Sri Lanka

**Towns North of Colombo Water Supply Project**

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Field Survey: From February 2009 to April 2009

## 1. Project Description and Outline of the ODA Loan Assistance


Map of the project area
(Entire Sri Kanka)

Tower and pump house in Mahara distribution center

### 1.1 Background

Sri Lanka is an island country located 30km southeast of India. The total area of the country is approximately 0.8 times the size of Hokkaido in Japan. The target area of the project in Towns North of Colombo[1] has a total extent of 14.3 km$^2$ and a total population of 530,000. The population is similar to the population of Meguro-ku in Tokyo, and the extent of the area is similar to the area of Himeji City in Hyogo Prefecture in Japan.

Most of the residents of the target area used wells or common taps as only small-scale water supply systems from springs and wells or extensions of neighboring water supply systems were available in the area. Some wells in the area, especially in the industrial area, were contaminated by industrial waste water, and others in the coastal area were often contaminated by salt water. The area has a lot of industrial estates; however, the unavailability of stable water supply was an obstacle to production activities.

In this way, the absence of water supply was a burden for residents and a hindrance to economic development of the area. Therefore, it was urgently necessary to construct water transmission and distribution facilities and enhance water supply capacity in the area.

[1] "Towns North of Colombo" is not an administrative area of the government of Sri Lanka but an administrative area of the National Water Supply and Drainage Board. It is in Gampaha District and bordered on the south by Colombo City. The target area of the project was a part of the Towns North of Colombo. See the map in Annex 1 for details.

1.2 Objective

The objective of this project is to enhance the water supply capacity of Towns North of Colombo, where there is increasing water demand, by constructing transmission and distribution facilities, thereby contributing to the industrial development and improvement of public health in the area.

1.3 Borrower/Executing agency

Democratic Socialist republic of Sri Lanka/ National Water Supply and Drainage Board (NWSDB）

1.4 Outline of the Loan Agreement

| | |
|---|---|
| Approved amount/ Disbursed amount | 5,308 million yen/ 5,122 million yen |
| Exchange of Notes/ Loan Agreement | May 1996/ October 1996 |
| Terms and Conditions<br>-Interest rate, Repayment Period, (Grace period) -Procurement | 2.1%, 30 years (10 years) -General untied |
| Final Disbursement Date | February 2007 |
| Main Contractor(Over 1 billion yen) | Beijing Municipal Engineering Corporation (China) |
| Main Consultant(Over 100 million yen) | Nihon Suido Consultants Co. Ltd. |
| Feasibility Study (F/S), etc. | 1995 : Proposal : NWSDB |

## 2. Evaluation Results (Rating: B)

2.1 Relevance (Rating: a)

This project has been highly relevant with national policies of Sri Lanka and development needs at the times of both appraisal and ex-post evaluation, therefore its relevance is high.

2.1.1. Relevance with national and scrotal policies

The Government of Sri Lanka implemented various water supply projects actively at the time of project appraisal. The target at that time was to provide piped water supply to all the population by 2000. The project was listed as the first priority in the water supply master plan updated in 1991 and was identified as the most urgent task in the water supply sector.

The water supply was also a highly prioritized issue in national development policies at the time of the ex-post evaluation. The Millennium Development Plan for the country stated that the government was planning to provide the piped water supply to all the urban population by 2015.

2.1.2. Relevance with needs

The need for water supply services and urgency of its expansion were high in the target area at the time of project appraisal as well as the ex-post evaluation, as the population was increasing and industrialization was accelerating.

2.1.3. Relevance of the project planning

It was agreed at the time of the project appraisal that an overall review of the F/S, review of water demand for the entire Colombo North area, selection of the most urgent target area, determination of project scope and detailed design of the facility should be conducted by consulting services during the early stage of the project, before starting civil work. The reasons for these determinations were as follows:

- There was a limitation on the amount of treated water supplied to Colombo North area at the time of appraisal. Therefore, water demand of the area should be minimized until an additional water source is ensured.
- Investment in the project should be minimized in order not to worsen the financial status of NWSDB, which would need further investment for the development of new water-sources in the future.
- Designed criteria of maximum day demand and maximum hour demand specified in the F/S should be reviewed. Water demand in each distribution area and capacity of reservoirs and towers specified in the F/S should also be reviewed.

In this way, the loan agreement for the project was signed before a final decision of the project scope was made. This arrangement enabled the project to select the most urgent needs of the area, which was developing rapidly, whereas it had only limited negative influence on the progress of the project.

2.2 Efficiency (Rating: b)

Although the overall project cost was almost as planned, the project period was longer than planned; therefore efficiency of the project is fair.

2.2.1 Output

(1) Transmission and distribution facilities

As Table 1 shows, all the planned works for transmission and distribution facilities were conducted almost as planned. At the time of the change of the project scope, the anticipated scope was divided into two, “Stage I” and “Stage II”. Considering the limited amount of yen loans as well as the time period, it was decided that the project would implement only the work in “Stage I”. However, a part of “Stage II”, which was urgent, was also conducted under the project.

Table 1 Comparison of planned and actual outputs

| Item | | | Detail of the items | | |
|---|---|---|---|---|---|
| | | | **Temporary plan at the time of project appraisal** | **Plan after the revision of project scope** | **Actual** |
| **Transmission facility** | Pump | | 50,000 $m^3$/day x 3 units | 27,000$m^3$/day x 2 units | 27,000$m^3$/day x 2 units |
| | Clear water storage | | 9,090 $m^3$ | 6,000 $m^3$ | 6,000 $m^3$ |
| | Transmission main pipeline | | From Ambatale water treatment plant to Church Hill Reservoir | From Ambatale water treatment plant to Church Hill Reservoir | From Ambatale water treatment plant to Church Hill Reservoir |
| | Ground reservoir | | 18,000 $m^3$ | 18,000 $m^3$ | 18,000 $m^3$ |
| | Gravity transmission pipeline | | From Church Hill Reservoir to the six distribution centers | From Church Hill Reservoir to the six distribution centers | From Church Hill Reservoir to the six distribution centers |
| **Distribution facility** | **Name of distribution centers** | **facility** | **Temporary plan at the time of project appraisal** | **Plan after the revision of project scope** | **Actual** |
| | Welisara | Tower | 1,000 $m^3$ | 1,500 $m^3$ | 1,500 $m^3$ |
| | | Distribution network | 20km | 12km | 10km |
| | Kandana | Reservoir | 2,000 $m^3$ | — | — |
| | | Tower | 1,000 $m^3$ | 1,000 $m^3$ | 1,000 $m^3$ |
| | | Pump | 576 $m^3$/hour x 3 units | — | — |
| | | Distribution network | 36km | 24km | 27km |
| | Ragama | Reservoir | 4,000 $m^3$ | 2,500 $m^3$ | 2,500 $m^3$ |
| | | Tower | 1,000 $m^3$ | 1,000 $m^3$ | 1,000 $m^3$ |
| | | Pump | 864 $m^3$/hour x 3 units | 390 $m^3$/hour x 2 units | 390 $m^3$/hour x 2 units |
| | | Distribution network | 74km | 20km | 17km |
| | Ja-Ela | Reservoir | 2,000 $m^3$ | 450 $m^3$ | 450 $m^3$ |
| | | | — | | 2500 $m^3$ (additional work) |
| | | Tower | 1,000 $m^3$ | — | — |
| | | Pump | 604 $m^3$/hour x 3 units | — | — |
| | | Distribution network | 54km | 14km | 14km |
| | Mahara | Reservoir | 3,500 $m^3$ | — | 6,000 $m^3$ (additional work) |
| | | Tower | 1,000 $m^3$ | — | 1,500 $m^3$ (additional work) |
| | | Pump | 936 $m^3$/hour x 3 units | — | — |
| | | Distribution network | 73km | — | 8km (additional work) |
| | Total length of distribution network | | 257km | 70km | 76km |

(Source: Project appraisal document, final design report and project completion report)

(2) Procurement of O&M equipment

Procurement of O&M equipment was conducted almost as planned, after a review of the needs of the O&M work.

(3) Consulting Services

Review of F/S, detail design, supervision of construction and training were planned under the consulting services. The services were conducted as planned. Planned and actual MM of the services were somewhat different, as the actual MM was longer than the planned MM, due to extension of the project period.

- Plan: Foreign: 91MM, Local: 190MM
- Actual: Foreign: 101.3MM, Local: 270MM

2.2.2. Project period

The implementation period of the project was planned as 68 months, i.e. from October 1996 to May 2002. The actual period was 98 months, i.e. from October 1996 to November 2004. The additional work was completed in November 2006. Consequently, the actual period was longer than the planned (144%), even without counting the period spent for the additional work. A 35-month delay in the commencement of the civil work was the main reason for the delay of the project period. The delay in the civil work occurred because of a contractor cancellation and the necessity of holding a re-bidding to select another civil contractor. There was also a little delay in the process of the selection of a consultant; revision of project scope and detailed design.

2.2.3. Project cost

The planned project cost was 6,245 million yen, including 5,308 million of yen-loan portion. The actual project cost was 6,474 million yen, including 5,122 million of yen-loan portion. The actual cost was thus 104% of the planned cost. The actual cost should be considered almost as planned, as it was 94% of the planned cost if the cost of the additional work is excluded. The funds for the additional works became available as there was a balance of approximately 400 million yen in the project budget due to the effective procurement procedures that ensured competitive bidding. Efficient project management, such as timely instructions to the contractor, frequent progress monitoring at the sites, rejection of unreasonable claims, etc. also contributed to the reduction of the project cost.

2.3. Effectiveness (Rating: b)

The rating for the effectiveness of the project could have been “c: low”, as the size of the population newly-connected to water supply and the average water consumption per day were less than half of that planned. However, considering the various factors mentioned below, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

Firstly, the above-mentioned low level of achievement of targets was caused by a factor which can be controlled by project. That factor was the limited amount of water supplied to the area, due to the long delay in the construction of the Kelani River Right Bank Water Treatment Plant, which should have been constructed in parallel with the project. Secondly,

the project created various positive impacts. For example, water supply services for the existing customers were significantly improved by the extension of water supply hours and an increase in water pressure. There were a positive impact to the industries in the area and an improvement in the sanitation and living conditions of the people in the area.

2.3.1. Operation and effect indicators

Table 2 and 3 show the newly-connected population and average consumption per day expected at the time of the change in the project scope and the actual numbers at the time of the ex-post evaluation. The figures are 12%-27% and 44%-46% respectively. The actual number of newly-connected population was calculated by multiplying the number of new domestic connections in the target area given from 2006 up to March 2009 by five[2].

Table 2 Number of newly-connected population in the target area

| | Planned (persons) | Actual (persons) | Achievement (%) |
|---|---|---|---|
| Dec. 2006 | 82,995 | 9,615 | 12% |
| Dec. 2007 | 96,757 | 19,680 | 20% |
| Dec. 2008 | 110,518 | 30,105 | 27% |

(Sources: Final design report of the project and documents provided by NWSDB)

Table 3 Average consumption per day in the area

| Year | Planned ($m^3$/day) | Actual ($m^{3/}$day) | Achievement (%) |
|---|---|---|---|
| 2006 | 28,030 | 12,471 | 44% |
| 2007 | 30,090 | 13,365 | 44% |
| 2008 | 32,243 | 14,944 | 46% |

(Sources: Final design report of the project and documents provided by NWSDB)

The source of the piped water supply for Colombo District and its suburbs, including the target area of the project, used to be the Kelani River. The Ambatale water treatment plant, of which capacity was enhanced under the project, was treating all the water to be supplied to the entire area. At the time of the project appraisal, water demand was continuously increasing as the population of the area was increasing year by year. However, it was difficult for NWSDB to make an additional intake at the Ambatale water treatment plant as there was a risk of saltwater contamination.

Under these circumstances, in order to meet the water demand in the future, NWSDB was planning to implement several projects for the development of water sources and the construction of water treatment plants. The figures showing planned newly-connected population and average consumption per day in Table 2 and 3 were projected on the assumption

[2] In the consumer survey conducted as a part of the ex-post evaluation, the average number of family members per household was considered as five.

that the following projects would be realized in time.

(a) Construction of Kalu Ganga water treatment plant

As a part of the Kalu Ganga (Kalu River) Development Project, the Kalu Ganga water treatment plant will be constructed. After the completion of the plant, treated water from the Kalu Ganga plant will be supplied to South Colombo which is located near the Kalu Ganga. Therefore, the Ambatale plant will be able to reserve its capacity, and a larger volume of water will be sent to North Colombo, including the target area of the project. Eventually, the amount of treated water supplied to the project area will increase.

(b) Construction of Kelani River Right Bank water treatment plant

The Kelani River Right Bank water treatment plant will be constructed with financial assistance from the Government of Denmark. The volume of treated water supplied to the Towns North of Colombo area, including the target area of the project, will greatly increase, as the plant, in addition to the Ambatale water treatment plant, will supply treated water to the area.

(c) Implementation of the stage II of the Towns North of Colombo Water Supply Project

The stage II of the Towns North of Colombo Water Supply Project will be implemented in parallel to the project (Stage I). Facilities to be constructed in Stage II will be commissioned from 2005 onwards, and thereafter, the number of connected households will increase dramatically.

However, the volume of treated water supplied to the target area did not increase as expected, as only a part of the above-mentioned assumptions were realized at the time of the ex-post evaluation, as explained as follows, and there is still a limitation on the capacity of the Ambatale water treatment plant due to the risk of salt water contamination, as mentioned earlier.

(a) Construction of Kalu Ganga water treatment plant

The Kalu Ganga Development Project was postponed due to the financial situation of NWSDB. At present, the phase I of this project (Kalu Ganga Water Supply for Greater Colombo Project; L/A signed in 1996), which was implemented with the support of an ODA loan from JICA (former JBIC), has been completed. However, the phase II (Water Sector Development Project II; L/A signed in 2008), including the construction of a water treatment plant, has just commenced. Therefore, the Ambatale water treatment plant does not have the extra capacity to supply more water to the target area.

(b) Construction of Kelani River Right Bank water treatment plant

Construction of Kelani River Right Bank water treatment plant became more urgent for NWSDB as construction of the Kalu Ganga water treatment plant was delayed as mentioned above. This project was funded by the Government of Denmark as planned. However, construction of the plant was delayed for five years due to problems in the process of the procurement of a civil contractor. Currently, the construction of the plant has not been completed; therefore, water supply from the plant to the Towns North of Colombo area has not started.

(c) Implementation of the stage II of the Towns North of Colombo Water Supply Project

The stage II of the Towns North of Colombo Water Supply Project was not implemented in parallel to the stage I, as the implementation of the project (the stage II) was not considered to be urgent, because the above-mentioned (a) and (b) projects delayed. At the moment, the project is being implemented with the assistance of an ODA loan from JICA as a part of the Water Sector Development Project I, signed in 2007, and the facility which will be constructed by the project is planned to be commissioned in 2011.

NWSDB considers that the delay in the construction of the Kalu Ganga water treatment plant, which was supposed to supply a large volume of water to the target area, should be the main reason behind the shortage of treated water in the area. NWSDB has stopped the extension of the distribution network and the provision of new connections at present due to the shortage of the treated water. Therefore, it is not in a position to improve the levels of achievement shown in Table 2 and 3.

2.3.2 Results of Financial Internal Rate of Return (FIRR)

The Financial Internal Rate of Return (FIRR) calculated at the time of the project appraisal was 7.6% with the following conditions:

- Cost: Project cost, cost of O&M and water treatment.
- Benefit: Income from water bill payments by consumers
- Project life: 33 years (40 years from the commencement of the project)

The FIRR recalculated at the time of the ex-post evaluation was 4.1%. The FIRR decreased mainly because there was a delay in the creation of benefits for the period of around three years, including the period for additional works, due to the delay in the completion of the project, and because benefits from the project were less than expected, as income from water bill payments by consumers was limited due to the limitation of the volume of treated water supplied to the area.

2.3.3. Qualitative effects

To examine qualitative effects of the project, a consumer survey of 250 selected households in the area was conducted. The results of the survey confirmed that water supply services for the existing customers, such as service hours and water pressure, were improved drastically by the project.

In response to the question of “Do you think water supply services were improved after the project?”, 81% of the respondents answered “Yes”, while only 13% chose the response, “There was no need for improvement as the services were good before the project.” Only 6% replied, “No”. Those who replied “Yes” to the question cited “an increase of service hours” and “an increase of water pressure” as examples for the improvement of the services.

As shown in Figure 1, the service hours in the entire target area increased after the project by three to seven hours, compared with the figures before the project. The average increase in the

number of the service hours per day was 4.1 hours.

(Unit: hours/ day)

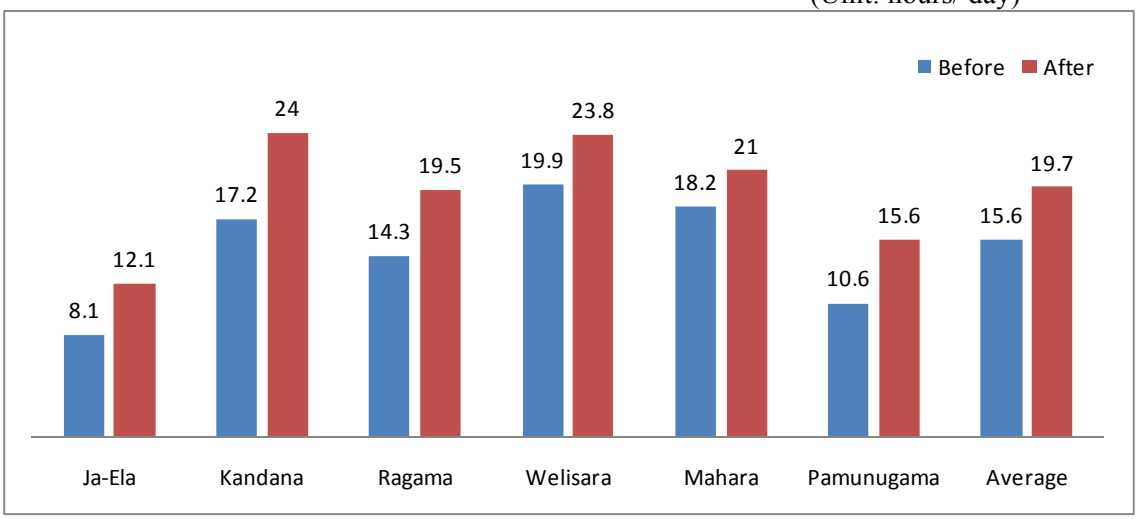


Figure 1 Service hours – Before and after the project

(Source: Consumer survey)

Figure 2 shows the distribution of households in terms of the service hours both before and after the project.

(Unit: hours/day)

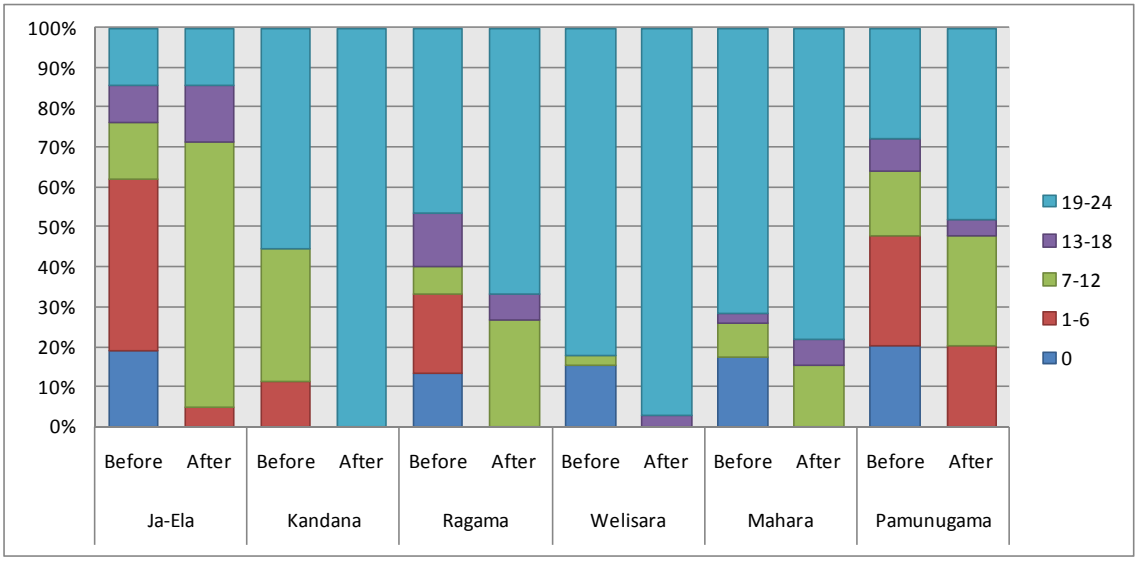


Figure 2 Distribution of service hours – Before and after the project

(Source: Consumer survey)

Figure 2 shows that there was a significant improvement for the households which had very limited service hours before the project. Details of the improvement are described below.

- Before the project, there were many households which had a connection to water but did not have any service. After the project, there are no such households.

In every area, except for Kandana, 12% – 20% of the households among the samples had the connection but did not have any water supply. This was a significant problem in Ja-Ela, where the ratio of such households among the samples was 20%. This was a particular problem seen in the households located at the end of the distribution network or where water pressure was very low. They had water supply at the time they were connected to the distribution network several years ago, but they gradually lost the service when water demand in the neighboring areas increased due to an increase of population and urbanization. After the project, all these households obtained several hours of water supply per day and there were no households that do not receive any supply at the moment.

- The number of households that have less than six hours of service was reduced

  The number of households that have less than six hours of service per day was drastically reduced, in addition to the above-mentioned benefit to the households that did not have any supply. For example, in Ja-Ela, the ratio of the households that had less than six hours of service per day was 43% among the samples before the project, but this was reduced to 8% after the project. In Pamunugama, too, the ratio of such households was 30% before the project, but it was reduced to 20% after the project.

2.4 Impacts

The project contributed to the development of commercial and industrial activities and the improvement of sanitary and living conditions of the community in the target area, and thus it is evaluated that the project produced the expected impacts.

2.4.1. Impacts to the project area and target community

(1) Contribution to development of regional industry

According to the documents provided by NWSDB, the following industrial estates and development areas in the target area were examples of areas that benefitted from the project:

- New connections were provided to the Muthurajawela Industrial Zone, which has a natural gas and petroleum storage facility and a terminal power station.
- Preparation work for water supply to the Katunayake Industrial Zone was conducted. Provisions were made at the distribution facility at the Ja-Ela Distribution center to supply water to the industrial zone for the future.
- Preparation work for water supply to the Biyagama Industrial Zone was conducted. The water supply will be enhanced by the transmission main pipeline constructed by the project and the distribution facilities to be constructed in Towns North of Colombo Water Supply Project Stage II.
- Preparation work for water supply to the Ekala Industrial Zone was conducted. The water supply will be realized to the area by distribution mains laid to Ekala by the project and distribution facilities will be constructed by the stage II project.

At the moment, NWSDB gives priority to the benefits for general consumers, and could not answer requests from factories in the area for new connections due to the limitations on the amount of treated water. Meanwhile, the following case study confirmed that a factory in the target area, which already had a connection, benefitted from the project because of the increase of service hours and improvement of water pressure.

A Case Study – Sanmyan Lanka Ceramic (a ceramic factory)

(The followings are the summary of an interview with a production manager of Sanmyan Lanka Ceramic)

Sanmyan Lanka Ceramic is a ceramic production factory with Korean capital and located in "Aniyakanda Industrial Estate" in Kandana City. The factory produces ceramic ornaments to be exported mainly to Japan, England and U.S.A. It was established around 16 years ago.

Ground water was not available by digging a well in and around the industrial estate. Therefore, factories in the estate depended on piped water supplied by NWSDB. The factory had a connection of the piped water; however, water pressure was very low. Water came out from a tap like a thread when opening a tap. As service hour was limited, the factory stored water to an underground storage, however, the amount of water supplied for a day was far from enough to necessary amount for a daily production, hand wash and toilet use by staff of the factory.

The factory needs a large amount of water during the production process. For example, they need to pour water continuously into a mill at the time processing ingredients. Until several years ago, the factory used to purchase water from a private company. The company bought water from bowsers. They usually need a bowser or two for a day, according to the amounts to be produced. The production manager used to wait for the bowsers eagerly at the gate of the factory, as the delivery was always delayed. It was a serious problem for the management of the factory that the production schedule was often disturbed when bowser comes late, that the quality of water from bowsers was not good, and that the cost of water from bowsers was expensive.

After 2007, soon after the commissioning of the distribution facility in the Kandana distribution center by the project, water supply became available to the factory 24 hours a day. Since then, they have not had any problems with water pressure and quality. In this way, their water problems were solved completely by the project. Currently, they do not need any additional supplies from the bowsers. Their water needs are completely fulfilled by the piped water supply. The production manager highly appreciates the project as production efficiency of the factory has improved very much owing to the project.

(2) Improvement of sanitary and living condition of residents

In addition to the consumer survey of 250 households mentioned above, to study the impact produced by the project on sanitary and living conditions of the residents in the target area, the external evaluator conducted interviews with 39 households which may have problems with

groundwater[3]. Figure 3 shows the result of the interviews.

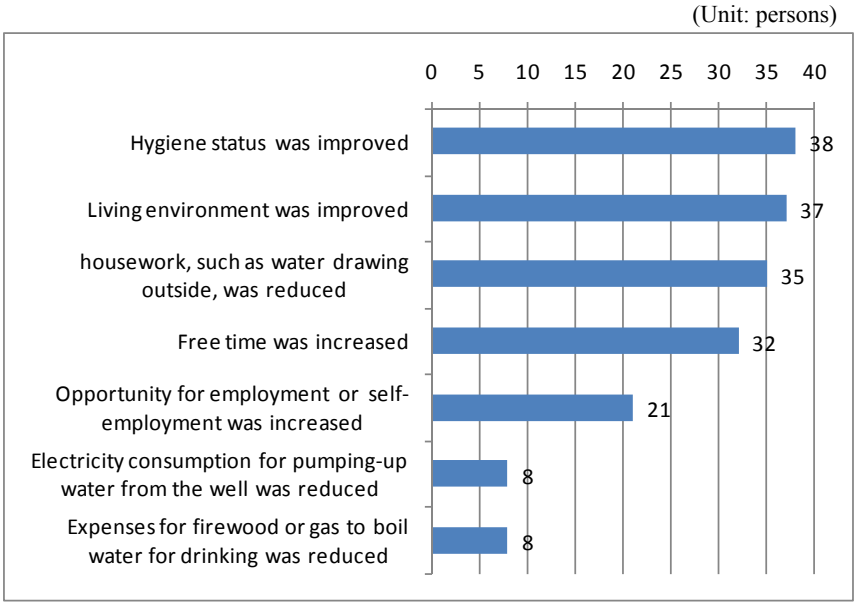


Figure 3 Impact on sanitary and living conditions owing to the supply of piped water

(Source: interview with the selected 39 households)

Figure 3 shows that most of the respondents recognized that "Sanitary and living conditions were improved owing to the supply of piped water." It is assumed that the supply of the piped water solved the above-mentioned problems because the residents were able to obtain adequate amounts of good quality water.

According to the interviews, 90% of the respondents mentioned that their "workload, such as water drawing outside of their premises, was reduced." As 74% of the respondents had a well within their premises, it was assumed to be a reduction of the workload of drawing water from a well on the premises and carrying the water to the kitchen and bathroom.

There were comparatively fewer households that recognized a reduction of electricity consumption spent for pumping up water from a well, and a reduction of expenses for firewood or gas spent for boiling water for drinking. Results from the questionnaire survey showed that around 40% of consumers boiled water for drinking before and after they obtained new connections of piped water supply; it is thus understood that there is no particular relationship between a reduction of expenses for electricity, firewood and gas and the supply of piped water with regard to the households in the target area.

A half of the respondents replied that opportunities for employment or self-employment increased after they obtained the piped water supply. This is because they had more available time due to the reduction of their workload for drawing and carrying water.

[3] Places which may have problems with groundwater were identified by the information from the OICs (officers' in-charge) of NWSDB in the target area. It was confirmed that the survey included a considerable number of households which have problems with groundwater, as 40% of the respondents replied that "water in the well is dried up during dry seasons" and 33% replied that "there were problems with the quality of water in wells, such as odor and color" in response to a question about the quality of water from their well. .

(3) Benefit for medical institutions

The following case study shows that the project improved water supply services to a main medical institution in the target area.

A case study – Ragama Teaching Hospital

(The following is a summary of an interview with the nursing staff of Ragama Teaching Hospital)

Ragama Teaching Hospital is one of the largest general hospitals in the Gampaha District. It has 1,350 beds and treats around 1,200 outpatients per day. The hospital first obtained piped water supply in 1987 by a water supply scheme for "Ragama hospitals water supply scheme". A distribution main was laid to the area from the Welisara Reservoir. In 1993, the volume of water supply was increased by the stage II of the same scheme. A gravity transmission main was laid and a water storage tank and a water pump were installed in the hospital.

After a while, because of a population increase, urbanization and industrialization, water demand in and around the area increased steadily. Distribution networks under the scheme were extended and new connections were provided. In the hospital, too, water consumption continued increasing as new hospital wards and medical facilities were added.

In this way, as water demand increased, the volume of water supplied to the area and the capacity of the distribution facility became insufficient at all to meet the demands. The hospital had a serious water shortage problem. The water supply was disrupted from around 10 o'clock at night until 4 o'clock in the morning every day. They did not have enough water necessary for the management of the hospital during the daytime as water pressure was low and the volume of supply was insufficient. For example, they often could not use operating theaters, flush water in toilets, wash their hands after nursing services and wash linens for inpatients. In particular, water outage at night disrupted emergency surgeries and treatment of emergency patients. They sometimes had turbid water during dry seasons.

The project constructed a water tower at the Ragama distribution center. The project also laid a gravity main to the center, which permitted gravity transmission from Church Hill to the Ragama area. Due to these improvements, the hospital has been enjoying a daily 24-hour water supply since 2007. The head nurse at the hospital confirmed that the hospital has been freed from the problems of water supply, and that the improved water supply is contributing much to the efficient management of the hospital.

(4) Benefit to non-target area

Water supply services to the Pamunugama area were improved by the project. The area is located northwest of the target area and was not included in the target area of the project. NWSDB recognized the urgent needs of the community in Pamunugama and connected a transmission line constructed by the project to distribution networks of the area. The volume of water supply to the area was subsequently increased by the arrangement.

A case study – Talahena village in Pamunugama area

(The following is a summary of interviews with residents in Talahena village)

Talahena is a coastal village located northwest of the target area. It was not included in the project area. Ground water under the village has been contaminated with mud and become turbid and brownish in color from long ago. Residents of the village pumped up the ground water from wells in the garden, filtered it and used it for domestic use. They used hand-made filters made of gravel and pebbles. They said that the filtered water can be used for domestic use, but it is not suitable to use for drinking at all.

The village obtained piped water supply around 15 years ago. However, from around 2000, the water pressure and volume of water were extremely reduced due to an increase of demand caused by the growing population and increase in the number of connections in the area. From around 2002 onwards, the water was not supplied at all to the households located at the end of the distribution network. In other words, these households had connections, but did not receive even a drop of water from the supply. Other households in the village also had very low water pressure. Water was not delivered up to taps in kitchens and bathrooms due to the low pressure. They had to dig out a pipe laid under the gardens, attach a tap, and obtain water at night and store it in a tank for drinking. If they could not obtain water by such means, they had to bring water from a common tap several kilometers away from their residences. This situation continued for around five years.

NWSDB recognized the serious problem of the residents, and made an arrangement to connect a transmission line constructed by the project to the distribution network of the area. The volume of water supplied to the area was subsequently increased by the arrangement. As a result, the villagers were again able to obtain water supply for several hours a day. Households located at the end of the distribution network were able to obtain water for drinking. Other households became able to obtain water even for kitchens and bathrooms.

However, some of the residents still have to store water at night from a tap attached to a pipe in the ground, store it in a tank and pump it to the taps in the house, as water pressure is still very low. The residents use water from wells, too, as the volume of piped water supply is not sufficient. They greatly hope the volume of piped water supply will increase soon, so that they can become freed from the costly and troublesome work of pumping muddy water from a well, filtering it, and pumping it again to the house. There are several households that do not have connections to the piped water supply, and they must obtain water for drinking from neighboring households. They are eagerly awaiting connections to the piped water supply.

<Reference>

- Assumed number of direct beneficiaries : Around 130,000 persons (water supply–connected domestic population in the target area)
- Assumed number of indirect beneficiaries : Around 200,000 persons (users of hospitals, schools, factories, shops, government institutions, religious facilities, etc.)

2.4.2. Impact on Natural Environment

(1) Impact by the construction work

There was no impact on the natural environment caused by the construction work of the project.

(2) Saltwater contamination

Saltwater contamination in Kelani River, which is a source of water supply to the target area, is a serious problem, which happens every year during the dry season due to a reduction of the flow pressure of the river. As a countermeasure, NWSDB used to provide sandbag-protection every year. However, such a temporary solution does not solve the problem, and the construction of a "rubber dam system" has been planned as a permanent solution. A part of the plan is under construction at the moment.

(3) Increase of discharged water

There has been no increase of discharged sewerage water in the project area, as the number of connections and volume of consumption are limited.

(4) Deterioration of water quality of water source

The deterioration of the water quality of the Kelani River is a serious problem. The Ministry of Environment has appointed a committee to carry out periodical monitoring of the water quality of the Kelani River and facilitate responsible local authorities in conducting on-site investigations of discharges of polluted water from factories and illegal connections to sewerages.

2.4.3. Land acquisition and resettlement

Two unauthorized houses beside the Kelani River were relocated at the time of construction of the gravity transmission mains. The relocation was conducted lawfully by the local authority in the area. No issues arose due to the affected people. Land acquisition was carried out in accordance with the Land Acquisition Act of Sri Lanka to obtain land for construction of the distribution facility. There were no houses or establishments on the acquired land, and appropriate compensatory payment was made to the land owner.

2.5. Sustainability (Rating: a)

No major problem has been observed in the capacity neither of the executing agency nor its operation and maintenance system, therefore sustainability of the project is high.

2.5.1. Executing agency

(1) Structural aspects of operation and maintenance

The Ambatale Production Unit of NWSDB under the Deputy Manager of Western Province is in charge of water treatment and transmission. Distribution is undertaken by each OIC office

and Area Engineer's Office of NWSDB. The manager of Towns North of Colombo Manager's Office has the overall responsibility for distribution. Around 200 staff in total are engaged in O&M work for the target area, including treatment, transmission and distribution of water. There are no particular issues with regard to institutional aspects of O&M. Responsibilities of the above-mentioned production unit and offices for distribution are clearly defined, and the organizational structure for O&M is well established.

(2) Technical aspects of operation and sustainability

Two posts for mechanics and one post for an electrician were not fulfilled at the Ambatale Production Unit. NWSDB is going to fill these posts very soon. Posts for technical staff necessary for O&M work were filled at the offices in charge of distribution, such as OIC offices, Area Engineer's Office and Manager's Office of Towns North of Colombo. NWSDB considers that the technical level of their staff is adequate, and there have been no problems in this regard. The pumps installed in the Ambatale treatment plant were the biggest pumps NWSDB had ever used. The project conducted a training course on operation of these pumps as a part of consulting services. Currently, staff members of NWSDB are operating the pumps without any problem.

(3) Financial aspects of operation and sustainability

(a) Cost of O&M and financial revenue generated by payment of service charges

As Table 4 shows, in the target area, the cost of O&M is covered by financial revenue generated by the payment of service charges. It is expected that the financial situation will be further improved by the tariff revision introduced in 2009 and the increase of new connections from 2010 onward.

According to the consumer survey, 81% of the respondents said they pay their monthly water bills regularly. The rest of the respondents (19%) said that they pay the accumulated charge once every two or three months, mainly because they said the amount of monthly bills is too small. There were no respondents who did not pay the bills. Accordingly, it appears that the payment of water bills by consumers is proceeding smoothly.

Table 4 O&M cost and income of target area

(Unit: Rs. 1000)

| Year | O&M Cost | | | Income | Difference |
|---|---|---|---|---|---|
| | Production cost | O&M cost | Total | | |
| 2006 | 18,156 | 43,818 | 61,974 | 66,615 | 4,641 |
| 2007 | 21,353 | 64,153 | 85,506 | 92,621 | 7,115 |
| 2008 | 31,978 | 69,878 | 101,856 | 108,627 | 6,771 |

(Source: Documents submitted by NWSDB)

(b) Financial status of NWSDB

The financial status of NWSDB had been improving until 2006. However, in 2007, the financial status, such as operating profit, net profit and assets-operation income ratio, suffered a reverse mainly because the cost of inputs, such as electricity, chemicals, fuel and salaries, became extremely high. According to an interview with senior officials of NWSDB, the financial status in 2008, which was not officially revealed, did not show improvement. The Water Sector Development Project, for which an agreement for a Japanese ODA loan was signed in 2007, is assisting the enhancement of the management and financial capacity building of NWSDB.

(c) Increase of water tariff

The water tariff has been increased every three years. Increases realized in 1999, 2002 and 2005 in recent years. However, the tariff was not revised in 2008. In February 2009, NWSDB introduced a new tariff, as the financial status of NWSDB will definitely become more fragile if there is no revision of the tariff.

(d) Non-Revenue Water Ratio

Table 5 shows the Non-Revenue Water (NRW) ratio of Towns North of Colombo, including the target area. The ratio is lower than that for the Colombo Municipal Council area and Greater Colombo, but it needs improvement. NRW ratios were worsened in 2006 and 2007 because there was a temporary loss of water at the time of the pipe-laying work and the connection of the new system to the old system by the project. NWSDB does not measure the NWR ratio only for the target area.

Table 5 Non-Revenue Water (NRW) Ratio for Towns North of Colombo

(Unit : %)

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|
| NRW | 24.3 | 20.1 | 20.5 | 27.5 | 24.8 | 21.7 |

（Source: Document submitted by NRW unit of NWSDB）

Table 6 shows NRW ratio for Colombo Municipal Council area and for Greater Colombo. They are slightly improving, but they are still very high.

Table 6 Non-Revenue Water Ratio for Colombo City and Greater Colombo

(Unit :%)

| Year | 1997 | 2000 | 2005 | 2007 |
|---|---|---|---|---|
| Colombo Municipal Council area | 57.0 | 53.7 | 51.3 | 52.7 |
| Greater Colombo | 47.0 | 38.7 | 35.9 | 37.84 |

（Source: Document submitted by NWSDB）

The Water Sector Development Project II, for which a Japanese ODA loan agreement was

signed, is going to assist NWSDB in improving the NRW ratios by implementing civil construction in the city. A technical cooperation project of JICA for the improvement of the NRW ratios will be implemented from late 2009 onwards for a period of three years.

2.5.2. Current status of operation and maintenance

(1) O&M for distribution facility

At present, the distribution of water is conducted by gravity as the number of connections is still limited. Therefore, the pumps installed at the distribution centers are not operated, and O&M for electrical and mechanical parts has not been necessary. The reservoirs constructed by the project were also not used for the same reason as mentioned above.

The Area Manager's offices and OIC offices are conducting the following O&M work based on public complaints: observation of meter readers and analysis of bills, leakage repairs of pipe lines and water meters, replacement of water meters and investigation and disconnection of illegal connections. The offices are conducting disconnection programmes once every three months to encourage consumers to pay their bills regularly. Under the programme, consumers are given notice to settle their bills immediately to avoid disconnection. Water Towers are operated by care-takers. The main task of the operator is to operate valves to avoid overflowing of water. Towers are cleaned around once every three months.

(2) O&M conducted at water treatment plant

Preventive maintenance of the pumps is carried out at the Ambatale water treatment plant in accordance with the planned schedule.

(3) Usage of vehicles for O&M procured by the project

All the vehicles provided by the project for O&M activities are utilized well by staff of NWSDB at the Manager's office of Towns North of Colombo, Ambatale Water Treatment Plant and Head Office.

(4) Water leakage at water pipe bridges

Leakages were found in the water pipe bridge at the time of sudden and frequent power failures. As a result of the study conducted by the consultant team and NWSDB, it was found that the flywheels fitted to new pumps were not able to fully counteract high upsurge pressures and that the 90-degree dimensional pipe configurations adopted at the crossings had less endurance to the pressure.

NWSDB repaired the pipe joints and stopped the leakages at the crossings. Two pressure vessels were fabricated and installed at a location 70 meters downstream from the pump house to supplement the function of existing flywheels and enhance endurance to the upsurge pressures at the time of power failures. NWSDB believes that the leakages will be completely stopped once the pressure vessels are commissioned by the middle of May 2009.

(5) Conversion of the pumps installed at Ambatale Water Treatment Plant and gravity

transmission mains from Ambatale to Church Hill

Treated water will be supplied to the target area of the project mainly from the Kelani River Right Bank Water Treatment Plant once it is completed. NWSDB is working out a plan for future usage of the two pumps installed at the Ambatale Water Treatment Plant and the transmission mains from Ambatale to Church Hill. There is an idea to use the pumps to enhance water supply to the Greater Colombo area under the Greater Colombo Water Supply Improvement project, which is one of the components of the Water Sector Development Project currently being implemented with the financial support of an ODA loan from Japan. There is an idea to use a part of the transmission mains from Ambatale to Church Hill to transmit water from the Kelani River Right Bank Water Treatment Plant to the Church Hill Reservoir and the rest of them to transmit water from the Kelani River Right Bank Water Treatment Plant to the Ambatale Water Treatment Plant for water supply to the Colombo City area. NWSDB has to study technical viability of these ideas in due course.

<Reference> Level of satisfaction of consumers to water supply services

Figure 4 shows the result of the consumer survey on the level of satisfaction of consumers to water supply services. The survey showed that 16% and 22% of the respondents wished to have improvement in water pressure and service hours respectively. A considerable number of consumers expressed their concern about the new tariff system introduced just a few weeks prior to the time of the survey. The levels of satisfaction regarding other factors, such as water quality, behavior and attitude of meter readers, convenience in bill payment and response to complaints, were generally high.

(Unit: %)

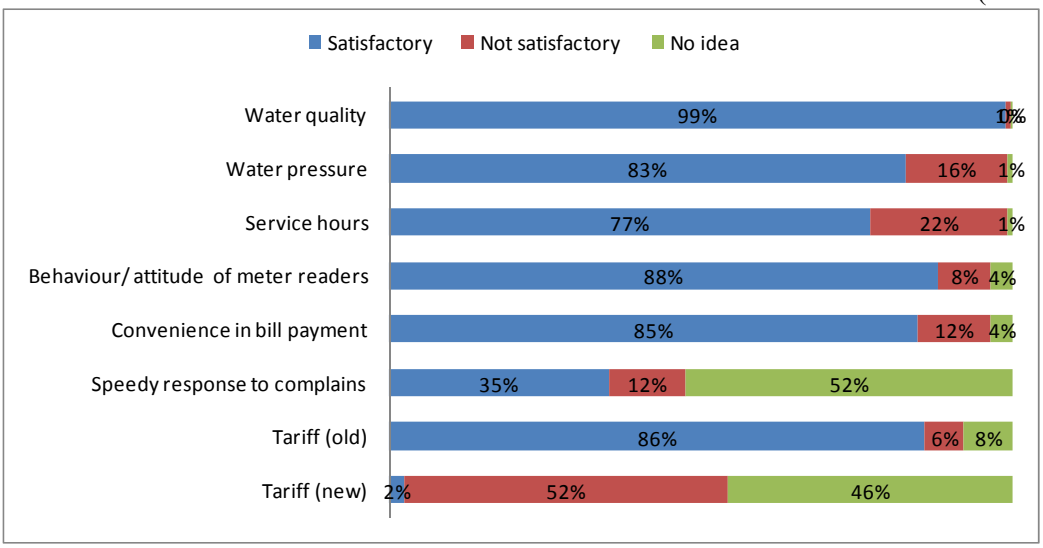


Figure 4 Satisfaction with the services of NWSDB

(Source: Consumer survey)

## 3. Conclusion, lessons learned and recommendations

3.1. Conclusion

Although the effectiveness and the efficiency of the project were moderate, the relevance and the sustainability of the project were high. In light of the above, this project is evaluated to be satisfactory.

3.2. Lessons learned

- Some expected effects of the project were not produced, as several projects, which were planned to be implemented in parallel to the project, especially construction of the water treatment plants, were delayed. It is crucial in water supply projects to implement integrated efforts as scheduled, including projects for the development of water sources, water treatment, transmission and distribution, in order to meet increasing demand.
- A review of planned target figures or achievement forecasts could be made by the conducting of a mid-term review of the project, in case important assumptions or external conditions of the project were drastically changed during the period of project implementation due to delays of other projects and other factors.

3.3 Recommendations

- It is recommended that the effects and impacts of the project and status of usage of the facility constructed by the project should be studied after completion of the Kelani River Right Bank Water Treatment Plant and the phase II of Towns North of Colombo Water Supply Project[4], when effects of the project will be fully realized.
- It is recommended that the improvement of the financial status of NWSDB and the NRW ratios also should be confirmed by continuous monitoring in the future as well, even though several measures have already been taken.

[4] Signed in 2007 as one of the components of the Water Sector Development Project, which is financed by a Japanese ODA loan.

## Comparison of original and actual project scope

| Item | Original | Actual |
|---|---|---|
| (1) Output | **<Civil construction>**<br>(Plan after the project scope change)<br>Transmission facility<br>(a) Pump<br>(b) Clear water storage<br>(c) Transmission main pipeline<br>(d) Ground reservoir<br>(e) Gravity transmission pipeline<br>Distribution facility<br>(a) Welisara (tower and distribution network)<br>(b) Kandana (tower and distribution network)<br>(c) Ragama (reservoir, tower, pump and distribution network)<br>(d) Ja-Ela (reservoir and distribution network)<br>(e) Mahara (no plan)<br><br>**<Procurement of O&M equipment>**<br>Procurement of vehicles<br>**<Consulting Services>**<br>Foreign: 91MM, local: 190MM<br>(a) Review of F/S<br>(b) Detailed design<br>(c) Supervision of construction<br>(d) Training | **<Civil construction>**<br><br>Transmission facility<br>(a) Pump<br>(b) Clear water storage<br>(c) Transmission main pipeline<br>(d) Ground reservoir<br>(e) Gravity transmission pipeline<br>Distribution facility<br>(a) Welisara (tower and distribution network)<br>(b) Kandana (tower and distribution network)<br>(c) Ragama (reservoir, tower, pump and distribution network)<br>(d) Ja-Ela (Two reservoirs and distribution network. One of the reservoirs was constructed as an additional works)<br>(e) Mahara (reservoir, tower and distribution network were constructed as additional works)<br>**<Procurement of O&M equipment>**<br>Procurement of vehicles<br>**<Consulting Services>**<br>Foreign: 101.3MM, local: 270MM<br>(a) Review of F/S<br>(b) Detailed design<br>(c) Supervision of construction<br>(d) Training |
| (2) Period | October 1996 – May 2002<br>(68 months) | October 1996 – November 2004<br>(98 months)（144% of plan）<br>Note: additional works were conducted for 24 months from November 2004 onwards.<br>Completion of the project was November 2006. |
| (3) Cost<br>Foreign currency<br>Domestic currency<br><br>Total<br>ODA loan portion<br>Exchange rate | <br>4,679 million yen<br>1,566 million yen<br>(811 million rupees)<br>6,245 million yen<br>5,308 million yen<br>Rs.1.0=¥1.93(as of October 1996) | <br>3,991 million yen<br>2,483 million yen<br>( 2,269 million rupees)<br>6,474 million yen<br>5,122 million yen<br>Rs.1.0=¥1.11 (Average between 1998 and 2007) |