activity: N/A

(8) Environmental and Social Considerations/Cross-Sectoral Issues/Gender Category

1) Environmental and Social Consideration

2) Category: B

3) Reason for Categorization: Based on the "JICA Guidelines for Environmental and Social Considerations" (published in April 2010), the project is determined to not have significantly adverse impacts on the environment in consideration of the characteristics of the sector that the project falls under, the project components, and the regions where the project takes place.

4) Environmental Permit: Although the project is not required to conduct an environmental impact assessment (EIA) under domestic laws, environment monitoring has been conducted according to an environment management plan (EMP) and an environment monitoring plan (EMoP) established based on the JICA Guidelines for Environmental and Social Considerations. The clearance with respect to compliance with the discharge standards of sewage treatment plants is expected to be issued by the Karnataka State Pollution Control Board in the future.

- 5 Anti-Pollution Measures: Regarding air quality, water quality, noise, and waste treatment during construction, in compliance with domestic laws, the project is subject to mitigation measures such as regular water spraying by contractors; prohibition of disposal of earth, sand, etc., and setting up of construction machine repair yards in areas close to water places; speed limits for vehicles; and regular waste collection. Therefore, the adverse impacts of the project on environments are considered to be minimal. When sewage treatment plants are put in service, the effluent and sludge are supposed to be discharged after being treated to satisfy the environmental and discharge standards of India. Therefore, sewage treatment plants are not expected to have any particularly adverse impacts on environments.
- 6 Natural Environment: Target sites for the project do not correspond to vulnerable areas such as national parks, etc., or areas close to these vulnerable areas. Therefore, the adverse impacts of the project on the natural environment are considered to be minimal.
- 7 Social Environment: In the project, a treatment plant will be constructed within the premises of an existing facility, while other facilities will be constructed on land owned by government agencies. Therefore, the project does not involve land acquisition and relocation of local residents.
- 8 Other/Monitoring: Contractors are supposed to monitor the air quality, noise, waste, etc., when the project is in the construction stage and monitor the water quality, waste, etc., after the commencement of services.

2) Cross-Sectoral Issues

- ① Climate change: Although the project uses surface water as a water source, distribution reservoirs and overhead water tanks to be constructed in the project for storing purified water are expected to ensure stable water supply in the future, even in drought periods, which may worsen due to climate change. Thus, the project contributes to climate change measures (application).
- ② Poverty measures and considerations: As measures to assist the poor who are living in urban areas, the target areas of the project where water supply and sewerage facilities will be constructed include poor residential districts. A program to provide water supply service to poor districts for free has also been implemented as a part of the project. Thus, the project is considered to be a project that contributes to poverty alleviation.
- ③ Measures against infectious disease such as HIV/AIDS: The executing

agencies have agreed to implement a list of measures (36 in total) to prevent the spread of COVID-19 infection during the formulation and implementation of the project, including the establishment of behavior rules that are effective for infection prevention, thorough implementation of the rules, and the implementation of contractual measures for contractors during peak periods of infection. The list clarifies the following actions: preparing materials and equipment for communicable disease control; improving work environments, including the promotion of behavior rules; supervising construction works with due consideration to infection prevention; raising awareness about the importance of infection prevention; and so on. JICA will receive quarterly reports of the status of execution from the executing agencies to monitor whether attention is being given to the effects of COVID-19 and whether the executing agencies are handling situations flexibly and appropriately throughout the project stages. During the construction work stage, the construction contractor will implement HIV/AIDS prevention measures for the construction workers.

3) Gender Category

■ Gender Informed (Significant) (Gender activity integration project)

<Details of Activities/Reason for Categorization> The project plans to implement specific measures such as consulting services for public relation and educational activities to share the importance of saving water and the proper use of toilets, etc., and arranging the locations and times of these activities to encourage the participation of female residents.

(9) Other Important Issues: N/A

4. Targeted Outcomes

(1) Quantitative Effects

Outcomes (Operation and Effect Indicators)

Indicator	Baseline (Actual value in 2016)	Target (2027) [2 years after project completion]
<Water Supply>		
Water supply amount (110 suburban villages) (MLD)	N/A	295
Water supply amount (BBMP) (MLD)	1,310 ¹⁾	1,750

Utilization rate of treatment plant ²⁾ (%)	N/A	56
<Sewerage>		
Sewage treatment amount (110 suburban villages) (MLD)	N/A	195 ³⁾
Utilization rate of sewage treatment plant ⁴⁾ (%)	N/A	47
Discharged BOD ⁵⁾ (mg/L)	N/A	10 or less
Discharged TSS ⁶⁾ concentration (mg/L)	N/A	20 or less
<Reference Value ⁷⁾ >		
Population served by piped water (110 suburban villages) (persons)	N/A	1,650,000
Population served by piped water (BBMP) (persons)	5,840,000	9,320,000
Population served by sewer (110 suburban villages) (persons)	N/A	1,480,000

¹⁾ The total nominal capacity of the existing treatment plants is used as the reference value of water supply.

²⁾ The water supply amounts are estimated based on the growth in demand along with population increase, and the utilization rate of the treatment plant to be constructed in the project is expected to reach 100% in 2035.

³⁾ The sewage treatment amount includes not only the amount to be treated in the plants to be constructed in the project but also those of the existing plants connected through the pipes to be laid in the project.

⁴⁾ The utilization rate of the sewage treatment plants is expected to reach 100% in 2034 after taking into consideration that a certain period is required for each house to connect to the pipes after they have been installed in 110 suburban villages.

⁵⁾ Biochemical Oxygen Demand (BOD): BOD is the amount of dissolved oxygen consumed by microorganisms when they decompose organic substances in water. It is an indicator of water pollution due to organic substances in rivers.

⁶⁾ Total Suspended Solids (TSS): TSS is the amount of solids suspended in water and an indicator of water pollution in rivers.

⁷⁾ The number of houses to be connected can be counted, but the number of users in each house is difficult to estimate, so the values shown are reference values.

(2) Qualitative Effects

Stabilization of water supply, improvement in health conditions and living environments of residents through the provision of sewerage service, improvement in the operation and maintenance capability of the executing agencies, promotion of women's social participation, poverty alleviation, and so on

(3) Internal Rate of Return

Based on the following conditions, the economic internal rate of return (EIRR) is 21.2%. The project is not intended to generate revenue from water and sewerage charges, so the financial internal rate of return (FIRR) is not calculated.

[EIRR]

Cost: Project, and operation and maintenance costs (excluding taxes)

Benefit: Reductions of costs for securing water at each house, medical care, and sewage treatment

Project Life: 30 years

5. External Factors and Risk Control

(1) Preconditions: N/A

(2) External Factors: N/A

6. Lessons Learned from Past Projects

The ex-post evaluation (conducted in 2005) of the yen loan project "Rural water supply and sewage and sanitary environment improvement project" with respect to water supply and sewerage development projects in India taught JICA the necessity of deliberating practical plans for a charging system that maximizes the beneficiaries' liabilities based on an accurate estimation of the residents' willingness and ability to pay for services as well as for the promotion of the use of water meters. It also taught JICA the necessity of extending continuous assistance to executing agencies so they can improve their technical capabilities in the operation and maintenance of projects. The ex-post evaluation (conducted in 2015) of "Bengaluru Water Supply and Sewerage Project", etc., also pointed out that the project took longer than scheduled due to changes in sewage pipe installation routes, which required a redesign and reapplication for permissions from relevant authorities. Thus, another lesson learned from the ex-post evaluation regarding the sewerage development is the necessity of setting a project period that takes into consideration possible changes in the project plan and associated reacquisition of permissions in the future.

In the project, it has been confirmed that the BWSSB established a financial

improvement plan that includes the revision of charging systems and that the users of the water supply service are obliged to install water meters at individual houses. Thus, the progress of the plan and the installation of water meters are continuously monitored. In addition, the consulting service related to the reinforcement of organizational capability has addressed the transfer of techniques related to design, supervision, and measures against non-revenue water supply to the staff of the BWSSB. As one of the lessons learned from the "Bengaluru Water Supply and Sewerage Project", the project period for sewerage development has been set with some margin in consideration of the project characteristics.

7. Evaluation Results

The project is suitable for the development issues in India and development policies of GOI, as well as the cooperation policies and analysis results of the government of Japan and JICA. The project aims to provide stable water supply and sewerage service to cater to the rapid increase in water demand through the development of water supply facilities with Cauvery River as a water source and sewerage facilities, thereby contributing to the realization of sanitary living environment and industrial vitalization in BBMP in Karnataka State. The project is also considered to contribute to Goal 6 (ensure availability and sustainable management of water and sanitation for all) of the Sustainable Development Goals. Therefore, it is highly necessary to assist the implementation of the project.

8. Plan for Future Evaluation

(1) Indicators to be Used

As described in Section 4.

(2) Future Evaluation Schedule

Ex-post evaluation: 2 years after project completion

End