Sri Lanka

Ex-post Evaluation of Japanese Grant Aid Project

"The Project for Improvement of Water Supply System in Matara District"

Junko Miura, Global Link Management

1. Project Description

Project Location

Malimboda Water Treatment Plant
(sedimentation pond)

1.1 Background

The pipe-borne water supply coverage in the project target area (ie. four divisions of Matara District: Matara four gravets, Devinuwara, Dickwella and Malimboda) was lower than that of the national average. When a drought hit the Southern part of Sri Lanka in 2001, water supply interruption continued for four months, which affected the basic living environment of local residents. In addition, increasing water demand along with increasing population growth and high Non Revenue Water (NRW) ratio [23] (approximately 40%) created water insufficiency, which resulted in water supply interruption in the project target area[24].

National Water Supply and Drainage Board (NWS&DB), the implementing agency of this project, made the best efforts to cover the area with the existing water plant and pipes, but the development of water sources could not meet the increasing water demand. Furthermore, the local residents depended on ground water for water sources due to the lack of access to pipe-borne water. A number of residents did not possess their own wells, thus mainly women and children had to fetch water from neighboring wells. Shallow wells in inland had water quality problem, which was causing the risk of water-borne diseases such as dysentery. The shallow wells were easy to dry up in the dry season, which also prevented the stable water supply. Under this situation, the expansion of the water supply area was urgently needed.

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[23] Non revenue water (NRW) ratio is the ratio of the water that has been lost before it reaches the customer against the water that has been produced. The typical causes include water leakage due to over-aged distribution pipes, illegal connections to pipes, etc. In Osaka City, the NRW ratio is approximately 7%.

[24] As of 2003, pipe-borne water was supplied for 12-20 hours/day in the city area and for 4-6 hours/day in two days in the rural area.

1.2 Project Outline

The objective of this project is to provide a satisfactory pipe-borne water supply facility to the population in four divisions of the Matara District (i.e. Matara four gravets, Devinuwara, Dickwella and Malimboda)[25] by augmenting the existing intake facility and water treatment plant, constructing a new reservoir and laying additional transmission/distribution pipes. The location of the project site and the project summary are shown in Figure 1 and Table 1.

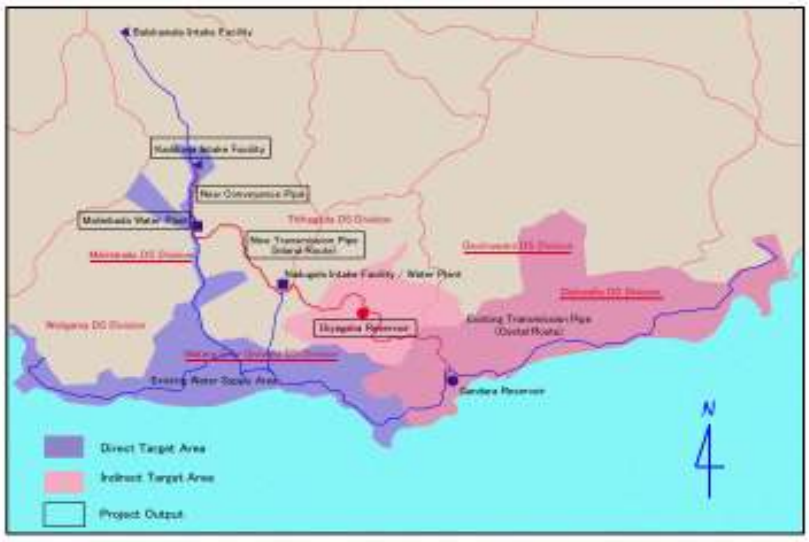

Figure 1- Location of Project Site

Table 1- Project Summary

Grant Limit/ Actual Grant Amount	1,498 million yen / 1,465 million yen
Date of Exchange of Notes	August, 2003
Implementing Agency	National Water Supply and Drainage Board (NWS&DB)
Project Completion Date	February, 2006
Main Contractors	Consortium of Taisei Corporation and Hitachi Plant Engineering & Construction Co. Ltd.
Main Consultant	NJS Consultants Co., Ltd.
Basic Design	Basic Design Report of the Project for Improvement of Water Supply System in Matara District was prepared by NJS Consultants Co. Ltd. From July, 2002 to March, 2003
Detailed Design	From August, 2003 to December, 2003
Related Projects	(1) Galle District and Matara District Water Supply Feasibility Study by JETRO in the year 2001. (2) Training related to various aspects of water supply sector has been provided by JICA during the past few years. It should be mentioned that a NWS&DB official who participated in the "Water Supply

[25] Direct target areas (new water supply area) include Diyagaha area (inland), Gandara Reservoir and its eastern side (coast). Indirect target areas (existing water supply area) include the western area of Gandara Reservoir (coast).

	Maintenance" training program sponsored by JICA from October to December 2003 was appointed to function as the Project Director of this project subsequent to his training.

2. Outline of the Evaluation Study

2.1 External Evaluator

Junko Miura, Global Link Management Inc.

2.2 Duration of the Evaluation Study

Duration of the Study: From November, 2009 to September, 2010.

Duration of the Field Study: From 7th March, 2010 to 13th March, 2010 and

From 9th May, 2010 to 15th May, 2010.

2.3 Constraints during the Evaluation Study

No particular constraint was identified.

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

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Policy of Sri Lanka

At the time of planning, it was noted that the Poverty Reduction Strategy Paper (PRSP) "Regaining Sri Lanka" (2002-2007)" developed by the Government of Sri Lanka had highlighted the importance of access to safe water and sanitation as one of the priority items in its agenda. When NWS&DB prepared its Corporate Plan (1999-2005) in the year 1998, it targeted to increase the water supply coverage to 79% by the year 2005 against the coverage of 65% (28% by pipe borne and 37% by traditional wells) prevailed at that time.

At the time of the planning, it was noted that the National Development Plan (*Mahinda Chintana*) (2006-2016) emphasized the importance of improving the access to safe water and sanitation. The Sector Plan for Drinking Water Supply for Sri Lanka (2005-2015) was formulated by the Ministry of Housing and Plantation Infrastructure and NWS&DB in the year 2003 aiming at the numerical targets given in the Table 2.

Table 2 - Targets in the Sector Plan for Drinking Water Supply

(Unit: percent)

Year	2005	2015	2025
Water supply coverage (National)	76	89	100
Water supply coverage (Matara District)	76	84	100

Source: Sector Plan for Drinking Water Supply for Sri Lanka (2005-2015)

The National Policy on Drinking Water, the first national policy on drinking water in Sri Lanka, was formulated in the year 2009. This policy out-lined to achieve safe drinking water coverage to 100% by the year 2025. NWS&DB Corporate Plan (2007-2011) targeted to increase the pipe-borne water supply coverage to 40% by the year 2011.

3.1.2 Relevance with Development Needs of Sri Lanka

At the time of planning, NWS&DB's Matara District Water Supply Development Program (2001) planned to increase the pipe borne water supply coverage to 100% in Matara District by the year 2025. Out of the fifteen planned schemes, the Matara Integrated Scheme which included the project target area was given the top priority considering the criterion[26] given under foot note. The above scheme was also the top priority at the time of ex-post evaluation.

3.1.3 Relevance with Japan's ODA policy

At the time of planning, one of the top priorities of the Japan's ODA policy towards Sri Lanka (1999) was to upgrade economic infrastructure[27]. Assistance for water sector was included in this priority area. When some officials of the NWS&DB were interviewed, it was realized that the high standard of safety control and good time management could be identified as some reasons for the comparative advantage of Japanese assistance over the other donors in the water sector in Sri Lanka.

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

3.2 Efficiency (Rating: a)[28]

3.2.1 Project Outputs

All facilities in Japanese side were constructed almost as planned. The output of the project is shown in Table 3. The length of the transmission pipes was slightly reduced because the pipe near Diyagaha Reservoir was laid as straight as possible[29]. The length of the distribution pipes was slightly extended in response to the new water demand in

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26 Population density, water sources, prevalence rate of water-borne diseases, future development plans such as roads and commercial facilities, estimated investment amount, payment capacity of beneficiaries, etc.

27 The six priority areas include the followings: upgrade of infrastructure, mine and industry development, agricultural, forestry and marine development, human resource development, improvement of health and medical system, and environment.

28 Rating is made only for the Japanese side.

29 It was originally planned that the transmission pipe would be installed along with the access road to the Diyagaha Reservoir.

Thalalla area and Kapugama area, which are hilly area in Devinuwara Division[30].

Table 3 Output (planned and actual)

Items	Planned	Actual
Kadduwa water intake facilities	Intake capacity to be augmented by: 15,750 ㎥/day Note	As planned
Raw water transmission facilities	Total length: approximately 3km	Almost as planned 2.8km (-0.2km)
Malimboda water treatment plant facilities	Treatment capacity to be augmented by: 15,000 ㎥/day (Total of 45,000 ㎥/day including the existing facility)	As planned
Treated water transmission facilities	Total length: approximately 21.3km	Almost as planned 20.5km (-0.8km)
Diyagaha reservoir	1,080 ㎥	As planned
Water distribution facilities	Total length: approximately 23km	Almost as planned 24km (+1km)

Note: The nominal water intake capacity after the project completion at Kadduwa Intake was planned to be doubled from the existing intake capacity of 15,750 ㎥/day. The water conveyed to Malimbada water treatment plant including the water from Balakawila Intake was planned to increase from 31,500 ㎥/day to 47,250 ㎥/day. Source: Basic Design Report (2003).

Kadduwa Intake Channel (Left: Existing, Right: New)

Malimboda Distribution Chamber

Malimboda Filtration Pond

3.2.2 Input

3.2.2.1 Project cost

The Japanese Grant ceiling amount at ex-ante was 1,498 million yen and local funds equivalent to 122 million yen was to be provided by the Government of Sri Lanka (GOSL) as counter part funds. However, the actual cost was 1,465 million yen from the Japanese Grant and local funds equivalent to 488 million yen from the GOSL. The Japanese Grant component was lower than the planned (97% of the planned cost) whereas the GOSL component was increased compared to its planned cost.

3.2.2.2 Project period

The planned project period was 27 months[31] whereas the actual project period was 31

[30] It was not originally planned to provide individual connections for approximately two hundred households including the households which relocated from the coastal area due to the Indian Ocean Tsunami in 2004. However, distribution pipe was extended to meet the urgent needs of these households.

[31] Including detailed design.

months. This project was implemented from August, 2003 (i.e. the commencement of detailed design) to February, 2006 (i.e .the commencement of operation). There was a delay of 4 months which is about 115% of the planned period. The reasons for this delay were unavoidable and beyond the control of project management. Those reasons could be listed as follows.

1) As directed by the Road Development Authority, design and construction technique of bridge crossings had to be revised. This has delayed the civil construction works by 3 months.
2) Because of the presence of hard rock along the transmission and distribution pipe routes it was required to use crushers to get rid of hard rock to facilitate pipe laying. This condition was not anticipated during the design stage. This has caused a delay in 3 months in completing civil works.
3) Ductile Iron (DI) pipe shipment from China was delayed by 3 months due to a typhoon occurred during this period. These DI pipes were to be laid as transmission and distribution mains.
4) Because of the *Tsunami* in Indian Ocean in December 2004, pipe laying work was suspended for a period of 1 month[32].
5) There was a month delay in laying of distribution mains along the roads in coastal areas which were badly affected due to Tsunami.

Although the project period was slightly longer than the planned, all reasons for the above delay were external factors such as natural disasters. However the project cost was within the plan; therefore, the efficiency of the project is high.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative effects

3.3.1.1 Operational Indicators set by the ex-ante evaluation

(1) Production Capacity and Maximum/Average Water Quantities Produced at the Malimboda Water Treatment Plant

The production capacity and maximum/average water quantities produced at the Malimboda Water Treatment Plant are shown in Table 4. Upon completion of this project, the water production capacity was increased by 15,000 ㎥/day as planned. At the time of ex-post evaluation, the maximum facility utilization rate of the augmented water

[32] Right after the *Tsunami*, it was difficult to secure the sufficient number of labor at reasonable cost because the labor cost drastically increased due to enormous reconstruction work in Sri Lanka. Required equipment for repairing roads was provided for a month to the Department of Roads for free of charge based on the agreement between NWS&DB and JICA.

treatment plant was 87% and the average facility utilization rate[33] was 79%. The above figures are appeared to be relatively low when pipe-borne coverage in this area is taken into account. According to the NWS&DB, the water demand was decreased partly because consumers started to save water after the revision of water tariff in February, 2009. According to the past experiences, this decrease in demand for pipe-borne water is a temporary phenomenon and it is expected to increase with time.

Table 4 - Water Supply Capacity of the Malimboda Treatment Plant

Indicators (unit)	2003(Baseline)	2010 (Ex-post evaluation)
	Existing facility	Total of existing and augmented facility
Water supply capacity (㎥/day)	30,000	45,000 (+15,000)
Maximum water supply amount (㎥/day)	31,800	39,100
Maximum facility utilization rate (%)	106	87
Average water supply amount (㎥/day)	NA	35,700
Average facility utilization rate (%)	NA	79

Source: The baseline data of the water supply capacity for 2003 is from JICA document, and baseline data of the maximum water supply amount is from the ex-ante evaluation summary. The actual data for 2010 is from NWS&DB Matara Office.

(2) Population Served and Average Water Consumption per Person

Table 5 illustrates the Baseline, Target and Actual figures of the population served and average water consumption per person. The population served as at 2009 was 204,834 persons, which exceeded the target set for 2009 (199,416 persons) under this project. Meanwhile, the average water consumption per person in the year 2009 (120ℓ/day) remained at a level similar to that in the baseline year of 2003 (122ℓ/day), which was below the target set for the year 2009 (145ℓ/day). According to the NWS&DB, one of the reasons may be that consumers gradually started to save water because of the water conservation awareness campaigns carried out in schools and public institutions in recent years. Another possibility may be the reduction in wastage due to the revision of water tariff in February, 2009. In fact, 130 - 140ℓ/day of average water consumption per person in the year 2008 was reduced to 120 ℓ/day in the year 2009.

Table 5 - Population Served and Average Water Usage per Person in the Project Area (Planned and Actual)

Indicators (Unit)	2003 Baseline		2009 Target		2009 Actual	
	Coast	Inland	Coast	Inland	Coast	Inland
Population served in direct target area (persons)	64,792	0	75,422	14,507	81,895	13,747
Population served in indirect target area (persons)	94,056	NA	109,487	NA	109,192	NA
Total population served	158,848		199,416		204,834	

[33] Average facility utilization rate = average water supply amount ÷ water supply capacity.

(persons)						
Average water usage per person (ℓ/day)	122	NA	145	145	120	120

Source: Baseline in 2003 and the target in 2009 are from the Basic Design Report (2003). The actual number of population served in 2009 was calculated by multiplying 4.2 persons per household (data from the census) and the number of connections(48,770) in the target area in "Performance of Commercial Activities" (January 2010), NWS&DB Matara Office.

Note: Direct target areas include Diyagaha area (inland), Gandara Reservoir and its eastern side (coast). Indirect target areas include the western area of Gandara Reservoir (coast).

(3) Water Supply Hours

Before the project, water supply was restricted to 12-20 hours per day in the urban areas and 4-6 hours once in every two days in the rural areas. According to the interview with the NWSDB officials upon completion of the project, the pipe borne water supply has been for almost 24 hours to most of the consumers in the project target area except in some hilly areas of Devinuwara Division (as described later).

The beneficiary survey results also show this general improvement. In response to the beneficiary survey in water supply hours, 97% of the beneficiaries responded that they were getting almost 24 hours/day un-interrupted water supply whereas about 2% responded that they were getting an interrupted water supply for a duration of 12 to 20 hours/ day and 1% responded that they were getting interrupted water supply for less than six hours. This beneficiary survey was conducted in three divisions: Matara four gravets, Dickwella and Devinuwara[34]. The total number of respondents was 100 (60 households, 20 commercial facilities and 20 public institutions). As this project gives a high priority to the water supply for low-income families in the inland area, the beneficiary survey was conducted in Diyagaha area and in coastal areas of Matara four gravets division separately in order to assess the difference in water supply hours between coastal areas and the inland area,. Figure 2 shows the beneficiary survey results with regard to the comparison of water supply hours before and after the project completion in each area.

34 There are Kadduwa Intake Facility and Malimboda Water Treatment Plant in Malimboda Division and Malimboda Division is included in the project target area. However, the number of direct beneficiaries in the division is less than that of other divisions; the beneficiary survey was not conducted in Malimboda Division.

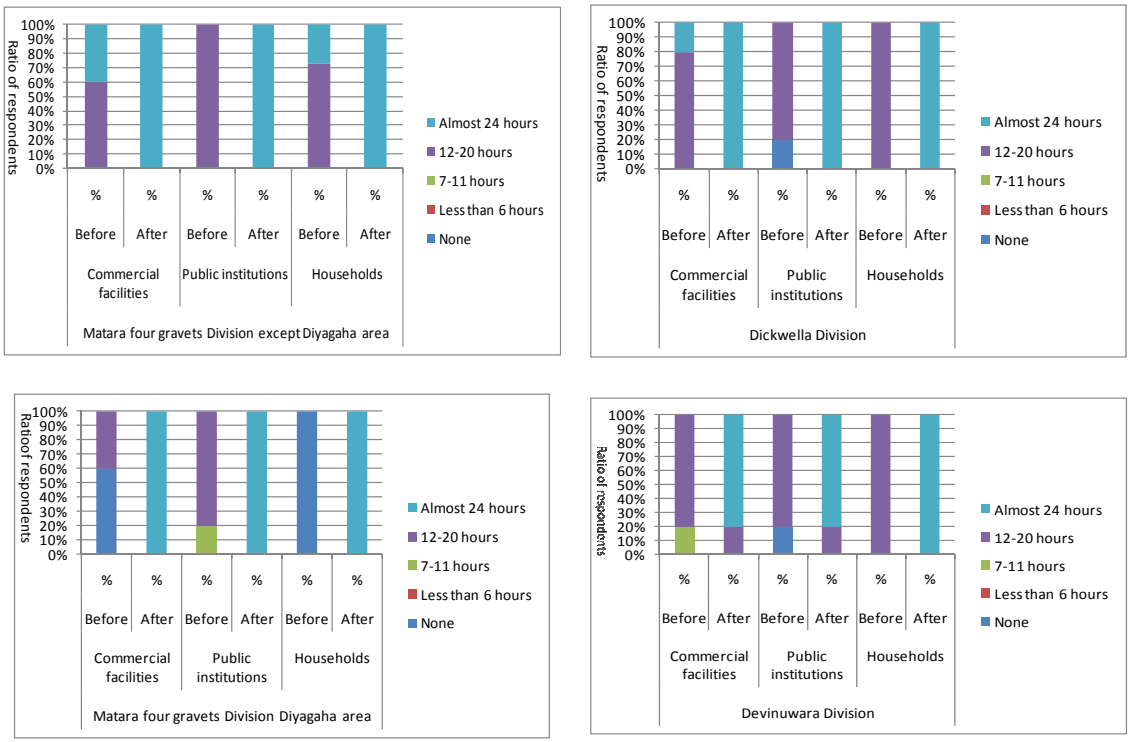

Figure 2 - Water Supply Hours per Day in the Project Target Area

Source: Beneficiary survey

As Figure 2 illustrates, Matara four gravets division (except Diyagaha area) and Dickwella division have the same behavior in respect of water supply hours; most of the beneficiaries had the access to pipe borne supply for about 12 to 20 hours per day before the project and now almost all the beneficiaries have the access for nearly 24 hours. In contrast, majority of the beneficiaries in Diyagaha area of Matara four gravets division had no access (including twice a day) to pipe-borne supply and some beneficiaries had the access for supply between 7 to 12 hours before the project. However, after completion of the project almost all the beneficiaries have the access for nearly 24 hours. In Devinuwara Division, many beneficiaries had the access to pipe-borne water supply between 12 to 20 hours per day and some had the access between 7 to11 hours before the project. Now most of the beneficiaries have the access for nearly 24 hours while a few beneficiaries have the access for about 12 to 20 hours. Some beneficiaries in Devinuwara division quoted that insufficient water pressure[35] in the distribution system in Thalalla area and Kapugama area during peak hours (5-7 am, 12-1pm and 6-7pm) as the reason for their interrupted water supply even after the project completion.

According to the NWS&DB, possible reason for insufficient water pressure in the area may be that it was difficult to respond to the unexpected rise in water demand. As a result

35 Approximately 0.003MPa. (This is equivalent to 0.31m of hydraulic head. In Japan, the water pressure at faucet is between 0.1 and 0.2 MPa.)

of housing projects in the area by local donors and NGOs for displaced residents after the *Tsunami* in 2004, the number of residents in the area was increased. Although this project extended the length of distribution pipes by 1km from the plan, the distribution system of smaller diameter pipes laid in the area does not have the capacity to cater the new water demand.

3.3.1.2 Other Indicators

Non Revenue Water (NRW) of Matara District sharply decreased from 40% in the year 2003[36] to 21% in the year 2009[37]. This figure is far below the NRW of 55% in Colombo City and that of the national average of 33% in the year 2009. The leakage component in the NRW also decreased from 28% in the year 2007 to 18% in the year 2008. Recently, the NWS&DB has carried-out non revenue water reduction activities such as leakage repairs, replacement of defective water meters and obsolete distribution pipes, detection of illegal connections, improvement in billing, and replacing public stand posts with individual connections etc. in achieving this end.

3.3.2 Qualitative Effects

3.3.2.1 Water Quality

The basic water quality parameters are monitored in the treatment plant laboratory everyday and 32 chemical parameters[38] are checked twice a year. Monitoring results of water quality at the plant as at March 2010 and the national standards of some quality parameters are shown in Table 6. The quality of treated water at the treatment plant fulfills the national standards in respect of these important parameters and thus it implies the adequacy of the treatment process to produce drinking water.

Table 6 Monitoring Results of Water Quality at Malimboda Water Treatment Plant

Item	National standard (614-1983)	Existing facility (2003)		Both existing and expanded facility (2009 Average)	
		before treatment	after treatment	before treatment	after treatment
Ph	6.5-9.0	6.3	6.9	NA	7.1
Turbidity (NTU)	<8.0	2.0	<5.0	NA	1.0
Color	5.0-30.0	9.0	<1.0	NA	5.0
Coli form count（CFU/100mL)	Nil	Nil	Nil	NA	Nil

Source: The figures for the existing facility (2003) are from the Basic Design Study Report (2003). The figures for the existing and expanded facility (2010) are from the water quality report, NWS&DB, Matara

36 Basic Design Report (2003).

37 The average of NRW in 2009 was calculated based on the monthly NRW of 2009. "Performance of Commercial Activities" (January 2010).

38 4 items for physical quality (color, smell, taste, etc), 20 items for chemical quality (pH, N, Ca, etc), 2 items for bacteriological quality (coliform bacteria), and 6 items for toxic substance (As, Pb, Hg, etc).

Office (analyzed by the NWS&DB Southern Regional Laboratory).

According to the random sampling done by the Matara District Water Quality Monitoring Committee (established in the year 2009), which is conducted twice a year, quality of water in the distribution network in Devinuwara Division fulfills the national standard requirements[39]. Moreover, from the beneficiary survey results, it was noted that all the respondents were satisfied with the improvement of water quality in respect of taste and odor.

Treatment plant laboratory

Chlorine injector

3.3.2.2 Water Pressure

According to the NWS&DB officials, the residual water pressure at receiving points in the project target area was between 0.03 and 0.06MPa (which is equivalent to hydraulic head of 3-6 meters). According to the beneficiary survey results, the improvement in water pressure was felt by all the participants, and the sufficiency in water pressure was also felt by almost all the participants. Although there were many complaints about water pressure in the eastern coastal area (Dickwella Division) before the project completion, now there are no more complaints. However, as mentioned above, NWS&DB still receives complaints about water pressure from the consumers who are living in hilly areas of Devinuwara Division.

Although water quantity and pressure in the distribution network are not up to expectation during peak hours in some areas, this project has largely achieved its objectives: stable supply of safe water (improvement in water quantity, population served, water supply hour, water quality and water pressure), and the facility utilization rate is high, therefore its effectiveness is high.

[39] Source: Regional Director of Health Service (RDHS), Matara District.

3.4 Impact

3.4.1 Intended Impacts

It could be concluded that the project has contributed effectively to the following three aspects directly as planned: 1) the reduction in cases of water-borne diseases; 2) the reduction in time spent for fetching of water by women and children; and 3) supply of water to the low income households in inland areas.

3.4.1.1 Reduction in cases of water-borne diseases

The number of dysentery and typhoid cases in the project target area has been decreased compared to the pre-2001 era. The numbers of dysentery and typhoid cases in the four divisions are shown in Figure 3. According to the public health inspector of the office of Regional Director of Health Service (RDHS) of Matara District, the decline in the cases is attributed not only due to the consumption of pipe-borne water but also due to the access to latrines, improvement of food hygiene and public health campaigns to create awareness of hygienic practices. However, it was noted that most cases were found in the areas where pipe-borne water was not available. Thus, the supply of potable water by the project facility is considered to be partially contributed towards reducing the cases of water-borne diseases.

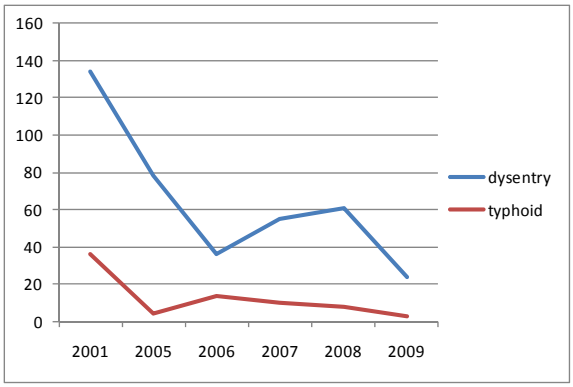

Figure 3 - Number of Dysentery and Typhoid Cases in the Project Target Area (unit: persons)

Source: Regional Director of Health Service (RDHS), Matara District

3.4.1.2 Reduction in time spent for fetching of water by women and children

According to the beneficiary survey, since the year 2006 all 18 households have been using only pipe-borne water although 15 of them were using traditional wells and other 3 households were using traditional wells and pipe-borne water both for their consumption before. This has resulted in saving their time for fetching water. As women and children were mainly responsible for water fetching[40], it can be concluded that now women and children have more time to concentrate on other productive activities after the project completion. According to the interview with a female beneficiary in the project target area, she now spends more time in reading books and watching TV than earlier as she no

[40] Out of 15 household samples, which depended only on wells, 20 mothers, 12 children and 3 fathers (plural choice) used to go for water fetching.

longer goes for fetching water.

3.4.1.3 Impact of Public Stand Posts on the Low Income Households in Inland

By the time of ex-post evaluation, most of the public stand posts installed by the project had been replaced by individual connections[41] and thus the impact of public stand posts on the low income households in inland could not be identified. However, according to the interview held with a beneficiary in Diyagaha area in Matara four gravets Division, who obtained his water requirements from a traditional well, public stand post and then from an individual connection, appreciated the service level of pipe-borne water supply and time saving in obtaining their water requirements. He has stopped boiling water when he started to make use of the public stand post and individual connection.

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

No major problem has been observed regarding the impacts on the environment. Disposal of waste water and sludge have been properly arranged. However, it seems that the ground water intrusion into the joints of the reinforced concrete (RC) slabs of sludge drying beds prevents sludge being dried[42]. As a consequence, it overflows and intrudes the surrounding paddy fields during the rainy season (from April to October) thus resulting in receiving complaints from farmers. According to the officials of Manager (O&M) Office in Matara District (hereinafter referred to as Matara Office), the cost to be incurred in repairing this defective sludge lagoon is not within their annual O&M budget and thus they have not been able to repair it yet. There is an urgent need for NWS&DB to respond to this defect.

Upon the completion of the project, salinity intrusion which had affected the water intake earlier has not been observed in Kadduwa Intake Facility recently.

3.4.2.2 Land Acquisition and Resettlement

With regard to land acquisitions, to an extent of 0.97 ha lands were acquired from 13 owners and the compensation was made appropriately in line with the government's regulations. The acquired land was either farmland or wasteland and thus there was no resettlement issue.

3.4.2.3 Impacts on Households and Economic Activities

Between the year 2006 and the year 2009, 98% of water from the Malimboda Water Treatment Plant (including the project facility) was used for households and 2% for

41 37 out of 43 public stands were replaced by individual connections as of March 2010.

42 This defect was not detected at the inspection in March 2007.

commercial institutions. Therefore, it was considered that the project had mainly contributed to the improvement of living standards of households. The beneficiary survey results of households and commercial institutions are shown in Figure 4 and Figure 5.

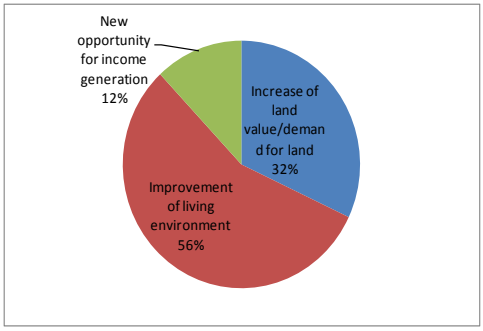

Figure 4 - Beneficiary survey result, benefit by the water supply (N=60 households)

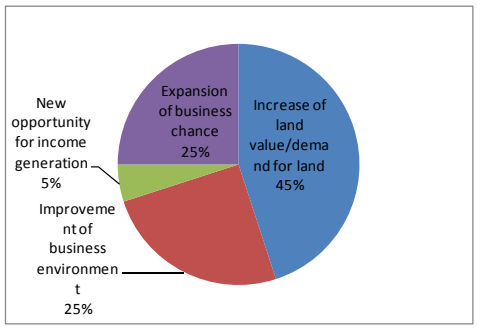

Figure 5 - Beneficiary survey result, benefit by the water supply (N=20 commercial facilities)

Source: Beneficiary survey

According to the beneficiary survey carried-out for households, improvement in living standards (56%), increase in value/ demand for lands (32%) and new opportunities for income generation (12%) were identified as economic impacts of the provision of pipe-borne facility under this project. In addition to the anticipated impacts such as reduction in the cases of water-borne diseases and time saving in fetching for water, the project had possibly contributed to improve the living standards and to create opportunities for income generation. Time saving in fetching for water would have brought income generation opportunities for the households.

According to the beneficiary survey carried-out for commercial institutions, increase in value/ demand for lands (45%), improvement in business environment (25%), expansion in business activities (25%) and new opportunities for income generation (5%) were identified as impacts on economic activities of the provision of pipe-borne facility under this project. In light of the above, this project had contributed not only to the expectations of the project as described earlier but also beyond such expectations. During implementation of the project, larger diameter pipes were laid in Kekanadura area in the Devinuwara division anticipating that this area would be developed as a residential and commercial centre in future. At the time of ex-post evaluation, this was evident as expected. This suggests a possible contribution from the pipe-borne facility of this project towards the economic development in the area.

One of the beneficiaries in Diyagaha area

Beneficiaries in Diyagaha area

Kekanadura area, Devinuwara Division

In light of the above, it could be noted that in addition to the anticipated impacts (ie. reduction in the cases of water-borne diseases, time saving in fetching for water and the pipe-borne facility in inland), the project had contributed to improve the living standards / business environment, to create opportunities for income generation and to increase in value of lands in the project area. No particular negative effects were observed.

3.5 Sustainability (Rating: a)

3.5.1Structual Aspects of Operation and Maintenance

The division of responsibility of the organizational hierarchy is clear and the number of O&M staff was increased upon the project completion. No major problems have been identified in the operation and maintenance system. At the time of ex-post evaluation, Matara Office under the supervision of the Regional Support Center Southern (RSC-S) is responsible for the operation and maintenance of the augmented facilities by the project. The number of staff of RSC-S and Matara Office is shown in the table below.

Table 7 Number of Staff of RSC-S and Matara Office (unit: persons)

	RSC-S	Matara Office	
		Matara Office	O&M Staff
2003	112	323	174
2009	110	361 Note	190

Source: NWS&DB, Matara Office

Note: Including 72 office staff.

From the year 2003 to the year 2009, the number of personnel in Matara Office was increased by 38 and that of O&M staff increased by 16 which were sufficient to operate and maintain the augmented facility[43].

[43] Meanwhile, the number of Matara O&M staff (including office staff up to manager level) per thousand

3.5.2 Technical Aspects of Operation and Maintenance

Technical capacity and capability to handle operation and maintenance can be considered to be satisfactory due to the following reasons:

1) the water treatment process of the augmented facility is the same as the treatment process of the existing facility;
2) sufficient number of personnel with appropriate level of skills are allocated for the operation and maintenance of the augmented facility;
3) a wide range of tailor-made training courses have been provided inside and outside the NWS&DB[44] in accordance with the annual training plan; and
4) required operation and maintenance manuals for the augmented water treatment plant have been provided;

Cadre of the skilled technical staff in Matara District by category-wise and the number of Training Courses available are shown in Table 8 and Table 9.

Table 8 Number of Skilled Technical Staff for the Water Supply in Matara District

(unit: persons)

Cadre	Engineers	Engineering Assistants	Chemist	Plant operators (Technicians)	Plant operators (Mechanics)	Total
Number	3	29	1	3	46	82

Source: NWS&DB, Matara Office, 2009

Table 9 Number of Available Training Courses (unit: number of courses)

	Courses	Number of courses
Internal	Technical courses	23
	Non-technical courses	22
	Computer courses	11
External		31

Source: Annual Training Program 2010, NWS&DB

As described in 3.5.4, the two inlet flow meters to the treatment plant indicate lower values than those of outlet flow meters. JICA Advisor to the NWS&DB is of the view that if the inlet flow-meters are functioning, those may not been broken, but there is a possibility that the calibration of the electromagnetic flow meters would not have been carried out properly. The O&M staff in Matara Office would not have used the same type of flow meters earlier. According to the O&M staff, although there was general guidance

connections decreased from 10 to 5.8 persons (current target: 5.5 persons) in the same period, which demonstrates the improvement of efficiency in organizational arrangement.

44 Internal training is conducted at NWS&DB Training Center in Colombo and the water plant. External training is conducted at universities and other institutions.

about the equipment by the supplier at the time of hand-over, they have not acquired sufficient skills for calibration of the electromagnetic flow-meters. Training component including the above skill was not included as a part of scope of work in the project.

3.5.3Financial Aspects of Operation and Maintenance

(1) Cash Flow Status of NWS&DB Matara Office

Cash flow statement of the NWS &DB Matara Office for the period from 2002 to 2009 is shown in Table 10.

Table 10 - Cash Flow of NWS&DB Matara Office (Unit: thousand rupee)

Item		2002	2007	2008	2009
Income	Water billing	47,448	188,223	206,411	295,400
	New connection	13,155	41,787	47,756	29,408
	Other revenue	3,757	106,382	37,834	43,754
	Total income	64,360	246,392	292,001	368,562
Expenditure	Salaries	33,254	161,011	182,796	194,781
	Utility	28,292	88,985	122,463	113,338
	Chemicals	2,706	8,823	12,841	10,635
	Meter	5,273	22,612	40,505	27,273
	Repair and Maintenance	2,466	7,163	4,279	18,668
	Others	2,763	18,321	18,181	31,289
	Total expenditure	74,754	307,015	381,165	395,984
Surplus/Deficit		-10,394	-60,623	-89,164	-27,422

Source: National Water Supply and Drainage Board, Matara Office

The surpluses from operating activities of NWS&DB Matara Office were decreased in the year 2007 and the year 2008 due to the increase in operating expenses such as salaries, utilities and chemicals. However, it was improved in the year 2009 because of the revenue increase as a result of tariff revision and the continuous effort for NRW reduction. Matara integrated scheme (which mostly overlaps the project target area) coming under the administration of NWS&DB Matara Office made a surplus of Rupees 21 million from its operations for the year 2009. NWS&DB Matara Office is planning to improve its financial situation through implementing NRW reduction programs and reduction of the number of staff per thousand connections.

As shown in Table 10, O&M budget is also increasing steadily.

National tariff enforced by the NWSDB was revised during the years 1999, 2002, 2005 and 2009. These tariff revisions considered to be justifiable due to the following reasons: 1) revenue collection is 98%; 2) discount is applied for low income households through the Samurdhi National Poverty Reduction Program; and 3) most of the participants who took part in the beneficiary survey felt that the tariff is reasonable. According to the

beneficiary survey, 85% (17 samples) of the 20 commercial institutions[45] felt that the water tariff is reasonable whereas 15% (3 commercial facilities) felt unreasonable; 90% (54 samples) of the 60 households[46] felt reasonable whereas 10% (6 households) felt unreasonable.

(2) Financial Status of the NWS&DB

Although the financial status of NWS&DB had been improving until the year 2006, major financial parameters such as surpluses from operating activities and surpluses from ordinary activities have been deteriorating since the year 2007. Currently, some activities are being implemented for strengthening of financial management under the JICA funded "Water Sector Development Project" in Colombo and Kandy.

3.5.4 Current Status of Operation and Maintenance

In general, operation and maintenance status of the augmented facility under this project is highly satisfactory. Some activities which are carried-out in respect of the operation and maintenance of Malimboda Treatment Plant could be listed as below.

1) Facilities were cleaned and well maintained.
2) Quality and quantity of water produced in the treatment plant are regularly monitored. Consumption of chemicals is recorded daily. Monthly monitoring results are displayed in the office so that the O&M staff understands the trend.
3) Inspection schedule of each unit / facility is displayed so that the O&M staff can easily identify the units / facilities to be inspected.
4) Operation and maintenance data are recorded properly and kept well.
5) All defects of units / facilities reported by the operation staff are recorded in the Job Register to ensure that they are attended to by the maintenance staff.

The two inlet flow meters to the treatment plant indicate lower values than those of outlet flow meters. As described earlier, there is a possibility that the calibration of the electromagnetic flow meters had not been carried-out properly. It is necessary to carry-out calibration of these meters in accordance with the instruction manual which was handed over to the maintenance staff at the time of project completion. It is also recommended to measure water flow by a portable ultrasonic flow meter at regular intervals to ascertain the correctness of the calibrated meters.

As explained earlier, in the sludge lagoon, it seems that ground water intrudes from the

[45] Average water charge per month of 20 samples of commercial facilities: 3,358 rupee
[46] Average water charge per month of 60 household samples: 333 rupee

joints of the RC slabs of sludge drying beds, which prevents sludge being dried. Thus, counter measures are to be undertaken immediately (See recommendation).

In January 2010[47], the motors of intake pumps were frequently tripped due to over -heating[48]. It was noted that this is due to rise in temperature in the intake pump house as a result of poor ventilation. These frequent interruptions affected the production and in turn water supply to the service areas. In order to avoid this situation, NWS&DB improved ventilation in the intake pump house in February 2010 by introducing exhaust fans using own funds. With this modification now no longer frequent interruption to intake pumps.

Job register of treatment plant

Operation record of treatment plant

Inlet flow meter of treatment plant

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

4. Conclusion, Recommendations and Lessons Learned

4.1 Conclusion

Although the project period was slightly longer than planned due to the external factors, relevance, efficiency, effectiveness and sustainability of the project are high. In light of the above, this project is evaluated to be (A) highly satisfactory.

4.2 Recommendations

4.2.1 Recommendation to NWS&DB

(1) To ensure a satisfactory water supply to hilly areas in Devinuwara Division (effectiveness)

In order to address this issue in Devinuwara Division (Thalalla area and Kapugama area), it is recommended for NWS&DB to explore the possibility of introducing either booster pumps to its distribution system or replace the existing distribution pipes with larger diameter pipes.

[47] The dry season is normally from November to March.
[48] This problem did not occur during the defect liability period.

(2) To enhance O&M capability and improve the environment (sustainability and impact)

It is recommended to carry-out calibration of the inlet flow meters in accordance with the maintenance manual. It is also worthwhile to measure water flow with a portable ultrasonic flow meter which is available in the NRW section of the NWSDB in Colombo at regular intervals to check the correctness of readings taken from the calibrated meters. With regard to the sludge lagoon, it is recommended to secure necessary funds from the NWS&DB annual budget and to get them repaired to avoid environmental pollution issues.

(3) Reduction of Non Revenue Water (effectiveness and sustainability)

It is important to reduce Non Revenue Water (NRW) or at least to maintain at the present level (21%) in order to get the maximum benefits of the project and to enhance financial viability. Currently, a NRW Reduction Project is being implemented in Greater Colombo area under the Technical Cooperation of JICA funding. It is worthwhile to establish a similar organizational model in Matara too (O&M Office) to promote NRW reduction in Matara District. Main objectives of this project are to enhance the managerial capacity of senior officials of the Regional Support Center (Western-Central) to plan and organize NRW Reduction Programs and to develop operational capability of the supervisory staff and skilled staff to carry-out NRW Reduction Activities as per the work programs. This project includes planning activities such as selection of areas, reviewing and modification of pipeline network drawings, assessment of NRW in the areas including identification of the present NRW ratio, preparation of NRW reduction work plans and operational activities such as on-the-job training on leak detection/ plumbing /pipe repairing, implementation of NRW reduction activities according to the work plan, determination of NRW reduction results and provision of feedback to future planning etc.

4.2.2 Recommendations to JICA

To assist to reduce Non Revenue Water (Effectiveness and sustainability)

In order to assist NWS&DB in achieving its objective in reducing NRW, it is recommended for JICA to conduct a follow up study in order to assess the ground situation in project area including the existing human and physical resources and to explore the possibility of implementing similar activities that are implemented in Greater Colombo area.

4.3 Lessons Learned

Project Management (good practices)

Project Director appointed by the NWS&DB for this project had followed a JICA training course just before his appointment and he acquired a very good knowledge in the standards of safety control and project management. What he had studied under this training program helped him to work in close co-operation with the Japanese consultant and contractors during the project implementation. This has contributed in minimizing extensions of the contract. Therefore, it is recommended for JICA to develop two to three weeks tailor-made training courses for project managers of similar projects. Then it is worthwhile to arrange similar training courses for would-be Project Directors before appointing them to similar projects.

Third Party Opinion

Kananke Arachchilage Jayaratne

President, Sevanatha Urban Resource Center

The ex-post evaluation on the above project done by the Japanese expert is very comprehensive. Her report has covered all aspects of the project including design and construction management, current status of O&M with details, user satisfaction and the impact of the project by going through secondary data sources, meeting key informants and having sufficient field observations and interviews with beneficiary families in the project area.

This is an important project designed and implemented by NWS&DB with the support of Japan Government's aid grant. Matara is highly populated district in the southern part of Sri Lanka. Therefore, it was a felt need of the district to provide pipe born water to meet the high demand by both people living along the coastal areas as well as those who did not have access to drinking water in inland. People were using unprotected shallow wells for washing and drinking purposes, which are mostly unhygienic. When water is in short supply, consumption level of non-revenue water (NRW) is in high. The augmentation of Matara water supply scheme was necessary to cover four Divisional Secretariat areas (Devinuwara, Dickwella, Malimboda and Matara). The project had been started in August 2003 and completed in February 2006 only in four-month delay as per scheduled time during a period when whole coastal area of Southern Sri Lanka was affected by Asian tsunami in 2004. Prior to the construction of the project only 64,792 people only in coastal area were served by pipe born water supply, however, after the completion of the project its coverage has increased by 47.6% including 13, 747 people in inland in 2009. As per the ex-post project evaluation report, rural people suffer most as they had water supply only

for 4 to 6 hours per day. At the time of ex-post project evaluation, 97% of project beneficiaries both rural and urban were enjoying 24 hours uninterrupted water supply. Water supply to some beneficiaries in Devinuwara Division was interrupted during the peak hours and due to lack of sufficient water pressure in pipes. It is insignificant because almost all beneficiaries are highly satisfied with current water supply situation. Another achievement of this project is the sharp decrease in level of NRW consumption in Matara after the project completion. It has decreased from 40% in the year 2003 to 21% in the year of 2009. This figure is far below the NRW of 55% in Colombo City and that of the national average of 33% in the year 2009. This project has proved that better the access to water lower the level of NRW. I find that this is a very important finding of the ex-post evaluation by the Japanese expert.

This project has made a large impact on the lives of the people. One is the decrease of water born diseases in the project area. Number of cases reported in dysentery has dropped from 135 in 2001 to 25 in 2009. In addition, there is a sharp drop in reported cases in typhoid too. There is no quantitative analysis in the evaluation, however, it reports and also having seen the level of beneficiary satisfaction, the time spent for fetching of water especially by women and children is almost zero now as they have individual water supply facility at their homestead. People use the time that they have saved due to this project for uses that are more productive and for recreational activities. It is obvious that better facilities in communities create more opportunities for livelihood improvement and value of natural and physical assets has increased in four divisional secretariat areas after the project.

According to the data gathered by the External Evaluator, NWS&DB has taken timely action for operation and maintenance of the entire water supply scheme. It has recruited sufficient number of staff for O&M. Project staff attached to the project has followed JICA training course and taken steps to improve standards of safety control and project management. However, I have noticed that user participation in project design, construction and in O&M is minimal. As a result, NWS&DB still has not been able to reach the break-even point of the project operations. According to my experience working with NWS&DB on NRW in Colombo, it is recommended that similar water projects should be implemented in Public, Private and Community Partnership (PPCP). Advantage of the PPCP model is such that after the completion of the water project, community with the involvement of small private sector looks after whole O&M parts including minor repairs. Therefore, there is no cost to NWS&DB for O&M and it would recover water tariff in full every month.