India

FY2018 Ex-Post Evaluation of Japanese ODA Loan

"Hussain Sagar Lake and Catchment Area Improvement Project"

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0. Summary

This project was implemented to improve water quality of Hussain Sagar Lake and provide a reliable recycled water supply and sewerage service by constructing trunk sewers, sewerage treatment facilities and recycled water supply facilities, dredging sediments, and so on, thereby improving the sanitation conditions of people, including the poor, in the catchment area and vicinity of the lake.

This project was consistent with the development policies of India to improve urban sanitation and the development needs of Hyderabad. Since it was also consistent with Japan's cooperation policies, which emphasise the environmental conservation of rivers and lakes, and urban sewerage development as one of the priority areas, the relevance of this project is "High". Although the project's cost remained within the budget, the project period exceeded the planned time; thus, the efficiency of the project was "Fair".

As for effectiveness, many of the operation and effect indicators were reached, and impacts were realised, such as the improvement of the sanitary conditions of local people, including the poor in the vicinity of the lake. The quality of the local environment for residents was also improved as a result of the reduction of foul odour, beautification of the environment, and the betterment of scenery. No major problems were observed in the institutional/organizational, technical, or financial aspect of maintenance and operation, and the necessary funding was secured. The current status of the operation and maintenance system is good, and problems are being properly dealt with. Therefore, the sustainability of the project's effect is "High".

In light of the above, this project is evaluated to be "Highly satisfactory".

1. Project Description

Project Location

Hussain Sagar Lake

1.1 Background

Hussain Sagar Lake, located in Hyderabad, Telangana, is a man-made lake that was built in 1562 by stemming a tributary of the Musi River. The Golconda Sultanate, at the time, tried to make the Northern part of the city liveable for many people by providing drinking and irrigation water. The lake was also the stage for important historical events, such as the truce with the Mughal Empire being negotiated on its shore in the seventeenth century. Although its initial role ended in the 1920s when water supply facilities were constructed, the lake water was used for drinking and irrigation until the 1930s.

With a surface area of 4.7 km^2, a depth of up to 9.8 m, and a circumference of 14 km, the lake is used for water sports such as yachting and canoeing. Along the lakeside, a promenade, many parks, amusement parks, a movie theatre, and many restaurants can be found. The lake also serves as a sacred place for Ganesha immersion during the Ganesha Festival[1] and is used for flower offering during the women's Floral Festival. Temples and a memorial park for former Prime Minister P.V. Narasimha Rao are also located at the lake. The state secretariat is close by. Because it is literally located in the centre of Hyderabad, and because of its shape, Hussain Sagar Lake is called the "Heart of the City".

In this manner, the lake played an important role in the city's development, and it is a cultural home for residents, as well as a recreational spot. However, as the city grows, untreated sewage and industrial wastewater had been flowing into the lake, causing eutrophication. At the worst point, two thirds of the lake's surface was covered by algae, including blue-green algae[2]. The foul odour in the dry season was unbearable; therefore, improvement of the lake water was urgently needed. Also, as the population increased as a result of the rapid growth of the IT industry, demand for water increased, and as a result, the use of recycled water was sought.

1.2 Project Outline

The objective of this project is to improve the water quality of Hussain Sagar Lake and provide a reliable recycled water supply and sewerage service in the catchment area and vicinity of the lake by constructing trunk sewers, sewerage treatment facilities and recycled water supply facilities, dredging sediments, and so on, thereby improving the sanitation conditions of people, including the poor in the catchment area and vicinity of the lake.

[1] Ganesha is as tall as 15 m, lifted by a large crane, and dedicated to the lake.

[2] The foul odor is generated by the decomposition of the blue-green algae by microorganisms (Project for Strengthening Capacity on Restoration and Management of Hussain Sagar Lake in India Appraisal Report (2005) and JICA documents).

<ODA Loan Project>

Loan Approved Amount/ Disbursed Amount	7,729 million JPY/4,839 million JPY
Exchange of Notes Date/ Loan Agreement Signing Date	March 2006/March 2006
Terms and Conditions	Interest Rate: 0.75% (main portion and consulting services) Repayment Period (Grace Period): 40 years (10 years) (same as above) Conditions for Procurement: General untied (same as above)
Borrower/ Executing Agency	President of India/Hyderabad Metropolitan Development Authority (HMDA)[3]
Project Completion	July 2016
Target Area	Hyderabad Metropolitan Area, Telangana State
Main Contractor (More than 1 billion JPY)	Triveni Engineering & Industries Ltd. (India)
Main Consultants (More than 100 million JPY)	NJS Co., Ltd. (Japan)/MWH India Private Limited (India)/ Tokyo Engineering Consultants Co., Ltd. (Japan) (Syndicate of three corporations)
Related Studies (Feasibility Studies, etc.)	Special Assistance for Project Formation (SAPROF) for Hussain Sagar Lake and Catchment Area Improvement Project, India (2005)
Related Project	【Technical Cooperation】Project for Strengthening Capacity on Restoration and Management of Hussain Sagar Lake in India (2005-2008)

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuko Fujita, Foundation for Advanced Studies on International Development

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2018-November 2019

Duration of the Field Study: 17 February-8 March 2019, 3-12 June 2019

[3] The name of agency changed from Hyderabad Urban Development Authority (HUDA) when the State of Telangana separated from the State of Andhra Pradesh in 2014.

2.3 Constraints during the Evaluation Study

None.

3. Results of the Evaluation (Overall Rating: A[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of India

At the time of project appraisal, *the 10th 5-Year Plan* (April 2002-March 2007) by the Government of India proposed improving urban sanitation by constructing drainage paths and making other changes. The Ministry of Environment and Forests was working on improving the water quality of lakes under *the National Lake Conservation Plan*. Under the plan, Hussain Sagar Lake was considered to be one of the ten lakes with high priority.

This project was considered to be part of the Hyderabad Sewage Master Plan developed by the state government. It was implemented as the first phase of comprehensive environment improvement with the final goals of "raising the water quality level of Hussain Sagar Lake to rank B[6] defined by Central Pollution Board by 2023" and "completing sewerage facilities in the catchment area" to improve the urban environment and infrastructure.

At the time of the ex-post evaluation, *Atal Mission*[7], upholding the goal of the development of a sewerage system and parks in urban areas, and *Smart Cities Mission*[8], targeting waste treatment, the development of parks and toilets, the retention and improvement of public health, and the utilization of recycled water, are mentioned in the *Three-year Action Agenda* (2017-2019). One of the goals of the *Swachh Bharat (Clean India) Mission* (2014-2019) is 100 percent door-to-door collection of waste in urban areas. *Strategy for New India @ 75*[9](October 2018, by NITI Aayog[10]) stresses the importance of drainage of sediments in rivers and lakes, as well as the promotion of recycled water. Also, waste management and the prevention of water pollution are considered to be important pillars used to obtain a sustainable environment[11]. *The National Water Policy* (2012) also advocates the use of recycled water to ensure efficient water use[12].

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4 A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

5 ③: High, ②: Fair, ①: Low

6 At the time of the project's appraisal, the Central Pollution Control Board of India ranked water quality using three levels. In terms of the biochemical oxygen demand (BOD), it was rated A for 2 mg/l or less, B for 3 mg/l or less, or C for 6 mg/l or less. Before the project, the BOD of Hussain Sagar Lake was 25 mg/l or less, which was far below rank C. It was expected that it would be 8.0 mg/l or less three years after the project's completion and 6.0 mg/l or less (rank C) by 2021 with the completion of a sewerage network. To reach the final goal of rank B, it was recognized that further effort (e.g., upgrading the sewage treatment method) was needed (JICA documents).

7 "*Atal Mission for Rejuvenation & Urban Transformation*" (2015)

8 Hyderabad was selected as one of 100 cities targeted under this mission.

9 "*Strategy for New India @ 75*" is a development plan that will be completed by 2022, which celebrates 75 years of independence.

10 The National Institution for Transforming India. Aayog means Policy Commission in Hindi. NITI Aayog is a policy formulation institution headed by the Prime Minister Modi, including representatives from states, replacing the Planning Commission, which had been in charge of formulating five-year plans for half a century (since 1951).

11 "*Strategy for New India @ 75*" (2018) NITI Aayog p.102, 104-105.

12 Ministry of Water Resources (2012), *National Water Policy*, pp.6-7.

As stated above, this project is consistent with policies of India and Hyderabad, both at the time of appraisal and the ex-post evaluation. Furthermore, in India, policies related to sewerage system development, waste management, improvement of people's awareness on hygiene, and the use of recycled water were issued one after another up to the time of the ex-post evaluation. Therefore, the project's relevance to India's policies at the time of the ex-post evaluation is high.

3.1.2 Consistency with the Development Needs of India

At the time of appraisal, the Greater Hyderabad metropolitan area, with a population of approximately 7 million (2006), was rapidly developing as a centre for the IT industry and tourism. With the development of the city, domestic sewage and industrial wastewater had been rapidly increasing while sewage treatment facilities were underdeveloped upstream; this area had a population of 1.6 million. As a result, untreated wastewater flowed into Hussain Sagar Lake, which is located in the city centre, and there was concern about the effects on the sanitary conditions of residents around the lake. Moreover, a waste-management system did not exist in the slums around the lake and upstream along the nalas[13], and residents threw trash into the lake and the nalas. Also, there was a shortage of clean water; thus, the utilization of recycled water was included in the project as a pilot project.

At the time of the ex-post evaluation, the population of Greater Hyderabad metropolitan area reached about 11 million (2019), and the population of Hussain Sagar Lake and the catchment area increased to 2.74 million (2018)[14]. Industrial wastewater has been regulated, and there was progress on the construction of sewerage facilities, although some untreated wastewater from common households and some business is still disposed in the nalas. Water pollution in the nalas has improved, but still remains. Therefore this project, which avoids the direct inflow of the nalas's polluted water into the lake, is highly necessary.

Concerning clean water supply, the water shortage problem was resolved at the time of the ex-post evaluation, and adequate supply is secured by the intake from the Krishna River. The installation of a water recycling facility to utilize treated water has been increasing at entities such as airports and hotels[15]. In the meantime, the state government is promoting green activities[16], and many trees and flowers have been planted by the lake and sidewalks. Since Hyderabad's temperature can exceed 40°C in some months during the dry season, and this area needs a considerable amount of water to keep it green, the provision of recycled water meets this demand.

[13] Nala started as a rainwater stream, and later, sewage water flowed in. Nalas are differentiated from rivers in India. Prior to the project, part of sewage from four nalas flew into Hussain Sagar Lake untreated.
[14] Population of Greater Hyderabad: Greater Hyderabad Municipal Corporation (GHMC). Population of the catchment area: the HMDA and the HMWSSB.
[15] Hearing from HMDA and HMWSSB.
[16] *Green Garden Policy* (2014-) of the State of Telangana. State Tourism Department hearing.

3.1.3 Consistency with Japan's ODA Policy

At the time of appraisal, based on policy dialogue, priority sectors in assistance policy to India had been focusing on water supply and sewerage development in urban areas and environment conservation, along with support for infrastructure development and poverty programmes. In Japan's *Official Development Assistance Charter* (2003) and *Medium-Term Policy on ODA* (2004), environmental improvement was considered to be one of the four priority areas "addressing global issues". In *Country Assistance Program for India* (2006), one of the three priority areas was improvement of poverty and environmental issues, in which assistance for the environmental conservation of rivers and lakes was mentioned. In the Japan International Cooperation Agency (JICA, formerly the Japan Bank for International Cooperation)'s *Medium-Term Strategy for Overseas Cooperation Operations* (2005), a goal to reduce poverty through sustainable growth was set, and one of the three priority sectors in assistance to India was measures to improve environmental problems.

As Japan's ODA policy to India, the improvement of environmental problems and conservation of lakes are important; thus, the project to improve environment by taking measures, such as constructing sewerage facilities, was consistent with Japan's ODA policy at the time of the project's appraisal.

3.1.4 Appropriateness of the Project Plan and Approach

This project was implemented for infrastructure development, such as construction of sewerage facilities, and to introduce a waste-management system in the catchment area and raise environmental awareness among the residents. This comprehensive approach for the conservation of the environment was appropriate to ensure sustainability.

This project has been highly relevant to India's development plan and needs, as well as to Japan's ODA policy. Therefore, its relevance is "High".

3.2 Efficiency (Rating:②)

3.2.1 Project Outputs

In this project, the HMDA was in charge of constructing sewerage facilities and ensuring environment improvement around the lake. The Hyderabad Metropolitan Water Supply and Sewage Board (HMWSSB) was in charge of constructing sewerage pipes, while the Greater Hyderabad Municipal Corporation (GHMC) was in charge of environmental improvement of the nala and slum development. Since there were three implementing agencies, the High-level Steering Committee was set up in addition to the Project Implementation Unit. The planned and actual components of the project are shown below.

Table 1 Planned/Actual Output and Implementing Agency

Planned	Actual	Implementing Agency
1) Sewage Facilities		
・Construction of sewage treatment plant (STP): 1 STP (30,000 m^3/day)	・Same as planned.	HMDA
・Upgrade of STP: 1 STP (20,000 m^3/day)	・Same as planned.	HMDA
・Construction of small-scale STP: 3 STP (8,000, 6,000, and 5,000 m^3/day 19,000 m^3/day in total)	・One STP (5,000 m^3/day) was constructed.	HMDA
・Construction of interception and diversion works (I&D): 6 sites	・Construction at 5 additional sites, total of 11sites.	HMWSSB
・Construction of trunk sewers: around 52 km, ring sewers: around 4 km	・Construction of trunk sewers 19.5 km, ring sewers 2.5 km	HMWSSB
2) Recycled Water Supply Facilities		
・ Construction of reservoirs, pumping stations, and pipelines: 15,000 m^3/day	・ Reservoirs, pumping stations, tanker-filling stations, and pipelines to the lakeside parks were constructed as planned. Pipelines for individual clients were not constructed due to change of needs.	HMDA
3) Lake Environment Improvement		
・Dredging and disposal of sediments: around 1 million m^3	・ 650,000 m^3 from 3 of 4 planned areas.	HMDA
・ Shoreline improvement: planting trees and building fences	・Same as planned.	HMDA
・ Surplus weir repair: setting water gate and associated repair of bridge	・Not taken up in this project.	GHMC
・ Nala improvement: planting trees and building fences (about 12 km) and a retaining wall (800 m)	・Planting trees and flowerbeds and building fences (6.7 km) and a retaining wall (194 m)	GHMC
・Installation of aeration equipment	・One barge-mounted aerator system, 7 jet fountains (aeration system[17]).	HMDA
・Prepare 10 idol immersion sites	・ Alternative immersion place was constructed, although it was abandoned due to lack of public support.	HMDA
4) Slum Development		
16 areas ・ Improvement of waste management (procurement of equipment, training) ・Construction of public toilets ・Development of sewerage networks	53 areas ・Developing waste collection system ・Repairing 5 public toilets ・Developing the sewerage networks was not taken up due to the narrowness of alleys	GHMC
5) Public Awareness Raising on Environment and Sanitation		
・Making leaflets, running media campaigns, putting together after-school activities, and hosting seminars.	・Same as planned.	HMDA
6) Capacity Building		
・Training public officers ・ Running public relations activities for citizens	・The HMDA's engineer training sessions in India and Japan and seminars were conducted by Technical Cooperation, Project for Strengthening Capacity on Restoration and Management of Hussain Sagar Lake in India (2005-2008). ・ Public relations were actively implemented utilizing radio, TV, signboard, and events around the lake.	HMDA

[17] System to expose water to air or to circulate air in the water to provide oxygen for microorganisms to decompose organic substances.

7) Consulting Services		
・Assistance in planning, detailed design, tendering, and construction management ・Slum development, awareness raising, and capacity building	・Same as planned.	HMDA

Source: JICA documents, hearing from the HMDA.

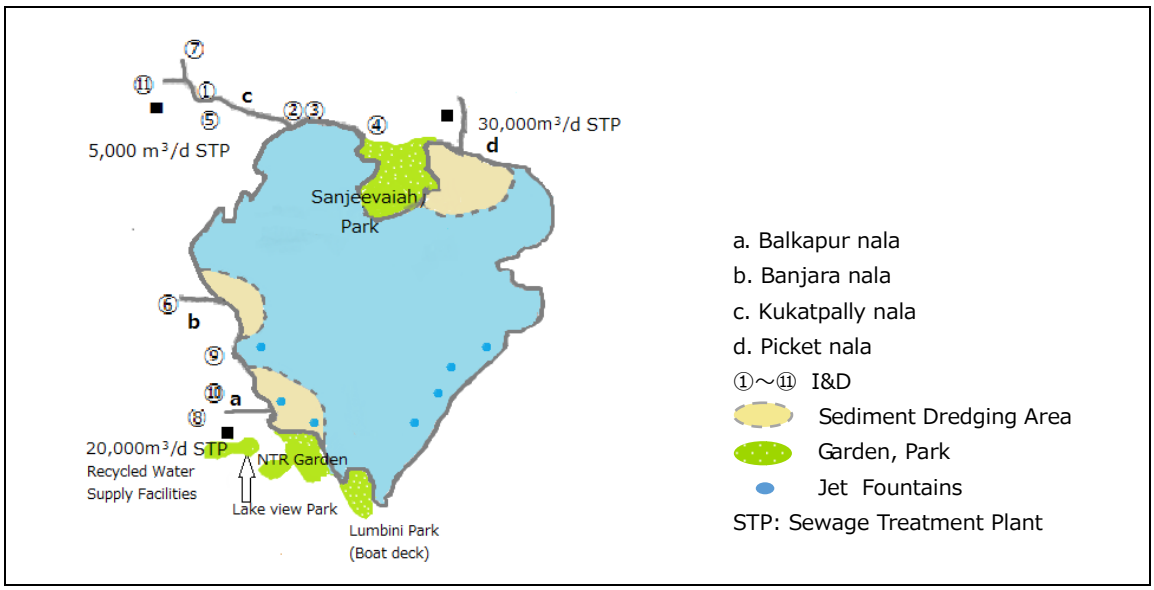


Figure 1 Hussain Sagar Lake and the Site of the Main Components of the Project

Reasons for differences between planned and actual components are explained below.

1) Sewerage Facilities

・Construction of small-scale STP: Among the three small-scale STPs planned, one with a 5,000 m^3/day capacity was constructed by Rangadhamini Lake, upstream of Kukatpally nala. Two other treatment plants were supposed to be constructed near Picket nala, although they were no longer necessary after a trunk sewer was constructed by the HMWSSB and diverted the sewage water of Picket nala in the dry season to the existing Amberpet STP, which has a capacity of 330,000 m^3/day (Hearing from the HMDA).

・Construction of I&D: Additional I&Ds were constructed because some of the construction sites of the trunk sewer were in heavily populated areas, which made construction difficult. Thus, the plan was changed to divert sewer water by enhancing I&Ds. Also, it was done using complete diversion to prevent the overflow of dry season sewage water into the lake.

・Trunk Sewers: Due to change of flow passage[18], some of the planned pipes became unnecessary, and the length of the trunk sewer was reduced (Hearing from the HMDA).

2) Recycled Water Supply Facilities

・At the time of SAPROF (2005), the supply of recycled water to clients, such as universities, who once utilized lake water and gave up as a result of the declining water quality was proposed.

[18] Additional I&D has been constructed on Necklace Road (outside of the project) to divert untreated sewage water from the lake. This I&D is planned to be completed in 2019.

The clean water supply has improved since then, however, and water recycling equipment for individual facilities has become increasingly popular. As a result, providing recycled water network was no longer necessary, and individual pipes for clients were not installed. The HMDA is utilizing recycled water for development around the lake and to water trees along the sidewalks and parks as planned (Hearing from the HMDA).

3) Lake Environment Improvement

・Sediment Dredging: Originally, four areas where four nalas flowed in were planned to be dredged. However, a pre-dredging sediment test showed a cadmium concentration over the standard levels at the mouth of Kukatpally nala. The cost to dredge and properly dispose of the waste was estimated to be 1.5 billion INR (about 2.4 billion JPY), which considerably exceeded the initial budget of 72 million INR. The cadmium was deep in the sediment and does not leak out if not dredged (hearing from the HMDA and Telangana State Pollution Control Board [TSPCB]). If it is dredged, taken out of the ground, and transported a long way to a landfill, residents may be exposed to the hazardous waste. After the HMDA and TSPCB examined the situation carefully, they decided that since the ultimate goal was improving the water quality, the method used to improve the water quality at the mouth of the Kukatpally nala area was changed to aeration (hearing from the HMDA).

In the other three areas, dredging was done as planned, and a total of 650,000 m^3 (hazardous substances were all below Indian standard) of sediment was dried and reduced to 200,000 m^3. From this, 80,000 m^3 was utilized to improve Sanjeevaiah Park and the shoreline, and 120,000 m^3 was landfilled in an abandoned quarry of Gajularamaran, 28 km northwest of the lake. In the abandoned granite quarry hole, lining was placed, and dry sediment was brought in. The filled up quarry hole was covered with 60 cm of soil, and 947 trees of varying types were planted on top.

TSPCB witnessed the landfill process. This process and how the HMDA dealt with cadmium were appropriate according to local environmental experts (hearing from National Geo-Physical Research Institute, TSPCB, Environmental Protection, Training and Research Institute [EPTRI]).

・Surplus weir repair (setting the water gate and associated repair of bridge): A separate project by the GHMC started in 2015 and provided a gated mechanism for the discharge of water at the surplus weir; therefore, the repair of the surplus weir was excluded from the project component. (The gate was completed later on with the GHMC's budget [hearing from the GHMC].)

・Nala improvement: Part of the location for fence and retaining wall construction (to keep people from throwing waste into and to keep residents from falling into the nalas; retaining wall is the base of the fence) was not used due to encroachment and because land for construction was not available. The GHMC has continued setting up fences and retaining walls since then (hearing from the GHMC).

・Relocation of Ganesha (idol) immersion places: There were ten places in the lake for Ganesha immersion during festival. In order to prevent degradation of water quality, the project tried to install

Ganesha immersion place outside the lake. However, immersion of Ganesha in the lake is instilled in people's beliefs and cannot be changed. Instead, the GHMC has been building 25 swimming pool-like facilities by lakes for immersion of small Ganesha. (Twenty of them were completed at the time of the ex-post evaluation.) Large Ganeshas are still immersed in the lake but the HMDA pulls them out within 48 hours. Every year, TSPCB checks the quality of the water before and after the festival to confirm that water pollution was not caused by Ganesha immersion (hearing from the HMDA and TSPCB).

4) Slum Development

・Increasing the number of slums

At the beginning of the project, 22 slums around the lake were assigned to four NGOs, and they conducted awareness-raising activities. However, there are many slums along four nalas, and only addressing the slums by the lake as originally planned had little impact on the improvement of environmental conditions for slum residents along the nalas. Since a large amount of waste flowed from the nalas to the lake unchanged, the plan was changed twice and resulted in 53 slums being targeted, adding 31 slums along the nalas. A waste-management system was introduced, and awareness-raising activities such as restraining from defecation, and training locals how to make compost out of kitchen garbage were conducted. These activities were implemented by the HMDA, the GHMC, and four of the above-mentioned NGOs; periodical reporting and information exchange opportunities were provided.

・As for building a waste-management system, reducing the amount of waste through awareness-raising activities helped. A door-to-door waste-collection system was introduced as well. Free tricycles were provided to residents who were in charge of waste collection, and by charging a waste-collection fee, it became a business.

・As for community toilets, since individual toilet construction was under way at the time of the appraisal, five toilets were repaired, not constructed. After repair, management was outsourced for three years until the role was completed, due to the spread of individual toilet and slum redevelopment by building apartment complexes (hearing from the HMDA's social development expert).

30,000 m^3/day STP

Interception & Diversion (I&D)

Fountains with recycled water

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost at the time of appraisal was 9,224 million JPY (the loan amount was 7,729 million JPY), and actual cost was 5,866 million JPY (the loan amount was 4,839 million JPY), which was within the planned cost (64% of the total planned cost, and 63% of the planned JPY loan). The planned cost from India's side was 1,495 million JPY, and the actual cost was 527 million JPY (hearing from the HMDA).

The main reason for the decrease of cost was the exchange rate. At the time of appraisal, 1 INR was 2.4 JPY, which depreciated almost 40% to 1 INR = 1.5 JPY at project completion. Other than exchange rate fluctuation, the decrease of input occurred corresponding to the decrease of output as follows[19].

-Sewerage facilities (total of three STPs): Due to the cancellation of two small-scale STPs, 778 million INR was disbursed, which was 91% of the planned cost of 853 million INR.

-Repair of surplus weir: The planned cost was 20 million INR. Zero percent was disbursed.

- Dredging and disposal of sediments (one area unexecuted): The cost was 252 million INR or 62% of planned cost, which was 406 million INR.

As for I&D construction, the actual cost was within the budget for six I&Ds, even though additional five I&Ds were constructed. Similarly, for slum development, cost remained within the budget, even though the number of slums targeted increased.

3.2.2.2 Project Period

The planned project period was 82 months, lasting from March 2006 (signing of Loan Agreement) to December 2012, while the actual period was 125 months, lasting from March 2006 to July 2016, which was significantly longer than planned (152% of the planned period)[20].

The main causes for the delay are as follows:

- Inundation of the construction site during monsoon season.
- Construction was difficult for two months out of each year, since lake side was overcrowded with many vehicles and people due to the Ganesha Festival.
- Treatment of dredged sediment took a long time to discuss with TSPCB, and it took a while to select a dumping site.
- Since sewerage pipes were laid under the road, construction had to be done after closing the road to all traffic. It took a long time to negotiate that arrangement with the traffic police.

According to hearings with the implementing agencies, various issues were discussed and solved at the High-level Steering Committee mentioned above, and further delays were avoided.

[19] Documents provided by the HMDA.
[20] Project completion was defined as the completion of construction, disbursement, and consulting services (JICA document).

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

Financial Internal Rate of Return (FIRR)

At the time of appraisal, the FIRR was considered impossible to calculate, since this project is not for profit. At the time of the ex-post evaluation, the FIRR was recalculated using the construction cost, operation and maintenance cost, change of parts cost, and increased income of the lakeside facilities as profit, resulting in cost over profit. This project is for environmental improvement; therefore, it is not suitable for calculation of the FIRR.

Economic Internal Rate of Return (EIRR)

At the time of the ex-post evaluation, the EIRR was calculated as 8.5%. In this calculation, the project life was considered to be 30 years from signing Loan Agreement, construction, operation, maintenance, and change of parts are included in costs, and sewerage service and waste-management fees; water tariffs for equivalent amounts of recycle water; increased income of lakeside parks; and land acquisition costs equivalent to the land became available by disposal of sediment were included in profit.

Although the project cost was within the planned projection, the project period exceeded the plan. Therefore, efficiency of the project is “Fair”.

3.3 Effectiveness and Impacts[21] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Status of Operation Indicators are shown in Table 2. Field surveys were conducted in February and June 2019, which means three years have not yet passed since completion. Therefore, the evaluation included future prospects, considering these figures tentative.

[21] The sub-rating for effectiveness is to be listed with consideration of impacts.

Table 2　Operation Indicators

Indicators	Baseline	Target	Actual	
	2005	July 2019 (3 years after completion)	July 2016 (Completion)	June 2019 (April 2019 for④)
i) Total population served by the sewerage system in the catchment area (10,000 persons)	47.9	104.9	NA	216[4)]
ii) Amount of wastewater treated(m^3/day)	20,000	55,000[2)]	55,000	55,000
iii) Rate of facility utilisation (%)	-	100	100	100
iv) BOD[1)] concentration for each STP (effluent) (mg/l) 20,000 m^3/day (upgrade)	<18	< 2	< 2	temporarily < 14.5
30,000 m^3/day (new)	-	< 5	< 5	< 14.7
v) Amount of recycled water supply (m^3/day)	-	15,000[3)]	15,000	7,500

[1)]Bio-chemical oxygen demand. [2)]Since cancelation of two small-scale STPs were officially approved by JBIC on 4 March 2008, the target was adjusted to 55,000 (20,000+30,000+5,000m^3/day). [3)]Among which, 7,000 m^3 was for public use (SAPROF Final Report (2005) pp 4-5). [4)]Calculated as the population of the catchment area times percentage of the population served, just like the baseline. The method of calculation of the baseline was based on documents provided by JICA. Population and percentage of population served are from the HMDA and the HMWSSB.

Source: Baseline, target and 2016 actual data are from documents provided by JICA. Actual data in 2019 i)～iii) and v) are from the HMDA, and iv) is from a third-party testing agent (Micro Testing Labs Pvt. Ltd.).

i) Total population served by the sewerage system in the catchment area

The population in the catchment area increased from 1.6 million (2005) to 2.74 million (2018), and the total population served by the sewerage system already far exceeds the target. It has to be noted that it is the result of not only this project but of the development of a sewerage network by the HMWSSB and local municipalities.

ii) Amount of wastewater treated

Target was achieved.

iii) Rate of facility utilisation

The facilities constructed are utilised 100%.

iv) BOD concentration for each STP (effluent)

All the targets were achieved at the time of completion (2016). As for 20,000 m^3/day STP, the membrane filtration system passed the end of its service life, and the process of selecting O&M contractor had already begun at the time of the ex-post evaluation; therefore, BOD (effluent) was temporarily high. A contractor was selected in June 2019, and the membrane filtration system is scheduled to restart in October[22]. As for 30,000 m^3/day for the newly built STP, the target was not reached at the time of the ex-post evaluation, since the filters were being exchanged; this is scheduled to be completed in July, and BOD is expected to recover accordingly. As for 5,000 m^3/day for the small-scale STP, although exit BOD was not listed as an indicator, the target was below 20 mg/l, and it was reached at the time of the ex-post evaluation.

v) Amount of recycled water supply

[22] Hearing at the HMDA

Regarding the recycled water supply, as mentioned before, the plan to supply a large number of users was cancelled because of improvement of water supply and common use of individual water recycling equipment. Although the approach was changed to sell recycled water by tanker in the lakeside parks, demand was low, and sales was dropped. The amount of water supply was reduced, and water has been used to water green spaces and plants in parks and on streets, as well as for construction. Since there are many large-scale parks with much greenery by the lake, and they require gallons of water, recycled water facilities are contributing to maintaining the lakeside landscape.

Status of the effect indicators are shown in Table 3.

Table 3 Effect Indicators

Indicators	Baseline	Target	Actual	
	2005	July 2019 (3 years after completion)	July 2016 (Completion)	April 2019
i) Percentage of the population served by sewerage system (%)	30	48	NA	78
ii) Improvement of lake water quality (BOD, mg/l)	≦25	≦8	16	28

Source: Baseline, target, and 2016 actual data are from documents provided by JICA. Actual data for 2019 are as follows: ① is from the HMDA and the HMWSSB, and ② is from the HMDA.

i) The percentage of the population served by the sewerage system

The percentage of the population served by sewerage system far exceeds the target. The project only constructed trunk sewer and STPs, and the HMWSSB and neighbouring municipalities are in charge of individual connections. In the old town (MCH) area, 98% (compared to 60% in 2005) coverage was reached, and 50% was achieved in surrounding municipalities (compared to 10% in 2005), showing a rapid increase in sewerage service coverage (hearing from the HMWSSB).

ii) Improvement of lake water quality

The BOD of lake water has not reached the target as of April 2019. One of the causes was an incident that took place in September 2017. An old trunk sewer of 1.8 m diameter burst near the lakeside NTR Garden, and it took six months for the HMWSSB to finally finish the repair in February 2018; during that time, a large amount of untreated sewage water flowed into the lake. At one point, the dissolved oxygen[23] of the lake fell in zero. To promptly clean up the lake water, the HMDA started bio remediation, which improves water quality by using microorganisms, in April 2018, and lake water quality has been improving gradually since then (hearing from the HMDA).

[23] Dissolved oxygen (DO) is the amount of oxygen dissolved in water. In general, more than 3 mg/l is required for fish and shellfish, and more than 2 mg/l is required for aerobic microorganisms to live. Malodorous substances may be generated in water below DO 2 mg/l. Higher DO means better water quality, unlike BOD.

Table 4　Effect of bio remediation (mg/l)

	Sept.2017 ~ Feb. 2018 Large amount of untreated sewer water flowed into the lake.	2018			2019	
		Apr. 30 (when started)	end of Jul.	end of Oct.	end of Jan.	end of Apr.
DO		NIL	3.2	4.8	3.0	6.4
BOD		50-70	14	22	25	28

Source：HMDA

Bio remediation work

3.3.1.2 Qualitative Effects (Other Effects)

<Increasing the environmental awareness of the people in the catchment area>

In the slum development component, tricycles were provided free of charge for waste collection. They were given to residents who had been collecting waste, and a fee-based collection system was introduced. At the time of the ex-post evaluation, some of the tricycles had been replaced by autos; however, the system itself continued with the effort of the women's group in each slum.

In all the slums where residents' hearings were conducted[24], the waste-collection system did not exist before this project, and residents said they used to dump waste in the nalas and the lake. Therefore, introducing waste-collection system in this project had a significant effect. According to the project's social development specialist and NGOs, it took four years for the residents to change their habits.

Even after the waste-collection system was introduced, the frequency of collection varied depending on the area, and not all people changed their habit of dumping waste in the streets and the nalas (NGOs and slum residents' interview, site visit). However, the collection service being introduced still caused a huge change in the slums.

The change in the environmental awareness of the residents can also be seen in their customs for the Ganesha Festival. Before this project, water pollution as a result of Ganesha immersion was a big problem. Ganesha are plaster figures moulded by wires and coloured with acrylic sprays; they used to be immersed in the lake by residents, and this caused eutrophication of the lake, attributed to the plaster and colouring. As a result of a massive awareness campaign on TV, on FM radio, and in newspapers by the project, many residents came to care about environment and started using eco-friendly Ganesha made of clay and natural colouring. The HMDA distributes 50,000 eco-friendly Ganeshas every year. TSPCB, as well as the HMDA, has been implementing environment awareness programmes for students since this project began,

[24] A total of 70 people (22 male, 48 female) in slums were interviewed. Group interviews were conducted in five slums with 60 residents (16 male, 44 female). Two sites by the lake and two sites along the nala were selected via consultation with the GHMC. Interviewees were selected through consultation with community leaders. Additional individual interviews were conducted in three slums, one lakeside, one along the nala, and one close to the lake and nala with 10 residents (6 male, 4 female).

distributing eco-friendly Ganesha on their own.

In this project, an environment campaign by Hussain Sagar Lake Club, which consists of 70 public/private primary and secondary schools, was launched, and various environment awareness events, such as a "human chain to protect the lake", were conducted by students. Such PR activities seemed to have a big influence on deterring residents from dumping garbage into the lake (hearing of TSPCB and the HMDA's social development specialist).

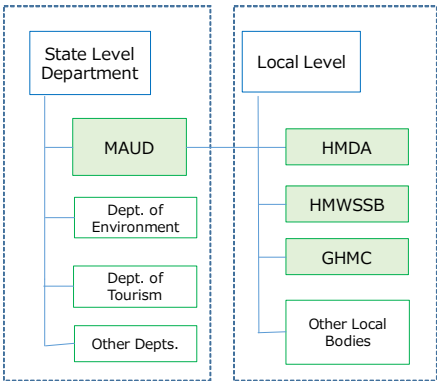
Moreover, excavators, aerator systems, and floating trash collectors can be clearly seen by the people and vehicles passing the lake. In a sense, witnessing garbage cleaning and aeration every day may raise people's environmental awareness (park visitors' hearing).

Although government policies, such as the Clean India Mission, which started in 2014, also played a role in raising residents' environmental awareness, the role this project played is considered substantial.

Colum: The role JICA played in realizing the project's effect

Prior to this project, JICA implemented Technical Cooperation, a "Project for Strengthening Capacity on Restoration and Management of Hussain Sagar Lake in India", for three years starting in 2005. In this project, activities, such as training HMDA officials in India and Japan, a seminar inviting people involved in preceding Japanese ODA Loan "Lake Bhopal Conservation and Management Project" (1994-2004) to Hyderabad, and an international seminar introducing the experience of cleaning up Japan's Lake Biwa, were conducted to learn experience and knowledge from past lake purification attempts.

This project had three implementing agencies, namely the HMDA, the HMWSSB, and the GHMC. Since each institution had a different objective and system in which to operate, JICA considered a high-level coordination mechanism to be essential. Thus, the High-level Steering Committee was established with the principal secretary of the Department of Municipal Administration and Urban Development (MAUD) of the State, which oversees three implementing agencies and related local municipalities (see figure). The committee was held twice a year to discuss important issues with JICA officials also present.



Source：SAPROFp9-2

A monitoring cell was also established to smoothly share information among related people in charge of slum development. It was a periodical information exchange mechanism used among implementing agencies and four NGOs, each of them was trusted with assigned areas. These implementing mechanisms made up one of the success factors of the project, as it required working with many related agencies and considerable coordination effort to achieve implementation.

A couple running a waste-management business with project-provided tricycles

Eco-friendly Ganesha

Women's group in the Makhta slum

3.3.2 Impacts

3.3.2.1 Intended Impacts

Intended impacts were improving the sanitary conditions of people, including the poor, in the vicinity of the lake and improving the quality of the living environment in Hyderabad. No quantitative indicator was set for impact.

i) Improving sanitary conditions of people, including the poor, in the vicinity of the lake

The foul odour as a result of eutrophication was significantly reduced (hearing from the HMDA, the GHMC, the HMWSSB, and other related agencies). The park users' hearing[25] resulted in 70% of respondents saying that the odour was reduced compared to before the project began, and the slum residents' hearing resulted in 90% of respondents acknowledging odour reduction. Moreover, some respondents in these hearings also pointed out that scattered garbage decreased and the mosquito population shrank.

ii) Improving the quality of the living environment in Hyderabad

The lakeside promenade was developed by the project, and in one area of Sanjeevaiah Park (which covers 37.2 ha and is one of the largest parks in Hyderabad), a bamboo garden, a forum with a national flag pole, and so on were developed on the dredged sediment disposal site. Trees and other plants were added. A butterfly garden containing various sweet-scented flowers favoured by butterflies is a place of relief for citizens. It is a beautiful park overlooking the lake and is favoured by families with small children and students on school trips who are escaping the hustle and bustle of the city.

The number of tourists in Hyderabad has increased substantially (19.54 million in 2018, a 204% increase from 2015); however, it is difficult to relate the project and an increase in the

[25] The park users' hearings were conducted in three lakeside parks (one of them was improved by the project) with 44 visitors (male 20, female 24) who had been living close by or had used the park before the project.

number of tourists since old towns with cultural and historical buildings, commercial areas, high-tech areas of the city are all away from the lake. Still, Hussain Sagar Lake is listed as one of the 12 sites to visit in Hyderabad, according to a pamphlet from the Telangana Tourism Department, and since the lake is a symbol of the city, the project positively impacted tourist visitation to the city.

There are three big park/amusement parks that collect entrance fees on the lakeside, all managed by the HMDA. The number of visitors to lakeside parks only increased after the project, as shown in the Figure 2. After separation from Andhra Pradesh, cross-border tourists decreased due to the tax on tourist buses from other states, and large-scale shopping centres were constructed with many surrounding restaurants and shops. When these opened, they became popular in other areas of the city and are negative factors to the lake and lakeside area, which is an older recreational zone (commercial entities' hearing). Nevertheless, lakeside park visitor numbers increased, which is highly likely the result of the project's lake and lakeside environment improvement.

Every weekend, the lakeside street is closed to automobile traffic, and an event called Happy Street Hyderabad is held. The lake became a community spot, and many citizens visit it with children, which did not happen when the foul odour was strong.

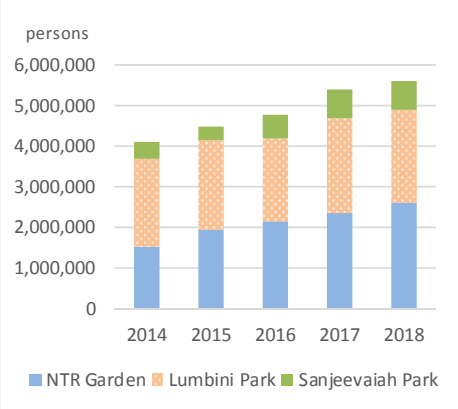


Figure 2 Number of lakeside park visitors

Butterfly Garden

School children descending from the sightseeing boat (Lumbini Park)

3.3.2.2 Other Positive and Negative Impacts

i) Impacts on the Natural Environment

According to the monitoring items at the time of the appraisal, environmental monitoring was done with the HMDA and the TSPCB during construction and was reported in the Quarterly Report. To mitigate traffic jams, construction was done at night, and transporting dredged sediment (not including heavy metals) to the disposal site was only conducted at midnight (hearing from the HMDA). After completion, the quality of the lake water is currently monitored by the TSPCB every day at a fixed-point. The EPTRI also monitors the water every month in four spots in the lake.

Sludge generated in STPs is dried and utilized as fertilizer (hearing from the 30,000m^3/day sewage

treatment plant).

The sediment disposal site in the Gajularamaran quarry is maintained by the Urban Greenery Department of the HMDA, and they water, monitor the trees' growth, and check whether encroachment has occurred. In the site survey, it was confirmed that the trees' growth is fair.

As for lake vegetation, algae, which used to cover the surface before the project, is contained by improving water quality and cleaning up the surface of the lake every day by trash collectors.

There is a marked increase in the number of migrant species returning to the lake. Environment improvement of Hussain Sagar Lake is not the only cause, since the number of other lakes in the city has been decreasing rapidly as a result of urban development. However, the return of some of migrant species, such as the northern shoveler and northern pintail, plus the increased presence of resident species, such as the spotbill duck and lesser whistling duck, is a positive sign that the lake is starting to attract birds again. On the other hand, very few exclusively fish-eating birds are present on this lake, meaning more time is necessary for various fish to thrive[26].

Spotbill ducks resting at Hussain Sagar Lake

Lakeview Park, which was developed by the project, is adjunct to the lake and used to be a cattle-bathing pond and drinking hole. Cattle-bathing and drinking places were prepared nearby, and the pond was transformed to a park, which now has two lakes that use recycled water from 20,000 m^3/day STP and rain water. Many birds and fish species are observed at this lake. At the time of the ex-post evaluation, the lake water had no smell, and verdant trees, such as palm trees and others, bore flowers. The promenade was cleaned up, and many citizens enjoy jogging and walking there now. The park is often utilized for movie sets for its beautiful scenery (hearing from the HMDA).

Lakeview Park before the project (by the HMDA)

Lakeview Park after the project

[26] Information and analysis provided by Mr. Humayun Taher (Deccan Birders Society).

ii) Resettlement and Land Acquisition

There was no resettlement and land acquisition during the project (hearing from the HMDA and MCH).

iii) Other Positive and Negative Impacts

This was the first time that advanced sewage water treatment using a membrane-based filtering system was used in India at the 20,000 m^3/day STP. Therefore, elementary and middle school and master's and PhD students, as well as environmental specialists, came to see it. It was also utilized for training members of the Indian Administration Services (hearing from 20,000 m^3/day STP).

Hyderabad, with 158 lakes and 834 ponds, is called the "city of lakes". If Hussain Sagar Lake, which is in the centre of the city and is its symbol, comes back to life, it is expected to lead to the revitalization of other lakes. Successful endeavours, such as waste collection in neighbourhoods and introducing bio-remediation, have been tried in other lakes. Reflecting these endeavours, cleaning up Hussain Sagar Lake is a model case for other lakes (hearing from the GHMC).

There was no negative impact from this project.

This project has achieved its objectives. Therefore, the project's effectiveness and impacts are "High".

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspects of Operation and Maintenance

After the completion of STPs, operation and maintenance were contracted out to a private company under the supervision of the HMDA (the initial construction contract included operation and maintenance for three years after completion). By a state order in June 2016, the HMWSSB took charge of STPs, sewerage pipes, recycle water facilities, and I&Ds because the HMDA was in a tax-related trial. Later, the case was resolved in favour of the HMDA, which had led the project from appraisal to completion, and again took charge of sewerage-related facilities, as well as the lake and lakeside facilities from January 2018. Among the facilities constructed by the project, the HMWSSB was only in charge of sewer pipes, and the GHMC was in charge of the nalas and slum development at the time of the ex-post evaluation[27].

The HMDA, with 564 employees, is in charge of urban planning covering the entire Hyderabad metropolitan area of 7,527 km^2, including the GHMC and the surrounding area. The division in charge of the lake has 31 staff, including 23 engineers (hearing from the HMDA).

The HMWSSB, which manages the sewer pipes laid by the project, has 3,400 staff. Management of the sewer pipes is contracted out to a private management company, and there are 10 supervising staff (hearing from the HMWSSB).

[27] The entire budget estimated as operation and maintenance costs at the time of appraisal fell under the HMDA's management.

The GHMC, as part of urban environment improvement, has been continuing slum development and the nala management. Also, some of the NGOs that worked on the project have continued activities in the area. In each slum, women's groups have been organized, and through these groups, the GHMC implements environment beautification, such as composting wet garbage and so forth (GHMC, NGO, and slum residents' hearing).

The number of staff is sufficient in the HMDA, the HMWSSB, and the GHMC (hearing from each organization).

3.4.2 Technical Aspects of Operation and Maintenance

As for the HMDA staff, in the Technical Cooperation Project for Strengthening Capacity on Restoration and Management of Hussain Sagar Lake in India (2005-2008), 30 engineers participated training in Japan on water quality management, and classroom lectures were held in India on lake water management. Engineers received sufficient technical training, and no technical problems were observed (hearing from the HMDA). The operation and maintenance company is strictly examined by competitive bidding, and the HMDA staff oversees them after the contract started as needed. As for the contractor of operation and maintenance, if they cannot meet the originally agreed level, the penalty will be imposed by contract (hearing from the HMDA).

In September 2017, when the ageing trunk sewer busted and sewage water flowed into the lake, the HMDA took appropriate actions, such as introducing bio-remediation as an emergency measure to contain the generation of algae and foul odour and commissioning detailed result monitoring from outside institutions.

Also, when that incident occurred, the HMWSSB, to avoid similar incidents, implemented the cured-in-place-pipe method to pour resin in a 1.6-km-long trunk sewer from a manhole upstream to repair the sewers from the inside and launched a major overhaul of 143 km of trunk sewers under management to fix problematic spots. Just like the HMDA, the HMWSSB selects contractors for the operation and maintenance of sewer pipes using competitive bidding, and once commissioned, engineers from the HMWSSB supervise them. To ensure service level, services are stipulated in exact detail, and as noted by the Functional Guaranteed System, a company that cannot provide the service level set in advance will not be paid (hearing from the HMWSSB).

3.4.3 Financial Aspects of Operation and Maintenance

The HMDA is a financially independent institution with park entrance fees, signboard rental fees, commercial building rent, and various commissions as its revenue sources. The operation and maintenance costs of Hussain Sagar Lake and its lakeside facilities can be covered by revenue from lakeside facilities (see Table below).

Table 5 The HMDA's lakeside facilities-related revenue and expenditures (Unit: INR)

		FY2015	FY2016	FY2017
Revenue	Park entrance fee	210,680,291	231,574,868	239,610,808
	Signboard rental fee	2,162,209	4,867,060	13,863,460
	Total	212,842,500	236,441,928	253,474,268
Expenditure	Total maintenance cost of lake and lakeside facilities	210,105,689	221,554,294	249,992,517

Fiscal year: 1 April to 31 March. Source: HMDA

As for the HMWSSB, the water and sewerage tariff and connecting fees are the main source of revenue, and if expenditure exceeds income, the state government subsidises the deficit. The GHMC has taxes and various fees as income and is operating with continuing surplus (hearing from the HMDA, GHMC, HMWSSB, and their financial documents).

3.4.4 Status of Operation and Maintenance

Three STPs are maintained well and kept clean; in addition, test results at the laboratory and data of treated amount are properly kept. Jet fountains were installed at seven spots in the lake, and they work every day at a fixed time to aerate the water. A barge-mounted aerator, excavators, and trash collectors are working every day to aerate, dredge sediment, and clean trash from the lake, moving in the lake from one place to another (site survey).

The parks and promenade developed by the project are well maintained, and there are fee-based garbage collection systems in local slums, although some trash remains on streets; still, the collection system is steadily working (site survey).

No major problems have been observed in the institutional/organizational, technical, or financial aspects and the current status of the operation and maintenance system. Therefore, the sustainability of the project's effects is "High".

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to improve water quality of Hussain Sagar Lake and provide a reliable recycled water supply and sewerage service by constructing trunk sewers, sewerage treatment facilities and recycled water supply facilities, dredging sediments, and so on, thereby improving the sanitation conditions of people, including the poor, in the catchment area and vicinity of the lake.

This project was consistent with the development policies of India to improve urban sanitation and the development needs of Hyderabad. Since it was also consistent with Japan's cooperation policies, which emphasise the environmental conservation of rivers and lakes, and urban sewerage development as one of the priority areas, the relevance of this project is "High". Although the project's cost remained within the budget, the project period exceeded the planned

time; thus, the efficiency of the project was “Fair”.

As for effectiveness, many of the operation and effect indicators were reached, and impacts were realised, such as the improvement of the sanitary conditions of local people, including the poor in the vicinity of the lake. The quality of the local environment for residents was also improved as a result of the reduction of foul odour, improvement beautification of the environment, and the betterment of scenery. No major problems were observed in the institutional/organizational, technical, or financial aspect of maintenance and operation, and the necessary funding was secured. The current status of the operation and maintenance system is good, and problems are being properly dealt with. Therefore, the sustainability of the project’s effect is “High”.

In light of the above, this project is evaluated to be “Highly satisfactory”.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency (HMDA)

i) It is desirable to prepare for the replacement of membrane-based filtration system well in advance for 20,000 m^3/day STP and filtration for 30,000 m^3/day STP so that there will be no interruption of future treatment to further improve the quality of the treated water flowing into the lake.

ii) It is necessary to continuously appeal to residents, asking them to refrain from dumping garbage in the lake, along the lakeside, and in the nalas. This can be done by seizing every opportunity granted through festivals and events.

iii) As for discharging industrial waste water into the nala, regulations are in place, and some controls are enforced, although residents along the nalas pointed out dumping taking place at midnight. Degradation of the nala’s water quality is not only harmful to the health of residents’ along the nala but leads to the deterioration of water in the lake. It is desirable that the HMDA request that TSPCB tighten control further on corporations breaking ordinances upstream of the nalas.

4.2.2 Recommendations for JICA

None.

4.3 Lessons Learned

i) Securing the sustainability of the waste-collection system in slums by making it fee-based and encouraging continuous undertakings by local people

A garbage-collection system with a small monthly fee was introduced to the residents in slums who used to dump garbage into the nalas and the lake before the project. By making it

fee-based, waste management became an established business and functions as a system.

Also, environmental awareness was raised among locals even though this project was not the only factor, since municipalities and local NGOs conducted awareness-raising activities as well. In realising that, the fact that women's group leaders who participated in the project's activities and NGOs rooted in the community have been continuing environment-improvement activities after the project had a significant effect.

ii) Comprehensive approach to promote effects

This project greatly contributed to the improvement of sanitation in the environment for the people living in the vicinity of Hussain Sagar Lake and to the improvement of the quality of life based on the environment for citizens in Hyderabad. This was because various elements worked together comprehensively: infrastructure development was used to improve water quality by constructing STPs, sewer pipes, and I&Ds. In addition, building fences and placing trash boxes acted as physical deterrence for improper garbage disposal. Cutting back the amount of garbage scattered along the lakeside, lake, and slums, was accomplished by environmental awareness-raising activities and the introduction of a waste-management system in slums, and the lakeside environment campaign to the citizens. The scenery of lakeside parks and the promenade was improved and new trees and shrubs were planted. The facilities such as the butterfly park, where local people enjoy lake views were enriched. This sort of comprehensive environmental improvement involves many organisations and requires a great deal of coordination. However, a big impact can be expected if the project is done properly.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
1) Sewage Facilities	・STP: 30,000 m^3/day, 20,000 m^3/day	・Same as planned
	・Small-scale STP: 3	・1STP
	・Interception and diversion works (I&D): 6 sites	・11 sites
	・Trunk sewers: around 52 km; ring sewers: around 4 km	・Trunk sewers: 19.5 km; ring sewers: 2.5 km
2) Recycled Water Supply Facilities	・Reservoirs, pumping stations, and pipelines	・Reservoirs, pumping stations, tanker-filling stations, and pipelines to the lakeside parks were constructed as planned.
3) Lake Environment Improvement	・Dredging and disposal of sediments: around 1 million m^3	・650,000 m^3
	・Shoreline improvement: planting trees and adding fences	・Same as planned.
	・Surplus weir repair: setting a water gate and associated repair of the bridge	・Not taken up in this project.
	・Nala improvement: planting trees and building fences (about 12 km) with a retaining wall (800 m)	・Planting trees and flowerbeds and building fences (6.7 km) with a retaining wall (194 m)
	・Installation of aeration equipment	・Same as planned.
	・Prepare 10 idol immersion places	・Not taken up in this project.
4) Slum Development	・16 areas	・53 areas
5) Awareness Raising	・raising public awareness about the environment and sanitation	・Same as planned.
6) Capacity Building	・Training of public officers ・Public relations activities for citizens	・Same as planned.
7)Consulting Services	・Assistance in planning, detailed design, tendering, and construction management ・Slum development, awareness raising, and capacity building	・Same as planned.
2. Project Period	March 2006-December 2012 (82 months)	March 2006-July 2016 (125 months)
3. Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency Total ODA Loan Portion Exchange Rate	 1,234 million JPY 7,990 million JPY (3,209 million INR) 9,224 million JPY 7,729 million JPY 1INR = 2.49 JPY (As of July 2005)	 1,220 million JPY 4,646 million JPY (2,659 million INR) 5,866 million JPY 4,839 million JPY 1INR = 1.77 JPY (Average between 2006 and 2016)
4. Final Disbursement	July 2016	