India

FY2020 Ex-Post Evaluation Report of
Japanese ODA Loan
"Bangalore Water Supply and Sewerage Project (II-1)/
Bangalore Water Supply and Sewerage Project (II-2)"

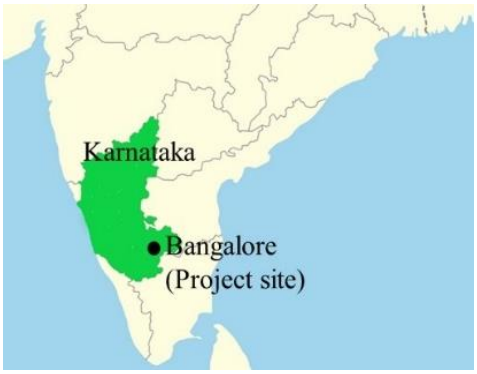
External Evaluator: Yumiko Onishi, IC Net Limited

0. Summary

The Project was to provide reliable water supply and sewerage services responding to the rapidly growing demand for water by developing water supply and sewerage facilities in the Bangalore metropolitan area, thereby improving living conditions and developing industry in the area. The Project has been consistent with the development plans and policies of the governments of India and Karnataka from the time of the Project appraisal to the ex-post evaluation. There are continuing needs for developing water supply and sewerage in the Bangalore metropolitan area, and the Project is consistent with such development needs as well. It is in line with Japan's ODA policy at the time of the Project appraisal, and the relevance is high. Most of the Project's original scope was implemented as planned in the Project, but some portions of it such as parts of slum development were implemented by other schemes. Owing to significant delays in the Project and the price escalation of materials and equipment during the implementation period, the Project cost exceeded the plan slightly. Therefore, the efficiency is low. With regard to effectiveness, the targets were achieved in the population served and the amount of water supplied in the water supply component. The sewerage component also achieved about 90% of its target. The unaccounted-for water (UFW) did not achieve its target. No adverse impact on the natural environment due to the Project has been reported, and appropriate measures were taken in the facilities constructed. Proper actions were taken for land acquisition as well. Therefore, the Project's effectiveness and impact are high. Regarding the sustainability of Project effects, the Executing Agency has a shortage of personnel. Although the water fee collection rate has been high in recent years, it is necessary to establish a mechanism for regular fee revision. Thus, the sustainability of the Project effects is fair.

In light of the above, the Project is evaluated to be partially satisfactory.

1. Project Description



Project location

A bird's-eye view of the T.K. Halli water treatment plant (Photo courtesy: Executing Agency)

1.1 Background

To develop the water supply, sewerage, and sanitation sector in India, budget has been allocated since the First Five-Year Plan (April 1951–March 1956) after the independence, and the development across the country started with it. Since then, the budget allocation for the sector has increased in every Five-Year Plan, and the central government has been leading the effort to develop the sector. Much funding and technical assistance from international donors have also been provided to the sector. As a result, access to safe water supply in India reached 86% in 2002, but the ratio of households with individual connection was merely 36.7% in 2001. Moreover, the duration of water supply was only four hours a day on average even in the national capital of Delhi because the speed of water source and supply development failed to keep up with that of the water demand surge due to population increase and industrial development.

Sewerage development was far behind compared to water supply. The ratio of India's population with access to the sanitation facilities was only 30% in 2002; the ratio of households with a toilet was 36.1% in 2001; and the sewer connection rate in the urban area was 22% in 1998. Moreover, more sewage was generated than the treatment capacity owing to rapid population increase and industrialization in urban area, resulting in sewage discharged to rivers in an amount far surpassing the natural capacity for purification, further threating the local sanitation and living environment with diarrhea and hepatitis caused by polluted water.

In addition, the quality of services was low for following reasons: insufficient recovery of the operation cost owing to a high water leakage rate caused by dilapidated water supply facilities; inappropriate fee structures for water supply and sewerage services; and inconsistent fee collection coupled with the inadequate institutional capacity of the organizations managing water supply and sewerage.

1.2 Project Outline

The objective of the Project is to provide reliable water supply and sewerage services by

augmenting the water supply from the Cauvery River and the sewerage system, thereby improving living conditions and developing industry in the Bangalore metropolitan area, the capital of the State of Karnataka.

Loan Approved Amount/ Disbursed Amount	(II-1) 41,997 million yen / 41,572 million yen (II-2) 28,358 million yen / 27,664 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	(II-1) March 2005 / March 2005(II-2) March 2006 / March 2006	
Terms and Conditions	Interest Rate	1.3%
	Repayment Period (Grace Period	30 years 10 years)
	Conditions for Procurement	General untied
Borrower / Executing Agency(ies)	The President of India / Bangalore Water Supply and Sewerage Board	
Project Completion	July 2017	
Target Area	Bangalore metropolitan area, State of Karnataka	
Main Contractor(s) (Over 1 billion yen)	SPML Infra Ltd (India)/Kirloskar Brothers Ltd. (India), SPML Infra Ltd (India), Degremont SA (France)/Degremont Private Ltd. (India), Sai Sudhir Infrastructures Ltd. (India)/IVRCL Ltd. (India), NCC Ltd. (India), Gammon India Ltd. (India)/Pratibha Industries Ltd. (India), Steel Authority of India Ltd. (India), Larsen & Toubro Ltd. (India), China Railway Shisiju Group Corporation (China)/Boorathnom Construction Co., Ltd. (India)/Taher Ali Industries & Projects (India), S.N. Gharpure (India)/Enviro Control Associates India Private Limited (India), Waterleau Group (Belgium)/KEC International Ltd. (India), Degremont (France)/Degremont Private Ltd. (India), IVRCL Ltd. (India), VA Tech Wabag GmbH (Austria)/VA TECH Wabag Ltd. (India), Indian Hume Pipe Co Ltd. (India), Suez Envrionnemet (France)/SPML Infra Ltd. (India), VA TECH Wabag GmbH (Austria)/VA Tech Wabag Ltd. (India)	
Main Consultant(s) (Over 100 million yen)	TCE Consulting Engineers Limited (India)/Nippon Jogesuido Sekkei Co., Ltd. (Japan)/Mott MacDonald Ltd. (United Kingdom)	
Related Studies (Feasibility Studies, etc.)	None	
Related Projects	<Japanese ODA Loan> Bangalore Water Supply and Sewerage Project (January 1996), Bangalore Water Supply and Sewerage Project Phase III-1 (January 2018) <Other international agencies> World Bank: Karnataka Municipal Water Energy	

	Efficiency Project (2004–2011) USAID: Guarantee for Karnataka Water and Sanitation Pooled Fund (1991–2011)

2. Outline of the Evaluation Study

2.1 External Evaluator

Yumiko Onishi, IC Net Limited

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October 2020–December 2021

Duration of the Field Study: July 19–23, 2021 and September 19–28, 2021

2.3 Constraints during the Evaluation Study

In this ex-post evaluation, the external evaluator visited the field only during the second field survey because of travel restrictions induced by the COVID-19 pandemic. As it was not possible to visit all the facilities created in the Project within the given time, between the external evaluator and the local consultant a water treatment plant and three sewerage treatment plants (STPs) were visited in person. Moreover, as a COVID-19 preventive measure, in-person interviews with the beneficiaries were avoided as much as possible. The evaluation was made based on the information obtained from the limited number of visited facilities.

3. Results of the Evaluation (Overall Rating: C[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of India

At the time of the Project appraisal, the Government of India, in its *Tenth Five-Year Plan* (April 2002–March 2007), was aiming to provide all villages with sustainable access to drinking water by 2007 in accordance with the minimum supply standards and to clean the major polluted rivers and improve their watershed environment. This was in addition to improving the indicators in the sanitation sector focusing on poverty alleviation. Moreover, in the *National Water Policy* of 2002, the Ministry of Water Resources aimed to place priorities on distributing water resources in the order of water supply, irrigation, and hydro power, to restrict the pumping of ground water based on the water retention capacity, and to provide safe and sufficient drinking water to all the people of India. The Ministry of Environment and Forest has been trying to clean rivers since 1985 starting with the Ganges, and was in the process of implementing river conservation and water quality programs nationwide through the construction of sewerage facilities under the *National*

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[2] ③: High, ②: Fair, ①: Low

River Conservation Plan, a national policy targeting 31 river basins and 157 cities.

Karnataka also formulated the *State Water Policy* of 2002 and the *Urban Water Supply and Sanitation Policy* of 2003. These policies emphasized the development of water supply and sewerage facilities that can meet the urban demand, making the water supply and sewerage services more efficient, and improving finances of the services.

Among India's development policies at the time of the ex-post evaluation, the *National Water Policy* of 2012 aims to develop water supply and sewerage so that central, State, and local governments can secure drinking water for the entire population. Moreover, the *Three-Year Action Agenda* (2017–2019) of NITI Aayog cites shortage of water supply and sewerage as an issue in urban development. Furthermore, the *Karnataka State Water Policy* formulated in 2019 aims to supply domestic and commercial water that is clean and affordable, and emphasizes the importance of ensuring equitable access to water and proper treatment of wastewater so that it does not cause pollution.

As seen above, from the time of the Project appraisal to the ex-post evaluation, the Government of India included in its development plans and policies the development of water supply and sewerage for securing drinking water and cleaning rivers. Similarly, the target area of Karnataka State refers to the necessity of developing water supply and sewerage in various policies. Therefore, the Project is consistent with the development policies of the governments of India and Karnataka.

3.1.2 Consistency with the Development Needs of India

In 2006, the Bangalore metropolitan area had a population of 6 million including adjoining eight urban local bodies (ULBs). However, the comprehensive master plan prepared by the Bangalore Development Authority targeting 2011 estimated that the population would increase by 2.5% per annum and reach 7.3 million by 2011. At the same time, the demand for water supply was estimated to increase from 908 MLD[3] in 2004 to 1,376 MLD in 2011. Although the service coverage of water supply within Bangalore city is high at 90%, the non-revenue water (NRW) rate including the leakage rate was 36%, and the average duration of supply was also six hours every other day. Furthermore, the water supply service coverage rate in the surrounding eight ULBs was only 40%.

It becomes imperative to develop sewerage when the demand for water supply increases because the wastewater generated also increases. However, at that time, the sewerage service coverage rate in the Bangalore metropolitan area was 53%, far behind the water supply.

As described above, the following major issues were recognized in the Bangalore metropolitan area: a) deteriorating living standards and limited industrial development owing to intermittent

[3] Million liters per day. 1 MLD = 1,000 m^3/day.

water supply, which was caused by the high leakage rate in the existing distribution channel in addition to the absolute shortage of water supply against the demand; b) deteriorating public sanitation condition, particularly in slums, which was due to untreated wastewater that flowed through open drains in cities and discharged into lakes and rivers; c) decreasing groundwater level owing to the pumping of water in an attempt to bridge the water supply gap caused by the shortage of surface water; and d) pollution of groundwater caused by undeveloped sewerage facilities.

The census in 2011 indicated that the population of the Bangalore metropolitan area was 8.5 million. With Bangalore's rapid development as an IT hub, many people moved there looking for employment opportunities. Thus, the population increased far beyond the forecast made at the time of the Project appraisal. Table 1 shows a forecast on population as well as the demand and supply of water. The gap between the demand and the supply is estimated to widen in the future.

Table 1: Forecast on population and water supply and demand

	Population (million)	Demand (MLD)	Supply (MLD)	Supply rate
2031	14.30	2,900	2,070	71%
2041	17.09	3,400	2,070	61%
2051	20.56	4,100	2,070	51%

Source: BWSSB

According to the Bangalore Water Supply and Sewerage Board (BWSSB), the Executing Agency, the implementation of the Project increased water supply from 90 LPCD[4] to 135 LPCD. The duration of water supply in the core residential area is four to six hours every other day at the time of the ex-post evaluation, which has not changed significantly from the time of the Project appraisal. An interview with a longtime Bangalore resident revealed that, around 2011, there was no fixed time for water supply, water was sometimes supplied only for an hour a day, and the water pressure was unstable. However, in the last few years, water supply has lasted for four to five hours every other day, and no water shortage has occurred, indicating a more stable water supply than the past.

The sewerage in Bangalore city and the surrounding ULBs is being developed along with the Cauvery Water Supply Scheme[5] (CWSS), making the sewerage service coverage rate 93.5% in the city. However, against the generated wastewater of 1,440 MLD, the amount of treated water in the Bangalore metropolitan area in 2021 is 800 MLD, leaving a huge gap between the

[4] Liter per capita per day

[5] At the time of the Project appraisal, a development plan on the water supply system with the Cauvery River as the source was divided in four stages and implemented. However, surrounding 110 villages were later added to the plan. Currently, the fifth stage is being implemented.

wastewater generated and treated (for details on wastewater treated in the Project, please see the "Efficiency" section). To respond to increasing sewage, BWSSB is urging commercial complexes above a certain size and group housings with more than 20 households to establish an STP within their premises and reuse treated water for purposes other than drinking water. In 110 villages around Bangalore city, sewerage has not been developed, and it is urgent to address the issues of sanitation and water even now. Accordingly, the construction of sewerage facilities are underway in Phase III of the Project.

In the Project, water treatment plants with the capacity of 550 MLD were constructed. Nevertheless, owing to the continuing population increase and the increasing demand for water supply, the supplied water amount remained at 65% of the demand even in 2020. The gap between the demand and the supply is expected to remain in the future as well. To address such situation, the Karnataka Urban Development Department issued an order in 2009 for buildings above a certain size to install a rainwater harvesting structure so that rainwater harvesting would be mandatory while raising awareness among citizens and imposing a fine on those not complying with the rules. In the sewerage sector as well, STPs with a certain level of capacity were constructed in the Project, but they are not operating at their full capacity and operational capacity has not caught up with the demand. Thus, the Project has been consistent with the development needs of the Bangalore metropolitan area at the time of the Project appraisal and the ex-post evaluation, and will continue to remain that way in the near future.

3.1.3 Consistency with Japan's ODA Policy

Assistance to the water supply and sewerage sector falls into "environmental improvement against conditions in urban areas with deteriorating environment and sanitary conditions," an important area identified in the Medium-Term Strategy for Overseas Economic Cooperation Operations (2002) to India. Moreover, it is in line with "the water supply, sewerage, and sanitation sectors to combat water problems directly related to people's health, which is becoming a serious concern because of industrialization and urbanization" mentioned in "environmental improvement", a priority area of the Country Assistance Strategy for India in FY2004. In addition to supplying sufficient and safe water, the assistance policy of JICA (former JBIC) in this sector was to extend support centering around the establishment of sewerage facilities to clean the major rivers that are used for not only water supply but also ablution.

The Project was implemented with the objective of improving the public sanitation condition of the Bangalore metropolitan areas, particularly in urban slums, and controlling the decreasing level of groundwater by constructing social infrastructure necessary for providing safe drinking water from surface water. Thus, as mentioned, it is consistent with Japan's ODA policy at the time of the Project appraisal.

The implementation of the Project has been highly relevant to the development plans and needs of India and Karnataka, as well as Japan's ODA policy. Therefore, the Project's relevance is high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

The Project comprised the following components: 1) water supply facilities, 2) sewerage facilities, 3) BWSSB management improvement, 4) slum development, and 5) consulting service. The consulting service was implemented as planned with detailed design, assistance in procurement, and construction management. Regarding the other components, the sections below describe the planned and actual outputs and major changes from the original plans.

1) Water supply facilities

Output	Plan	Actual
a) Headrace	Shiva Anicut – T.K. Halli water treatment plan (total length 18.4 km/open channel 2.6 km, pipeline 15.8 km)	Total length 17.1 km/open channel 0.7 km, pipeline 16.4 km
b) Expansion of a water treatment plant	T.K. Halli (500 MLD)	T.K. Halli (550 MLD)
c) Clean water transmission system	T.K. Halli – city (pipeline 68.4 km)	T.K. Halli – city (pipeline 68.35 km)
d) Pumping station	3 locations (discharge capacity 2,320 m^3/hour)	3 locations (discharge capacity 4,050 m^3/hour)
e) Distribution reservoir	6 locations (total capacity 147 million liters)	7 locations (total capacity 152 million liters)
f) Rehabilitation of distribution pipe	Replacement of old pipes and meters to reduce UFW (covering approximately 300,000 households)	Replacement of old pipes and meters to reduce UFW (covering approximately 326,000 households)

At the time of the Project appraisal, the T.K. Halli water treatment plant was designed for 500 MLD. However, it was ultimately changed to 550 MLD considering the most appropriate pumping capacity and ensuring that it would be possible to meet requirements in case of repairing the dilapidated existing plant within the premises.

2) Sewerage facilities

Output	Plan	Actual
a) STPs	11 STPs, total capacity 403 MLD	10 STPs, total capacity 336 MLD
b) Sewerage system	Total length 113.9 km (trunk mains 90 km, pumping mains 23.9 km)	Implemented by the Greater Bangalore Water and Sanitation Project

c) Sewage pumping stations	Intermediate sewage pumping station x 8, terminal sewage pumping station x 5	Intermediate sewage pumping station x 5, terminal sewage pumping station x 7

The number of STPs and their capacity were changed from the plan for the following reasons: the size of the land available for facilities, the surrounding environment, and the budget were considered during the detailed planning after the Project started, and the STP designs were modified. As each STP was to treat the wastewater generated in a specific area, considering the pace of the population increase in the area, it was envisaged that the gap between the wastewater generated and treated would be about 38 MLD when all the facilities are operated at their full capacity in the areas served by the ten STPs. Owing to the changes in the STP designs, the Project did not achieve the amount of wastewater to treat as originally targeted. However, the changes were made considering various conditions, and are deemed appropriate.

3) BWSSB management improvement

At the time of the Project appraisal, the following were targeted as the key performance indicators of BWSSB: reducing UFW, removing unmetered public fountains, reducing staff per 1,000 water-supply connections from 7.3 to 5.6, and reducing accounts receivable. When confirmed during the ex-post evaluation, unmetered public fountains have been completely removed. the number of staff per 1,000 water-supply connections was 4.12. Measures were taken for UFW in three zones in the target area,[6] and the outcome is described in the "Effectiveness" section.

Regarding accounts receivable, the arrears were equivalent to 6.4 months in 2003, but were reduced to 2.53 months by March 2020. Table 2 presents the water bill collection rates of BWSSB in recent years. The collected amounts shown in Table 2 include the previous arrear payment and penalties. Nevertheless, the collection rate is credible, and this has made it possible to reduce accounts receivable.

Table 2: Water bill collection rate of BWSSB

Unit: INR ten million

	FY2015	FY2016	FY2017	FY2018	FY2019
Billed amount	1,050	1,151	1,205	1,287	1,355
Collected amount	1,054	1,151	1,191	1,296	1,364
Collection rate	100%	100%	99%	101%	111%

Source: BWSSB

[6] Repair of distribution pipes, leakage detection using device, installation of meters, and removal of illegal connections are implemented.

BWSSB achieved a high collection rate in recent years, and behind it are a few specific initiatives. The first is the introduction of an automated payment machine for improving the bill collection system. The machine, called Kaver Ecom, was introduced around 2004–2005. Originally, the machine enabled the customer to pay water and electricity bills. Thereafter, it was used mainly by low-income families who would make cash payment for bills for small amounts until the E-governance Department of Karnataka introduced an integrated public service called Bangalore One, which is a one-stop shop for such purposes as utility bill payment and passport application. In recent years, many people have switched to online payment because of the spread of digital payment and the impact of COVID-19.

In addition to making it easier for the consumer to pay water bills by setting up Kaver Ecom, BWSSB set a strict measure for those who do not pay on time. Bill payments that are more than two weeks overdue incur a penalty equivalent to 20% of the billed amount. A non-payment for two to three months may cause the services to be terminated.

Moreover, BWSSB's service stations have a target for bill collection rate, which is regularly monitored by the headquarters.

The introduction of methods to make bill payment easier for the consumer, the implementation of strict rules, and the setting of a target within the organization are all contributing to improving the water bill collection rate.

In addition, human resource development, public relations and awareness activities, and introduction of Supervisory Control and Data Acquisition (SCADA)[7] were proposed under the Project. As part of human resource development, a dedicated section and a system were established, and a staff training plan was formulated. In addition, BWSSB reportedly implemented public relations and awareness activities, but no details were furnished. Regarding SCADA, a master server was installed in a BWSSB office in Bangalore city, and SCADA was installed at the T.K. Halli water treatment plant and a pumping station associated with the plant, as well as the V. Valley and Hebel STPs.

4) Slum development

Originally, the Project had planned to lay water distribution pipes and sewer connections in 362 slums, and switch from public fountains (water stand posts) to metered individual and/or shared water supply. To implement the slum development component, strengthening the social development section in BWSSB and establishing a slum development coordination committee comprising multiple related agencies were considered.

[7] SCADA makes it possible to manage water inflow and outflow at water treatment plants, pumping stations, and STPs in a comprehensive manner, and conduct integrated management of water treatment plants including those constructed in the CWSS stage I to III.

For the Project, a social development expert from the Women and Child Development Department was seconded to BWSSB and took charge of slum development. According to interviews with BWSSB officials, although no slum development coordination committee was established, coordination with the Bangalore municipal corporation (Bruhat Bengaluru Mahanagara Palike) and the Slum Development Board was done when necessary, and there was no problem with regard to coordination with other agencies.

In a slum survey conducted in the city of Bangalore between 2004 and 2008, the government recognized 362 slums. After the Project started, it turned out that 80 out of the 362 slums already had water supply and sanitation facilities developed by other agencies, while 32 had disappeared. Of the remaining 250 slums, only 164 became the targets of the Project. From the perspective of selecting proper beneficiaries, targeting only the government-recognized slums seems appropriate.

Regarding the transition from public fountains to metered connections, slums switched to either individual household connections or shared connections based on a survey on slum residents' preferences.

3.2.2 Project Inputs

(For details, please refer to "Comparison of the Original and Actual Scope of the Project" at the end of the report).

3.2.2.1 Project Cost

The Project cost at the time of the Tranche 2 appraisal was JPY 84,172 million, out of which JPY 36,544 million was foreign currency and JPY 47,628 million was local currency. Of the Project cost, JPY 70,355 million was provided by a Japanese ODA Loan with JPY 36,544 million as foreign currency and JPY 33,811 million as local currency.

The actual Project cost was JPY 94,344 million with the ODA Loan disbursement of JPY 69,236 million (JPY 41,572 million for Tranche 1 and JPY 27,664 million for Tranche 2), and JPY 25,108 million by the Karnataka State government.

The total Project cost combining Tranche 1 and 2 is 112% against the target and slightly exceeded the planned cost. The main reason that the total Project cost slightly exceeded the planned one at the time of the appraisal is that the Project was impacted by the price escalation of materials on many occasions owing to the prolonged Project duration.[8] The cost increase was observed mainly in the civil works of water supply and sewerage facilities (117% against the plan). The cost associated with BWSSB management improvement was reduced by approximately JPY 2 million.

[8] The inflation rate between 2006 to 2017 was 230%.

3.2.2.2 Project Period

At the time of the Project appraisal, the planned Project period was from March 2005 (L/A) to March 2013 (8 years 1 month, 97 months). Although the construction of water supply and sewerage facilities under the ODA Loan portion was to be completed by March 2011, Project completion was defined as the end of the consulting service.

Based on these definitions of Project commencement and completion, the actual Project period was from March 2005 (L/A) to July 2017 (12 years 5 months, 149 months), and significantly exceeded the plan at 154%. The STPs of the Project were completed and started operating accordingly between December 2017 and December 2019. The following are the reasons for the delays in the Project.

- Civil works affected by untimely rain
- Protests (strikes) by crane operators and truck drivers
- A long time to procure sand because of the protests above and the government's environmental protection policy
- Shortage of laborers
- Increased excavation due to hard rocks (caused by insufficient spacing at the time of geotechnical investigation)
- Increased number of concrete saddle support for transfer main constructed in swamps
- Delay in shifting of utility-related facilities such as electric wires

In addition, the main reason for the Project's delays is that it took about two years to conclude the consulting service contract. The Project was approved as the next phase of ODA Loan "Bangalore Water Supply and Sewerage Project," and the Executing Agency was familiar with the procurement procedure for consulting services. However, it took more time than expected until contract signing because expressions of interest were reinvited and a third party filed complaint on technical and price evaluation results. Thus, these delays were difficult to foresee or take countermeasures beforehand.

3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

As shown in the table below, the Financial Internal Rate of Return (FIRR) and the Economic Internal Rate of Return (EIRR) were calculated for the Project at the time of the Project appraisal. Internal rates of return at the time of the Project appraisal were recalculated in accordance with ex-post evaluation references based on the documents in which the details of the original calculation could be confirmed. The results, recalculated using the year of L/A signing as the base year, are as shown below. One of the reasons for the difference between FIRR at the time of the Project appraisal and the ex-post evaluation is that, owing to the delay in commercial operation of the facilities caused by the one in Project implementation, the duration of benefits generation

became shorter than the one at the time of the Project appraisal. In addition, according to the assumption at the time of the Project appraisal, a 5% water fee increase per annum was expected in the benefit calculation. However, in the recalculation during the ex-post evaluation, fee revision was taken as every seven years, which is close to the actual fee revision frequency, and resulted in reduced benefits. Regarding EIRR, data necessary to calculate benefits, particularly the cost saving by switching from other sources of water supply, could not be obtained from BWSSB. Thus, EIRR could not be recalculated at the time of the ex-post evaluation.

Table 3: Internal rates of return and assumptions[9]

	FIRR	EIRR
Internal rate of return	Appraisal: 6.07% Ex-post evaluation: 4.77%	Appraisal: 12.84% Ex-post evaluation: unable to recalculate
Cost	Project cost, operation and maintenance (O&M) cost	Project cost (excluding taxes), O&M cost
Benefit	Revenue from water supply and sewerage services	Revenue from water supply and sewerage services, cost saving by switching to BWSSB water from other sources
Project life	30 years	

To sum up efficiency, although there were partial changes in outputs, it is fair to conclude that the most appropriate design was employed for water supply and sewerage facilities after the Project started. Most of the Project scope was implemented as planned, but parts of slum development and the installation of automated paying machines were implemented by other schemes such as Bruhat Bengaluru Mahanagara Palike. Owing to the Project delay, material costs increased during the implementation period, and the Project cost exceeded the plan. Considering the portions of the scope excluded from the Project, the outputs delivered against the Project cost are not necessarily satisfactory. Moreover, a significant delay in the Project period resulted from the process of consultant procurement, as well as hard rocks and shortage or laborers, which were difficult to foresee at the time of the Project appraisal. Therefore, the efficiency of the Project is low.

3.3 Effectiveness and Impacts[10] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

In this section, the effectiveness of the Project shall be confirmed by comparing target and actual figures of indicators set at the time of the Project appraisal. The section explains mainly

[9] Internal rates of return from the time of the Project appraisal are from the Tranche 2 appraisal.
[10] Sub-rating for Effectiveness is to be put with consideration of Impacts.

the following: the amount of water supply and UFW regarding the water supply project; and the amount of wastewater treated regarding the sewerage project.

Table 4: Operation and effect indicators of water supply project

	Baseline	Target	Actual		
	2003	2015	2017	2018	2019
		2 years after completion	Completion year	1 year after completion	2 years after completion
Total population served (million)	4.016	7.420	10.670	11.170	11.780
Amount of water supply (MLD)	810	1,310	1,366	1,336	1,380
Rate of facility utilization (%)	-	100	95	93	95
Unaccounted-for water[11] (%)	36	16	33	28	24
Leakage rate (%)	31	13	25	23	20
Population served (%)	66.5	95.0	97.0	98.0	99.0

Source: Baseline and target figures are from JICA, and actual figures were provided by the Executing Agency.
Note: Actual figures of UFW are the average of three zones where the UFW activities were implemented.

In the water supply project, total population served, amount of water supply, and rate of population served achieved the targets. For the amount of water supply, the actual figure from FY2017 is above the target because the development of water supply in Bangalore is continuing after the Project, and the total water supply capacity of BWSSB has reached 1450 MLD as of 2021. The T.K. Halli water treatment plant constructed by the Project has the capacity of 550 MLD. It has increased its capacity in a phased manner from 450 MLD since it started operation in 2014, reaching full capacity at the time of the ex-post evaluation.

With regard to UFW, according to the JICA India Office and BWSSB during the ex-post evaluation, the target figure for UFW pertains to three zones where the interventions were made. Thus, the actual figures in Table 4 are averages from the three zones. In zone-wise performance, certain areas have achieved a UFW rate of less than 10% in 2021. Moreover, according to an interview with a BWSSB field staff, no incident of wastewater seeping into the distribution pipe of water supply has occurred since UFW measures were taken, and complaints on polluted drinking water, which occurred two to three times a month, ceased by the time of the ex-post evaluation. For setting the target figure, it appears that the Project referred to the Ministry of Urban Development's UFW benchmark of 20%. However, as 20% is a figure achieved by better performing water utilities of developed countries, and the target may have been a little too

[11] BWSSB uses the following equation for UFW calculation: (water input into the system – (water billed + water legally supplied but not billed + water used for operation + water supplied by tanker))/water input into the system x 100.

ambitious in the Project. The UFW targets in *Blueprint for the Future* (2018), BWSSB's vision document, back this argument; the document aims to achieve 30% in 2025 and 15% in 2050.

Table 5: Operation and effect indicators of sewerage project

	Baseline	Target	Actual*		
	2003	2015	2019	2020	2021
		3 years after completion	Completion year	1 year after completion	2 years after completion
Total population served (million)	3.19	7.02	9.00	9.80	10.80
Amount of wastewater treated (MLD)	408	1,111	800	800	1,050
Rate of facility utilization (%)**	-	90	45	77	92
BOD concentration of effluent (mg/liter)	Less than 20	Less than 20	Less than 20	Less than 20	6 to 12***
Population served (%)	53	90	75	80	85

Source: Baseline and target figures are from JICA, and actual figures were provided by the Executing Agency.
* STPs of the Project were completed and started commercial operation between December 2017 and December 2019. Thus, 2019 is used as the completion year for the sewerage project portion.
** Actual figures are for 10 STPs constructed in the Project.
*** Calculated by the external evaluator based on water quality monitoring results obtained from three STPs during the ex-post evaluation.

The amounts of wastewater treated in 2020 and 2021 by BWSSB are 1,183 MLD and 1,372 MLD, respectively, and it remains 68–77% of the total capacity in recent years (meaning the facility utilization rate). On the other hand, according to BWSSB, the facility utilization rate for the Project is above 90% three years after the Project completion.

The BOD concentration of effluents is monitored every day in the water quality testing laboratory set up in STPs. According to the analysis reports of water quality testing, the BOD concentration was 6–12 mg/liter depending on the STP and the time. In Karnataka, the rules on BOD level for effluents were revised in 2015 and the maximum permissible BOD level was set as 10 mg/liter, but another revision took place in 2017 and the permissible level became less than 20 mg/liter. Therefore, the BOD concentration of the Project is within the permitted level compared with the standard revised in 2017.

Doddabele STP

Effluence from STP

3.3.1.2 Qualitative Effects (Other Effects)

Described in the Impacts section.

3.3.2 Impacts

3.3.2.1 Intended Impacts

At the time of the Project appraisal, the expected impacts were "improving living conditions of the Bangalore metropolitan area, particularly in slums" and "developing the industries particularly in the target area including Japanese companies." For the first impact, interviews in the target areas were conducted with regard to reduction in time for fetching water among women, access to properly treated water (of quality better than before), and reduction in water-borne diseases as reported by BWSSB. Regarding the second impact, the impact of the Project seems on not only Japanese companies in the Bangalore metropolitan area, but also other firms there. Benefits are likely to be larger for companies in water-intensive sectors; thus, the impact has been understood as "developing the industries in the target area" without limiting beneficiaries to Japanese companies.

During the ex-post evaluation, interviews were conducted with the service station staff of BWSSB in charge of the Kumar Park area slum, and two representatives as well as a few residents of the slum. Before the Project, there were two public fountains in the slum, and mainly women collected water needed for the day, waiting in a que for several hours between 3 to 7 a.m. Barring a few households who were considered unauthorized, all the households in the slum were provided with an individual tap by the Project. About half the households had a water tank on the roof depending on the size of the house and economic conditions. The remaining households were still storing water in buckets from the individual connection between 3 to 7 a.m. every other day as those were the supply hours for the area. According to a female resident, before the Project implementation, they had to carry two to three buckets of water from the public tap at a time, and had to make two to three trips between the house and the public fountain. There is no doubt that the women's time and labor for fetching water were reduced by the Project. Although there was

no specific report on changes on incidence of water-borne diseases, the interviewed area is one of the areas where UFW measures were implemented; thus, as described earlier, polluted drinking water, which was earlier reported two to three times a month, has stopped by the time of the ex-post evaluation. Although the areas surveyed in the ex-post evaluation are limited, labor for fetching water was reduced and access to better-quality water has become possible; thus, the Project contributed to improving the quality of the living environment in the areas. In the slum areas, water up to 10,000 liters per month is provided at no cost to the households that are below the poverty line determined by the government.

Interviews with beneficiary companies were not conducted. Nevertheless, the T.K. Halli water treatment plant is supplying water to the industrial area in a suburb of Bangalore. Although there is no water-intensive industry around Bangalore, considering that bulk water supply is given to the industrial area, it is fair to say that the Project is contributing to industry to a certain extent.

Individual tap and buckets for storing water in a slum

Water quality testing laboratory

3.3.2.2 Other Positive and Negative Impacts

Impacts on the Natural Environment

The Cauvery River is the source for the water supply component of the Project. Land subsidence by water intake was not foreseen, and the water treatment plant and the pumping stations were to be designed with due consideration on noise. Moreover, effluence from the STPs was to be treated in accordance with Indian laws and then released to the rivers. Accordingly, the Project was classified as category B of the *JBIC Guidelines for Confirmation of Environmental and Social Considerations* (April 2002) as it does not fall into sectors and characteristics that will impact the environment, nor is it in a sensitive area. Furthermore, it was determined that any adverse impact from the Project on the environment would not be significant.

An interview with BWSSB during the ex-post evaluation revealed that no environmental monitoring of the Project during its implementation was conducted for the following reasons: the

water treatment plant and the STPs were located in the suburbs, there were no crowded residential areas around them, and the facilities were constructed within the existing compound. After the Project's completion, water quality was tested in the water treatment plant and the STPs for inflow and effluence. At the T.K. Halli water treatment plant, pH, turbidity, alkalinity, conductivity, magnesium, chloride, and coliform etc. are monitored every day while pH, BOD, COD, suspended solids, residual chlorine, phosphorus etc. are monitored every day at STPs. In addition to the daily water quality analysis at STPs, there is a third-party inspection every month, and the State Pollution Control Board comes for random checking. According to the recent monitoring results obtained during a site visit, each parameter is fulfilling the standards set by the State Pollution Control Board. Moreover, BWSSB has not been served any notice from the government for non-compliance so far. Facility-wise results of monitoring are available on BWSSB website.

Sludge is disposed of within the compound of the water treatment plant while each STP deals with it differently. The K&C Valley STP uses the anaerobic treatment process; the generated methane gas is used for energy while composted sludge is provided to farmers at no cost. The Nagasandra STP disposes of sludge produced in the facility by transporting it to a land located 25 km away.

Resettlement and Land Acquisition

According to information at the time of the Project appraisal, the land needed to be acquired for the Project was 123 ha (47 ha for the water supply component and 76 ha for the sewerage one), and none of the land fell into a culturally protected area. Land acquisition would be carried out properly in accordance with the domestic law and no resettlement was expected in the Project.

The ex-post evaluation revealed, as described earlier, that the water treatment plant and the STPs were constructed within the premises of existing facilities, and most of them did not require new land acquisition. In this phase of the Project, the only land acquired was 36 acres (15 ha) from the Karnataka Industrial Area Development Board,[12] except 0.789 ha. This land was secured by the State government in anticipation for future development, and thus, had no structures, and no resettlement took place. BWSSB purchased remaining 0.789 ha of land from a real estate agent. The land was vacant at that time because the agent had the land with expectations of future development, and thus, no resettlement took place. For land acquisition from different parties, Indian relevant act and appropriate guidelines were observed as planned, and there has been no complaints or disputes.

[12] The Karnataka Industrial Area Development Board (KIADB) is a State government organization promoting stable industrial development in the State. Since the 1960s, it has secured lands across the State including the Project target area in view of future industrial development, and provided them to water treatment plants, STPs, and industrial areas. BWSSB purchased land needed for the Project from KIADB.

Unintended Positive/Negative Impacts

The water treatment plant constructed by the Project uses the Dissolved Air Flotation (DAF) technology.[13] In India, this is the first time for a 500 MLD-level plant to employ the technology. The plant has attracted engineering students and personnel from water utility companies from across the country, and provides educational opportunities to them (however, the issues with the DAF technology are described in the Sustainability section).

Methane gas produced in the K&C Valley STP from sludge is used for 5 MW power generation and it is registered as a clean development mechanism (CDM). At this STP, treated wastewater is supplied to the neighboring Kolar District, which is 80 km away, to minor irrigation tanks for ground water recharge.

Summing up Effectiveness and Impact, the water supply project achieved its targets in both population served and amount of water supply, and the sewerage project achieved about 90% of its targets. The UFW part failed to achieve its target, but the target seems beyond the achievable level within the given time period. No adverse impact on the natural environment from the Project was reported, and proper measures were taken in each facility. Proper procedures were followed for land acquisition as well. It is fair to say that the Project achieved most of its objectives. Therefore, the effectiveness and impacts of the Project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

BWSSB, the Executing Agency, was established in 1964 by the Bangalore Water Supply and Sewerage Act to plan, develop, and operate water supply and sewerage facilities in Bangalore city and the surrounding eight ULBs. Although the O&M of the pipeline and related facilities after the Project completion was BWSSB's responsibility, the water treatment plant, pumping stations, and STPs were to be outsourced to the private sector while the O&M of the facilities in slums were expected to be done by the residents with support from NGOs.

In 2021, BWSSB is in charge of water supply and sewerage services in the total area of 800 km^2 including the core of the Bangalore metropolitan area (245 km^2) and the surrounding eight ULBs (330 km^2) in addition to 110 villages (225 km^2). An Indian Administrative Service officer is normally appointed as the head of BWSSB.

BWSSB has the CWSS department that is responsible for formulating and implementing projects. There are separate departments for O&M of the water supply and sewerage facilities constructed. A Chief Engineer is appointed as each department's head. The CWSS department is in charge of facility design and construction while completed facilities are transferred to

[13] The technology is normally applied at water treatment plants with the capacity of 100 MLD or less. Because the needed equipment for DAF is small, it can be operated in comparably limited space. DAF has an advantage of stabilizing the quality of water treated, and is suitable for water sources with low turbidity. In India, the only facility with DAF other than the Project-built one is found in Maharashtra (60 MLD).

departments in charge of O&M. Under such arrangements, it did not seem that, O&M departments were specifically coordinating with the CWSS department regarding reasons for changing facility designs during Project implementation and operation bearing in mind future demand for water supply and wastewater. There is no apparent issues at the facilities in terms of O&M caused by weak coordination and cooperation among the departments at the time of the ex-post evaluation. However, this may be a factor for issues in the future on operation system, such as no involvement of staff having expertise in sewerage sector in planning and target setting on operation and facility designs.

According to the information provided by BWSSB, there has been many vacancies in the organizations, ranging from 30 to 40% of the sanctioned posts for many years. Based on job categories, assistant engineers and other personnel who are involved in routine O&M on Group B[14] had 69% vacancy in FY2015 and 41% in FY2019, particularly having many vacancies. As a result, an assistant engineer who is in charge of one service station (service area) is actually looking after two to three service areas putting additional load on their responsibilities[15].

The O&M of major water supply and sewerage facilities is outsourced to contractors,[16] and on the part of the contractors, there are sufficient staff deployed.

Facilities in slums are operated and maintained by BWSSB in the same way as those in other areas. The Water and Sanitation Committee, as planned in the Project appraisal, was established in the slum areas, but it performed only awareness-raising activities and coordination with BWSSB, and the residents are not involved in the O&M of the water supply and sewerage facilities.

Owing to COVID-19, the BWSSB headquarters was temporarily closed, and the personnel were working from home, but water supply and sewerage services have been in operation without any disturbance. Most of the O&M staff of facilities (including those from the contractors) reside near the facilities, and the operation has not been affected.

3.4.2 Technical Aspect of Operation and Maintenance

At the time of the Project appraisal, the technical and implementation capacities of BWSSB were considered appropriate because the organization was familiar with Japanese ODA Loan procedures from the experience of implementing Phase I of the Project. Moreover, the Project components included the formulation of a human resource strategy and training through consulting services, and BWSSB's technical capacity was expected to be strengthened. However,

[14] The four job categories are Groups A to D. Group B members are mainly assistant engineers who belong to a mid-level technical job category.

[15] As of February 2022, BWSSB has recruited 105 personnel, many of them in the position of assistant engineer to fill the gap.

[16] The O&M of the water treatment plant and STPs constructed in the Project is outsourced to the contractors who built the facilities with a seven-year contract. Thereafter, bids are invited every three years for the O&M contract. In three facilities visited, the contractors seemed to have sufficient number of personnel.

at the time of the ex-post evaluation, it was not possible to obtain any information on any specific initiative for human resource development or any training strategy and plan in BWSSB.

In the O&M departments of BWSSB, regular safety training and awareness activities are carried out mainly around the facilities, and the safety training is provided every month. According to interviews with BWSSB and O&M contractors, staff in charge are equipped with proper skills and knowledge, and daily operation is carried out without any issues. In 2018, an O&M manual for the facilities, an equipment manual, and a manual for troubleshooting were prepared; the manuals are reviewed each year and revised if required. It has been reported that the staff actually use these manuals.

In the water supply and sewerage facilities, multiple records such as daily inspection are kept. Among the main ones are an inspection checklist (electricity-related items and other equipment), a water quality record, and a sludge disposal record.

As seen above, the water supply and sewerage facilities are maintained by the contractors who constructed them. The contractors perform day-to-day O&M using their rich technical experience, following the lessons learned from Phase I of the Project.[17] Various manuals are also in place, special attention is paid to the safety in the facilities, and a field visit has confirmed that inspection records and other matters are kept properly.

3.4.3 Financial Aspect of Operation and Maintenance

Table 6 presents the revenue and expenditure of BWSSB from FY2012 to FY2019 (the financial report for FY2019 is unaudited).

Table 6: Balance sheet of BWSSB

Unit: INR ten million

FY	2012	2013	2014	2015	2016	2017	2018	2019
Revenue	584	741	1,143	1,281	1,446	1,550	1,675	1,925
Water revenue	512	592	979	1,087	1,218	1,300	1,400	N/A
Others (inclusive of subsidy)	71	149	164	194	228	250	275	N/A
Expenditure	780	1,155	1,400	1,327	1,481	1,615	1,805	2,021
Establishment cost	130	153	164	192	201	210	225	273
Power charge	325	357	550	414	464	550	650	648
Repair and maintenance	78	95	110	120	134	150	175	246

[17] One of the lessons learned from Phase I is as follows: a contract was concluded with contractors, who constructed the facilities, to have them maintain the facilities for seven years after the Project completion. This arrangement made possible daily O&M using the contractors' sufficient technical experience and has helped keep the facilities in good condition.

	General administration	51	87	77	107	93	100	125	167
	Depreciation	88	163	183	191	212	220	230	258
	Interest payment	108	300	316	303	302	310	325	331
	Provisions	1	1	1	1	74	75	75	98
Balance		-196	-414	-257	-47	-34	-65	-130	-96

Source: BWSSB

As shown in Table 6, BWSSB has been posting a deficit. As described earlier, the collection rate of water bills is credible. In addition, the balance turns to a surplus if the depreciation and the interest payment are excluded from the expenditure. At the same time, the water fee structure has an issue. Currently, the production cost for 1 kiloliter of water is INR 42, but the average fee charged is INR 28. Moreover, more than 50% of the O&M cost (establishment cost, power charge, repair, and maintenance) is on power charge that increases every year based on the revisions notified by the government.[18] On the other hand, the water fee has not increased since the revision in 2014 (implemented in 2015),[19] and there is no periodic fee revision. Furthermore, with regard to the free water quota for the poor that was mentioned in 3.3.2.1, there was a subsidy from the Karnataka State government. However, owing to a budget shortfall in the State government, the subsidy was reduced from FY2021.

As of September 2021, BWSSB is proposing a revision of the water fee structure to the State government. Even if the revision is approved this time, power charge will be increased regularly in the future as well. Therefore, it would be better if the water fee could be revised regularly as well. In relation to this, in May 2020, the Government of India, considering the COVID-19 situation, announced provision of additional financing equivalent to 2% of the State GDP to the States that implement four reforms specified by the central government. One of the four reforms is on ULB and utility companies, urging them to have a water and sanitation fee structure that reflects the current cost and the past inflation. In response, one of the States notified 5% annual increase in the water fee starting FY2021. Although it would be desirable for BWSSB to take advantage of such government reform initiative and implement regular fee revision, the Executing Agency cannot decide on its own as it is beyond its responsibility and dependent on political situation.

In addition to fee revision, a reduction of UFW is estimated to contribute significantly to expanding the revenue source. Thus, such reduction would be also effective in improving BWSSB's financial status.

[18] The annual increase in power charge is about 7%.

[19] Prior to 2014, the last fee revision was in 2005.

3.4.4 Status of Operation and Maintenance

BWSSB practices preventive maintenance, and daily inspection is conducted according to a checklist at each facility. During the site visit, it was confirmed that the inspection records are kept properly. The facilities visited in the ex-post evaluation are as follows:

- T.K. Halli water treatment plant, pumping station, distribution reservoir, and SCADA system
- K&C Valley, Nagasandra, Doddabele STPs and pumping station
- Master server at SCADA Center

The check on the records and the interviews with staff at the facilities during the site visit revealed that the facilities had not faced any major problem. Both the water treatment plant and the STPs are functioning and inspected and maintained regularly. Thus, the facilities and their premises are kept in proper conditions.

None of the necessary spare parts is difficult to procure, and they are ordered and procured under the management of the contractors.

Summarizing the sustainability of the Project, the O&M of the facilities is outsourced to the contractors who constructed them; the contractors implement the O&M with sufficient human resources and technical knowhow and experience. However, BWSSB has many vacancies and weak cooperation and coordination among the departments in the organization was observed. Although BWSSB has good track record on collection rate of water bills in recent years, the organization needs a system for regular fee revision. Among the facilities visited in the ex-post evaluation, no issues were observed, and daily inspection and regular maintenance are implemented. A few minor problems have been observed in the institutional/organizational aspect and the financial aspect. Therefore, the sustainability of the Project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project has been consistent with the development plans and policies of the governments of India and Karnataka from the time of the Project appraisal to the ex-post evaluation. There is a continuing need to develop water supply and sewerage in the Bangalore metropolitan area, and the Project is consistent with the development needs as well. It is in line with Japan's ODA policy at the time of the Project appraisal, and the relevance is high. Most of the Project's original scope was implemented as planned, but some portions of it such as part of slum development were implemented by other schemes. Because of the significant delay in the Project, there was price escalation during the implementation period, and the Project cost has slightly exceeded the plan. Therefore, the efficiency is low. Regarding effectiveness, population served and the amount of water supplied in the water supply component achieved the targets. The sewerage component also

achieved about 90% of its target. UFW did not achieve its target. No adverse impact on the natural environment reported by the Project has been reported, and, appropriate measures are taken in the water supply and sewerage facilities constructed. Appropriate actions were taken for land acquisition as well. Therefore, the effectiveness and impacts of the Project are high. Regarding the sustainability of the Project effects, the Executing Agency has a staff shortage. Although the water fee collection rate has been credible in recent years, a mechanism for regular fee revision is needed. Thus, the sustainability of the Project effects is fair.

In light of the above, the Project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Currently, the water fee structure of BWSSB cannot recover the incurred cost considering that the average fee charged is not meeting the unit production cost of water, and the fact the fee has not been revised since 2014. At the time of the ex-post evaluation, BWSSB has proposed a fee increase to the Karnataka State government, but regular revision will be required in the future as well. To make regular revision possible, it is proposed to continue urging the State government to take advantage of the reform pushed by the central government and issue a government order enabling fee revision each year.

Fee revision is not easy from the political perspective. Therefore, it is necessary at the same time to have the people of the State recognize the production cost of water they consume every day, and understand the importance of an appropriate fee structure. To this end, dialogue with the people and awareness activities are also recommended.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Measures for improving the water fee collection rate

BWSSB has been achieving a high collection rate of the water fee in recent years. The following three main underlying actions by BWSSB have contributed to this outcome: a) introduction of automated bill payment machines and online payment, b) strict action against defaulters, and c) setting a BWSSB service station-wise target for the collection rate and regular monitoring by the headquarters. By introducing the easier methods for the consumer to pay their water fee and imposing strict rules while setting targets within the organization, BWSSB has been successful in improving the water fee collection rate.

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
(a) Water supply facilities	i Headrace ii Water treatment plant expansion x 1 (500 MLD) iii Clear water transmission system iv Pumping station x 3 v Distribution reservoir x 6 vi Rehabilitation of distribution pipe	As planned 1 (550 MLD) As planned As planned 7 As planned
(b) Sewerage facilities	i STPs x 11 (403 MLD) ii Sewerage system iii Sewage pumping stations: sewage pumping station x 8, terminal sewage pumping station x 5	10 (336 MLD) Implemented by other projects Sewage pumping station x 5, terminal sewage pumping stations x 7
(c) BWSSB management improvement	UFW, SCADA, human resource development	Almost as planned
(d) Slum development	i 360 slums ii Strengthening the BWSSB social development section, establishing the slum development coordination committee	164 slums Partially implemented
(e) Consulting service	Detailed planning, construction management etc.	As planned
2. Project Period	March 2005–March 2013 (97 months)	March 2005–July 2017 (149 months)
3. Project Cost		
Amount Paid in Foreign Currency	JPY 36,544 million	JPY 4,711 million
Amount Paid in Local Currency	JPY 47,628 million (INR 19,128 million)	JPY 81,402 million (INR 41,960 million)
Total	JPY 84,172 million	JPY 94,344 million
ODA Loan Portion	JPY 70,355 million	JPY 69,236 million
Exchange Rate	INR 1.00 = JPY 2.49 (As of July 2005)	INR 1.00 = JPY 1.94 (Average between January 2005 and December 2019)
4. Final Disbursement	July 2017	