Sri Lanka

Ex-Post Evaluation of Japanese ODA Loan
"Greater Kandy Water Supply Project"

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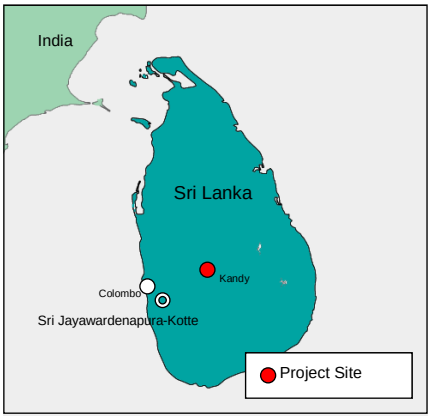
0. Summary

This project is highly consistent with government policies, and no problems with operation and maintenance (O&M) systems can be found. Although slight concern remains about the financial sustainability of the implementing agency (the National Waster Supply & Drainage Board, NWSDB) itself, the O&M-related earning positions are robust, with the operating balance surplus of the facilities involved in this project steadily expanding. Major indicators such as population served by this project, amount of water supplied, and facility utilization rate have exceeded 80% of the target value, and there is no particular problem with the quality of the treated water produced. Furthermore, numerous positive impacts are appearing, including the improvement of both public health and the business environment in the target areas. In addition, in terms of efficiency, although the project period was longer than planned, project cost was kept within the planned amount. In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Location Map

Katugastota Water Treatment Plant

1.1 Background

At the time in 1997, Kandy, the capital of Sri Lanka's Central Province and the country's second largest city, had fallen into a situation where, along with rapid population growth in the metropolitan area, the demand for water far outstripped the water supply capacity. In particular, there was concern about the increasing seriousness of water shortages within the city of Kandy and in the northern part of Greater Kandy.

Specifically, according to JICA's appraisal documents, the water supply capacity for Greater Kandy in 1997 was about 60,000 m^3/day, which was grossly insufficient to cover the maximum demand for water of about 130,000 m^3/day. Even in areas equipped with water supply facilities, supply of water had been rationed by district to certain days and hours due to supply capacity restrictions. It was predicted by JICA's appraisal documents that the maximum demand for water in 2015 would reach 170,000 m^3/day, making the increase of water supply capacity a

pressing task. In addition, according to the 2001 Sri Lankan census, it was believed that rapid, long-term population growth in the Greater Kandy area was a certainty, and the situation was one in which future pressures on water supply and demand could not be avoided.

Against this backdrop, advancing the implementation of a new water supply project for Greater Kandy was an urgent challenge for the Sri Lankan government at the time, and the prompt implementation of a water supply project for the purpose of drastically closing the supply-demand gap was desired.

1.2 Project Outline

The objective of this project is to secure a constant supply of water and to expand the capacity of water supply for Kandy City and northern district of Greater Kandy Area by constructing new facilities for water supply, thereby contributing to the improvement in public health and living environment in the target area.

Loan Amount / Disbursed Amount	5,151 million yen / 4,644 million yen
Exchange of Notes / Loan Agreement Signing Date	January 2001 / March 2001
Terms and Conditions	Interest Rate: 0.95% (0.75% for Consulting Services) Repayment Period:40 years (Grace Period:10 years) Conditions for Procurement: Bilateral Tied[1] (General Untied for Consulting Services)
Borrower / Executing Agencies	Democratic Socialist Republic of Sri Lanka / National Water Supply and Drainage Board, NWSDB
Final Disbursement Date	June 2008
Main Contractors (over 1 billion yen)	Hitachi Ltd. (Japan) / Taisei Corporation (Japan) (JV)
Main Consultant (over 100 million yen)	NJS Consultants Co., Ltd. (Japan) / Nihon Suido Consultants Co., Ltd. (Japan) (JV)
Feasibility Studies, etc.	1997 - 1999 Feasibility Study (by JICA) 2000 - 2002 Detailed Design (by JICA)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Onishi (Mitsubishi UFJ Research & Consulting)

2.2 Duration of Evaluation Study

Duration of the Study: December, 2010 – November, 2011

[1] This project was implemented by applying "Special Yen Loan". This is a facility established in 1998 for the rapid economy recovery of Asian nations which had been affected by the economic crisis, aiming at to provide financial assistance for infrastructure provision which helps to streamline logistics and distribution facilities, to strengthen production bases and to deal with large-scale disaster preventions. Under this scheme, more discretionary loans are granted than in regular projects in terms of interest rate and repayment period, with the conditions that i) prime contractors are tied to Japanese firms, and ii) country of origin of goods and services to be procured are limited to Japan (Total cost of goods procured from other countries shall be no more than 50% of the total yen loan amount), thereby leading to an expansion of opportunities for Japanese firms to participate in Official Development Assistance projects.

Duration of the Field Study: March 9, 2011 – March 24, 2011 / July 10, 2011 – July 16, 2011

2.3 Constraints during the Evaluation Study

None.

3. Result of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Sri Lanka

Relevance with the national policies

At the time that project appraisal was carried out in 2001, the Sri Lankan government had set a state objective of "Safe Water for All by 2010" and was working on expanding the water supply network. In addition, under the "Six Year Development Programme" (1999-2004), concrete targets had been set for the development of water supply facilities and the provision of safe drinking water, such as: (1) The supply of safe drinking water under a socially reasonable tariff system, (2) The development of water facilities capable of 24-hour supply, and (3) The efficient utilization of water resources.

Meanwhile, the administration of Mahinda Rajapaksa that came into power in 2005 sought to correct regional income disparities and wealth inequalities through infrastructure development, as well as promote priority investment in growth centers in each region, through the "Mahinda Chinthana (Mahinda Vision)" announced at the time of inauguration, as well as the policy framework for turning this vision into reality, "Creating Our Future. Building Our Nation: The Economic Framework of the Government of Sri Lanka."[4] In addition, at the Sri Lanka Development Forum held in January 2007, the Ten Year Horizon Development Framework 2006-2016, which sets promotion of basic infrastructure development in regions, including water supply infrastructure, as a priority strategic area, was enacted and announced under President Rajapaksa's strong initiative.

Therefore, for both program planning and ex-post evaluation, investment in infrastructure development, especially the promotion of investment in the water supply and sewerage sector, has been assigned high priority in higher-level national policies, and consistency of national policy even through changes of administration has been secured. Thus, consistency between this project's objective of "improving public health through stable supply of water" and national policy is very high.

Relevance with the sector policies

At the time of appraisal in 2001, the Public Investment Program 1997-2001 that set the Sri Lankan government's plan for public investment had an allocation of LKR 23.525 billion planned for the water and sewerage sector, equivalent to 6.9% of the total investment amount, and continuous capital investment into that sector was declared as a fundamental policy.

As of 2011 as well, the National Policy on Drinking Water announced in June 2009 continues to hold up the "sustainable supply of safe water" to urban and rural areas as a mission of the utmost importance. In addition, the National Policy on Drinking Water Supply and Sanitation (2004) formulated by the project implementing agency National Water Supply & Drainage Board (hereafter NWSDB), sets the following two targets for water supply development: (1) Percentage (penetration rate) of safe water of 85% by 2015, and 100% by

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

[3] ③: High, ② Fair, ① Low

[4] Specifically, (1) Development of road networks, (2) Expansion of electric power supply capacity, (3) Development of ports, and (4) Water and sewerage sector investment, are set as priority areas for investment.

2025, and (2) Percentage of drinking water supplied by water piping of 100% in urban areas and 75% in non-urban areas by 2015.

Therefore, for both program planning and ex-post evaluation, a certain level of ongoing investment in the water and sewerage sector has been clearly stated in the basic objectives for sector policy, and water supply development in greater metropolitan areas continues to be emphasized.

3.1.2 Relevance with the Development Needs of Sri Lanka

In 1997, when the feasibility study for this project was carried out, water demand had already far outstripped water supply capacity in Greater Kandy, which includes Kandy City, and due to restrictions on supply capacity, there were districts with limitations on water supply days and hours. As shown in Table 1 below, water supply capacity has been significantly strengthened in 2007[5] as a result of the October 2006 start of operation of facilities related to this project, including water treatment plants. On the other hand, maximum daily demand for water has increased an average of 3.5% each year, and the supply-demand gap that had once been mitigated is again expanding.

Maximum demand is predicted to reach 183,000m^3/day in 2015, and supply of safe water through expansion of water supply capacity continues to be a pressing task.[6] Had this project——which achieved substantial increase of water supply capacity and greatly contributed to bridging the supply-demand gap——not been implemented, the current supply-demand gap was projected to have widened more than it has.

Table 1: Water Demand and Supply in Greater Kandy Area

Unit: 10,000 m^3 / day

Year	Maximum Daily Water Supply a	Daily Water Demand		Demand - Supply Gap b-a
		Maximum b	Average	
2005	6.0	14.7	12.2	8.7
2006	6.0	14.2	11.9	8.2
2007	9.7	14.7	12.2	5.0
2008	9.7	15.1	12.6	5.4
2009	9.7	15.6	13.0	5.9
2010	9.7	16.3	13.6	6.6
2015 1)	*18.0*	*18.3*	*15.2*	*0.3*
2020 2)	*18.5*	*20.5*	*17.1*	*2.0*

Source: Answers to the questionnaire to NWSDB and JICA Mid-Term Review Report
Note 1: Planned (for daily water supply) and forecasted (for daily water demand) figures by NWSDB
Note 2: The operation of the project facilities started in October 2006.

3.1.3 Relevance with Japan's ODA Policy

Under the policy of implementing yen loans to Sri Lanka in 2001 at the time of the appraisal, Japan was taking a course of assisting Sri Lanka that centered on water supply development programs in urban areas with urgent water demand, based on the recognition that water utilities are social infrastructure that contribute to the improvement of public health and the living environment, and that particularly in urban areas they are infrastructure that is indispensable to carrying out economic activities. Japan also had the policy of expanding the targets of water supply development from the Greater Colombo area to regional core cities such as Greater Kandy, while trying to improve the financial aspects of the implementing agency

[5] The maximum water supplied has risen from 60,000m^3/day to 97,000m^3/day, an increase of 62%.

[6] Due to the high supply needs, Water Sector Development Project was implemented as a follow-up to this project, and a plant capable of treating 100,000m^3/day is now under construction. For details, see the Sustainability section below, etc.

NWSDB. Therefore, this project was extremely consistent with Japan's aid policies.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

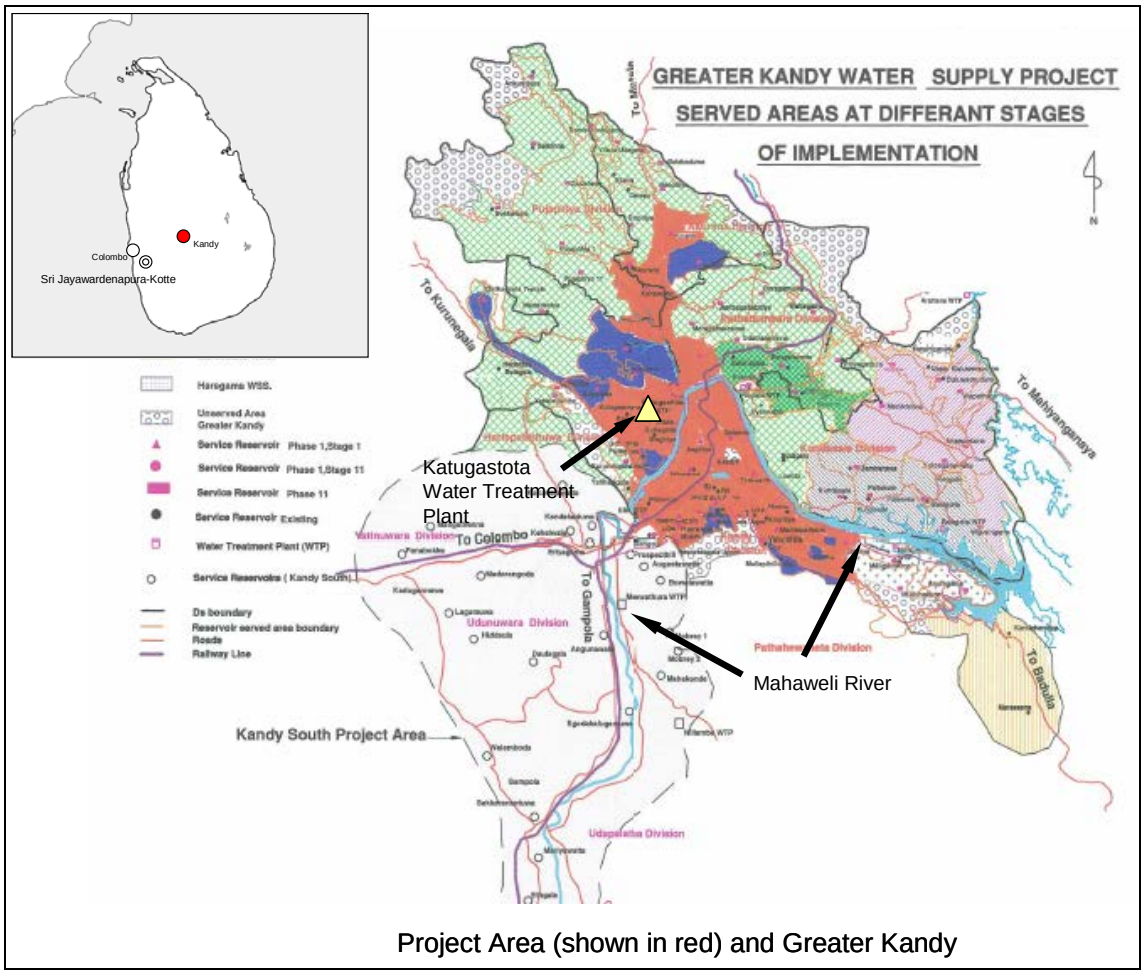


Figure 1: Location of the Project Site

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Comparison of outputs planned and actual performance is shown in Table 2 below. There is no major change for the following three outputs: i) Intake capacity of intake facilities, ii) Treatment capacity of treatment facilities, and v) Procurement of maintenance equipment.

On the other hand, reductions in scope were confirmed for water conveyance, transmission and distribution facilities. In particular, the outputs for i) conveyance pipelines, iii) transmission pipelines, iii) pumping stations, iv) number of distribution facilities (reservoirs) total reservoir capacity, and distribution pipeline length are lower than planned. The reasons for the shrinkage in scope and the reduced outputs are as follows:

Table 2: Changes in Output

Project Components	Original	Actual	Differences
i) Intake and Raw Water Transmission Facility			
· Intake Capacity	115,000 m³/day	The same	As planned
· Conveyance Pipelines	2,200m	1,100m	50% of original plan
ii) Water Treatment Plant			
· Treatment Capacity	33,000 m³/day	36,700 m³/day	Mostly as planned
iii) Water Transmission Facility			
· Transmission Pipelines	39,290m	26,696m	68% of original plan
· Pumping Station	24 stations in total	4 stations in total	17% of original plan
iv) Water Distribution and Chlorination Facility			
· Distribution Reservoirs	18 reservoirs in total	4 reservoirs in total	22% of original plan
· Reservoirs Capacity	9,358m³	5,900m³	63% of original plan
· Distribution Pipelines	Approx. 30,000m	14,870m	49% of original plan
v) Procurement of Maintenance Equipment	Water quality analysis equipment, Leakage detection equioment, Truck with loading crane, etc.	Water quality analysis equipmen, Asphalt cutters, Backhoes, PCs, etc.	Mostly as planned (Some of the equipment were procured under Water Sector Development Project.)
vi) Consulting Services			
· Consulting Service M/M	352M/M in total (Foreign:138M/M, Local: 214M/M)	620.52M/M in total (Foreign: 56.14M/M, Local: 564.38M/M)	176% of original plan
· Consulting Service TOR	Bidding support, Construction supervision, Studies on environmental measures, etc.	Mostly as the same	Mostly as planned

Source: JICA internal documents, answers to the questionnaire to NWSDB and results of interviews

- ✓ The original scope could not be pushed through because construction cost greatly exceeded the estimate at the time of detailed design (hereafter "D/D") due to unexpected sharp increase in minimum bid price.[7,8]

[7] The estimate at the time of D/D was about LKR 3.3 billion (about JPY 4.1 billion at the current rate), while the minimum bid price was about LKR 4.87 billion (about JPY 6 billion), a roughly 50% markup. (Source: JICA internal data)

[8] Though the rationale is not necessarily evident, NWSDB has pointed out that one of the reasons for the increased project cost was that the procurement under Special Yen Loan was Japan-tied (Source: Answers to the questionnaire to NWSDB). On the other hand, at the time of the mid-term review in 2006, the consultants claim that the both NWSDB and contractor sides have not been fully aware to receive the high quality Japanese technology and know-how through Special Yen Loan, and have not been able to appropriately respond to it at that time. At the same time, the contractor did not directly refer to the project cost or the quality itself, but they pointed out the delay of the

- ✓ Due to the above situation, in August 2003 a second-best option of excluding some water distribution areas from the scope and dealing with the excluded areas in a follow-up project (Water Sector Development Project)[9] was adopted through the discretion and approval of the implementing agency, Kandy Municipal Council (KMC), the consultants, and JICA.
- ✓ Through the above process, they a) Reduced the number of water distribution facilities (reservoirs) from 18 to four, and b) Nearly halved the length of water distribution pipelines.[10] In tandem with this, c) The length of water transmission pipelines was reduced by 30%, and d) The number of pumping stations was decreased to 1/4 of the original scope.
- ✓ Change of conveyance pipeline specifications arose mainly due to construction site conditions and improvements in safety.

Regarding vi) consulting services, consultant input also rose significantly over the original estimate. There are two reasons for this increase: (1) The increase in work hours of local consultants in charge of construction management that came along with the extension of project implementation period and, (2) Expansion of process management personnel that came along with the increasing complexity of process management.[11] For local consultants, who cost less than foreign consultants, there have been cases of increases in employment volume after project commencement, and a similar situation can be seen as having occurred this time.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total cost of the project was originally 6,710 million yen (the Japanese ODA loan share was 5,151 million yen) but the actual project cost was 6,172 million yen (the Japanese ODA loan share was 4,644 million yen), which was equivalent to 92% of the original plan.

Foreign currency portion (about JPY 2.9 billion) was almost at the same level as the original plan at the time of project appraisal, but the local currency portion (about LKR 4.1 billion) greatly exceeded the original plan of about LKR 2.6 billion. Causes of the increase of the local currency portion included: (1) Generation of additional work due to changes in design, (2) Increase in consultant costs accompanying the delay in construction, and (3) Sudden rise in construction material[12] and construction worker personnel costs due to tsunami reconstruction after December 2004[13]. At the same time, due to the impact of the depreciation of the Sri Lankan rupee, which exceeded inflation rate, overall project cost decreased slightly.

As already stated in the Output section above, a portion of the scope was eliminated due to a significant rise in the minimum bid price.

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construction work due to the lack of sufficient preparation by NWSDB (Source: JICA Mid-Term Review Report).

[9] Water Sector Development Project is currently in progress through a JICA yen loan. Project completion is scheduled for September 2012. Total project cost is JPY 17.64 billion.

[10] The Kandy Municipal Council had initially objected to this reduction in scope because its area would be greatly affected by the decrease in areas receiving water distribution, but it understood the unavoidable situation entailed by the steep rise in bid price, and in the end agreed to the reduction in the number of reservoirs from 19 to four. (Source: Official at KMC Water Department)

[11] For background on the increased complexity of process management see the Project Period section below.

[12] For example, compared to the 11.5% rise in wholesale prices overall in 2005, the wholesale prices in the same year for investment commodities, including construction materials, rose by 36%, and 30% in 2006. (Source: Central Bank of Sri Lanka Annual Report, etc.)

[13] The breakdown of expense item in local portion was: LKR 2.10 billion for civil works, LKR 0.12 billion for consulting services, LKR 0.06 billion for land acquisition, LKR 0.54 billion for taxation, and LKR 1.30 billion for others (including administrative costs). Civil works costs and consulting service costs were severely increased compared to those of the original plan (53% and 125% increase, respectively).

3.2.2.2 Project Period

The project period was longer than planned.

The project was scheduled from March 2011 to May 2006, a period of 63 months, but it extended to 68 months, from March 2001 to October 2010[14], which was equivalent to 108% of the original plan.

Table 3: Comparative Table of Project Periods

Task	Original Schedule (months)		Actual (months)		Differences (months)
Consulting Service	Apr. 2001 – Dec. 2005	(57.0)	Apr. 2001 – Mar. 2007	(72.0)	- 15.0
Tender / Procurement[1)]	Sep. 2002 – Dec. 2003	(16.0)	Sep. 2002 – Dec. 2003	(16.0)	0.0
Civil Works	Oct. 2003 – Dec. 2005	(27.0)	Oct. 2003 – Dec. 2006	(39.0)	- 12.0
O&M Training	Jan. 2006 – May 2006	(5.0)	Apr. 2006 – Sep. 2006	(6.0)	- 1.0
Completion Certificate[2)]		n.a.		Jan. 2007	n.a.
Total[3)]	Mar. 2001 – May 2006	(63.0)	Mar. 2001 – Oct. 2006	(68.0)	- 5.0

Source: JICA internal documents, answers to the questionnaire to NWSDB and results of interviews

Note 1: Bidding for construction works began earlier than originally planned. As shown above in the Project Cost section, minimum bid price exceeded the original budget, and time was needed to deal with this. However, the contract for construction works was signed by December 2003, without falling behind the original plan.

Note 2: Although project completion certificate was issued in January 2007, the operation of the constructed facilities started in October 2006. Auxiliary works inside and outside the facilities (fence installation, landscaping, etc.) and preparation of as-built drawings, were carried out in the period from October 2006 to January 2007.

Note 3: Project commencement was defined as the date of L/A conclusion. For the definition of the date of project completion, refer to the Footnote-14.

The main reasons for the delay included: (1) Redesign work[15] accompanying the review of the D/D and delay in the start of main construction work[16], (2) Suspension of night work remotely caused by the intensification of the civil war after the presidential election of November 2005, and the accompanying increase in complexity of construction schedule supervision, and (3) Difficulty in recruitment of construction workers due to the sudden rise in personnel costs during the aforementioned tsunami reconstruction process. Occurrence of a three-month delay was due in particular to the effects of (1).

In addition, as shown in the Efficiency section above, a portion of the outputs of this project, such as water distribution facilities, was greatly reduced. In cases where output has been reduced, it is necessary to take it into consideration when evaluating the project period. However, intake facility and water treatment plant specifications were virtually unchanged from the original plan, and the intake facility and water treatment plant construction components were critical path activities for both the original and actual construction work period. For these reasons, the reduction in the distribution reservoirs and the water distribution network could not

[14] Although the loan completion date for this project was June 2008, as shown in Table 1 above, the majority of construction was completed in October 2006, and all of the related facilities began operating in October 2006. Since from that time onward, water was supplied throughout Kandy and project effects began to appear, it is considered reasonable to set project completion to the above date of start of operation.

[15] In particular, in the course of foundation work for the Asgiriya Reservoir, the largest under this project at 4,100m^3, there was a need to carry out basic redesign because the position of the bedrock was considerably deeper than that predicted by the ex-ante ground survey. Regarding accuracy of the detailed design and cost estimate, the NWSDB considers the implementation method and implementation scale of the ground survey to have been somewhat insufficient. (Source: Results of interview with the NWSDB)

[16] It has been pointed out that the advance to the contractor was paid six months after contract signing. Subsequently, recruitment of personnel by the contractor in the early phase of construction work was somewhat delayed. (Source: JICA internal documents)

become factors in shortening the construction work period, and the output reduction did not impact the evaluation of the project period.

The sharp increase in the bid price of contractors was one kind of external factor, and scope reduction was an unavoidable measure. As a result, even though investment of input (funds) was close to that of the original plan and outputs were reduced, the above phenomenon should be considered as "a result of a next-best policy that dealt with external factors," and the design change is judged appropriate. Furthermore, regarding the project period, as will be shown below, the output reduction this time did not become a factor shortening the construction work period. Therefore, the above phenomena did not have an influence on the evaluation of the project period.

Although the project cost was lower than planned, the project period was longer than planned (117% of the original plan), therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: ③)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Population served, average water supply per capita and percentage of population served

Population served by this project: As of the end of March 2011, the population served by this project within the target areas was 255,000 people (refer to Table 4), and close to the post-scope reduction revised target of 258,000.[17]

After completion of facilities related to this project, various work aimed at increasing connections (sales activities aimed at making new connections and customer service improvements through the introduction of Key Performance Indicators (KPIs)) led by the NWSDB Regional Support Centre - Central (RSC Central) has succeeded, and the number of households connected to the waterworks has been steadily growing since 2007.[18]

Factors behind the population served by this project reaching the revised target include: (1) The abovementioned management efforts by RSC Central, (2) The fact that in comparison to the distribution pipeline length reduction, the reduction in total capacity of reservoirs was effectively contained (63% from the original plan was secured; for details see the Efficiency section), while giving consideration to priority levels of the target areas for supply, and (3) The fact that through a Water Sharing System[19] with Kandy Municipal Council (KMC), the water distribution network within Kandy City was utilized to secure a certain volume of water supply.

Average water supply per capita: The per capita water volume supplied for Greater Kandy, which includes the area in this project, was 135 liters/day (converted with an average of 4.3 persons per household) as of the end of March 2011, falling short of the 2005 level of 159

[17] If long-term non-residents and other floating population of 145,000 are included, population served by the project becomes 400,000. (Source: NWSDB RSC Central)

[18] 161,461 households in RSC Central's jurisdiction were connected as of end of October 2010. The annual growth rate is 8%.

[19] **"Water Sharing System" with the Kandy Municipal Council**: Mutual accommodation is being carried out between the NWSDB and the KMC Water Department. The predecessor of this mutual accommodation system was the water supply system from the Kandy City Water Treatment Plant to NWSDB-administrated districts that began in 1998. At present, a maximum of about 4,500 m^3/day is being supplied by the Kandy City Water Treatment Plant to the NWSDB-administrated districts of Ampitiya and Thennekumbura. Meanwhile, immediately after completion of this project in October 2006, water supply from the NWSDB-side began, and an average of about 15,000m^3 to 16,000m^3/day is being supplied from the Katugastota Water Treatment Plant that was completed through this project to various districts in Kandy City under the administration of the KMC Water Department. The NWSDB benefits from being able to sell and get water charge for the entire amount of 15,000-16,000 m^3/day from the Department of Water without concerns about non-revenue water and enjoy the revenue benefits. On the other hand, the Department of Water, although having to pay a certain cost of buying the water, has the advantage of being able to secure a continuous flow of high quality tap water. This mutual accommodation system is a win-win situation for the two parties.

liters/day. In addition, when limited to the target areas of this project, per capita water volume supplied falls to 129 liters/day[20]. Two main factors are thought to be behind the shortfall from the 2005 level: (1) The rise in water charges in 2005 and 2009, and (2) The awareness activities such as the water conservation campaign developed nationwide by the NWSDB.

Percentage of population served: The percentage of population served by water supply in Greater Kandy as a whole has reached 56% as of the end of 2010, due to the abovementioned steady growth of the population served by this project. This level is twice the baseline figure of 28% at the time of project appraisal in 2001.[21] In addition, facilities related to Water Sector Development Project, which is a follow-up to this project, are scheduled to begin operations within 2012, and percentage of population served is expected to improve further.

Table 4: Achievement Rate of Main Indicators

Operation and Effect Indicators	Baseline Data (2001, At the Time of Appraisal)	Target Value (Expected Completion Year) a	Actual Value (2005, At the Time of Mid-Term Review)	Actual Value (As of 2011) b	Achievement Ratio (%) b/a
Population Served	Not known[2)]	258,000[3)]	Not known	255,000	99%
Average Water Supply per Capita [1)]	Not known	Not known	159 liter/day	135 liter/day	n.a.
Percentage of Population Served[1)]	28%[4)]	79%[4)]	35%	56%	n.a.
Water Supply Volume (to be added by the Project)	n.a.	36,670m^3/day	n.a.	33,000m^3/day	90%
Rate of Facility Utilization	n.a.	100%	n.a.	90%	90%
Water Supplied Hours (for inside Kandy City)	20 hrs/day	24 hrs/day	20 hrs/day	24 hrs/day	100%
Water Supplied Hours (for outside Kandy City)	7 hrs/day	24 hrs/day[5)]	4-10 hrs/day	24 hrs/day	100%

Source: Answers to the questionnaire to NWSDB, results of interviews with NWSDB, Project Completion Report, NWSDB Annual Report, JICA Mid-Term Review Report, etc.

Note 1: The per capita water volume supplied for Greater Kandy, which includes the area in this project

Note 2: Data for project target areas after project scope reduction is unclear. Under the original plan at the time of appraisal (which included areas covered by existing reservoirs, in addition to areas covered by the 19 reservoirs that were newly scheduled for construction under this project before the scope reduction), it was 288,000.

Note 3: This is post-project scope reduction target. The target at the time of the 2005 Mid-term Review was set at 147,103, but later adjusted upward. It does not included floating population.(Source: Answers to the questionnaire to NWSDB)

Note 4: Estimated figures by NWSDB (Source: NWSDB Corporate Plan 1999-2005)

Note 5: Revised target value after the Mid-term Review in 2005 (Source: JICA Mid-Term Review Report)

(2) Water supply volume, rate of facility utilization and water supplied hours

Due to the abovementioned steady increase in the population served by this project, the original (pre-scope reduction) water supply volume target of 36,670 m^3/day has been mostly achieved. The degree of facility utilization rate attainment is likewise high (target rate: 90%).

As for hours of water supplied per day, the numbers for both inside and outside Kandy City have improved substantially over the time of the appraisal in 2001. The extent of gains outside Kandy City, including rural areas, is especially high. Since many poor people live in the rural areas outside Kandy City, it is imagined that the significant increase in hours of water supplied per day is contributing a certain degree to the improvement of the living environment for the poor.

[20] Derived from the following calculation: 33,000 m^3/day (which is the average water supply volume per day as of 2011) / 255,000 (which is the population served by the project as of 2011)

[21] Moreover, the target at the time of appraisal was set at 79%, but this was before project scope reduction, and comparison using this value is deemed unsuitable.

(3) Water quality

This project's water quality monitoring at water intakes is being carried out at laboratories set up in water treatment plants and at the test facility at NWSDB Headquarters. To date, no serious problems with water quality have been confirmed. At the five points on the Mahaweli River, which is the intake source for this project, periodic water quality monitoring is being implemented at a frequency of once daily to once every three months.

Getambe Water Intake Point (This Project)

At the time of appraisal in 2001 and at the present time (2010), on the whole figures are improving except for DO (dissolved oxygen), and no particular problems with the water as waterworks source water can be seen. Due to the further adoption of water supply facilities, including through this project, and the increase in population and tourists, the amount of polluted water discharged into the Mahaweli River is growing. However, from what can be seen in the monitoring results shown in Table 5 below, the impact on water quality is estimated to be minor.

Table 5: Monitoring Status of Water Quality at the Selected Locations of Mahaweli River

Selected Location for Monitoring Activities	Year of Examination	pH	BOD (mg/l)	SS (mg/l)	DO (mg/l)
Peradeniya Water Intake (located at the upstream from Project's water intake facility)	2001 2010	6.12 6.52	2.3 3.2	25 6	8.0 7.0
Water Intake of KMC Treatment Plant (Ditto)	2001 2010	6.01 6.50	2.2 2.9	120 10	8.7 7.1
After downstream of confluence with Meda River (Ditto)	2001 2010	6.08 6.70	6.5 3.0	29 14	7.5 7.2
Gohagoda Water Intake (Ditto)	2001 2010	6.02 6.80	1.8 1.8	30 13	6.7 7.0
Polgolla Water Intake (Located at the downstream from Project's water intake facility)	2001 2010	6.08 6.92	3.5 2.0	25 17	8.2 7.0
Environmental Standards on Raw Water used for water supply (in Japan)		6.5 - 8.5	Desired: < 1.0 Disapproved: > 3.0	Below 30 in general	Desired for Water Creatures: >6.0

Source: Documents and information provided by NWSDB

Note 1: BOD: Biochemical Oxygen Demand, SS: Suspended Solids, DO: Dissolved Oxygen. All of these indicators are the typical environmental standards on the quality of river and lake water.

Note 2: Upper rows have 2001 values, lower rows 2010 values. pH and DO are minimum annual values, while SS and BOD are maximum annual values. All recorded pH levels have been below 7.0.

Note 3: Inspection locations are all inside Kandy City. Inspection locations are listed from most upstream. The planned Gohagoda intake site is the one originally scheduled for intake point construction of the Katugastota Water Treatment Plant (a plant that was built through this project), and is situated in the vicinity of the current Getambe intake point.

Moreover, regarding the Kandy City Wastewater Management Project[22] that was being

[22] **Kandy City Wastewater Management Project**: At the time of project appraisal, the Sri Lankan government was requesting a Greater Kandy Water Supply and Sewerage Project. However, the wastewater portion was scrapped from the components because tariff policy and implementation system for the wastewater plan were insufficient. Subsequently, the wastewater portion was planned under the Greater Kandy Wastewater Management Project and the loan agreement (L/A) was signed on March 26, 2010 (agreed amount under the L/A: JPY 14.087 billion). The project is being promoted with NWSDB as the implementing agency. Start of facility utilization is currently targeted for October 2017.

planned at the same time as this project (details below), a great deal of emphasis was initially being placed on monitoring of Mahaweli River water quality because the discharge point of wastewater treated at a wastewater treatment plant was planned at a location upstream from the water intake locations of this project. Construction under this wastewater management project began in 2010, and facilities are scheduled to go into service in October 2017. Monitoring of the quality of water in the Mahaweli River should continue, while paying attention to developments in the wastewater management project[23].

(4) Target and status of non-revenue water rate

At the time of appraisal in 2001, regarding measures for contributing to the financial sustainability of NWSDB, following were scheduled to be implemented by NWSDB itself as part of its Corporate Action Plan: (1) Formulation of appropriate water tariff policy, (2) Strengthening of the fee collection system, (3) Strengthening of inventory control, along with (4) Taking measures to reduce non-revenue water (NRW). Therefore, no component regarding reduction of non-revenue water was included in this project, and thus no NRW rate targets were set.

Table 6: Non-Revenue Water Rate in the Project Area

Category	2001 (Baseline)	2005	2009	2011
Inside Kandy City	Not known	46%	45%	45%
Outside Kandy City	41%	28%	40%	34%
National Average	Not known	34%	31%	32%

Source: Answers to the questionnaire to NWSDB and Kandy Municipal Council, NWSDB website, etc.

However, an NRW countermeasure component was included in Water Sector Development Project, the follow-up to this project. For now, the various activities involved in this component are being implemented in the target area of this project.[24] As shown in Table 6 below, after the start of this project, lowering of NRW rates outside of Kandy City, which is under the jurisdiction of NWSDB RSC Central, is progressing due to the abovementioned various countermeasures.[25]

Meanwhile, regarding inside Kandy City, which is under the administration of the KMC Water Department, NRW rate is holding at a high 45%. As shown below in the Sustainability section, shortages of various resources (insufficient number of employees, lack of skills, etc.) are thought to be the chief causes.

3.3.1.2 Results of Calculation of Internal Rates of Return (IRR)

(1) Financial Internal Rate of Return (FIRR)

FIRR figures were recalculated with several conditions described in Table 7 below. (For more detailed analysis, refer to Appendix.)

The result of recalculating FIRR was 0.03%, which was lower than the 3.74% at the time of project appraisal. Reasons for this are thought to be: (1) O&M costs were more than double the amount estimated at the time of appraisal, and (2) The degree predicted at the time of appraisal for the water tariff increase was somewhat optimistic (3% annual increase).

[23] Note that it is planned to establish the "external monitoring committee" to monitor the quality of the effluent to be discharged from the facility under the Kandy City Wastewater Management Project.

[24] These include: (1) Renewal of old distribution pipes, (2) Renewal of metering equipment, and (3) Opening of a 24-hour customer helpline to address water leakage.

[25] The increase in NRW rate between 2005 and 2009 was due to the opening of new water supply facilities, including those under this project, and an accompanying sharp increase in the number of connected households.

Table 7: Recalculation of FIRR

Timing	Preconditions and Assumptions for Recalculation (Project Life: 50 years after the commencement of the Project for each case)		FIRR
At the time of appraisal (in 2001)	Costs:	Construction cost, consulting service cost, operation and maintenance cost	3.74%
	Revenue:	Water tariff revenue (assuming 3% increase in water tariff every year after operation)	
At the time of ex-post evaluation (in 2011)	Costs:	Construction cost, consulting service cost, operation and maintenance cost (based on the actual expenditure up to 2010)	0.03%
	Revenue:	Water tariff revenue (assuming 10% increase in water tariff every 5 years after 2015)	
	NRW:	Assuming 5% reduction every 5 years from 2015 up to 2040, being 30% in 2015 as a base rate and being 5% after 2040 as a convergence rate.	

(2) Economic Internal Rate of Return (EIRR)

The economic internal rate of return (EIRR) was not calculated due to limited resources for this study because it would have been necessary to clarify input data from the beneficiary side, such as beneficiaries' WTP (Willingness to Pay) for water usage through individual interviews or through the estimation by using prices of substitution goods and water tariff level.

3.3.2 Qualitative Effects

Effects such as improvement of public health and betterment of the living environment through upgrading of water supply conditions are appearing. Details are in the Impact section below.

Even though some outputs have been significantly reduced, the main indicators, including population served by this project, amount of water supplied, and facility utilization rate, have all reached 80% of the target or greater. In addition to there being no particular problem with the quality of treated water produced, regular water quality monitoring of the intake source for this project, the Mahaweli River, is being implemented under a solid system. While the still-high NRW rate in areas under Kandy Municipal Council's jurisdiction is a cause for concern in the mid-to long term, various measures are being undertaken under the follow-up Water Sector Development Project to reduce NRW rate.

This project has largely achieved its objectives; therefore its effectiveness is high.[26]

3.4 Impact

3.4.1 Intended Impacts

(1) Impact on Public Health

Regarding waterborne diseases before and after completion of this project, the following results were obtained from a beneficiary survey.

Table 8: Waterborne Diseases before/after the Project (For General Population, N=63)

Answers from Beneficiaries	Category of Water Users	Kandy City	Harispattuwa Division	Akurana Division	Total
Number of respondents who suffered from some water-related diseases **before** Project completion	New User	3 out of 10	9 out of 10	7 out of / 11	19 out of 31
	Existing User	0 out of 10	0 out of 10	0 out of 12	0 out of 32

[26] Furthermore, the customer satisfaction survey on "Special Yen Loan" scheme revealed that the NWSDB highly evaluates the technological competence of the Japanese contractor and the reliability of the Japanese-made equipment procured through this project.

Answers from Beneficiaries	Category of Water Users	Kandy City	Harispattuwa Division	Akurana Division	Total
Number of respondents who suffered from some water-related diseases **after** Project completion	New User	0 out of 10	0 out of 10	0 out of 11	0 out of 31
	Existing User	1 out of 10	0 out of 10	0 out of 12	1 out of 32

Source: Results of beneficiary survey[27]

Note: "New user" refers to a beneficiary who was newly connected to the water supply after completion of the project. "Existing user" refers to a beneficiary who had been receiving water services since before project completion.

It would be hard to describe the decreasing trend in infectious waterborne diseases shown above as solely due to the impact of this project, as it is naturally also thought to be largely due to the educational activities such as the Cleaning Campaign being developed throughout the country by the Sri Lankan Ministry of Health[28] and the strengthening of health education. At the same time, we can discern from the above beneficiary survey results that: (1) It is a fact that waterborne diseases among residents have decreased thanks to this project (the effects are especially significant outside Kandy City), and (2) Sewerage is still in an undeveloped stage.[29] From these findings, we can suppose that this project contributed a certain extent to waterborne disease reduction in Greater Kandy, along with improvement in quality of water supplied and increase in the percentage of population served.

(2) Impact on Living Environment

A survey of beneficiaries' level of satisfaction regarding the quality (turbidity/clarity, water pressure, quantity, and continuity) of water services revealed the following results. It can be seen that through the implementation of this project, the level of water supply services improved greatly. Satisfaction level is relatively high among newly connected users.[30]

[27] Beneficiary survey implementation overview:
Locations: Areas served by this project (Three areas: inside Kandy City and the divisions of Harispattuwa and Akurana outside the city)
Subjects: General population, companies, and public institutions (hospitals, schools, etc.)
Total sample: 195 (63 from general population, 70 private companies, 62 public institutions), segmented two-stage random sampling
Data collection method: Face-to-face interview

[28] A regional community organization in each area called a CDC (Community Development Committee) takes the initiative in this campaign to eradicate waterborne infectious diseases through activities such as cleaning drainage ditches in residential areas.

[29] The Kandy City Wastewater Management Project is currently in progress through a JICA yen loan. At the time of analysis regarding improvement of public health, it will be important to pay heed to the existence/nonexistence of a wastewater management project and related developments. However, at present sewerage is inadequate in Kandy City. Because water supply development will impose increased burden on the environment, it is vital to advance measures for wastewater treatment concurrently with water supply development, and the early completion of this wastewater management project is much awaited. Furthermore, although it is expected that sewage from daily life in Greater Kandy has increased along with the increase in water supply due to this project, the water quality of the Mahaweli River−one of the destinations of sewage discharge−has not worsened significantly, as shown in the Effectiveness section above.

[30] According to the beneficiary survey results, among service indicators, turbidity/clarity, water pressure, and quantity achieved a very high level of improvement from pre-project to post-project. As for continuity (the frequency of water outages), as shown in Table 9 (iv), the number of beneficiaries who responded "satisfactory" rose roughly fourfold after the end of project completion (from 17 to 67). To the separate question regarding continuity, the number of beneficiaries responding that outages occur once or more per month was 46 before project completion, while about half (24) responded thusly after project completion.

Table 9: Customer Satisfaction in Water Quality

i) Turbidity and Clarity
(Existing User: N=103, New User: N=89)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	24	89	79
Moderately Satisfactory	65	13	8
Not Satisfactory	14	1	2
Total	103	103	89

Source: Results of beneficiary survey

ii) Water Pressure
(Existing User: N=102, New User: N=90)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	24	79	72
Moderately Satisfactory	59	17	12
Not Satisfactory	19	6	6
Total	102	102	90

Source: Results of beneficiary survey

iii) Water Quantity
(Existing User: N=101, New User: N=90)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	35	84	76
Moderately Satisfactory	54	14	14
Not Satisfactory	11	3	0
Total	100[1)]	101	90

Source: Results of beneficiary survey
Note 1: Not answered from 1 existing user

iv) Continuity
(Existing User: N=101, New User: N=90)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	17	67	70
Moderately Satisfactory	56	27	14
Not Satisfactory	28	8	6
Total	101[1)]	102	90

Source: Results of beneficiary survey
Note 1: Not answered from 1 existing user

(3) Impact on Business Environment

Regarding change in the business environment after project completion, the following responses were obtained from a total of 70 companies in the beneficiary survey.

Table 10: Business Environment before/after the Project (N=70, Multiple Answers)

Answers by Private Companies	Kandy City	Harispattuwa Division	Akurana Division	Total
Production/Sales were increased after receiving new water	4	8	12	24 / 70
Quality of products/services were improved after receiving the new water	14	8	12	34 / 70
Number of customers were increased after receiving the new water	7	4	5	16 / 70
Production cost /Service delivery cost were decreased after receiving the new water	0	2	1	3 / 70

Source: Results of beneficiary survey (for 70 private companies)
Note: Type of business of interviewee: Tourism (including hotel, restaurant, etc.), Manufacturing (including textiles, pottery, etc.) and Service sector (automobile sales, car repairing, telecommunications, food, grocery retailing, education, finance, etc.)

Similarly, regarding level of improvement of business environment for companies, in-depth interviews of one manufacturing company and one tourism company in Greater Kandy[31] at the time of the field survey obtained the following views on the direct effects associated with project completion.

[31] The manufacturing company is a slipper making company (established 1986, 150 employees, located in the suburbs of Kandy City). The tourism company is a hotel and restaurant business (established 1998, 25 rooms, located inside Kandy City).

Table 11: Results of In-Depth Interviews with Private Companies in Greater Kandy Area

Answers by Interviewees	Type of Business
Conditions of water quality, pressure, and hours supplied all improved markedly.	Tourism, Manufacturing[1)]
Supply of high quality water backed up a decision to make a new investment (add hotel rooms).	Tourism
Due to continuous supply of safe water, we annexed food and drink facilities (restaurant and bakery) to the hotel, along with a spa facility.	Tourism
The hotel industry in the Kandy area is surely benefiting from the start of the supply of good quality water.	Tourism
Water tariff are somewhat high.	Tourism, Manufacturing
We use well water instead of waterworks as industrial-use water for manufacturing. Three reasons: (1) Water tariff are high, (2) Even if water quality is low, it has no impact on manufacturing, and (3) Plenty of rainwater can be collected during rainy season, so there is no incentive to use the waterworks.	Manufacturing

Note 1: Although the manufacturing company is not using water from the project for industrial use, it uses water from the project for employees' drinking and domestic use.

According to the above beneficiary survey results, through the provision of quality water services that came with project completion, various positive impacts are being enjoyed by many companies located in Greater Kandy and contributions to the improvement of the business environment can be observed. In particular, about half (34) of the 70 companies in the beneficiary survey responded that the quality of products or services improved after the start of water supply under this project. Regarding the tourism industry, specifically hotel operators, it is surmised that as stated in the above interview results, they have benefitted greatly from the project in the area of food and drink service provision.[32]

3.4.2 Other Impacts

3.4.2.1 Impact on Natural Environment

(1) Implementation status of IEE and EIA

To consider the impact of this project on the environment, an Initial Environmental Examination (IEE) and an Environmental Impact Assessment (EIA) were executed through a JICA development study. Deliberations on the following were carried out: (1) Land acquisition, (2) Impact due to water intake, (3) Impact on water quality, (4) Impact on transportation, (5) Odors and noise, and (6) Monitoring methods.

The IEE report was submitted to the Sri Lankan Central Environmental Authority (so-named at the time) in June 1993. Although there was no obligation to submit the abovementioned EIA,[33] one was prepared in February 1999 through the JICA development study.[34]

(2) Implementation status of environmental monitoring

Environmental monitoring of noise, vibration and impact on transportation was implemented during construction work by the contractor as needed. There was one complaint each from surrounding residents regarding noise and vibration during construction. The matters

[32] On the other hand, the manufacturing company that gave the in-depth interview remarked, "Regarding use of waterworks for industrial-use water, due to fee levels there is no incentive for continuous use." For some manufacturing companies, the high level of tariff was an obstacle to use.

[33] Regarding the EIA, since this was a water project with volume that fell below the level requiring EIA under Sri Lankan environmental law (500,000m^3/day), implementation of legal procedure and authorization was not required. In this relation, a letter to that effect was issued in August 1998 from the Sri Lankan Central Environmental Authority (so-named at the time).

[34] The approval of the Environment Agency was required in the construction of the intake facility and water treatment plant. On August 21, 1998, approval to carry out landfill construction at two construction sites for the intake facility and the water treatment plant was issued.

were solved by suspending nighttime work and changing equipment. When implementing environmental monitoring during construction work, in order to obviate discontent among residents, a questionnaire survey for residents was carried out, and complaints were processed in a timely fashion. There was no problem with the response by the implementing agency.[35]

As explained in the Effectiveness section, at a frequency of once daily to once every three months, periodic water quality monitoring is being implemented at the five points on the Mahaweli River with the collaboration between NWSDB and Kandy Municipal Council. No serious problems with water quality have been confirmed.

3.4.2.2 Implementation Status of Resettlement and Land Acquisition

The project involved resettlement of local residents and land acquisition. Table 12 below shows the scale and process of the resettlement.

No particular problems can be seen in the resettlement process. At the time of the mid-term review only two households were set for resettlement, but in the end 26 households became subject to resettlement. Resettlement was implemented smoothly[36]. Social infrastructure in the new location was better developed than that in the old location, and no dissatisfaction has emerged regarding compensation payments.[37] The Kandy City Municipal Council currently employs the majority of the resettled residents.

Table 12: Status of Resettlement and Land Acquisition of the Project

Item	Actual Status
Project-Affected Families (PAFs)	133 households
Scale of Resettlement	26 households
Compensation for Resettlement	1,554 million LKR
Detailed Process of Resettlement	Stakeholder meetings for resettled households were held separately, and replacement housing was built in line with the requests of the residents to be resettled. Infrastructure development (including water and electricity) was also carried out concurrently with housing construction. (Most of the resettled residents lived within the plot scheduled for construction of the water treatment plant)
Land Acquisition Price	For the land acquisition price, the application of the average price of actual transactions using market price as a criterion was permitted. The project-implementing agency applied to the Cabinet and the price was decided. In this relation, official approval was given at a Cabinet meeting in April 2006. Based on this approval, the government issued an official notice, and payment was made.
Scale of Land Acquisition	69 cases, 8.54 ha in total
Expenses for Land Acquisition	7,472 million LKR

Source: JICA internal documents and answers to the questionnaire to NWSDB

Note: Acquisition of farmlands and forests was completed before the start of construction, and construction work using these lands was advanced. Land acquisition was implemented based on the Land Acquisition Act (1950). There were 69 cases of farmland and forest acquisition. The earliest piece of land was acquired in October 2000 and the latest at the end of 2006.

Therefore, in addition to making contributions to waterborne disease reduction, this project, through its implementation, has significantly improved water supply services and service level, and is contributing to the betterment of the business environment for local companies. One can say that many positive impacts have been generated through this project's implementation.

[35] The NWSDB distributes questionnaires to nearby residents during construction work in order to receive complaints, and is working to obviate discontent among residents. It received a total of 13 complaints. Six were unrelated to the construction work, and the remaining seven were regarding damage to parapets on houses. The appropriate response was taken by the contractor. (Source: Results of interview with NWSDB)

[36] Majority of the resettled people were in planned site for a water treatment plant. After the final decision of the site location, some of the settlers were newly moved to this site. (Source: Results of interview with NWSDB)

[37] Source: Results of interviews with the NWSDB and Kandy Municipal Council.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspect of Operation and Maintenance

NWSDB[38] and the Water Department of Kandy Municipal Council (KMC) are responsible for operation and maintenance (hereafter O&M) of the related facilities that were built in the project. There is a clear demarcation between NWSDB and KMC for their responsibility of O&M activities, and there seems to be no problem with the operation and maintenance structure.

The NWSDB's organizational structure includes departments involved in policy and strategy making, and water and sewerage project implementation, as well as Regional Support Centers (RSCs) set up in 11 regions throughout the country. One of the abovementioned RSCs, RSC Central, is in charge of O&M for facilities related to this project. As for O&M for facilities inside Kandy City related to this project, the KMC Water Department is in charge. For details, see Table 13.

Table 13: Responsibility Matrix of Operation and Maintenance Activities

Type of Facilities	NWSDB Regional Support Center – Central	Kandy Municipal Council (KMC)
Water Intake and Raw Water Transmission	In charge	n.a.
Water Treatment Plant in Katsugastota	In charge	n.a.
Water Transmission Facilities	In charge, except for KMC area	Pumping station in KMC area
Water Distribution Facilities	3 service reservoirs, Distribution pipelines except for KMC area	1 service reservoir (Asgiriya), Distribution pipelines in KMC area

Source: Answers to the questionnaires to NWSDB and Kandy Municipal Council

As shown in Table 14, O&M activities (excluding large-scale repairs) of the related facilities under NWSDB's responsibility are implemented by direct management. O&M manuals have been prepared by the consultant. No particular problems regarding implementation structure of RSC Central are found for planning, bidding and management of the contractors upon large-scale repairs.

Table 14: Operation and Maintenance System of Project Facilities (for NWSDB only)

Stage/Category of Maintenance Activities	Planning	Preparation of Tender Documents	Implementation	Supervision
Daily Maintenance	Kandy North	n.a.	Kandy North	Kandy North
Periodical Maintenance	Kandy North	n.a.	Kandy North	Kandy North
Large Scale Maintenance	RSC Central	RSC Central	Contractors	RSC Central

Source: Answers to the questionnaire to NWSDB

Note: RSC Central refers to the headquarters of NWSDB Regional Support Center-Central, and Kandy North refers to the Kandy North Branch of NWSDB Regional Support Center-Central.

Meanwhile, although virtually all O&M work on related facilities under the administration of the KMC Water Department, excluding pumping stations, is carried out directly by the department, a lack of supervisors and engineers possessing the necessary skills has been cited.[39] Since there are currently only two technical engineers engaged in O&M work, one engineer is responsible for an average of 15,000 households (customers). One of these engineers is also scheduled to leave the job. On the other hand, the situation seems to be much worse in KMC,

[38] NWSDB is a public corporation that was established under the legal authority of the National Water Supply and Drainage Board Law, No.2 of 1974, which came into force in January 1975. It oversees development, supply, operation and management of water and sewerage facilities.

[39] Source: Result of interview with KMC Water Department staff

considering the fact that one engineer or manager of RSC Central is responsible for an average of 2,500 households.[40] Furthermore, as explained later, there is also some concern over the lack of seasoned employees engaged in O&M activities.

Table 15: Number of Staff of NWSDB and KMC Water Department

Year	NWSDB Staff in Total	Of which, O&M Staff	Of which, O&M Staff of RSC Central
2007	8,768	6,830	Not known (89)
2008	9,006	7,079	1,054 (111)
2009	9,063	7,432	924 (108)
2010	9,018	7,485	911 (122)

Source: Prepared from NWSDB Annual Report, NWSDB website, PCR and answers to the questionnaire to NWSDB

Note 1: In parentheses: the number of personnel among RSC Central O&M workers who are involved in O&M of facilities related to this project

Note 2: Part-time workers are included in the total number of NWSDB staff.

Year	KMC Water Department Staff in Total	Of which, O&M Staff
2008	267	147
2009	264	147
2010	268	143

Source: Prepared from answers to the questionnaire to KMC Water Department

Note: Among O&M workers, there are only two supervisors/engineers. The rest are all ordinary workers.

Based on sufficient awareness of this situation, RSC Central is appropriately providing the necessary O&M work support (including assistance for pumping station maintenance) to the KMC Water Department, and to date no serious problems have occurred[41]. However, for a fundamental solution to this problem, over the long term an increase in O&M supervisory and engineering staff at KMC is desirable.

As shown in Table 15, although the total number of NWSDB personnel has not fluctuated significantly over the past three years, the number of workers engaged in O&M activities has been rising and accounted for 83% of total personnel in 2010. The number of O&M workers at RSC Central has trended slightly downward, but from 2007, measures have been taken to increase O&M staff engaged in facilities related to this project in response to the growing number of customers, and the proportionate volume of personnel is being secured on an ongoing basis. As for KMC Water Department employees, neither the overall number nor the number of O&M workers has fluctuated significantly over the past three years. According to a Water Department engineer, even though the number of customers served has virtually doubled since project implementation (15,000 to 30,000), no increase in number of personnel has been carried out, and there seem to be problems in the timely implementation of O&M work.[42]

3.5.2 Technical Aspects of Operation and Maintenance

Technical skills of engineers and workers

The total number of employees at NWSDB RSC Central assigned to technical jobs for operation, maintenance, and management are 122 persons as of 2010, consisting of 21% of

[40] This figure is obtained from the following calculation – Total number of connected household under RSC Central (53,860, as of 2010) divided by the number of manager level staff (21) who are in charge of O&M. Conversely, additional 10 managers or engineers will be necessary in order for KMC Water Department to reach the level of RSC Central.

[41] As previously explained, the NWSDB is receiving a certain volume of water supply from the Kandy City side through the "Water Sharing System". It seems that NWSDB's incentives for continuing the support for KMC might be relatively high, considering the situation that water leakage rate are directly linked to the performance of NWSDB's own water supply services.

[42] According to the KMC Water Department engineer, although Kandy City has a stipulation that water pipe repair work shall be completed within three hours, a situation where this cannot be observed due to the shortage of staff persists. In addition, despite the existence of a plan to increase Water Department personnel by 2020, it does not seem to have been implemented yet. (Source: Results of interview with KMC Water Department engineer)

university graduates, 21% of diploma graduates, and 58% of others. They have five to 15 years of experience in operation and management of the water supply facilities. Regarding the KMC Water Department, the total number of employees assigned to O&M activities are 143 persons as of 2010, consisting of 2.5% of university graduates, 2% of high school graduates, and 95.5% of others. They have ten years of experience on average in O&M of the water supply facilities.

As shown in Table 15, the number of O&M workers at RSC Central has trended slightly downward, but from 2007 measures to increase staff engaged in O&M work at facilities related to this project have been taken, and the proportionate volume of personnel is being secured on an ongoing basis. The NWSDB has many similar water facilities in Sri Lanka, and is amply accumulating O&M skills through the operation of these facilities. It would appear that there is no problem with the quantity and quality of engineering and technical staff. However, in addition to the aforementioned insufficient quantity of KMC Water Department employees, a need for capacity building in terms of quality has also been cited.[43]

Lecture Room at Katugastota WTP Site

Training programs provided by contractors of the Project

Various trainings for technical staff for maintenance have been conducted by the contractors from 2006 to 2008. Three types of training are provided; 1) lecture[44], 2) OJT during commissioning period, and 3) overseas training[45], with he total number of participants of 238.[46] Training is conducted by the contractor constantly, and the contents of the training are valued by the trainees.[47] [48]

3.5.3 Financial Aspects of Operation and Maintenance

Taking facilities related to this project alone, the operating balance surplus is growing, and the earning position for O&M is sound. However, with the NWSDB overall, although earning capacity is improving, some concerns about short-term financial security remain due to the increase in loan interest payments.

(1) Earnings condition

From 2002 onward, NWSDB has posted a deficit every year. The main causes are: (1) Increase in general administration cost (overhead costs), (2) Start of and increase in interest payable on past loans that have come along with the end of repayment grace periods, and (3) Increase in cost of sales (direct operating expenses). In particular, overhead costs have nearly doubled between 2006 and 2010 as shown in Table 16. As mentioned earlier, taking into account the fact that total number of employees has remained about the same over the past three years (about 9,000), it seems that indirect department costs have become bloated. The main factors

[43] Source: Results of an interview with a KMC Water Department engineer.
[44] Subjects include control systems for water treatment facilities, pumping equipment, electrical components, and SCADA.
[45] Overseas training: Two engineers participated in a roughly three-month training program that was then operated by JICA, and received training in various numerical calculation methods required for O&M planning.
[46] The actual scope of implementation was a total of 1,820 man-days. Average number of days participated per person was 7.6.
[47] Source: Results of interviews with employees who underwent training.
[48] KMC Water Department staff did not participate in the above training during the project implementation period, but some employees are scheduled to participate in a training program under the follow-up project Water Sector Development Project that is currently underway.

behind the rise in cost of sales are the rise in electricity, fuel, and other fees associated with the sharp global rise in the price of oil.

At the same time, along with the start of operations of new water facilities (including those of this project) and the increase in population connected, as well as water tariff increases mentioned later, sales are growing sharply at a speed greater than that of the growth in cost of sales (direct operating expenses).[49] In particular, due to the water tariff revision in 2009, gross profit margin (operating profit on sale of water), which had fallen in 2008, has recovered rapidly from 2009 onward.

As for trends in water tariff increase,[50] tariff were raised a total of four times starting in 1999. Most recently, a revision was implemented with the assistance of the ADB in February 2009. These increases are being carried out with a high level of frequency compared to other developing countries in general, and while they do have an aspect of responding to the rise in the consumer price index,[51] they are still exerting a great upward impact on the earning capacity of the NWSDB.[52]

Table 16: Profit and Loss (P/L) Statement of NWSDB

Unit: Million LKR

Year / Item	2006	2007	2008	2009	2010
Sales of Water	5,869	6,481	6,743	9,670	10,744
Direct Operating Expenses	4,080	4,903	6,089	6,322	7,047
Operating Profit on Sale of Water	1,789	1,578	654	3,348	3,697
Administration Overheads	*1,349*	*1,762*	*1,895*	*2,062*	*2,564*
Revaluation Deficit	-	-	-	-	*12,697*
Depreciation	*1,100*	*1,381*	*1,398*	*1,410*	*3,423*
Profit from Operation Activities	255	▲575	▲1,715	184	▲13,654
Finance Cost	512	852	1,193	1,569	1,419
Profit from Ordinary Activities before Tax	▲150	▲1,224	▲2,848	▲1,336	▲14,975
Net Operating Profit after Tax	▲214	▲1,278	▲2,915	▲1,425	▲15,080

Source: Prepared from documents provided by NWSDB

Note: The huge deficit in FY2010 (LKR 15 billion, or about JPY 12 billion) came along with the recording of loss on revaluation, aimed at the change of accounting standards to IFRS (International Financial Reporting Standards).

As for measures to reduce NRW (which are not included in this Project, as described in the Effectiveness section), in line with the Corporate Plan drawn up by NWSDB Headquarters, unique countermeasures are being adopted under the leadership of each regional support center. Although NRW rate level is much lower than it was before project implementation, in 2010 it was still relatively high, with a national average of 32% and a value of 32.5% in areas under the jurisdiction of NWSDB RSC Central. Various measures aimed at further NRW reduction are being carried out in the follow-up project Water Sector Development Project, and continuing implementation of these measures will be desirable beyond the completion of that project.

[49] Cost of sales increased 73% over the past five years, while sales increased 83% over the same period.

[50] Regarding water tariff, the Sri Lankan government is currently planning to introduce a tariff adjustment mechanism that responds to the rise in the price index. The Cabinet looks ready to approve it by the end of this year at the earliest.

[51] Since 2005, the consumer price index (Colombo Consumer Price Index, (CCPI)) has risen between 10% and 25% each year. (Source: Department of Census and Statistics)

[52] At the same time, slightly less than 50% of the overall population are benefitting from discount tariff for the impoverished. (For example, fees for new connections are about 1/3 of ordinary fees.) In order to further boost earning capacity, there are expectations for more newly connected population and secure collection of water tariff, along with curtailment of costs and streamlining of indirect departments.

(2) Financial status

The capital ratio at the end of FY2010 was about 77%, maintaining a high level. However, as shown in Table 17, total liability is consistently trending upward, and the burden of interest payments on loans is weighing on management.[53] In the past, current ratio and quick assets ratio were maintained at very high levels, but both ratios are close to 100% now as a result of the sudden increase in current liabilities accompanying the jump in interest payments. Some degree of concern remains regarding short-term financial security and short-term solvency.[54]

Table 17: Balance Sheet (B/S) of NWSDB

Unit: Million LKR

Year / Item	2006	2007	2008	2009	2010
Assets					
Current Assets	13,620	13,093	15,190	13,460	15,044
Quick Assets	5,079	6,021	5,250	4,301	4,175
Fixed Assets	89,991	100,813	115,632	135,978	140,284
Total Assets	**103,611**	**113,906**	**130,822**	**149,438**	**155,328**
Liabilities and Equity					
Equity Capital	84,175	92,797	105,226	118,734	119,508
Current Liabilities	2,136	2,852	5,315	7,379	9,345
Fixed Liabilities	17,300	18,257	20,281	23,324	26,475
Total Liabilities and Equity	**103,611**	**113,906**	**130,822**	**149,438**	**155,328**

Source: Prepared from documents provided by NWSDB

Table 18: Financial Indices

Year / Item	2006	2007	2008	2009	2010
Gross Margin Ratio (%)	30.5	24.3	9.7	34.6	34.4
Sales to Receivable Ratio (%)	1.2	1.1	1.3	2.2	2.6
Days Sales Outstanding	316	339	284	162	142
Gross Debt (Mil. LKR)	19,436	21,109	25,596	30,703	35,820
Current Ratio (%)	637.6	459.1	285.8	182.4	161.0
Quick Asset Ratio (%)	444.5	331.3	216.3	131.3	116.9
Fixed Assets to Fixed Liability Ratio (%)	88.7	90.8	92.1	95.7	96.1
Capital Ratio (%)	81.2	81.5	80.4	79.5	76.9

Source: Prepared from P/L and B/S

(3) Operation and maintenance expenditure relating to the Project

Operating balance in the areas involved in this project that are under the administration of NWSDB RSC Central (the northern part of the Greater Kandy area) have shifted from a deficit in FY2008 to a surplus in FY2009, along with: (1) The water tariff increase in February 2009, and (2) Higher water tariff revenue due to the increased number of connected households. The surplus further expanded in FY2010.[55]

[53] For the payment of principal on loans, a certain amount of subsidies is provided from the government. The ratio of subsidies differs depending on the loan case.

[54] Receivables generated from unpaid water charge, etc., have been decreasing in the past several years. However, as shown in Table 17, as of 2010 the sales to receivables ratio of 2.6 and the average days sales outstanding of 142 are still at low standards, making for a situation where an average of over four months are needed to collect fees. In order to improve financial soundness, ongoing upgrade of the fee collection system is desirable.

[55] The annual expenditure for O&M after the start of operation of the project's facilities has slightly risen over the past three years. Expense items are comprised of: (1) Utility costs (including electricity and fuel), (2) Personnel costs, (3) Chemicals cost, and (4) Repair work costs. Utilities and personnel account for over 80% of the overall expenditures.

Table 19: Income and Expenditure relating to Project

Unit: Thousand LKR

Item	2008	2009	2010
Water Tariff Revenue	70,770	112,042	147,731
Connection Charge	15,716	15,812	19,794
Other Income	8,471	10,864	5,109
Water Sale to KMC	44,944	72,286	77,681
Total Income	**139,900**	**211,004**	**250,315**
Personnel Costs	43,339	47,439	59,557
Utility Costs (Electricity, Fuel, etc.)	79,062	85,441	87,353
Chemicals Cost	8,346	8,508	8,455
Repairs Work Costs	5,801	5,595	5,601
Other Costs	27,131	22,818	21,161
Total Expenditure	**163,679**	**169,801**	**182,126**
Approved Budget	**133,429**	**172,043**	**157,013**
Operating Surplus	**▲23,778**	**41,203**	**68,189**

Source: Prepared from documents provided by NWSDB

Table 20: O&M Budget of KMC Water Department

Unit: Mil.LKR

Item	2010
Personnel Costs	120
Utility Costs (Electricity, Fuel, etc.)	80
Chemicals Cost	6
Other Costs	137
Total Expenditure	**343**
Approved Budget	**350**

Source: Prepared from results of interview with KMC
Note 1: Water purchase from NWSDB are not included.
Note 2: Separate income/expenditure data for only the areas related to this project could not be obtained due to "difficulty in providing"(KMC Water Department).

As part of its activities to decentralize and strengthen the authority of the regional support centers, NWSDB is currently instructing each RSC in independent accounting. In response, RSC Central is carrying out various measures of its own. These activities are all being steadily implemented under the leadership of RSC Central upper management, and are highly commendable as managerial efforts on the part of the implementing agency.[56] In addition, a plant with water treatment capacity of 100,000m^3/day will begin operating by the end of 2012 through the follow-up project Water Sector Development Project. This will result in further expansion of RSC Central's overall source of income and create an environment for improving its earning position.

Furthermore, cases where the each year's approved budget amount is lower than the actual expenditure have occasionally been seen. Improvement in the accuracy of budget estimates is desirable.

As shown in Table 20, the KMC Water Department's O&M expenditures as of 2010 fall below the budget amount. According to the KMC Water Department, "There will be no problem with budget allocation amounts if electricity tariff don't rise drastically."

3.5.4 Current Status of Operation and Maintenance

In general, the utilization status and O&M of the various facilities and equipment under the administration of the NWSDB (intake, water treatment, transmission, and distribution facilities and related equipment) are good, and no major problem has occurred to date. Items such as an O&M manual have been developed through this project.

Although some problems have occurred after the facilities went on-line, including: (1) Frequent power outages,[57] (2) Difficulty procuring some spare parts,[58] and (3) Difficulty

[56] RSC Central is drawing up various original strategies (including strategies to reduce excess personnel, increase connected population, reduce NRW rate, and lower chemical purchasing costs) and steadily putting them into practice. Many aspects of these efforts are under the leadership of RSC Central's upper management, and as shown in the Effectiveness and Sustainability sections, the fruits are being vividly manifested. In view of the progress in the privatization of electric power, water, and other public corporations and the decentralization of power from central governments to local governments in developing countries under the direction of the World Bank and other entities, one good idea regarding loans to public enterprises in countries where decentralization is advancing is to assess, to the extent possible, the competence and leadership capabilities of upper management, and make the assessment an important element of the financing (loan) decision. (If upper management changes frequently, then this may not be the case.)

[57] **Frequent power outages:** There has been difficulty in supplying power to pumping stations due to frequent power outages. Since continuous use of a generator during outages has cost disadvantages, a dedicated power line is being laid from the major power grid near the Ukuwela Power Station to the project's water treatment plant. Project cost is LKR 23 million, with completion scheduled by December 2011.

customizing SCADA (Supervisory Control And Data Acquisition),[59] NWSDB RSC Central is continually looking for solutions, which it is steadily putting into practice. This development is the fruit of the proposal making and leadership capabilities of RSC Central's upper management, as well as the ability of the relevant personnel to act on them, and is highly commendable as a timely and pioneering response by the implementing agency.[60]

Procured Generator

As for facilities related to this project that are under the administration of the KMC Water Department, although there are problems such as the shortage of engineers and supervisors in charge of O&M, as stated earlier, various support for O&M activities is being given by RSC Central, and no serious problem has occurred to date. However, in order to fundamentally resolve problems, as already stated, O&M supervisory and engineering personnel increases and employee capacity building are desirable.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is highly consistent with government policies, and no problems with operation and maintenance (O&M) systems can be found. Although slight concern remains about the financial sustainability of the implementing agency (the National Waster Supply & Drainage Board, NWSDB) itself, the O&M-related earning positions are robust, with the operating balance surplus of the facilities involved in this project steadily expanding. Major indicators such as population served by this project, amount of water supplied, and facility utilization rate have exceeded 80% of the target value, and there is no particular problem with the quality of the treated water produced. Furthermore, numerous positive impacts are appearing, including the improvement of both public health and the business environment in the target areas. In addition, in terms of efficiency, although the project period was longer than planned, project cost was kept within the planned amount.

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[58] **Difficulty procuring spare parts:** The NWSDB is obligated to have competitive bidding in the procurement of high-priced equipment, but for some of the equipment from Japan, Japanese equipment manufacturers do not have directly managed offices in Sri Lanka (they do have local agents), and the implementation of bidding is somewhat difficult. According to the NWSDB, when they make various inquiries related to spare parts procurement, the responses from the Japanese headquarters of these manufacturing companies have been without exception poor, and in many cases the matter is not addressed in a timely fashion. To deal with this situation, a proposal is underway for a procurement system at NWSDB headquarters that considers lifecycle cost. (Specifically, a proposal has been made to build an Emergency Procurement Scheme for procurement business under LKR 50,000, and introduce a procurement mechanism that takes bidding cost into consideration (including single tendering contracts).

[59] **Difficulty customizing SCADA:** Regarding SCADA systems procured from Japanese manufacturers, there is a low degree of flexibility for system design, and customization with system changes is difficult. In order to resolve this issue, NWSDB's IT engineers are developing their own system (a reservoir water level monitoring system) and addressing system change needs. The follow-up project Water Sector Development Project is currently working on a fundamental solution to this issue.

[60] In addition, due to regular inspection of the dam located at the headwaters of the Mahaweli River, for a few days a year there were conditions under which water level necessary for intake could not be secured. At the end of 2010 an agreement was made between the Mahaweli Development Agency, which administers the dam, and RSC Central to take steps to secure water level. The timely response to this issue is also commendable.

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

4.2 Recommendations

4.2.1 Recommendations for Executing Agency

Recommendation for NWSDB RSC Central

After commencement of this project, the NRW rate has trended downward in the area outside Kandy City, which is administered by NWSDB RSC Central. However, the rate is still at a high 45% in the area inside Kandy City, which is under the KMC Water Department's jurisdiction. While this is primarily an issue under the authority of the KMC Water Department, the NWSDB is receiving a certain volume of "water supply" from the Kandy Municipal Council through the "Water Sharing System," and trends in NRW rate (= leakage rate) are directly linked to the performance of its own water supply services. Therefore, it is desirable that the NRW countermeasures being carried out under follow-up project Water Sector Development Project continue to be implemented after completion of the latter project, in tandem with the KMC Water Department. Furthermore, taking into account the fact that the KMC Water Department is lacking in various resources, it is desirable that this matter be advanced with NWSDB taking the initiative.

Recommendation for KMC-1

Only two technical engineers are engaged in O&M duties at KMC Water Department, and each of these engineers is responsible for an average of 15,000 households (customers). There is also concern over the lack of seasoned O&M workers. Based on sufficient awareness of this situation, NWSDB is carrying out various types of assistance to KMC Water Department, and to date no serious problems have occurred. However, for a fundamental solution to this problem, it is desirable that O&M supervisory and engineering staff at KMC be increased based on a medium to long-term employment strategy. In particular, it can be recommended to increase approx. ten (10) supervisory staff in a phased manner, in view of the fact that the level of support from NWSDB might become low[61] after the completion of Water Sector Development Project (currently scheduled for September 2012).

Recommendation for KMC-2

NRW countermeasures should be advanced diligently. For example, the 24-hour customer helpline for water leaks that NWSDB is introducing through Water Sector Development Project is an effective measure contributing to NRW rate reduction, as well as an attractive policy that can raise customer satisfaction directly. The possibilities for its mid- to long-term implementation should be explored.

Recommendation for NWSDB RSC Central and KMC

Under the Kandy City Wastewater Management Project that was scheduled for concurrent implementation with this project, the discharge point of treated wastewater from a sewerage treatment plant was planned to be located upstream from the water intake facility of this project. This point was considered problematic at the time of appraisal, and a numerical simulation was run regarding future water quality trends.[62] This sewerage project began separately in 2010 as a new yen loan project, with the facilities scheduled to go into service in October 2017. Since the location of the treated sewage discharge point is not expected to change significantly, Mahaweli River water quality monitoring should continue, while paying attention to developments in the

[61] This may be caused by the situation that the number of customers under NWSDB RSC Central will drastically increase soon after the completion of this project.

[62] After technical deliberations, it was concluded that the discharge point being upstream from the intake point would not pose a problem for water quality. (Source: JICA internal documents)

wastewater management project.

4.2.2 Recommendations for JICA

In light of the KMC Water Department's lack of various resources, it might be quite difficult for KMC to advance NRW reduction measures on its own. Considering the possibility of collaboration with and/or expansion of JICA's on-going technical assistance project[63], it is hoped that some kind of indirect support is carried out in a form that successfully utilizes the expertise and existing resources—both hard (e.g., O&M equipment) and soft (e.g., program to reduce NRW)—of the NWSDB RSC Central, where certain countermeasures are already being advanced.

4.3 Lessons Learned

N.A.

[63] "The Capacity Development Project for Non Revenue Water (NRW) Reduction in Colombo City", which is the technical assistance project of JICA, is currently implemented. (Expected completion date: September 2012)

Comparison of Original and Actual Scope

Item	Plan	Actual
A) Output		
1.1 Intake and Raw Water Transmission Facility		
· Intake Capacity	115,000 m³/day	As planned
· Conveyance Pipelines	2,200 m	1,433 m (for D/D), 969 m (for Mid-term Review), 1,100 m (Final output)
1.2 Water Treatment Plant		
· Treatment Capacity	33,000 m³/day	36,700 m³/day
1.3 Water Transmission Facility		
· Transmission Pipelines	39,290 m	41,585 m (for D/D), 27,111 m (for Mid-term Review), 26,696m (Final output)
· Pumping Station	24 stations in total	8 stations in total (for D/D), 4 stations in total (Final output)
1.4 Water Distribution and chlorination Facility		
· Distribution Reservoirs	18 reservoirs in total	19 reservoirs in total (for D/D), 4reservoirs in total (for Mid-term Review and final output)
· Reservoirs Capacity	9,358 m³	12,710 m³ (for D/D), 5,900 m³ (for Mid-term Review and final output)
· Distribution Pipelines	Approx. 30,000 m	27,687 m (for D/D), 17,366 m (for Mid-term Review), 14,870 m (Final output)
1.5 Procurement of Maintenance Equipment	Water quality analysis equipment, Leakage detection equiomen, Truck with loading crane, etc.	Water quality analysis equipment (Turbidity meter, pH meter, etc.), Asphalt cutters, Backhoes (for water distribution pipeline works), PCs, etc.
1.6 Consulting Service		
· Consulting Service M/M	352M/M in total (Foreign:138M/M, Local: 214M/M)	620.52M/M in total (Foreign: 56.14M/M, Local: 564.38M/M)
· Consulting Service TOR	Bidding support, Construction supervision, Studies on environmental measures, etc.	Mostly as the same
B) Project Period	March 2001 – May 2006 (63 months)	March 2001 – October 2006 (68 months)
C) Project Cost		
Foreign currency	2,898 million yen	2,855 million yen
Local currency	2,647 million LKR	4,115 million LKR
Total	6,710 million yen	6,172 million yen
Japanese ODA loan portion	5,151 million yen	4,644 million yen
Exchange rate	1LKR ＝1.44 yen (as of February 2000)	1LKR ＝ 0.806 yen (as of March 2007)

Appendix: Detailed Analysis of Financial Internal Rate of Return

As shown in Table 7 of the main text of this report, Financial Internal Rate of Return (FIRR) were recalculated with several conditions and assumptions described below.

Appendix Table 1: Conditions and Assumptions for FIRR Recalculation (Base Case)

Timing	Conditions and Assumptions for Recalculation		FIRR
At the time of appraisal (in 2001)	Costs:	Construction cost, consulting service cost, operation and maintenance cost	3.74%
	Revenue:	Water tariff revenue (assuming 3% increase in water tariff every year after operation)	
	Project Life:	50 years after the commencement of the project	
At the time of ex-post evaluation (in 2011)	Costs:	Construction cost, consulting service cost, operation and maintenance cost (based on the actual expenditure up to 2010)	0.03%
	Revenue:	Water tariff revenue (assuming 10% increase in water tariff every 5 years after 2015)	
	(NRW:	Assuming 5% reduction every 5 years from 2015 up to 2040, being 30% in 2015 as a base rate and being 5% after 2040 as a convergence rate.)	
	Project Life:	50 years after the commencement of the project for each case	

The details of conditions set out in each case are as follows:

Costs: Construction cost, consulting service cost and operation and maintenance (O&M) cost are considered as the "cost" item for FIRR recalculation, in the same manner at the time of project appraisal. All the costs used for the recalculation are based on the actual record up to 2010. Taxes, duties, land acquisition cost and interests during construction (IDC) were excluded from the cost item, followed by the principles of FIRR calculation.

Revenue: Earnings induced by the water supplied from the Katugastota Water Treatment Plant, which is one of the project facilities, are considered as the "revenue" item for FIRR recalculation. This item consists of i) water tariff revenue from both existing and new users, ii) water connection charge from new users, and iii) revenue from water sale to Kandy Municipal Council (KMC)[1]. As to the water tariff revenue among them, it is assumed that the tariff will increase by ten percent every five years after 2015[2]. Non-revenue water (NRW) rate is assumed to reduce by five percent every five years from 2015 up to 2040, being 30% in 2015 as a base rate and being five percent after 2040 as a convergence rate[3], which is the similar level with the developed nations.

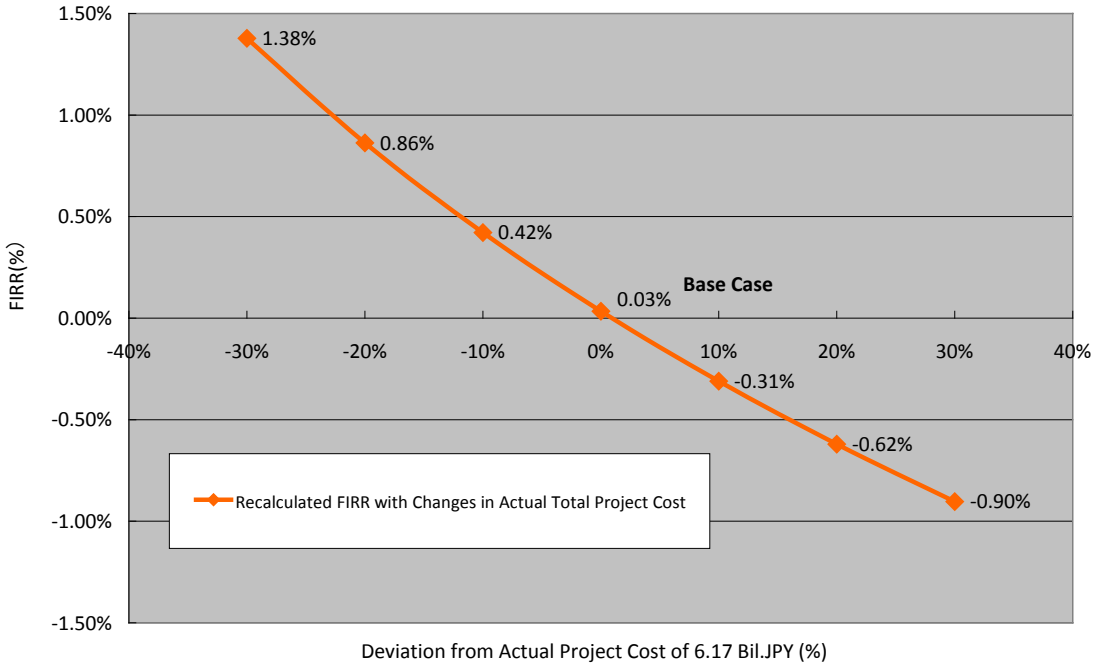
Project Life: 50 years after the commencement of the project is assumed in the same manner at the time of project appraisal.

As described in Section 3.3.1.2 of the main text of this report, the result of recalculating FIRR was 0.03%, which was lower than the 3.74% at the time of project appraisal. By setting this result (FIRR=0.03%) as the "Base Case", a sensitivity analysis was firstly conducted to review the correlation between the actual total project cost and the FIRR, with the total project cost as a parameter. The following figure shows the results.

[1] For the detailed facts and background information regarding water sale to KMC, refer to Footnote-19 of "Water Sharing System" with the Kandy Municipal Council, shown in the main text.

[2] The frequency of increase, once every five years, is assumed lower than that of the situation up to now, once every three years (four times in 12 years since 1999). Note that the NWSDB did not have "official prospect" for the frequency and degree of increase in the water tariff, although they answered to the post evaluator that 10% increase every three years was assumed.

[3] This scenario was assumed, considering the fact that i) the NRW rate as of 2011 is recorded as 34% in the target area of the project and ii) the improvement ratio of the NRW rate of NWSDB as a whole is about one percent per year on average (34.3% in 2006, 33.9% in 2007, 32.1% in 2008, and 31.1% in 2009).

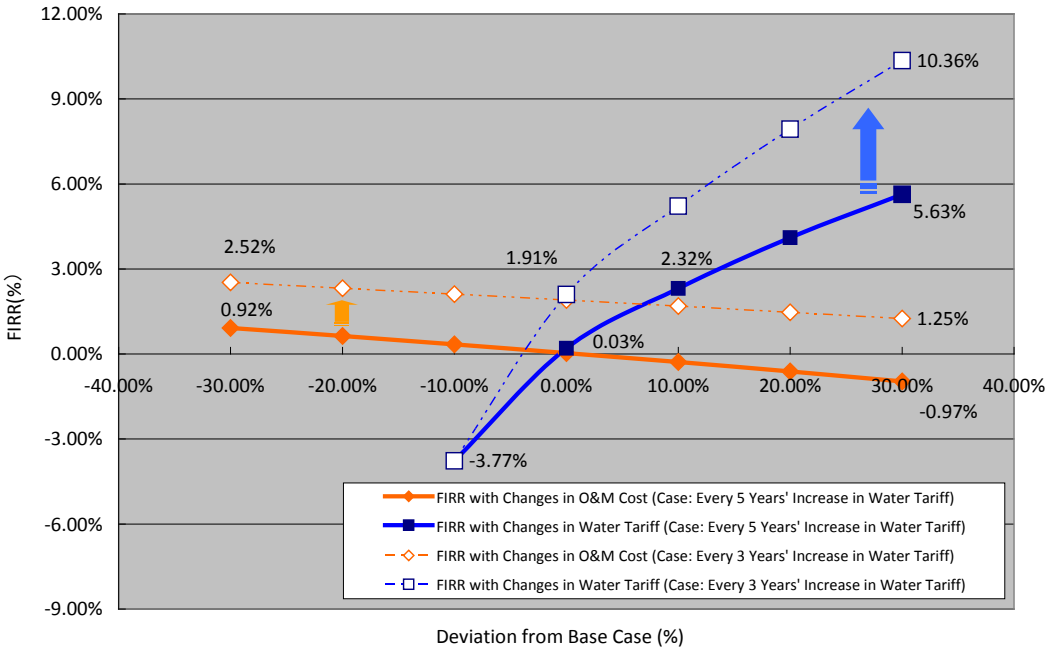


Appendix Figure 1: Results of Sensitivity Analysis of FIRR Recalculation #1
(Parameter: Actual Total Project Cost)

The horizontal axis (X-axis) represents the percentage changes in the actual total project cost of 6.17 billion Japanese Yen (which is equivalent to approx. 6.90 billion Sri Lankan Rupee), whereas the vertical axis (Y-axis) shows the calculated FIRR for each case. As can be seen from the figure, the FIRR would have increased from 0.03 to 1.38% if the actual total project cost had decreased by 30% from the original estimation. The "30% decrease" in the total project cost, 4.8 billion Sri Lankan Rupee in local currency equivalent, is approximately the same amount of the estimated total project cost of 4.7 billion Sri Lankan Rupee at the time of appraisal in 2001. Although the value of 1.38% is still low as an internal rate of return, the feasibility and profitability of the project would have further increased if the total project cost had been within the one estimated at the stage of planning in 2001.

Next, another sensitivity analysis was conducted to examine the future profitability of the project, being with i) O&M costs and ii) water tariff level as the parameters. The following figure shows the results. In a similar way with Appendix Figure-1, the horizontal axis represents the percentage changes in each parameter whereas the vertical axis shows the calculated FIRR.[4] If O&M costs increase by 30% from the current level, for example, the FIRR will decrease down to -0.97%. At the same time, the value will increase up to 0.92% if O&M costs can be reduced by 30% from the current level. As for the water tariff level, the recalculated FIRR will be improved up to 2.32%, by a ten percent increase in water tariff level from the base case (which means a 20% increase in tariff every five years).

[4] This kind of figure is called "a spider chart", which is deemed as one of the most useful tools for a sensitivity analysis where multiple parameters are used. The spider chart shows how the IRR (or Net Present Value, NPV) varies as a result of varying one of the input parameters while keeping the others constant.



Appendix Figure-2: Results of Sensitivity Analysis of FIRR Recalculation #2
(Parameters: O&M Cost and Water Tariff Level)

Considering the above analysis and as shown in Appendix Figure-2, the results suggest that the FIRR of the project is relatively more sensitive to changes in water tariff level, and less sensitive to changes in O&M costs. Additionally, one can see from the spider chart above that the two lines will be shifted upward, if assuming that the tariff increase every three years after 2015. (This result demonstrates that the FIRR will drastically be improved with the changes in frequency of water tariff increase.) Given the above, it is necessary to continuously increase the water tariff level, together with efforts in reducing O&M costs, in order to secure and enhance the profitability of the project[5].

[5] Additionally, and naturally, the reduction of non-revenue water (NRW) rate assumed in the base case (five percent reduction every five years from 2015 up to 2040, being 30% in 2015 as a base rate and being five percent after 2040 like in developed countries) should also be necessary as a prerequisite for this.